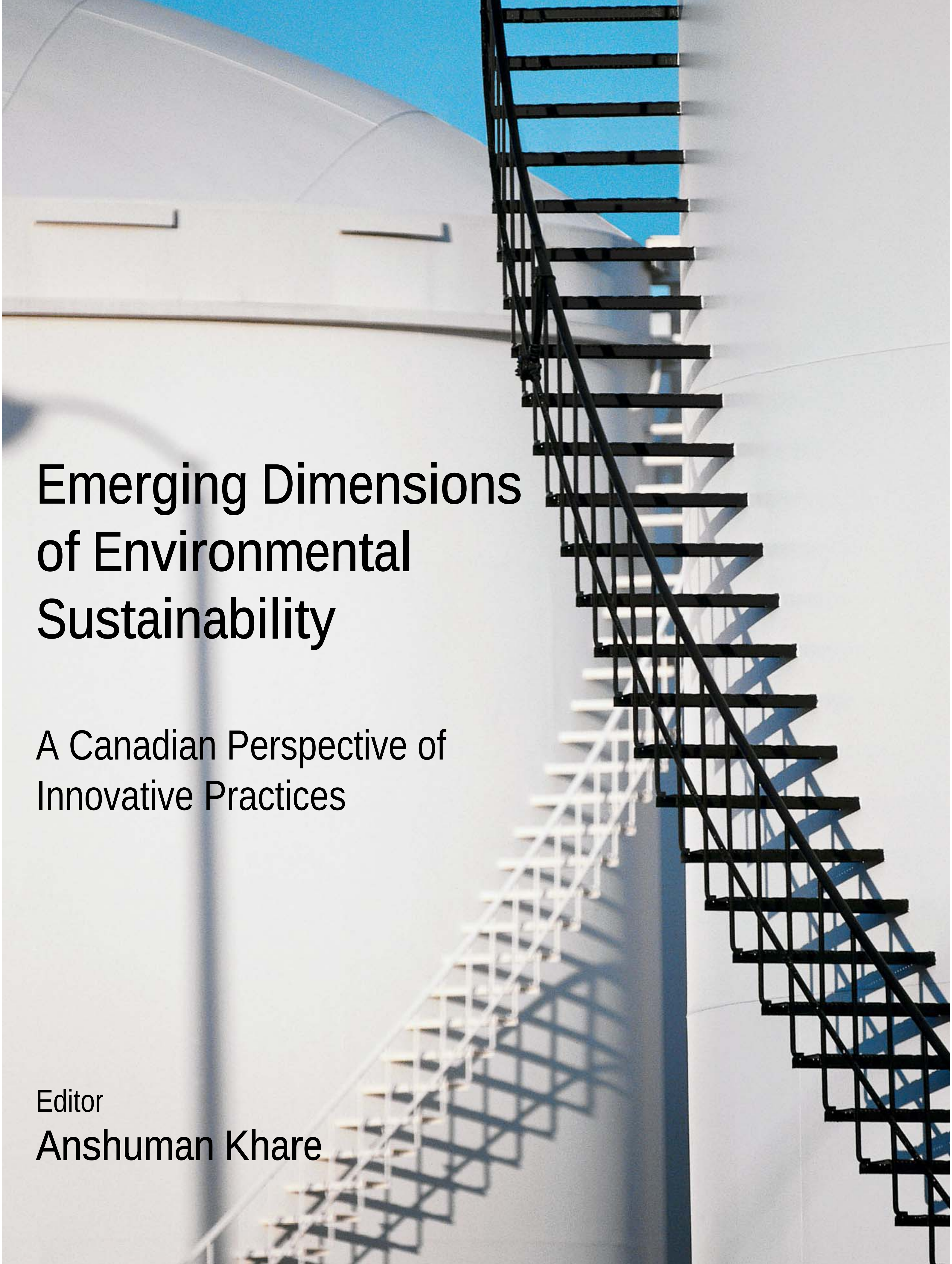

Emerging Dimensions of Environmental Sustainability

A Canadian Perspective of Innovative Practices

Editor
Anshuman Khare

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Foreword

Dominique Abrioux

Although Athabasca University differentiates itself from most sister institutions by virtue of the online, distance delivery of all courses and programs, like other universities it ensures that course content is informed by current research and scholarship. Research represents a key component of our mission as a leading open university, and faculty actively pursue research that spans the subject areas in which courses are offered, thereby also significantly impacting Canada's cultural, scientific, and professional development.

The Centre for Innovative Management took a step forward in promoting collaborative research in the emerging field of sustainability by establishing the **Online Centre for Corporate Stewardship** with a view to:

- Promote the philosophy of corporate stewardship.
- Building a collaborative online community of corporate stewards.
- Pursuing applied research in the area of corporate stewardship.
- Developing a learning environment in which to develop ethical business leaders.
- Creating educational programs in the area of corporate stewardship.
- Recognizing that Corporate Stewards making a difference in the world.
- Having the Centre recognized by others as a Centre of Excellence.

This edited book "**Emerging Dimensions of Environmental Sustainability: A Canadian Perspective of Innovative Practices**" is the first attempt to showcase the work done by a dedicated group of Athabasca University faculty and alumni in the field of sustainability. The book is also supported externally by contributions from established researchers and practitioners working in the area of sustainability.

Environmental sustainability is emerging as one of the key issues that will determine the kind of world that we leave to future generations. Even though one of the premises of this book is that no positive measure can be too small, Canada, with its large stocks of natural resources, can undoubtedly have a great impact on safeguarding its environment and encouraging other nations to do likewise. This makes the Canadian perspectives that underlie this book all the more relevant and important.

Readers interested in further analyzing the complexities of environmental sustainability, with its often contradictory impact on the economy, society and the environment will be drawn to this important work whose theoretical framework and diverse case studies argue that success, organizational sustainability and even strategic advantage, can come to businesses that consider environmental sustainability as an ally rather than a foe.

DOMINIQUE ABRIOUX
President – Athabasca University

Preface

Anshuman Khare

"**Emerging Dimensions of Environmental Sustainability: A Canadian Perspective of Innovative Practices**" is a book about hope and about a future that is taking shape. In our day to day life we hear about the destruction of the environment by business; however, things are changing and in reality businesses have started taking the first steps in being "environmentally correct."

This book brings together Canadian practitioner-authors to share management practices that are successful in their organizations. It presents a compilation of articles highlighting government (federal and provincial) and corporate initiatives for promoting environmental sustainability in Canada and showcases relevant public policies and management practices. Throughout the book, there is a strong focus on innovative management thinking and practices.

When teaching in the area of environmental sustainability, one typically focuses on the quantum changes expected through science, technology, or the discovery of new sources of energy. Often, we don't examine the smaller measures that can contribute to sustainability (e.g., proper management of available resources, waste reduction, and responsible manufacturing activities). In short, there is an immense scope for pursuing environmental sustainability through innovative management practices.

Every industry is involved with some sustainability initiatives. What is really interesting is the fact that around the globe, similar industries have different ways of achieving their environmental responsibilities.

Unfortunately, there is little written that documents actual practice in various parts of the world in different industrial sectors. At this time, most of the books on environmental sustainability are about what can be done. Environmental sustainability reports generated by international bodies at best capture what is logical to do. This field of study lacks case studies and commentary from practitioners on what is working.

The book presents a selection of work being done at the Centre for Innovative Management, Athabasca University in the area of environmental sustainability and corporate stewardship and attempts to fill the gap between theory and practice, between what should happen and what is happening.

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Acknowledgements & Permissions

Anshuman Khare

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I am also very grateful to the contributors to this book. I acknowledge their participation in making this book a reality and their continuous support in its publication. My thanks to Bob Willard, James Hartshorn, Joel Nodelman, Paul Hunt, Anne Papmehl, Winston Gereluk, Luciano Azzolini, Monica Curtis, Roger Harris, Michael Byl, Scott McKay, Brenda Johnston, Bev Fenerty-McKibbon, Srikanth Venugopal and Jerome Hoog. Without your contribution this book would not be possible.

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His research and teaching interests include the economic implications of social and corporate responsibility issues, international marketing, business-to-business marketing, and service quality measurement. Some of his articles have been published in journals such as the Ivey Business Journal, the Canadian Journal of Marketing Research, and the Journal of Business and Industrial Marketing.

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His research interests are modern industrial organizations, learning organizations, and environment-related production management from a system theory and resource viewpoint. He has published three books and about 30 articles and research papers in Germany and abroad.

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SECTION I: SUSTAINABILITY

1 The Perfect Storm of Sustainability Mega-Issues: Threat or Opportunity for Business?

Bob Willard is the author of *The Sustainability Advantage: Seven Business Case Benefits of a Triple Bottom Line* (New Society Publishers, 2002). He is a leading expert on the business value of corporate sustainability strategies and in the last two years has given over 90 keynote presentations to corporations, consultants, academics, and non-governmental organizations. Bob applies business and leadership development experience from his 34-year career at IBM Canada to engaging the business community in proactively avoiding risks and capturing opportunities associated with sustainability issues.

His next book, written in conjunction with his forthcoming doctoral thesis, will address why some companies are committed to sustainability, why others are not, and how to overcome senior management resistance to making that commitment.

He has served on the advisory boards of the Certificate in Corporate Social Responsibility program at the University of Toronto, the Ontario Sustainable Energy Association (OSEA); and Eco-Energy Durham. He is currently on the advisory boards of The Natural Step, Canada, and the Certificate in Adult Training and Development offered by the University of Toronto.

A resident of Ontario, he is a delighted owner of one of the first Honda Civic hybrid-electric cars sold in Canada.

More information about Bob and *The Sustainability Advantage* can be found at www.sustainabilityadvantage.com.

2 Toward Sustainability: Expanding the Scope of Environmental Management Systems

James Hartshorn is a senior consultant and environmental management specialist in the Mississauga, Ontario, Canada office of Golder Associates Ltd., an international employee-owned consulting engineering company specializing in the application of earth sciences and engineering to environmental, natural resources and civil engineering projects. James has over eight years experience in EMS-related projects for firms throughout Canada and the U.S. for clients in a variety of industrial and public sectors. He has received training as an ISO 14001 and OHSAS 18001 Lead Auditor and is a Certified Environmental Auditor with the Canadian Environmental Auditing Association. His current interests include corporate governance for sustainable development, and the operationalizing of sustainable development policy. Mr. Hartshorn completed his academic training at Queen's University at Kingston, Ontario, Canada and at The University of Toronto, Ontario, Canada specializing in Geomorphology. He recently completed a Master of Business Administration degree and Graduate Diploma in Business and Sustainability at York University in Toronto, Ontario, Canada. James has presented and published extensively on environmental management, corporate social responsibility and sustainability issues as they apply to both public and private sectors.

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Anne has maintained an interest in her original academic discipline of Italian by teaching non-credit courses on Italian language and Italian opera at the University of Toronto and The University of Western Ontario.

5 Industrial Relations as a Factor in Environmental Sustainability

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SECTION II: MARKET BASED INSTRUMENTS

6 Role of Market Based Instruments in the New Business Paradigm

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7 Energy Efficiency in Electric Utilities: An Opportunity for Restorative Economics at SaskPower

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8 Sustainable Development Issues and Strategies For Alberta's Oil Industry

Roger Harris works as an Operations Superintendent for Canadian Natural Resources Ltd, a major Canadian oil producer. He currently manages a portfolio of conventional oil and gas properties in Alberta and is well versed with the production and environmental issues facing the upstream sector. He has worked at several locations in Alberta and in Tulsa, Oklahoma and has held various engineering and operations positions including non-conventional oil operations and engineering research. He holds undergraduate degrees in Science and in Chemical Engineering from Lakehead University, Ontario, Canada and is a registered Professional Engineer in the Province of Alberta. His professional interests include operations management, petroleum economics, production engineering and environmental science.

9 Integrated Forest Management in the Boreal Mixedwood Forest: A Review of Policy and Management Implications in Alberta

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10 Awareness Development for an Energy Management Program for Social Housing in Canada

Scott McKay has previous environmental experience in working with a team involved in analyzing the social and environmental impact of oil and gas development in Canada's north. He has also worked in the social housing area and recognized the opportunity to combine a personal interest in the environment with the need for social housing organizations to reduce utility costs and consumption. Scott holds a Masters degree in Business Administration from Athabasca University.

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Michael C. Mayo is an Associate Professor of Marketing at Athabasca University and teaches in the on-line MBA program. Prior to joining Athabasca University, he taught at the University of Toronto's Graduate School of Management (1988 – 1994) and the School of Business at Ryerson Polytechnic University (1994 – 1997). Prior to his academic career, he worked for twenty years in marketing and technical positions in the telecommunications industry. His research and teaching interests include: the economic implications of social and corporate responsibility issues, International Marketing, Business to Business Marketing, and Service Quality Measurement. Some of his publications have appeared in: The Ivey Business Journal, The Canadian Journal of Marketing Research and The Journal of Business & Industrial Marketing.

SECTION III: ORGANIZATIONAL PERSPECTIVES

12 Canada Post Delivers Energy Conservation

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13 Towards Effective Management of Methane Emissions from Natural Gas Pipelines

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Section I: Sustainability

I Sustainability

Michael C. Mayo

Sustainability is multi-dimensional and, despite the breadth of definitions, a general consensus is developing as to what we are talking about when we use the term within a specific context. A general approach to defining environmental sustainability is to couch the discussion in terms of forms of progress that meet the needs of the present without compromising the ability of future generations to meet their needs (found in the World Commission on Environmental Development Report, 1987). When we talk about environmental sustainability, we are talking primarily about the interaction of economic activity with nature and the outcomes of that interaction. What is becoming the more enlightened approach to a discussion of the economics-nature interaction, is to use the "**triple bottom line**" approach in which economic, environmental and a host of social responsibilities are dealt with as interactive and usually competing. Triple bottom line thinking deals with a variety of stakeholders that has a significant influence on, in the case of these readings, **environmental sustainability**.

In this section a group of researchers addresses environmental sustainability from five related, but different perspectives. Bob Willard ("The Perfect Storm of Sustainability Mega-Issues: Threat or Opportunity for Business?") begins by using the popular movie from 2000 "The Perfect Storm" to describe the interaction of five issues that will have a profound impact on a company's operations. The five issues are: climate change, pollution and health, globalization backlash, the energy crunch and the erosion of trust. The forces will manifest themselves to companies in the form of five stakeholder groups, which, while individually manageable, can become deadly in combination – i.e., a "perfect storm" of threats to sustainability.

Willard relates the issues and stakeholders to risk management. The five issues in combination with the five stakeholder groups produce ten market forces that constitute the risk management problem. To make the matter more complex, there are several dimensions of business risk that result from specific issue / stakeholder interactions.

Going beyond the warning of impending disaster, Willard offers ways of converting the threats into opportunities. The article concludes by listing seven bottom line benefits available to companies that capitalize on the opportunities. The key to success lies in “alert and forward thinking executives who will anticipate market trends, analyze their potential impact on the firm, and mobilize the company around strategies that capitalize on associated opportunities” (p. I.16).

In the next paper, “Toward Sustainability: Expanding the Scope of Environmental Management Systems,” James Hartshorn begins with the premise that “sustainability is an ecological, system wide imperative” (p. I.30). The author argues that, while not entirely sufficient, the existing ISO 14001 standard forms a reasonable starting point; and, that by enhancing the ISO standard with elements of other guidelines addressing sustainability, progress can be made. The fundamental management issue revolves around the problems of addressing and managing the range of environmental issues facing organizations. An environmental management system (EMS) is needed to begin to comply with a growing number of environmental regulations, and, the ISO 14001 EMS can promote both compliance and sustainable development.

A discussion of the strengths and weaknesses of the ISO standard presents a balanced assessment and concludes that one of the primary advantages of the ISO standard is its flexibility thus allowing it to address the complexity of sustainable development. Two case studies are provided illustrating the successful use of ISO 14001 (Husky Injection Molding Systems and Dow Chemical).

To balance his treatment of ISO, Hartshorn describes ten other sustainability-seeking standards having broad application. To conclude, a list of the key structural components required of any EMS is presented. Three of the most important of these are the requirement to provide a mechanism for effective stakeholder engagement, techniques for public reporting and the development of a robust set of performance measures.

In the third paper, “A Guide to Corporate Sustainability: Reflections of Two Sustainability Practitioners,” Joel Nodelman and Paul Hunt provide insights gleaned from their over fifty years of experience in the development and implementation of programs related to sustainability. After a brief history of the development of sustainable development policies in Canada, the authors address some of the issues that are faced by practitioners as they advance the sustainability agenda within the Canadian business environment. The basic problem faced by managers is the constant balancing of economic and social responsibility imperatives, i.e., make money, but not at the expense of social concerns (the environment, ethics, stakeholders, regulations and societal expectations). To compound the complexity of balancing competing interests is the problem of how managers are trained. Basically, the authors contend that most managers are not equipped to manage social issues and that stakeholder management, while a new framework for managing social issues, is not well understood.

Since firms face a variety of stakeholders, managers must learn how to recognize and respond to groups with various levels of power and influence. Effective stakeholder management is linked directly to sustainable development in terms of the balance that must be struck between stakeholder expectations and the economic integrity of their organizations.

To help management make informed decisions, sustainable development specialists must perform a set of tasks. Among these tasks are: tracking trends, analyzing the impact of the trends, communicating findings, recommending action and educating the organization about sustainable development.

The authors recommend disaggregating sustainability issues into smaller, more manageable pieces, using a continuous improvement approach. The journey to sustainable development is predicated upon continuous improvement in balancing competing interests.

In the fourth paper, “Environmental Sustainability Through Knowledge Management,” Anne Papmehl presents six case studies describing how Canadian organizations, having environmental or corporate social responsibility agendas, are using knowledge management (the effective use of intellectual capital) to become more environmentally sustainable. The cases reveal a cross section of Canadian industries and sectors including: Technology (DuPont), Hospitality (Fairmont Hotels), Manufacturing (Husky Injection Molding Systems), Finance (RBC Financial Group), Energy (Suncor Energy, Inc.) and Forestry (Tembec). Although diverse, there are important commonalities. Among these are:

1. sustainability is driven by the intellectual capital resident in the organizations;
2. a top-down consciousness toward the environment that informs the culture and decision making of the organization;
3. knowledge flows upward from employees at all levels within the organization and external stakeholders as opposed to the traditional flow of information from a central authority downward.

The author concludes that the interaction of sustainable development and intellectual capital creates an effective means for solving environmental problems as well as fundamental business problems.

In the last paper, “Industrial Relations as a Factor in Environmental Sustainability,” Winston Gereluk argues that good industrial relations are a key ingredient in environmental sustainability. Historically, industrial relations have essentially been left out of sustainability planning, yet the importance of the human side is a critical success factor in accomplishing the environmental, as well as the economic and social dimensions of sustainability. The link between environmental sustainability and industrial relations lies in the fact that employees must be involved in implementing the changes brought on by environmental policy initiatives. To the extent that the employees are unionized, industrial relations becomes an integral art of implementing changes.

The author gives several examples of successful employee-employer actions related to environmental sustainability. Among these are: Suncor (Canadian), Chemical Industries Social Partners’ Agreement (Germany), Swedish Government and the Swedish Confederation of Professional Employees, and the Brazilian Government and Brazilian trade unions. Despite some successes, the author indicates that the concept of partnership can be “overextended” indicating that most employment relationships are not reflective of the partnership approach.

The article provides a discussion of emerging guidelines and prescriptions to mitigate the costs that have been borne by workers as organizations pursue economic, social and environmental sustainability objectives. The concept of “just transition” is introduced to describe the problems of employees affected by the actions of organizations struggling to sustain themselves. To conclude the article, some specific mechanisms (recommended by the Canadian Centre for Policy Alternatives) for insuring a “just transition” in the energy field are presented.

The goal of this section is to present varied but complementary approaches to understanding the complexities of environmental sustainability. The issues presented and the complexities of the interactions of legitimate competing interests indicate that much more needs to be learned about environmental sustainability.

The message from these articles is that environmental concerns are part of a larger set of concerns in which positive economic outcomes alone are not sufficient to sustain an organization. Specifically, a host of diverse social issues now play a growing role in the sustainability of any organization.

The articles are an interesting and thought provoking way to explore the subject of this book.

1 The Perfect Storm of Sustainability Mega-Issues: Threat or Opportunity for Business?[1]

Bob Willard

Abstract

Environmental issues can no longer be considered by business in isolation from social and economic issues. The three dimensions of sustainability—economic, environmental, and social—are increasingly intertwined three legs supporting the stool of a company's license to operate. The business of business is still business, as long as it is operating in an environmentally and socially responsible manner.

To support this assertion, I select five emerging environmental and social global mega-issues to analyze for their impact on business: climate change, pollution and health, globalization backlash, the energy crunch, and erosion of trust. Each is a market force stirring five groups of demanding stakeholders: green consumers, activist shareholders, civil society, government regulators, and the financial sector. In isolation, each mega-issue and aroused stakeholder group many seem like a dismissible blip on the radar screens of companies' environmental scans. In combination, they can be deadly. As these mega-issues and demanding shareholders swirl around each other, feeding on each others' energy and increasingly connecting with each other through the Internet, they create a "Perfect Storm" of threats that can suddenly blindside unsuspecting companies.

Happily, smart companies will anticipate the market forces in their strategic business planning and position themselves to capitalize on the rapid evolution and synergy of emerging environmental, social, and economic market forces.

Keywords: sustainability, risk management, stakeholders, market forces, climate change, profit.

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[1] This article is based on a chapter in Bob Willard's forthcoming second book, as yet untitled, to be published by New Society Publishers, Gabriola Island, B.C., in the spring of 2005, all rights reserved.

Introduction

Between October 27 and 29, 1991, Hurricane Grace formed over the warm waters of the Atlantic Ocean off the east coast of Florida. In the next two days, it swept north, pushing 10-15 foot swells toward the coast of south-eastern United States (USA Today, 2000). By October 29, it was downgraded by meteorologists from a hurricane to a tropical storm and lay just off the coast of Bermuda (Visible Earth, 1991). It was no longer considered a threat.

About the same time, an extra-tropical cyclone was moving across the Great Lakes and an old warm front was swirling off the coasts of the Atlantic Provinces and New England States. These two weather systems suddenly joined with Hurricane Grace on October 30 and 31, causing the old hurricane to regenerate itself into a new monster hurricane that came to be known as the "Halloween Storm" or the "Perfect Storm." With average waves 40-80 feet high, and some waves recorded at 101 feet high—higher than a 10-story building—some meteorologists say it was the worst storm in history (Warner Brothers, 2000).

Hybrid storms such as this are rare but can be particularly dangerous. Sometimes merging storm systems cancel each other out. Sometimes they feed on each other. Only because the Perfect Storm occurred in the mid-Atlantic were horrendous property damage and casualties avoided. Devastation did happen, though. *The Perfect Storm* movie and book chronicle the experiences of the ill-fated Andrea Gail fishing boat caught in the full force of the storm in the mid-Atlantic (Warner Brothers, 2000).

Like the real meteorological event, a "perfect storm" of market forces is brewing on the horizon for unsuspecting companies. Some forces may initially appear minor to the organization or be dismissed as irrelevant. However, if these separate market forces were to synergistically cluster together, their combined impact on unprepared companies could be devastating. Wise business strategists tracking emerging market forces will react to early blips on their environmental scan radar screens and ensure their companies are ready to capitalize on them, rather than be blindsided by them.

The 1991 perfect storm resulted when three weather fronts suddenly converged and fed on each other's energy. The potential perfect storm or risks for businesses consists of at least ten threatening market forces, five of which are demanding stakeholder groups.

1. "Green" consumers
2. Activist shareholders
3. Civil society / nongovernmental organizations (NGOs)
4. Governments, both national and international
5. The financial sector

Each stakeholder group is powerful. However, it is not discrete—the same individual might be a consumer, a shareholder, and an NGO member. As overlap among these market forces becomes more pronounced, the chance of them merging to become a unified tidal wave of rising expectations about corporate citizenship also increases.
What mega-issues are turning up the heat under simmering, demanding stakeholders? The HIV/AIDS epidemic, population growth, and viral pandemics are certainly candidates. I will look at five others as a representative sample.

1. Climate change
2. Pollution and its effect on health
3. Globalization backlash
4. The energy crunch
5. Erosion of trust in institutions

Mega-Issues + Demanding Stakeholders → Business Risks

In combination with the five demanding stakeholder groups, the five mega-issues form ten threatening market forces that contribute to five categories of business risk.

1. Market risks
2. Balance sheet risks
3. Operating risks
4. Capital cost risks
5. Sustainability risks

In Figure 1 (Willard, 2002, pp. 121-138), the labels for the mega-issues, demanding stakeholders, and business risks in the three columns are deliberately offset, signifying they are not uniquely associated with neighbouring factors. Some mega-issues fuel several stakeholder groups, others only one. In turn, some demanding stakeholders contribute to several business risks, others to only one.

I mentioned demanding stakeholders may incestuously overlap. So may mega-issues. Worries about climate change may intersect with concerns about pollution and the energy crunch. Concerns about the impact of global trade may also erode trust in corporations. The five mega-issues swirl around each other, feeding off each other's momentum. They fan the flames of demanding stakeholders and present direct threats to corporations. No one knows how, or if, the ten market forces will coalesce. This uncertainty makes their potential impact on an industry sector or individual corporation all the more challenging to estimate. The potential of a perfect storm of market force risks makes anticipation and preparation wise, which is the value of traditional risk management in business.

I will examine each of the ten market forces, outlining the "what" and the "so what" of each as a business threat. First, I will consider the five mega-issues and then the five demanding stakeholder groups. Finally, I will explore business opportunities that arise from this potential storm of market forces—innovative and smart executives can use judo-like strategies to transform the energy of threatening market forces into impetus for business opportunities.

Mega-Issue #1: Climate Change

The Intergovernmental Panel on Climate Change (IPCC), the world's most authoritative body of climate scientists issued its third report in September 2001. It confirmed that human activity is contributing to a rise in concentrations of six greenhouse gases.[2]

[2] The six greenhouse gases are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulphur hexafluoride (SF_6), perfluorocarbons (PFCs), and hydrofluorocarbons (HFCs). The first three are the most prevalent, with methane and nitrous oxide being 23 and 296 times more

burning fossil fuels accounts for 80 to 85% of human-made carbon dioxide emissions (Alberta Government, 2001). The Kyoto Protocol requires a 5% reduction below 1990 CO_2 concentration levels by 2010-2012.

Figure 1: Mega-Issues + Demanding Stakeholders → Business Risks

10 Market Forces		***5 Categories of Business Risk***
5 Mega-Issues	***5 Demanding Stakeholders***	
1. Climate Change	**1. "Green" Consumers**	**1. Market risks** Regulatory bans or restrictions on sales Reduced market demand for products Degradation of product quality by environmental factors Customer boycotts or reduced acceptance
2. Pollution / Health	**2. Activist Shareholders**	**2. Balance sheet risks** Remediation liabilities Insurance underwriting losses Impairment of real property values Damage assessments Toxic torts
3. Globalization Backlash	**3. Civil Society / NGOs**	**3. Operating risks** Costs of cleaning up spills and accidents Risk to worker safety from handling hazardous materials Expensive regulation-driven process changes Reduced process yields Rise in prices of materials or energy
4. The Energy Crunch	**4. Governments**	**4. Capital cost risks** Product redesign to meet new industry standards or regulations Costly input substitutions to meet new industry standards or regulations Pollution and waste treatment upgrades
5. Erosion of Trust	**5. Financial Sector**	**5. Sustainability risks** Competitive disadvantage from energy or material inefficiencies Impact of mandatory take-back rules Exposure to future taxes and regulatory restrictions **+ More Difficult Access to Capital**

potent, respectively, than carbon dioxide as green house gases. Using similar appropriate ratios, green house gas volumes are usually expressed in carbon dioxide equivalents.

Despite the U.S. government's rejection of the Kyoto Protocol, the U.S. National Academy of Sciences agreed with the IPCC report in June 2001. In 2004, the chief scientific advisor to the British government, Sir David King, urged the United States to take climate change more seriously, saying "Climate change is the most severe problem we are facing today, more serious even than the threat of terrorism" (Conner, 2004). A leaked Pentagon report in early 2004 echoed the concern that climate change is a threat to national security and global stability. In surprisingly alarmist language, the Pentagon report predicts global chaos, anarchy, and nuclear threats in the next 20 years as nations scramble to secure dwindling food, water, and energy supplies caused by climate change catastrophes (Stipp, 2004).

Climate models predict that the Earth's average temperature might increase by about 1.4-5.8°C over the next 100 years. A warming of this magnitude could significantly alter the Earth's climate. An Australian study found that small climatic changes can double wind speed, triggering a four-fold increase in property damage. If summer temperatures increase slightly, carbon dioxide levels can double resulting in a 17-28% increase in the number of wildfires and a 143% increase in really severe wildfires (Jackson, 2003). Storm patterns and severity might increase, a rise in sea level would displace millions of coastal residents, and regional droughts and flooding could occur. The agriculture, forestry, and energy sectors could all be significantly affected, with most other sectors being indirectly affected (Environment Canada, 2003).

Global warming can cost corporations and their insurers billions of dollars. Munich Re, a large German reinsurance company, estimates that global warming could cost $300 billion annually by 2050 in weather damage, pollution, industrial and agricultural losses and other expenses. Companies may also face unexpected expenses because of compliance with future regulations, fines, taxes and caps on greenhouse gas emissions. Swiss Re is reviewing the companies it insures to determine what they are doing to manage climate change risk and is considering excluding from coverage companies or directors that are not addressing it (Cortese, 2004).

The Carbon Disclosure Project report (Whittaker, 2003), a unique collaboration by 35 major institutional investors controlling over $4 trillion of assets, quantified the potential financial impact of climate change on the 500 largest global companies by market capitalization. The survey is the largest ever to assess and provide hard data on a company's exposure to climate change through impacts of both extreme weather events and regulation of greenhouse gas emissions, presenting these factors in terms of the value of shareholdings in corporations worldwide. The report reveals that the financial impact of climate change extends well beyond the obvious, emissions-intensive sectors such as oil and gas and electric utilities. Companies in the financial services, transportation, semiconductor, telecommunications and electronic equipment sectors, among others, will also be significantly affected.

The study estimates that as much as 15 % of the total market capitalization of major companies may be put at risk by climate change. The discounted present value of potential carbon liabilities within a single carbon-intensive manufacturing firm could represent as much as 40% of its entire market capitalization (Whittaker, 2003, p. 6). The study found that while 80 % of respondents acknowledge the importance of climate change as a financial risk, only 35-40 % are actually taking action to address the risks and opportunities.

Pressure for such assessments has been growing. Shareholder resolutions that ask companies to disclose or reduce greenhouse gas emissions won an unexpectedly high 30 % of the vote at some companies during the 2002 annual meeting season. Law firms and insurance companies are setting up business units to deal with climate-related risks. And more institutional investors are lobbying the Securities Exchange Commission and companies for better disclosure of environmental risks, particularly those related to climate change (Cortese, 2004).

The threat of climate change is for real. Companies that identify the risks and implement policies to reduce them will have a competitive advantage and boost their share prices (Reuters, 2003).

Mega-Issue #2: Pollution /Health

Climate change concerns focus on one form of industrial pollution—the discharge of greenhouse gases into the air. Pollution and health concerns are about other industrial pollution—the discharge of toxic emissions and hazardous waste into air, water, and soil, directly or indirectly affecting our health.

Marq de Villiers (1999, pp. 112-117) chronicles the sobering dangers of water pollution. In Eastern Europe, there is hardly a river, stream, or brook that isn't contaminated with runoff from industrial effluents, agricultural pesticides and herbicides, or worse. In China, 80% of the country's 50,000 kilometers of major rivers are so degraded they no longer support any fish. A World Bank study in 1997 put the cost of air and water pollution in China at $54 billion a year, equivalent to an astonishing 8% of the country's gross domestic product. There are more than 8,000 kilometers of shoreline on the U.S. side of the Great Lakes, but only 3% are fit for swimming, for supplying drinking water, or for supporting aquatic life. Each year 50-100 million tons of hazardous waste is generated in the watershed for the lakes, 25 million tons of pesticides alone.

Air pollution is equally troubling, especially smog. The World Health Organization reported in 2002 that 3 million people now die annually from the effects of air pollution, three times the number of people who die from car accidents. In the U.S., air pollution claims 70,000 lives per year, equal to the combined total of deaths from prostate and breast cancer, compared to 40,000 traffic fatalities (Fischlowitz-Roberts, 2002). Imagine the outrage if 70,000 Americans were suddenly killed by terrorists on their own soil, compared to the 3,000 who died on 9/11.

The Ontario Medical Association reports there are 1,900 premature deaths in Ontario yearly from air pollution due to cardio-respiratory illnesses and the number could rise to 2,600 per year by 2015 (Ontario Medical Association, 2002). Air pollution costs Ontario citizens more than $1 billion a year in hospital admissions, emergency room visits, and absenteeism according to the analysis contained in the report -- $600 million in direct medical costs and $560 in indirect costs to employers and employees for lost time. If one uses conservative estimates of the value of pain and suffering, and loss of life, these add a staggering $5 billion and $4 billion respectively to the total. This gives a total annual economic loss of $10 billion in 2000, rising to $12 billion by 2015 (Ontario Medical Association, 2002). And that is just in one province in Canada.

Health concerns cause people to take industrial pollution personally. Waste and emissions represent lost value, business costs, and a threat to present and future human generations. The backlash from the public as they connect the dots between illness and industrial pollution can erode a carefully earned corporate reputation if a company, or another company in its industry sector, is seen as being irresponsible or uncaring about the health impacts of their emissions. When our health is threatened, and especially when our children's health is in jeopardy, we are aroused to take aggressive action against polluters.

Mega-Issue #3: Globalization Backlash

The World Trade Organization (WTO) was founded during the Uruguay round of the General Agreement on Tariffs and Trade talks in 1995. With the World Bank and the International Monetary Fund, it completed the triumvirate of three multilateral institutions worked out largely between the United States and Great Britain after World War II (Korten, 1996, p. 173). The stated goal of the WTO is "to improve the welfare of the peoples of the member countries … the WTO is the only international organization dealing with the global rules of trade between nations. Its main function is to ensure that trade flows as smoothly, predictably and freely as possible" (World Trade Organization, 2003).

The goals of the WTO are worthy. However, one contentious issue is the unlevel playing field that puts poorer nations at a disadvantage. In particular, persistent trade barriers, perverse subsidies, corruption, monopolies, and deficient property rights serve to perpetuate unsustainable practices. Losers in the market globalization process tend to be the low-skilled workers in industrial and developing countries and, in the developing world, farmers who must compete against subsidized farm goods from wealthier countries. The result is that industry sectors in which the South holds a clear competitive advantage—agriculture and textiles, for example—remain among the least liberalized and are characterized by persistent high and price-distorting subsidies. The present market is largely unfair because it is "unfree," burdened by policies and conditions that hinder the poor from freely competing in it (Holliday, Schmidheiny, & Watts, 2002, pp. 42, 43, 52, and 53).

Another issue is WTO accountability. Critics describe the WTO as "a global parliament composed of unelected bureaucrats with the power to amend its own charter without referral to national legislative bodies" (Korten, 1996). In fact, when a WTO panel decides that a domestic law violates WTO rules, it may recommend that the offending country change its law or face financial penalties, trade sanctions, or both (Korten, 1996). A third issue is patent protection embodied in the WTO's Trade Related Aspects of Intellectual Property Rights (TRIPS), especially as it relates access in less-developed nations to essential medicines (Engler, 2003).

Behind concerns about globalization is the degree of corporate influence on and within the WTO. For example, when the U.S. Congress debated the inclusion of China in the WTO, "top business leaders issued a stern warning to federal lawmakers: vote against the deal with China and we will hold it against you when it comes time to write cheques for your campaigns" (Barlow & Clarke, 2001, p. 76). This blatant coercion of elected officials casts doubts on WTO integrity.

The primary mandate of WTO national representatives, many of whom are from big business, is to open other markets to exports from their own countries. They tend to give trade goals precedence over all other public policies like full employment, health and safety regulations, environmental standards, and protecting the democratic rights of citizens to determine the use of their part of the global commons (Korten, 1996). It is small wonder that many people equate globalization with a corporate desire to expand into new markets more for their own benefit than the benefit of citizens in recipient countries, causing a backlash of resentment against global corporations.

Mega-Issue #4: The Energy Crunch

Dwindling fossil fuel resources, the escalating cost of their retrieval and refinement, and the pollution they cause is an ever-increasing concern. World energy consumption demand will grow 150- 230% by 2050 (World Resources Institute, 2002, p. 25). Unfortunately, research by the University of Uppsala in Sweden predicts world oil and gas supplies will be unable to meet demand sometime between 2010 and 2020, decades sooner than previously predicted because global reserves are 80% smaller than had been optimistically estimated (Arthur, 2003). Experts haggle over exact dates but it is clear that access to finite fossil fuel reserves will be very problematic within a generation or two.

The United States consumes 19.5 million barrels of oil a day and has to import half of it, 9.8 million barrels a day. Its daily imports are trending toward 17 million barrels by 2020. The ramifications of U.S. dependence on foreign oil are economic, environmental, and military—would the U.S. be as consumed with Iraq if Iraq grew radishes instead of sitting on the second largest oil reserves in the world? Would it be as interested in Afghanistan if a one million-barrel-a-day oil pipeline from the Caspian basin to the Pakistan coast did not have to go through territory ruled by unpredictable Taliban “warlords?” (Ray, 2004).

Alternative energy options are discouraged by “perverse subsidies” to the nuclear and fossil fuel industry. They are called “perverse subsidies” because they subsidize environmentally destructive behaviour. Citizens are billed twice for them: once when their taxes pay for the subsidies and again when they bear the direct and indirect costs of environmental restoration and health care costs. Between 1948 and 1998, the U.S. federal government spent $112 billion on research and development (R&D) for the energy industry: $66 billion on nuclear energy R&D, $26 billion for fossil fuels R&D, but only $12 billion on R&D for renewable energy and $8 billion for R&D on energy efficiency (Dauncey & Mazza, 2001, p. 199). Figure 2 details $29-46 billion of annual subsidies to the U.S. fossil fuel industry, a significant part of industrial countries’ $200 billion in annual subsidies to the fossil fuel industry (Gelbspan, 2003).

Figure 2: U.S. Fossil Fuel Subsidies (Dauncey & Mazza, 2001, p. 199)

Tax subsidies and loopholes	$14.7 billion per year
Federal programs	$2.36 billion per year
Military protection	$10.5 to $23.3 billion per year
Strategic oil reserve	$1.6 to $5.4 billion per year
Sub-total	**$29 to $46 billion per year**
Environmental health costs (externalized by companies)	$39 to $182 billion per year
Grand total	**$68 to $228 billion per year**

Subsidies and tax loopholes keep the price of fossil fuels artificially low, making it hard for renewable energy to compete. Fossil fuel companies give big-time campaign donations and political action committee contributions to encourage politicians to keep the subsidies in place and the special program subsidies flowing. From 1993-1999, Southern Company, Chevron, General Electric, ARCO, Texaco, and 121 other companies that benefited from federal energy subsidy programs gave $39 million in campaign donations and received $7.3 billion in government grants over the seven years: a 186:1 return on their investments (Dauncey & Mazza, 2001, p. 198).

There is nothing like a brownout or blackout to bring home our dependence on electricity, or a sudden spike in gasoline prices at the local pump to wake us up to our dependence on foreign oil. Whatever the root cause, both governments and corporations are subjected to additional scrutiny when citizens are personally deprived of resources (energy, water, food) that they have taken for granted. As they come to realize how their tax dollars are funding an energy crunch of unsustainable solutions, they will demand transition to fiscal incentives for renewable energy … and expect companies to support that demand.

Mega-Issue #5: Erosion of Trust

The residual affect of corporate scandals is eroding public trust in the business community. Trust is the essential enabler that allows the wheels of commerce to glide smoothly. Without it, corporate legitimacy is threatened.

The fallout from the Enron, WorldCom, Qwest, Tyco, and Global Crossing unethical activities is reflected in a Gallup International and Environics International *Voice of the People* poll commissioned by the World Economic Forum (2002). It surveyed 36,000 people in 47 countries between July and December, 2002, and found a dramatic lack of trust in organizations, especially global and large national companies. Asked to rate their level of trust in 17 institutions to operate in the best interest of society, respondents ranked global companies and large domestic companies second last.

It is difficult to measure the precise economic impact of trust. However lack of trust leads to weaker business partnerships, higher risks, higher interest rates, and lower profit margins (World Economic Forum, 2002). No wonder trust and corporate citizenship were themes of the World Economic Forum in Davos, Switzerland, in January 2003.
The passage of the Sarbanes-Oxley Act in the U.S. Congress in July 2002 aims to improve auditor independence, ban loans to company officers and directors, improve corporate responsibility, ensure financial disclosure, and mandate corporate accountability while guarding against conflicts of interest (Baue, 2003a). However, more needs to be done by corporations to rebuild trust, polish tarnished corporate reputations, and protect their social license to operate.

Wild Card Mega-Issues

Among climatologists, a huge concern is the “discontinuity scenario”—a potentially catastrophic, sudden, and irreversible shift in global climate patterns, such as the erasure of the Atlantic "conveyor belt" of currents.[3] Similarly, "discontinuity threats" to business can come from any direction, suddenly and unexpectedly.

Suppose you run a successful company. It is big, has excellent brand recognition, has expanded internationally, has captured the majority of market share in your industry, and is still growing impressively. It is also headquartered in the U.S. Suddenly, the 9/11 terrorist attack occurs, the Enron scandals erupt, and the war against Iraq is launched. As the economy suffers, so do you.

Then a Boycott Brand America campaign is launched (Adbusters, 2003) and millions of people are invited to sign a petition against American companies as symbols of American power and arrogance, as a protest against the invasion of Iraq despite world-wide protests. If you are a proud executive in a large, successful American corporation, you may feel a wave of fury as you learn of the petition. Nobody said the world would be reasonable. Discontinuous market forces happen. They are wild cards in the game of commerce. The important question is not validity of the boycott, nor is it what your reaction is. The important question is how effectively you anticipated and mitigated this potential wild card market force.

Wild card mega-issues do not start from scratch. They build on existing platforms of issues and engage stakeholders who are already organized and can spread like wildfire. For example, the Boycott America campaign could be a lightening rod for civil society stakeholders angered by corporate globalization and erosion of trust. Wild card risks are just that—wild. They are difficult to tame with defensive strategies hastily crafted after the crisis has arisen. The best defence is a good offence—a solid, hard-earned corporate reputation for environmental stewardship, social responsibility, and ethical behaviour.

Now I will describe the five groups of demanding stakeholders who are energized by the five mega-issues.

Demanding Stakeholder Group #1: "Green" Consumers

Despite their environmentally sounding label, "green" consumers are concerned about both social and environmental issues. The driving mega-issues that concern them are climate change, pollution / health, and depletion of resources such as forests and fish stocks. They are concerned that greenhouse gases from industry contribute to climate

[3] Climate change scientists are concerned we may be on the brink of disrupting the Gulf Stream flow. Why might that happen? The Great Ocean Conveyor belt of the Gulf Stream depends on its warm, salty water sinking when it reaches the North Sea, as it becomes cooler and its salinity makes it relatively dense, and returning to the South Atlantic tropics via deep ocean currents. If increasing warm rains and melting Arctic glaciers dilute the water at the North Atlantic end of the Gulf Stream so it is relatively warmer and less salty, the whole conveyor belt could slow down … or stop. There has already been a 20% decline in the amount of deep water flowing southward through a crucial, kilometer-deep channel between the Faroe and Shetland Islands near Scotland. So what? A slower or extinct Gulf Stream would produce much more extreme winters in eastern North America. Shipping lanes, rivers, and harbours would freeze far earlier; crops would fail; and our energy use would soar. Northern Europe would be as frigid as Siberia and probably unable to feed itself. A recent Pentagon report argues that even a mid-range disruption of the Conveyor could generate mass migrations and interstate and civil war across Europe, Asia, and Latin America.

change. They are concerned about immediate and more long-term socio-environmental impacts of hazardous waste and smog-producing pollution. They are concerned about corporate responsibility.

And they are voting with their wallets. Environics International's *CSR Monitor* (2002, pp. 67-70) survey found that in Australia, the U.S., Canada, and Great Britain, 77%, 69%, 66%, and 61% respectively said they had punished or rewarded companies in the last year because of their social performance. "Rewarded" means buying products or speaking positively about the company and "punished" means refusing to buy products or speaking critically about the company. Despite 9/11 and the distracting fear of terrorist attacks, the increases over the previous year in consumer activism were 11%, 15%, 14%, and 21% for Australia, the US, Canada, and Great Britain, respectively. It is interesting that higher punishment tendencies came from internet users, the higher educated, and people over 24 years old. Even if survey "halo effect" is allowed for and the numbers are factored down to account for differences between attitudes displayed in surveys and actual consumer behaviours, the number of customers using green attributes as a differentiator may be significant if those demographics fit your company's customer profile.

Environmental considerations have settled into the public consciousness as a second-tier consideration for everyday consumers. John Elkington (1998, pp. 6 & 124) warns that what seems like a soft, spongy consumer shift in values can turn almost overnight into concrete-hard opposition -- "soft" values like concern for future generations are superseding traditional "hard" values like the paramount concern for the financial bottom line. Carl Frankel (1998, p. 140) graphically describes green consumers as the superficial whitecaps on a powerful sea change in environmental consumer power. He points to the growing interest in alternative therapies, organic food, and "natural" products as evidence of the growing green consumer movement.

"Buyer beware" or "producer beware"?

Demanding Stakeholder Group #2: Activist Shareholders

Interest in social and environmental issues has risen significantly over recent years and investors are beginning to ask more informed and detailed questions about companies' corporate social responsibility performance (CSR Europe, 2004). Internationally, pension funds with assets of over $1 trillion have begun to use their collective financial muscle to promote greater climate change disclosure and accountability from the world's largest corporations (Innovest, 2002, p. 12). Sustainable development, corporate social responsibility, and climate change are the fastest growing categories of stockholder initiated resolutions. Shareholder relations waters are becoming choppy.

As investors stand up and are counted, using their voice and vote to call for strengthened corporate governance and solid corporate citizenship, they move from passive holders of stock to active and responsible owners. They understand the leverage they have as individuals and institutions who have invested their capital and faith in companies. In 2003, shareholder activists filed a record 31 global warming resolutions, up from 19 in the 2002 proxy season and 6 in 2001 (Financial Times, 2004) —it is the fastest growing area of shareholder activism. Out of 862 resolutions filed in 2003 at publicly traded U.S. companies, 237 were on social or environmental issues (Financial Times, 2004).

The five largest carbon dioxide emitters among U.S. power companies – American Electric Power, Cinergy Corp., Southern Company, TXU Corp., and Xcel Energy – simultaneously faced global warming and related shareholder resolutions at their 2003 annual meetings (Makower, 2003, p. 2). The level of support for the resolutions was 27% at American Electric Power, 23% at Southern, and 24% at TXU. At Exxon Mobil, 22% backed a similar resolution. The United States Public Interest Group says resolutions concerning global warming won about 18% support from shareholders at a dozen or so companies in 2002 and over 25% support at more than twice that number of companies in 2003. Putting this in perspective, the Investor Responsibility Research Center said in the 32-year history of shareholder activism on shareholder issues, only board diversity proposals have had average shareholder support levels topping 20% (Seelye, 2003).
An awakened investor community is one of the most interesting emerging drivers of corporate attention to CSR.

Demanding Stakeholder Group #3: Civil Society/NGOs

Environics International's *CSR Monitor 2002* survey (Environics, 2002), referenced earlier, determined that 17% of people are "Social Activists" with high expectations of companies to solve social problems and to act ethically. Another 26% are "Latent Activists" who may soon become Social Activists, bringing the combined total to 43% of the population who are, or may soon be, actively challenging companies to assume greater social and environmental responsibility.

Many of these activists can be described as members of "civil society." They belong to non-governmental organizations (NGOs) like labour movements, youth-led networks, women's networks, farmers associations, environmental groups, religious organizations, civil rights organizations, and peace networks. There are more than one million non-profit organizations registered in India, 300,000 in Brazil, and 180,000 in Canada. The civil society sector represents the eight-largest sector in the global economy. With global expenditures of well over $1 trillion, if all civil-sector groups were amalgamated in one country, they would form the eight largest economy in the world. NGOs also employ more people than the private sector by a margin of six to one (Barlow & Clarke, 2001). They are a formidable force and becoming better organized with each new public demonstration.

The claim-to-fame issue for converging NGOs was anti-corporate globalization, with environmental and public health concerns imbedded within that cause. The "Battle of Seattle" that disrupted the November 1999 proceedings of the World Trade Organization included protestors from environmental protection groups, civil rights, and a wide range of other platforms (Grayson & Hodges, 2002, p. 36). Civil society is a market force to be reckoned with, and should be included when corporations are engaging with influential stakeholders. Failure to do so may create an adversarial relationship that will consume significantly more time and resources than a partnership relationship, regardless of how challenging that may seem at first.

Demanding Stakeholder Group #4: Government Regulations

Government regulations, or the threat of them, can trigger company action on sustainability. Legislated compliance is the first rung on the sustainability ladder, with the top rung being voluntary sustainability leadership. Government policies and regulations control pollution and hazardous waste, and ensure a safe and healthy workplace for employees. For companies missing early market signals, regulations are a wake-up call. How far a company decides to go beyond compliance will determine its competitive advantage.

A regulation on the books is interesting. Enforcement is compelling. The teeth behind the regulations are almost as important as the regulations themselves. Strong penalties such as significant fines and jail terms for executives or board members, coupled with rigorous enforcement mechanisms, can galvanize management attention.

What's new? Government regulations are creeping into new areas. The global mega-issue of climate change is embodied in the Kyoto Protocol, as discussed earlier. As signatory countries enact regulations to comply with the Protocol, companies will be required to mitigate their greenhouse gas emissions or face lawsuits holding them accountable for contributing to climate change. Even though the U.S. has not ratified the Kyoto Protocol, U.S. companies are not off the hook. A broad kind of class action suit, such as the one filed by Maine, Massachusetts, and Connecticut against the Environmental Protection Agency (EPA) to force it to regulate CO_2 emissions, is being spurred on by the EPA's 2003 declaration that carbon dioxide is not a pollutant and therefore need not to be regulated under the Clean Air Act (Baue, 2003b). In 2002, Friends of the Earth, in conjunction with Greenpeace and several western cities, charged the Export Import Bank and the Overseas Private Investment Corporation with providing over $32 billion in loans and funding to U.S. corporations for overseas projects without complying with National Environmental Policy Act requirements to assess the environmental impact of projects they finance and without gauging their potential contributions to global warming (Baue, 2003b).

In late 2003, the Friends of the Earth formed the Climate Justice Programme -- an international group of lawyers, scientists and more than 40 civil groups -- to promote the use of law to fight climate change using laws covering polluters, product liability, human rights violations and public nuisance (Financial Times, 2004). Governments can prosecute corporate environmental transgressors, holding either the company or its officers and directors criminally liable. How long will it be before companies face litigation on their greenhouse gas emissions from activist NGOs or governments, analogous to tobacco company suits? These class action suits may prove to have a trickle down impact on corporate indifference to greenhouse gas emissions.

Regulations are becoming more complex as international regulations and trade globalization add additional environmental and social policies and regulations to the national pile. Regulations are within the ever-growing civil foundation of expectations that corporations are expected to meet to earn their civil and legal license to operate. Companies ignore them, or wait for them, at their peril.

Demanding Stakeholder Group #5: Financial Sector

Over 70% of CEOs surveyed by the World Economic Forum in 2003 believe mainstream investors will have an increased interest in corporate social responsibility in the future (World Economic Forum, 2004, p. 13). Investment fund managers agree. In a 2003 survey of 388 fund managers, financial analysts, and corporate investment relations officers across nine European countries, 52% of fund managers believed that social and environmental considerations will become a significant aspect of mainstream investment decisions over the next two years (CSR Europe et al, 2003, p. 4).

In business, there is a wry employee expression, "What interests my manager fascinates me." An executive version might be, "What interests financial markets fascinates me." The financial sector includes financial services advisors, insurers, reinsurers, asset managers, pension fund managers, financial analysts, investment banks, commercial banks, venture capital companies, project financers, investment advisors and brokers, and rating agencies (Whittaker, 2002, pp. 4-7). If companies were patients, financial analysts would be doctors poking, prodding, and diagnosing their short- and long-term financial health. Corporate patients want clean bills of health from their financial analyst doctors.

Financial markets focus on financial capital, the tip of the value iceberg. However, financial analysts increasingly recognize that financial capital rides on a base of so-called intangibles that represent an ever-increasing percentage of market value – 80-85% in 2000 for Fortune Global 500 corporations, versus 30% in 1980 (Whittaker, 2004). Fully one third of the information used to justify investment decisions is non-financial (Ernst & Young, 2000, p. 8). To avoid a Titanic-like encounter with the value iceberg, analysts' sonars must recognize the materiality of invisible intangibles below the surface, all of which are sustainability related risks or value-driving opportunities (Gilding et al, 2002, pp. 10, 22).

A Conference Board of Canada analysis of the performance of seven prominent funds[4] and indices found compelling evidence that investment portfolios consisting of companies committed to sustainable development have matched or outperformed their benchmarks (Feltmate et al, 2001, p. i). Given this positive correlation, investment analysts are starting to request company environmental and social reports as information sources about holistic company health and management strength.

An awakening financial sector is becoming a powerful catalyst to companies paying more attention to environmental liabilities and risks. When big investors start showing an interest in your corporate responsibility attributes, sustainability agnostics suddenly get religion.

Rising Expectations

Rather than remaining as marginalized considerations, social and environmental topics have crept into mainstream business discourse. Harvard Business Review issues have included W*hat's a Business For?* by Charles Handy (2002), *The Competitive Advantage of Corporate Philanthropy* by Michael Porter and Mark Kramer (2002), and *The Virtue Matrix* by Roger Martin (2002). These articles show the relevance of smart social and environmental strategies to corporate financial performance. The sea change is starting.
Consumers, shareholders, NGOs, the financial sector, and governments are demanding more and more information about corporate social and environmental performance. As companies become more open and transparent, market forces keep pushing for

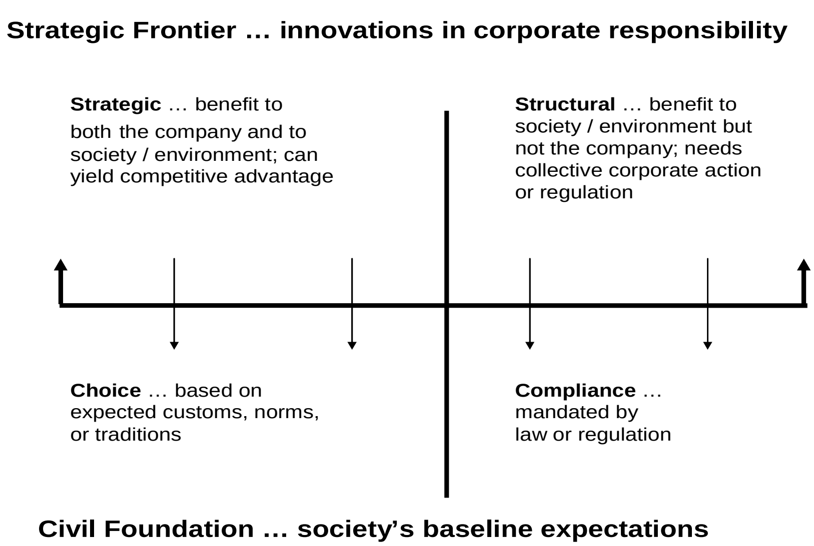
[4] The seven funds examined were Domini Social Equity Index (US), EcoValue 21 (U.S.), Dow Jones Sustainability Group Index (International), Storebrand Scudder Environmental Value Fund (European), the Jantzi Social Index (Canadian), Ethical Funds (North American), and Sustainable Value Pension Fund (Canadian).

improved performance. There is a growing emphasis on the quality of management of corporate social responsibility, not just on whether companies do it at all. It doesn't stop —continuous improvement applies as much to sustainability as it does to quality.

In a way, companies have set themselves up for higher expectations: they benefit from increasing privatization of services previously provided by governments; they influence government investment and trade policies through corporate-funded think tanks; and they lobby for government subsidies and corporate tax relief. For example, the Royal Bank of Canada, with 2001 pre-tax profits of $3.9 billion, will save $500 million per year from a 13-point reduction in federal and provincial income taxes by 2005 – over 10 times the $45 million they spent on social responsibility initiatives in 2001 (Stanford, 2002). As the role of government recedes, public expectations advance that corporations with deep pockets will take the dialogue to their major stakeholders, credibly communicate their corporate responsibility activities, and exercise more meaningful corporate citizenship to fill the void. Or at least pay their fair share of taxes.

Roger Martin (2002) points out in his *Virtue Matrix* article that the public is continuously ratcheting up the bar on the civil foundation to which corporations are expected to contribute (see Figure 3). In a sense, companies are victims of their own good deeds. Corporate behaviour that falls into the lower quadrants of the virtue matrix may have originated on the strategic frontier, but today it is either mandated by law or enforced by custom or tradition. Thus, complying with environmental law or providing on-site day care wins corporations little credit in the public minds today. Such conduct is less a responsibility than a duty. For a company to earn public credit for its behaviour, it has to engage in activities that reside in the strategic frontier.

Figure 3: The Virtue Matrix (Martin, 2002)



New benchmarks of corporate sustainability commitment are being used, like how downsizings are handled and the fundamental nature of core products (like genetically-modified foods, tobacco, hamburgers, fossil fuels) being produced by companies. What used to be considered leading and enlightened social or environmental practices are now considered to be the entry-level ante for a social license to operate.

Rising Expectations → Business Risks

Rising expectations result in new regulations, tougher criteria for bank loans and insurance, forced redesign of manufacturing and operating processes, lawsuits, new environmental liabilities, and revenue stream exposures. As shown in Figure 1, they can be classified as market risks, balance sheet risks, operating expense risks, capital cost risks, and sustainability risks. Rising expectations and resultant risks are impacting the license to operate.

According to a 2003 poll conducted by GlobeScan, 84% of Canadian shareholders think investment and financial communities should pay more attention to environmental and social performance when valuating companies, 83% believe companies should go beyond their traditional economic role, and 51% have punished a socially irresponsible company in the last year (Turnbull, 2004).

Most of the "unexpected" crises that buffet companies should have been anticipated – they are "predictable surprises." The bad news is that all companies are vulnerable to potential market upheavals caused by the ten market forces. The good news is that business leaders are trained by business schools to continuously do environmental scans to recognize threats, prioritize risks, and do contingency planning. Alert and forward thinking executives will anticipate market trends, analyze their potential impact on the firm, and mobilize the company around strategies that capitalize on associated opportunities. Failure to do so can leave an organization vulnerable to financial disaster.
The meteorological perfect storm was unfair to the Andrea Gail fishing boat trapped in its fatal embrace. Rising expectations about corporations' role in mitigating major issues in the world today may also be unfair. No one promised market forces would be fair or reasonable. Savvy executives concerned with the long-term sustainability of their enterprise will give serious consideration to the above market forces when planning business strategies, regardless of their personal views about them.

There is no lessening of stakeholder expectations in times of economic downturn. In fact, recessions sharpen the message that what happens to business matters to society, so what happens to society should matter to business. Companies unprepared for threatening new market forces could be in for a rough ride. Traditional responses to risks may no longer be adequate or appropriate. However, innovative corporations that anticipate and prepare for market surprises will thrive. They will convert the energy from the perfect storm of coalescing risks and threats to a perfect storm of business opportunities.

Risk of Being Personally Sued

A final word on risk. The real grabber for senior company officers is being personally sued and jailed for allowing company environmental transgressions. Samuel Johnson's observation that “when a man knows he is to be hanged in a fortnight, it concentrates his mind wonderfully” (Lynch, 2004) is an apt metaphor for the way personal liability focuses the attention of corporate officers and directors on avoiding corporate environmental transgressions. Suddenly, it’s personal.

Paul Hawken tells the story about being asked to speak to a group of business people in Melbourne Australia and to make the business case for sustainable development. Instead, he asked them what the business case was for worldwide endemic poverty, for double-glazing the planet with greenhouse gases, and for business models that destroy people and life. He predicted that in our lifetime we will see convictions of corporations and corporate leaders for crimes against humanity (Hawken, 2003).

The real teeth in the Canadian Environmental Protection Act 1999 is provision for fines up to $1 million a day or up to five years’ imprisonment for any officer or director who assented to the violation (Environment Canada, 2000, p. 18). Although somewhat dated, a 1990 survey of officers and directors of a cross-section of major Canadian corporations by Diane Saxe (1990, pp. 104 & 109) reinforced that corporate executives would be more likely to take action to have their companies avoid environmental offences if they could be prosecuted personally for such offences. She found that the policy of prosecuting all the directors and officers who could have prevented pollution but who failed to do so, whenever the corporation was prosecuted, was the most effective in increasing environmental expenditures, without increasing the adverse side effects (the willingness of individuals to serve as directors and corporations moving to other jurisdictions). The threat of personal shame, fines, and even imprisonment helps to focus executive attention on due diligence in environmental matters.

<u>Transforming Mega-Issues into Mega-Opportunities</u>

I have suggested that threats can be transformed into opportunities. Here is how companies might address the five mega-issues, transforming their risks into opportunities:

1. Climate Change. Reduce company green-house gas (GHG) emissions to below regulatory requirements. Go further than required and build carbon credits as a potential source of revenue – the potential market size for GHG trading is $10 billion to $3 trillion by 2010 (CO2e.com, 2001, p. 4). Declare zero GHG emissions as a company goal.
2. Pollution / Health Concerns. Work on upstream sources of hazardous waste by replacing hazardous materials and chemicals with more benign substitutes. Reduce and recycle, using closed loop processes. Take back products at the end of their useful lives and reuse components. Move from outright sales to leasing products. Declare zero waste as a company goal.
3. Globalization Backlash. Work with industry trade organizations to lobby governments and influential international organizations like the World Trade Organization, the World Economic Forum, the International Monetary Fund, and the World Bank to improve the fairness of international trade rules. Position the company to capitalize on fairer trade regulations.

4. The Energy Crunch. Commit to alternative green energy and co-generation. Work aggressively with NGOs and governments to transition perverse subsidies for fossil fuel providers to equitable treatment for alternative renewable energy providers and users. Consider a company goal of being off the utility grid.
5. Erosion of Trust. Recommit to ethical financial, environmental, and social behaviour. Use third party audits to verify company behaviours are ethical and in the best interests of society. Build trust. Reward internal whistle-blowers.

The biggest impetus for these initiatives is not a growing corporate sense of social responsibility, but market forces—concerned customers, vocal employees, and hard-nosed investors who are worried about the value of their holdings (Grayson & Hodges, 2002, p. 7). The real benefit of these initiatives will be realized when demanding stakeholders see that the company is sincerely undertaking significant corporate stewardship strategies, integrating them with core business strategies and re-branding the company as being environmentally and socially responsible.

Seven Bottom-Line Benefits

Companies can not only mitigate the ten threatening market forces, they can capitalize on them. Specifically, they can benefit is seven ways (Willard, 2002).

1. Easier hiring of top talent, by attracting people whose values resonate with company sustainability values and who want to work in that kind of company (Save 1% of today's hiring costs).
2. Higher retention of top talent, since employees caring about company environmental and social good works want to stay with it longer (Save 2% of today's attrition costs)
3. Higher productivity from employees, energized by a contributing to the success of a firm doing worthwhile work (Increase productivity by 10.5%)
4. Reduced expenses in manufacturing, through eco-efficiencies, dematerialization, recycling, process redesign, and waste reduction (Save 5% of today's manufacturing costs)
5. Reduced expenses at commercial sites, through eco-efficiencies in energy and water usage, and increased employee stewardship of consumables (Save 20% of today's costs in those three areas)
6. Increased revenue, as green consumers are attracted to the company's products and services, services are expanded, and new markets are opened (Increase revenue by 5%)
7. Reduced risk and easier financing, through risk avoidance, lower insurance premiums, better loan rates, and higher attractiveness to investors (Save 5% of risk-related expenses)

What bottom-line results do these seven benefits yield? For a composite company based on five real high-tech companies, and using assumptions based on the lower, conservative range of benefits realized by case study companies, the potential increase in profit is 38%,[5] without allowing for potential revenue from carbon emissions trading.

Expressed a different way, the value of the company's financial capital will be improved, as will associated values of its manufactured capital, its contribution to natural capital, human capital, intellectual capital, knowledge capital, and social/relationship capital with its important stakeholders.

A benefit is not a benefit to an executive unless it is viewed as relevant to that executive. That is obvious. However, the implications are not always as obvious. Too often, sustainability proponents do not understand that executives are driven by their measurement and reward systems and these systems are not uniform throughout executive ranks. Is the executive paid on increased revenue or increased profit? Is he or she rewarded for reducing operating expenses or for attaining a minimum rate of return on capital expenditures? The differences matter and the business case must be appropriately tailored for different executives within the same company.

Executives will want to examine assumptions to verify that they are valid for their company and situation. They should. Using Excel worksheets[6], they can substitute their industry's language and company-based assumptions to assess the robustness of the sustainability business case for their company. Service companies would remove the benefit about manufacturing savings. NGOs and public sector organizations would focus on the human resources benefits and commercial site operations benefits. Small and medium sized enterprises (SMEs) would scale back some factors. The business case is remarkably robust. Even if the productivity benefit were scaled back to 4% from 10.5% and the revenue increase was more conservatively estimated as 2% instead of 5%, the potential profit increase would be 20%—still a compelling prospect.

Now that is an exciting perfect storm for companies with courage and foresight!

Conclusion

Change literature is unanimous on one premise: a "burning platform" causes change. The "burning platform" expression comes from a story told by Daryl Conner (1993, p. 93) in *Managing at the Speed of Change.* He tells the story of an oil platform explosion and fire in the North Sea off the coast of Scotland in July 1988. It was the worst catastrophe in 25 years of North Sea exploration: 168 people died, 63 survived. One of the survivors, Andy Mochan, plunged 15 stories into a burning sea of oil and debris where he knew he could survive only 20 minutes in the freezing water.

Why did he jump? When interviewed in the hospital later, he said he had chosen uncertain death over certain death—he knew that if he stayed in the inferno on the platform he would die. The pain of the "status quo" was too great. He jumped because he had to, not because he was attracted by a personal growth opportunity or a business case for a exhilarating swim. Organizational change is often precipitated by a "burning

[5] The backup to this calculation and the detailed assumptions derived from hundreds of case studies are described in *The Sustainability Advantage* and are not repeated here, for brevity.
[6] *The Sustainability Advantage Worksheets* are available from the New Society Publishers web site at http://www.newsociety.com/bookid/3794

platform" like the perfect storm of mega-issue and demanding stakeholder storm clouds gathering on the horizon. More specifically, unless there is a *perceived* urgent need to change, we usually will not.

Happily, the push of disruptive market forces is complemented by the pull of an attractive shared vision of how much more profitable the company can be after the change is complete. Discomfort with the present status quo is eased when the desire to change is fostered by self-interest. A pot of gold at one end of the rainbow makes avoiding a socio-ecological-economic crisis at the other end more attractive.

Smart executives will convert the perfect storm of sustainability market force risks to innovative opportunities to thrive. They will be the Andy Mochan's of the business world who have the courage to leap into a more sustainable way of doing business. The prospects for those who do not are no better than for the ill-fated Andrea Gail.

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2 Toward Sustainability: Expanding the Scope of Environmental Management Systems

James Hartshorn

Abstract

The challenge of sustainability presents an opportunity for firms to generate competitive advantage through: i) the exploitation of market inefficiency; and ii) the development of novel products and services. Such advantage is likely to be gained by firms with capabilities for organizational outreach, innovation and change, which in turn rely on integrated, inclusive business management processes. In most firms, however, environmental, quality, safety and public relations functions are departmentalized and many such advantages are not realized. Moreover, organizations are confused by the vast array and varying quality of sustainability-related standards and initiatives now in the marketplace and are often intimidated into doing nothing.

Since its introduction in 1996, many firms have implemented a formal environmental management system (EMS) following the ISO 14001 standard. However, business integration and sustainability are not prescribed or promoted by this standard. Most EMS are site-based, and generally limited in scope to activities that are 'inside the box', or within the confines of the plant. Sustainability is an ecological, system-wide imperative. As such, any management system designed to promote progress towards sustainability must necessarily consider the actions of companies and individuals throughout that organization's environmental, social and economic value chain.

Despite weaknesses in the existing ISO 14001 standard from a sustainability perspective, it is not entirely insufficient to address the complex reality of sustainable development. It provides a general framework for action, and is flexible enough to allow for the incorporation of 'beyond compliance' and 'beyond environmental' initiatives. Until such a time that a fully integrated sustainability management system standard is developed, management systems such as those defined by the ISO 14001 standard, perhaps enhanced by components and elements of other sustainability-seeking standards and guidelines, should be viewed as useful tools for promoting progress towards sustainability.

Keywords: innovation, integration, environmental management, standards, sustainability, value chains.

Introduction

There is little agreement over the theoretical definition of sustainable development, and even less agreement as to what it means in practical terms. Corporate uncertainty as to how far to address environmental and social issues, and how to go about addressing the issues, has compromised and represents perhaps the most significant stumbling block to progress towards sustainability. Even once a commitment to sustainable development is made, organizations are often uncertain as to how to go about 'bridging the gap' between sustainability policy and action. While the concept of sustainable development has certainly helped companies expand the scope of their thinking about strengths, weaknesses, threats and opportunities, to include non-traditional, non-tangible and non-financial aspects of organizational sustainability, most are struggling with the transition to sustainable enterprise.

The number of approaches that firms can take to operationalize sustainability is as great as the number of definitions of the concept. Some of the more innovative and proactive firms have interpreted the challenge of sustainable development as an opportunity to exploit market inefficiencies and to create a range of 'future' products and services.[1] Other more risk averse firms have decided to batten down the hatches and hope to ride out the waves of change by increasing their commitment to existing products and technologies.

What all firms will agree on, whether they subscribe to radical corporate reinvention, modest change or no change at all, is the desire for sustained growth and profitability. These same firms will also acknowledge (some more reluctantly than others) the importance of gauging and responding to stakeholder concern regarding the health and welfare of the human and natural environment. The general public, investors and other stakeholders are increasingly incorporating environmental and social performance and values into investment, purchasing and employment decisions. Rotherham (2001) estimated that one in every eight dollars invested in the US is managed by an ethical mutual fund. Increasingly, university curricula are exposing students in business, law, engineering as well as arts and science programs to environmental and social issues. As early as 1992, it was estimated that as much as 44 percent of the Canadian population, aged 29 or less, had been, or was then in the process of being educated at a time when sensitivity to the importance of the environment was heightened in Canada.[2]

By implication, these statistics suggest that future stakeholders (including business leaders, employees, investors and the general public) will be more conscious about the environmental and social impact of their decisions, and will be interested in a more

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[1] Consistent with the economic theories of Joseph Schumpeter (1934), a number of commentators have noted that the economy is driven by innovators who, through the introduction of substitution technologies and new business models unseat incumbent firms and upset the foundations of the industry (Abernathy and Clark 1985; Christensen 2000). More recently, Porter and van der Linde (1995), Reinhardt (1999), Hart and Milstein (1999), Hedstrom et al. (2000), Larson (2000), Hart (1997) and others focused on the emerging challenge of sustainable development as being a catalyst for a contemporary round of improved competitiveness and even more radical 'creative destruction', offering almost unparalleled opportunity for companies with the vision and foresight to recognise it.

[2] UNCED (1992). *Canada's National Report*. See:
http://www.idrc.ca/esummit/documents/n28e.html

inclusive and responsible approach to business planning and management. Managers will be looking for ways to internalize environmental and social costs, and drive down these costs of production through the use of innovative technology. They will be looking for a means to better understand and control each aspect of their operations that may interact with the human and natural environment, and for a means to enhance reputation and accountability. Most managers agree that it is impossible to maintain compliance with the myriad of environmental regulations without some form of environmental management system. It follows that a mandate for sustainability management can be accomplished through the adoption and implementation of some form of sustainability management system. This does not mean that new management methods need to be invented. Rather, it requires a new cultural orientation and refinements to existing systems, practices and procedures. The means to help achieve this goal already exist in the form of a globally-accepted and adopted framework for managing environmental issues, ISO 14001. This chapter explores the value of that framework in promoting progress towards sustainability.

Background on Sustainable Development and Policy in Canada

Since the 1972 Stockholm Conference on the Human Environment, the term "sustainable development" has been at the center of the environment and development debate. The definitions for sustainable development and sustainability are numerous and contended. Some adopt an anthropocentric definition wherein sustainability means the sustenance of humankind; for others, sustainability means that all species, not just humans, are sustained.

The dictionary definition of sustainable development, when broken down into its component parts, is simply:

> *growth, which may be endured for a long period* (Allen, 1985).

The most commonly accepted definition and one which is not (generally) disputed is that presented by the report of the World Commission on Environment and Development, published as "Our Common Future". That report defined sustainable development in terms of intergenerational equity, and is written as:

> "*development, which meets the needs of the present without compromising the ability of future generations to meet their own needs*" (WCED, 1987).

The International Institute for Sustainable Development (IISD), in conjunction with Deloitte & Touche, developed the following description of sustainable development for business strategy:

> *"For the business enterprise, sustainable development means adopting business strategies and activities that meet the needs of the enterprise and its stakeholders today while protecting, sustaining, and enhancing the human and natural resources that will be needed in the future"* (IISD, 1992).

For organizations, the latter definition is arguably more practical and actionable than the former. While the overreaching intent is to promote the adoption of a corporate agenda that contemplates and attempts to mitigate such pressing global issues as poverty, collapsing fisheries, finite resource depletion and global warming, the implication is that by not adopting more proactive strategies to protect the current and future needs of all stakeholders, the survival of the organization may be compromised.

From the perspective of operationalizing sustainable development, this is where the rubber hits the road. Our ability to address these and other pressing global issues will boil down to corporations being convinced of the value of sustainability-seeking management strategies. Corporations control the majority of world economic activity and are the main mechanism for technological, economic and cultural change. With their influence over financial, human and natural resources, corporations more than any other organization have the means to effect positive change and truly sustainable development.

To date, however, business has not been turned on to sustainable development, and the long-term economic benefits of adopting a more proactive stance with respect to the protection and enhancement of society and the environment have apparently not been well communicated. The environmental and health & safety functions of the organization continue to be perceived as cost-centers, and are typically marginalized. The functions are commonly provided with a bare minimum of resources and funds, and are therefore limited in their ability to do anything more than maintain a compliance focus. These isolated departments, even if properly trained and focused on performance, can rarely promote real progress towards sustainability because little or no authority is vested in them to make changes across the enterprise

Where corporations demonstrate a reluctance to assume a best practice model of governance, regulators traditionally step in to exercise a policy of mandatory abatement and enforcement. However, the government in Canada has been slow to enforce the adoption of a sustainable development agenda. The main problem is that regulators are commonly pulled between two competing mandates. On the one hand, government has the responsibility of limiting impact on health, safety and the environment, and upholding environmental quality and emission standards. On the other hand, government has an interest in facilitating economic growth, and not unnecessarily handcuffing business through inflexible regulatory regimes. Still, the command and control approach seems to be preferred by most regulators, and tends to satisfy critics who suggest that the government is too lenient on polluters and not doing enough for the environment. Command and control regulation can only be characterized as prescriptive and inflexible, and typically provides few direct incentives for firms to innovate, which is fundamental to those firms with sustainability-seeking strategies.

In May 2000, the Auditor General released Report on Plans and Priorities for 2000/2001. Commenting on this report, and the Canadian government's commitment to sustainable development, Federal Environment Minister David Anderson emphasized the need to move beyond the traditional command and control approach, to employing the forces of competition, innovation and entrepreneurship.[3] Subsequently, in December 2000, Minister Anderson suggested that governments everywhere are recognizing that the

[3] Report available at http://www.oag-bvg.gc.ca/domino/other.nsf/html/00plan_e.html/$file/2000-01e.pdf

pursuit of environmental sustainability and environmental policy-making should not be restricted to traditional command and control approaches[4]. These comments perhaps imply increasing government interest in voluntary self-regulation and the use of tools such as environmental, health & safety and sustainability-seeking management systems, which provide the impetus for technological change and improved sustainability performance.

The relative merits of mandatory and voluntary regulation have been debated and reviewed in detail by others.[5] However, the environmental literature has generally overlooked the means by which public agencies may harness commercial institutions and resources residing outside the public sector to further policy objectives. One of the objectives of this chapter is to examine the role that free-market, non-regulatory policy instruments (specifically EMS) can have in achieving policy objectives for sustainable development.[6] Specifically, is the ISO 14001 standard for EMS sufficient in its current form to further current policy objectives and meet the new challenges of sustainable development?

The ISO 14001 Framework for Environmental Management

There are a number of internationally-recognized standard-setting bodies, many of whom have published systems standards and specifications for quality, environmental and health & safety management. Of these, the International Organization for Standardization (ISO) is perhaps the best-known and most universally recognized standard-setting body.

ISO was established in Geneva in 1946 with the mandate of standardizing industrial and consumer product specifications to facilitate the exchange of goods and services and the transferability within and between countries. ISO became the international standards-setting body, working with public and private enterprise to effect technical standardization decisions. In the early 1980's, ISO moved into organizational management with the introduction of a series of certifiable quality management standards (ISO 9000 series). With the recognition that a management system used to identify and eliminate quality defects could also be used to identify and correct pollution defects, the introduction of the quality system standard was closely followed by environmental management standards (ISO 14000 series) in the mid 1990s.

[4] Comments made to delegates at the Supporting a Sustainable Future: Making Dollars and Sense – An International Conference on the Use of Economic Incentives and Instruments in Environmental Policy, Vancouver, British Columbia, December 2000.

[5] See for example: Gunningham, N. & Grabowsky, P. (1988). *Smart Regulation: Designing Environmental Policy*. Clarendon Press: Oxford; MacDonald, D. (1991). *The Politics of Pollution*. McClelland and Stewart: Toronto; Gibson, R. (ed). (1999). *The New Politics of Corporate Greening*. Broadview: Peterborough; Fiorino, D. (1996). Toward a New System of Environmental Regulation: The Case for an Industry Sector Approach. *Environmental Law* 26, 457; Weber, E. (1998). *Pluralism by the Rules: Conflict and Cooperation in Environmental Regulation*. Georgetown University Press: Washington D.C.

[6] Specifically, it is this author's intent to examine how the EMS framework may be utilized as a tool to help promote sustainable development.

These ‘softer’ standards represent a quite significant shift from the earlier more traditional, technical and performance prescribing standards, emphasizing systems *conformance* rather than performance. Critics of the standards, who have argued that that the lack of performance requirements or mandatory requirements for adoption of specific engineering practices limits their effectiveness, have not overlooked this fact. However, these standards and specifications also provide a powerful foundation from which environmental management has been reconsidered and even redefined. The application of the quality systems concept to environmental management underlined the ISO technical committee’s belief in the interconnectedness of the environmental function with other functions of the organization, the community and the regulatory environment.

ISO 9000 and ISO 14000 are based on the universal model for performance measurement and continuous improvement, known as the Deming Wheel or Deming Cycle. In the 1950’s, W. Edwards Deming proposed that business processes should be analyzed and measured to identify sources of variations that cause products to deviate from customer requirements. Deming devised a simple generic tool wherein business processes are placed in a continuous feedback loop, such that managers can identify and change the parts of the process that need improvement.

To meet the ISO 9000 and ISO 14001 specifications, the management system must be designed in accordance with a series of elements, generally organized into four phases: Plan, Do, Check and Act. The ‘Planning’ phase involves development of a policy, identification of significant aspects, identification of legal requirements, and the setting of targets and objectives. The ‘Doing’ phase involves the development, implementation and maintenance of programs to achieve the targets and objectives. The ‘Checking’ phase involves the monitoring and measurement of operational activities, corrective actions to resolve non-conformance with established procedures or performance objectives. The ‘Act’ phase involves the periodic review of the management system in its entirety by senior management to determine its suitability, adequacy and effectiveness. This last stage is crucial for continual improvement in environmental management.

ISO 14001 *Environmental Management Systems – Specification with Guidance for Use* is the only standard within the 14000 series of standards against which a third party may certify an organization. The standard provides for a systematic approach to the management of activities that interact with the environment, and for the monitoring and measurement of those activities with respect to established objectives and targets. Furthermore, the standard is designed to promote continuous improvement in management and performance. As previously noted, these standards are procedural rather than prescriptive; in other words, they provide only specifications and guidance for systems and evaluation tools, rather than test methods or performance levels.

The other 14000-series standards have been described well by others (see Hortensius and Barthel, 1997) and will not be discussed in detail here. However, a brief overview of one particular standard (ISO 14040, *Life Cycle Assessment*) is fitting.

Sustainable development is an ecological, system-wide imperative, and requires (to the extent possible) accounting for the environmental (and social) performance of organizations and individuals throughout the organization’s environmental, social and economic value chain. Life cycle assessment is the systematic cradle to grave review of a product, in which all stages of product life are taken into account from raw material input to final disposal. The typical goal of such an assessment is to compare the environmental impact of compatible products or services, or to identify opportunities to enhance environmental value or reduce the unnecessary consumption of resources. The outcome of this assessment is often an incremental or occasionally radical change in process and production systems.[7]

ISO 14040, *Life Cycle Assessment: Principles and Framework* outlines the methodology for the various phases of life cycle assessment, including the scoping of the exercise, inventorying and assessing the impact of each life stage and assimilating and interpreting the results. Supporting guidance documents (ISO 14041 and 14042) provide additional information on life cycle inventory and assessment. Despite the fact that the ISO 14001 specification requires the consideration of impacts over which the organization does not have direct control, detailed life cycle assessment is rarely employed. The exercise can be very labour-intensive and when undertaken must be carefully scoped out in advance. The benefits of life-cycle assessment are generally overlooked from an environmental management perspective, likely due to the complex nature of most detailed and useful assessments and because the culture of the organizations in which most EMS are developed does not promote the use of such tools.

From an organizational sustainability perspective, however, life cycle assessment can be a very useful tool. An increasing number of organizations and companies are viewing the use of this and similar tools (including design for environment) as an opportunity for identifying product and process improvement opportunities and demonstrating environmental performance to downstream customers. They hold the view that pollution is not a by-product of the manufacturing process, but rather a defect in the manufacturing process. Organizations are also employing this tool in response to pressure from customers, expanded notions of board of director liability, and regulatory pressures (increasingly from supplier requirements, and product and material take back regulations). The ultimate value of life cycle assessment is somewhat dependant on the vertical structure of industry, and on an organization’s ability to exert control over the product system. Life cycle assessment will generally be more appropriate for those firms whose position in the value chain allow them to define the eco-profile of the product system. A good example of this is in the automotive industry, where the large assemblers are the holders of the most complete knowledge on product composition and performance. This position provides these firms with the greatest scope for extracting environmental and social benefits from the product system.

Sustainability challenges organizations to consider issues such as the environmental impact of the materials they select, the social implications of their products and operations, and in some case the need for their product at all. Life cycle assessment demands that the evaluator think outside of the box of the organization, promoting the consideration of interorganizational and interdisciplinary relationships. Such lateral thinking can help in achieving improvements in the material and energy efficiency of products, reducing environmental and human health-related risk, designing for disassembly and recyclability, and extending the durability and functionality of products.

[7] Life Cycle Assessment and innovation in large firms is well described by Berkhout (1996). Other examples of the effective use of these tools are described by Brady et al. (1999).

Implementing Sustainability Through ISO 14001—The Challenges

ISO 14001 has been employed by many organizations in many industries to facilitate the management of environmental issues. There is growing evidence of a positive correlation between corporate environmental management and value creation, a comprehensive review of which is beyond the scope of this paper.[8] However, the most commonly cited reasons for developing a formal environmental management system include: limiting liability (due diligence), corporate image and growing public concern over environmental issues, customer (supply chain) demand, and the fact that industry standards and codes of conduct that incorporate a best practice-based approach to environmental management are often relied upon by government to help shape public policy, and serve as the foundation for government standards.[9] Up to the end of 2002, approximately 49,500 ISO 14001 certificates had been awarded in 118 countries, an increase of 35 % over the end of December 2001. In Canada, at least 1,064 certificates had been awarded by the end of 2002, up from 801 at the end of 2001 and 475 at the end of 2000.[10]

These figures underline the recognized benefits and positive attributes of this international standard for environmental management. However, a number of limitations are apparent when ISO 14001 is considered through the sustainability lens:

Transparency: The lack of requirement for public accountability represents perhaps the single largest criticism of the ISO 14001 specification. In terms of public reporting, the specification only requires that the organization's policy be made publicly available, and that a log of external communication be maintained. The specifications do not require public reporting or stakeholder consultation on environmental matters. Any sustainability-seeking management system should necessarily commit to public reporting of objectives and performance against stated objectives. Without knowing what sorts of legal, ethical, environmental, financial and social objectives each organization pursues, stakeholders cannot effectively evaluate an organization's commitment to sustainable development and push that organization to continuous improvement.

[8] In his paper on the relationship between the environmental performance and financial performance of large US companies, Bhat (1999) concludes that lower pollution per sales revenue has a positive impact on profit margins and stock market values. Reinhardt (1999) describes a number of 'design for environment' initiatives that help bring the environment 'down to earth' and deliver increased value to shareholders while making improvements in environmental performance; see also Porter and van der Linde (1995). Lovins (1999) cites a number of examples of firms that have incorporated the value of natural capital into the business balance sheet. That author argues that reducing the wasteful and destructive flow of resources represents a major business opportunity; see also Figge, F. (1998). Environmental Shareholder Value. *Centre for Economics and Business Administration* Report No. WWZ-Study No. 54.

[9] See Hunter, D., Salzman, J. & Zaelke, D. (1998). *International Environmental Law and Policy*. Foundation Press: New York; also Reinhardt, F.L. (2000). *Down to Earth: Applying Business Principles to Environmental Management*. Harvard Business School Press: Boston.

[10] Reference: The ISO Survey of ISO 9000 and ISO 14001 Certificates, 12th Cycle – Up to and including December 31, 2002. Available at: http://www.iso.ch/iso/en/iso9000-14000/pdf/survey12thcycle.pdf

Inclusivity: Other fundamental flaws in the ISO 14001 EMS standard are highlighted by Roht-Arriaza (1995). She suggests that the standard was developed to the practical exclusion of less-developed countries and small and medium enterprises, which limited the content and the subsequent effectiveness of the standard. Callenbach et al. (1993) note that even more fundamentally, environmental management systems standards do not question the dominant corporate paradigm, and reinforce the status quo. They suggest that the standards promote only cosmetic changes to environmental and health & safety management, and a focus on systems and regulatory compliance rather than performance improvement.

Scope: Gleckman and Krut (1997) contend that despite Agenda 21 and the 1992 Earth Summit declarations being cited by ISO 14000 Technical Advisory Group members during the drafting of the specification as the main catalyst for ISO 14000, the standard does very little to promote a sustainability agenda.[11] The recommendations of Agenda 21, or any other international agreements or conventions, are not reproduced in either the specification appendices or supporting documents.[12] A 1996 report prepared by the European Partners for the Environment (EPE) and SustainAbility, the UK think-tank on sustainable development, reviewed current environmental management systems in the context of sustainable development, specifically exploring the scope of stakeholder involvement that will be required in making a transition from environmental to sustainability management.[13] Key among the weaknesses of the current standard was the missing social dimension. This sentiment is supported by Moomaw (2001), who states that the exclusion of a social value metric limits the functionality of EMSs.

Scale: Most significantly from a sustainability perspective, the current ISO 14001 standard is commonly interpreted to promote a site-based, unilateral view of the organization. Aspects and objectives considered by an EMS are typically limited to those that can be most easily managed and most readily quantified. Most organizations limit the scope of their EMS to activities that are ‘inside the box’, in other words within the confines of the plant. However, as noted previously, sustainability is an ecological, system-wide imperative. Management systems that are implemented at the level of the organization are inherently limited in their ability to measure progress towards sustainability, simply because they are unable to account for the environmental and social performance of activities outside their sphere of influence. A management system designed to address the issues of sustainable development and promote progress towards sustainability must therefore be able to consider the actions of organizations and individuals throughout the organization’s environmental, social and economic value chain.

[11] Agenda 21: Programme of Action for Sustainable Development, UN Doc. A/CONF. 151/26/Rev.1 (Vol.1) Rio de Janiero, 14 June 1992.

[12] Since the UN Conference on Environment and Development (“Earth Summit”) in Rio de Janeiro, Brazil, in June 1992, sustainable development has been a key theme at a series of international conferences discussing pathways to development. Canada has agreed to two of the more important conventions that support sustainable development, specifically the *Convention on Biological Diversity* and the *United Nations Framework Convention on Climate Change*.

[13] EPE/SustainAbility Ltd. (1996). *From EMAS to SMAS: Charting the Course from Environmental Management and Auditing to Sustainability Management*. SustainAbility Ltd.: Brussels, Belgium.

Furthermore, much longer time periods will need to be considered to account for the intergenerational equity obligations of sustainable development. Extension of the time scale implies examination of long-term consequences of proposed activities and the possibilities for reversing the consequences of past decisions. In most applications of ISO 14001, organizations assume a relatively short-term view of their activities and impacts.

Measurement: One of the key challenges facing companies that have made a commitment to sustainable development is how to track progress towards sustainability, and communicate it to employees, regulators and other important stakeholders. Measuring the sustainability of products, processes or services is complicated by the lack of commonly accepted measurement standards and sustainability performance indicators, by the fact that sustainability is inherently complex and multi-faceted, and by the fact that sustainability is highly dependent on the actions up and down the supply chain. Fiksel et al. (1999) highlight the fact that key principles for measuring sustainability are not considered by ISO 14001. These include: addressing the dual perspectives of resource consumption and value creation, considering the complete triple bottom line of economic, societal and environmental performance, applying life-cycle (cradle-to-grave) thinking, and using lagging and leading indicators of performance.[14]

Implementing Sustainability Through ISO 14001—The Opportunities

While there are certainly detractors, there is also strong support for the use of ISO 14001 in furthering the sustainability agenda. Sutton (1996) suggests that most organizations do not use ISO 14001 to its full potential, and adopt a minimalist approach to environmental management. He cites the culture in which these systems are implemented as presenting perhaps the most significant obstacle to their use as a sustainability management tool. The 'default' implementation of EMS, driven primarily by private interest, sets limitations on its use as a tool for furthering the sustainability agenda.[15]

It is true that ISO 14001 does not explicitly exclude the consideration of non-environmental aspects. The standard is not prescriptive in terms of how an organization goes about the identification and assessment of aspects, performance metrics and targets, and does provide the framework for organizations to embrace other principles of sustainable development. While there are certainly a number of shortcomings, this international standard for environmental management, in its current form, is not entirely insufficient to address the complex reality of sustainable development. It provides a general framework for action, and is flexible enough to allow for the incorporation of 'beyond compliance' and 'beyond environmental' initiatives. In addition, the structure

[14] Fiksel et al. (1999) discuss a variety of sustainability indicators and best practice measurement across several industries.

[15] Sutton (1996) suggests that most organizations implement 'default' environmental management systems that focus only on activities having direct, negative environmental impacts, and emphasize prevention of pollution, waste minimization and energy conservation. However, exercising this default approach limits the effectiveness of the EMS, and precludes the consideration of the indirect impacts that are more relevant from the sustainability perspective.

and methodology prescribed by the standards promote inclusivity, flexibility and an innovation-focused approach to business management, which is crucial for sustainability.

A number of organizations have successfully employed ISO 14001 to help them integrate environmental, employee and community health, welfare and development programs with core business processes. Some of these firms have implemented policies, procedures and programs that go well beyond the traditional scope of an environmental management system. Two such firms are Husky Injection Molding Systems (HIMS) and Dow Chemical Company (Dow). Both HIMS and Dow exhibit many traits and characteristics of a sustainable enterprise, principally by focusing on product and service innovation and on the less tangible aspects of business processes. These firms have relied on an inclusive, proactive and innovative management systems formula, and are presented here to help to illustrate the potential for ISO-based management systems to facilitate progress towards sustainability.

Case Study 1 – Husky Injection Molding Systems[16]

Business Overview

HIMS is a publicly-traded Company based in Bolton, Ontario which designs and manufactures injection molding machines (IMMs), polyethylene terephthalate (PET) preform molds, hot runners and robots. These are used for the manufacture of a wide range of products in the packaging, automotive and technical industries. Those products include soft drink bottles, food containers, automotive fascia (interior and exterior trim), and plastic housings for cellular phones and laptop computers. The Company enjoyed 2003 sales of over $600M, serving customers in over 100 countries, and employs more than 3,000 people operating from 3 manufacturing campuses and 40 service and sales offices around the world.

Operating Sustainable Development Philosophy

HIMS operating philosophy is grounded in four firm beliefs: a refusal to compromise the health and safety of its employees, natural environment or Company; integration of environment health & safety (EHS) issues into every aspect of its business; empowerment of its employees to resolve EHS concerns; and a commitment to core values (making a contribution, proactive environmental responsibility, passion for excellence, uncompromising honesty and bold goals). These core values are cited as influencing corporate strategy and forming the basis for business and management practices around the world.

Environmental Stewardship

The firm has adopted the ISO framework to facilitate the management of the environmental health & safety aspects of its business. HIMS has an integrated

[16] This case study has been compiled from the following resources: Five Winds International. (2003). *CSR Case Study: Husky Injection Molding, Determined to Make a Contribution*; EthicsScan (2003). Ethical Performance Comparison: Industrial Products Companies. *The Corporate Ethics Monitor* 15(1), 2-8; Husky Injection Molding Website: http://www.husky.ca; Personal communication with Dr. Dirk Schlimm, Vice President Human Resources, Husky Injection Molding Systems Inc., April 2001 and with Mr. Glenn Atkinson, Director Environment, Health & Safety, Husky Injection Molding Systems Inc., April 2004.

environment health & safety committee at each manufacturing site, and has implemented a range of proactive and innovative EHS programs and initiatives at various levels of the organization, most notably at the product design stage. Examples include: energy efficiency programs to address the energy intensive life cycle of its products, design for environment initiatives to reduce raw material use in plastic bottles (so called “thin-walling”), extensive waste and hazardous chemical reduction programs, and strict (albeit voluntary) reporting of atmospheric releases. HIMS has also introduced an innovative ‘green shares’ program, whereby employees who undertake activities reinforcing the firm’s core values (such as car-pooling, recycling and volunteering) are rewarded with Husky common shares. HIMS has established ‘beyond compliance’ targets with respect to environmental performance, most notably through greenhouse gas emission reduction programs, solvent use and waste reduction initiatives and energy efficiency programs.

Social Responsibility

HIMS has reached out to its stakeholders, and has built on the monitoring and measuring elements of its integrated EHS management system to help track employee well-being, supplier performance and community development initiatives. HIMS defines stakeholders to include not just shareholders but all individuals and communities that are affected by its business operations. The Company maintains its commitment to employee well-being through fitness, wellness and childcare facilities, and to the community at large through community and education donations programs. HIMS requires its suppliers to demonstrate a commitment to environmental management and audit their performance. By deliberating expanding the reach of its management system to stakeholders over which it has only indirect control, HIMS is addressing one of the more significant imperatives of sustainable development, namely that a firm’s value chain be engaged.

Sustainable Enterprise

HIMS has given significant attention to the integration of the principles of sustainable development into its business practices. HIMS has been rewarded for its efforts through inclusion in the Jantzi Social Responsibility Index, which lists 60 Canadian companies that pass a set of broadly-based social and environmental screens. HIMS has assumed a proactive strategy of sustainable growth, with the identification and formal management of opportunities (and threats) pertaining to environmental, social and economic aspects of decision making. More specifically, HIMS has a formal written position with respect to environmental and social issues, and its corporate objectives pledge competitive advantage through the integration of social, environmental and economic imperatives. HIMS has engaged its stakeholders from an environmental, social and economic perspective, and has established a position of best in sector with respect to the control of a range of sustainability-related aspects.

HIMS’s commitment to corporate social responsibility and the effective management of this commitment through an integrated management system has facilitated the attraction and retention of the best people, superior workplace morale and safety, excellent customer and community relationships, and perhaps most importantly, credibility and trust.

Case Study 2 – Dow Chemical Company[17]

Business Overview

Dow is a leading science and technology company based in Midland Michigan, which provides innovative chemical, plastic and agricultural products and services to a range of consumer markets. With 2003 sales of $33 billion, Dow serves customers in more than 180 countries and a wide range of markets including food, transportation, health and medicine, personal and home care, and building and construction. The company employs over 46,000 people and has 123 manufacturing sites in 32 countries, supplying more than 3,500 products.

Operating Sustainable Development Philosophy

Dow states clearly and unambiguously that to achieve its mission, *to constantly improve what is essential to human progress by mastering science and technology,* it must operate according to values that speak to the economic, social, and environmental responsibilities of business and society. In 2000, Dow adopted a sustainability strategy and established a series of sustainable development guiding principles to govern Dow's corporate behavior and decision-making. In 2001, the Company's senior management developed and adopted a 12-Point Sustainable Development Operating Plan template to allow each business to integrate the dimensions of Sustainable Development into their unique strategies.

Environmental Stewardship

Dow has assumed aggressive 'beyond compliance' targets for chemical emission and release reductions. Dow has achieved progress in emission reductions and by 2001 had successfully met the self-imposed 2005 goal of 75% reduction of emissions of 29 priority compounds. As of 2003, Dow had reduced emissions of these compounds by 81%, during a period in which production rose by 24%. Dow is a signatory to the Responsible Care commitments of several chemical trade associations (including the Canadian Chemical Producer's Association). Dow reports to being at "100% practice in place" for the original 106 social, technical and economic practices embodied in Responsible Care.

Social Responsibility

As a signatory to Responsible Care, Dow is committed to a range of employee and community health, welfare and development obligations. The backbone of the Responsible Care program is a commitment to employee and public safety, which is achieved through engaging customers, suppliers, carriers, competitors and the public in a transparent fashion about chemical manufacture, use, storage, handing and transportation. Stakeholder engagement and community development are the foundation of Dow's Sustainable Development Guiding Principles, which are: measurement and transparency, eco-efficiency; meeting local and Dow standards; product stewardship; stakeholder partnerships and dialogue; ecosystem integrity; employee and public outreach; and equity and quality of life.

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[17] This case study has been compiled from the following resources: Five Winds International (2003). *Environmental Sustainability Case Study: Pollution Prevention at Dow*; Dow Chemical Website: http://www.dow.com; Personal communication with Mr. Scott Noesen, Vice President Sustainable Development, Dow Chemical Company, April 2004.

Sustainable Enterprise

Dow has given significant attention to the integration of the principles of sustainable development into its business practices, and has been recognized by the Dow Jones Sustainability World Indexes as one of the top performers for the global chemical industry group. Acknowledging the systemic nature of sustainability, Dow has identified its operations as part of a larger overall system and strives to produce products and services that are valuable to others and “fit-in" with the larger natural and human environment. Moreover, the Company has committed to engaging a wide range of stakeholders, both up and down the value-chain, to foster enhanced health, safety and environmental management (through full life cycle analysis of products from concept to manufacture, to use and disposal) and employee and public health & welfare.

To help achieve this commitment, Dow has defined what it calls an “Operating Discipline Management System”, encompassing the policies, requirements and work processes of Environment, Health, Safety, Manufacturing, Human Resources and Quality. The Operating Discipline Management System is compliant with ISO 9001:2000, as well as ISO 14001 and ISO 16949:2000. Dow contends that the implementation of an integrated management system promotes business excellence through the leveraging of best practices between disciplines. Under this system, each business, location and facility is obligated to establish, communicate and ensure consistent implementation of programs that define performance objectives and operating discipline to be achieved in the management, design, construction, operation, maintenance and closure of Dow locations and facilities.

Other Standards and Frameworks for Sustainable Development

To this point, we have contemplated the potential for existing environmental management system standards to promote progress towards sustainability. However, ISO 14001 is just one of an array of possible mechanisms for measuring, evaluating, improving and communicating progress towards sustainability. Some of the other more widely adopted sustainability-seeking standards are summarized below.[18]

[18] An excellent summary of existing published sustainability-related standards and guidelines is provided in SIGMA, 2003. The SIGMA Guidelines Toolkit: SIGMA Guide to Guidelines and Standards Relevant to Sustainable Development (reference: http://www.projectsigma.com/Toolkit/SIGMAGuideToSD.pdf). This guide reviews 20 standards and guidelines relevant to sustainable development. It includes the UN Global Compact, EMAS, The Natural Step, Social Accountability 8000, Investors in People, Global Sullivan Principles, The Ethical Trading Initiative Base Code, Balanced Scorecard, the European Foundation Quality Model - Excellence Model, The Global Reporting Initiative, AA1000 framework, Combined Code of Corporate Governance, ISO family of standards, the London Benchmarking Group, OECD Guidelines for Multinational Enterprises, Caux Roundtable Principles for Business, Amnesty International’s Human Rights Guidelines for Companies, the Principles for Global Corporate Responsibility, Business Impact Task Force, UK Government Sustainable Development Strategy.

Social Accountability 8000 (SA 8000)

First published by the Council on Economic Priorities Accreditation Agency (CEPAA) in 1998, the standard is focused on workplace conditions in supply chains. SA 8000 was designed to be the first auditable international standard for companies seeking to guarantee the basic rights of workers. It is based on twelve International Labor Organization (ILO) conventions, the United Nation's Universal Declaration of Human Rights, and the UN Convention on the Rights of the Child. Requirements of this standard address nine essential areas where organizations must comply with relevant local legislation and with the standards own provisions: Child Labor; Forced Labor; Health and Safety; Freedom of Association; Freedom from Discrimination; Disciplinary Practices; Work Hours; Compensation; and Management Practices. SA 8000 has close links to several other standards, and was modeled on the ISO 14001 management system specification. However, unlike ISO 14001, SA 8000 prescribes specific performance standards. In 2000, CEPAA became known as Social Accountability International (SAI), which serves as the accreditation body and has accredited independent third-party registrars to assess and monitor conformity to the standard. SA 8000 requires transparency in the form public reporting of objectives and performance (for more information, visit***: http://www.cepaa.org***).

AccountAbility 1000 (AA1000)

Published by the Institute of Social and Ethical Acountability, a UK-based organization in 1999 (revised in 2002), the AA1000 Framework was developed to address the need for organizations to integrate their stakeholder engagement processes into daily activities, and to help embed the management of (and accountability for) social and ethical issues into an organization’s strategies and operations. There are many similarities between the structure (processes) of the AA1000 Framework and the ISO 9000 and 14001 specifications for quality and environmental management. A series of specialized modules (AA1000 Series) are being developed to support the AA1000 Framework. The first of these modules (AA1000 Assurance Standard) was published in 2003. This auditable standard was developed to help ensure the credibility and quality of organisation's public reporting on social, environmental and economic performance. It is a generally applicable standard for assessing, attesting to, and strengthening the credibility and quality of an organization’s sustainability reporting, and their underlying processes, systems and competencies. The AA1000 Assurance Standard is specifically designed to support assurance of reports based on the Global Reporting Initiative (GRI) Sustainability Reporting Guidelines (for more information, visit***: http://www.accountability.org.uk***).

Global Reporting Initiative Sustainability Reporting Guidelines (GRI)

In an effort to facilitate the preparation, use and verification of sustainability reports, and encourage comparability and generic reporting principles, the Global Reporting Initiative (GRI) has published Sustainability Reporting Guidelines. The GRI was convened by the Coalition for Environmentally Responsible Economies (CERES) and the United Nations Environment Programme (UNEP) in 1997, and incorporates the sustainable reporting principles and initiatives of a number of non-governmental organizations, consultants, universities and other stakeholders from around the world. The GRI Sustainability Reporting Guidelines are designed to facilitate the reporting by organizations on the economic, environmental, and social dimensions of their activities, products, and services. The Guidelines (initially published in March 1999 and revised in 2002) attempt to account for the linkage between the economic, environmental and social aspects of sustainability, and elevate the concept of sustainability reporting to the level of general acceptance and practice now accorded to financial reporting, and to a lesser extent, environmental reporting (for more information, visit: ***http://www.globalreporting.org***).

Occupational Health and Safety Management System (OHSAS 18001)

ISO has yet to introduce occupational health and safety (OHS) management system specifications, however, these have been introduced by others and include: BS 8800 *Guide to Occupational Health and Safety Management Systems*, introduced by the British Standards Institute in 1996; *Occupational Health and Safety Management System: A Guidance Document*, published by the American Industrial Hygiene Association in 1996; and most recently the British Standards Institute specification OHSAS 18001 *Occupational Health and Safety Management Systems: Specification*, introduced in 1999. OHSAS 18001 *Occupational Health and Safety Management Systems: Specification* is the only standard against which a third party may certify an organization. The OHSAS 18001 specification is supported by a guidance document (OHSAS 18002), which provides guidance on the implementation of the elements of the specification. At the time of writing, this is the only other document in the 18000-series of standards, and is generally consistent with the ISO 14004 guidance document for environmental management systems.

The ISO 14001 and OHSAS 18001 specifications are almost identical, with the only significant differences being in the planning elements of the OHS management system (identification, assessment and control of workplace hazards and subsequent all inclusive setting of objectives) and the OHSMS requirement for the hazard assessment of proposed corrective actions. Other than minor variations in wording, the core elements of the standards are the same. The authors of the OHSAS 18001 specification (British Standards Institute) acknowledge that this was intentional, to facilitate the integration of the environmental and health & safety functions and systems (for more information, visit: ***http://www.bsi.org.uk***).

France's Sustainable Development – Corporate Social Responsibility Guide (SD 21000)

Published by the Association Française de Normalization (AFNOR) in 2003, the Sustainable Development – Corporate Social Responsibility Guide was designed to facilitate the incorporation of sustainable development principles into corporate policy and strategy and to promote the continual environmental, social and economic performance improvement. More specifically, the guide's principal objective is to aid in adapting the technical characteristics and culture of existing management systems to integrate the principles of sustainable development. SD 21000 references several existing management system specifications (including: ISO 9000, ISO 14001, SA 8000 and OHSAS 18001) as being potentially subject to review and adaptation, and describes a range of quite prescriptive implementation tasks (for more information, visit: ***http://www.afnor.fr***).

Israel's Social Responsibility and Community Involvement Standard (SI 10000)

Published in draft form by the Standards Institution of Israel in 2001, the Social Responsibility and Community Involvement Standard sketches criteria for leadership and policy implementation of social responsibility and community involvement. The Standards Institution of Israel is Israel's official body for the preparation and publication of Israeli standards. The standard outlines expectations for management and employee actions with respect to community giving and support, including levels of financial contribution, as well as workplace safety, environmental management and ethical conduct. Specifically, the SI 10000 standard stipulates: workplace environment (health & safety and employee development) performance criteria; requirements for environmental management systems; the need for an ethical code of conduct; and the nature and format for public reporting. The standard references and adopts many of the elements and features of the ISO 9000, 14001 and AA1000 standards. In fact, the standard adopts in its entirety the SA8000 standard for social accountability, and requires public reporting in accordance with the Global Reporting Initiative (GRI) and the principles of AA1000 (for more information, visit: ***http://www.sii.org.il***).

Japan's Ethics Compliance Management System Standard 2000 (ECS2000)

Published by Reitaku University's Business Ethics and Compliance Research Centre in 2001, the Ethics Compliance Management System Standard 2000 covers issues of both ethical conduct and social contribution, with priority placed on activities to control and reduce negative social impacts. The standard places some emphasis on organizational efforts to comply not with only the letter but also the spirit (ethical foundation) of relevant laws, regulations, rules, and codes of conduct. With the exception of Isreal's Social Responsibility and Community Involvement Standard (SI 10000), which contemplates the organizational ethical conduct, this is the only standard which prescribes a management system structure for ethical compliance. While a number of Japanese companies have fashioned strong track records on environmental management and innovation in product design, a series of corporate ethics scandals in 1997 prompted the development of this standard. It has been adopted by a number of major Japanese corporations, including Hitachi Chemicals, Mitsubishi Real Estate and Sumitomo Bank. This standard also references and adopts many of the elements and features of other management systems standards, in particular the ISO 9000 and 14001 standards, and is based on the Plan, Do, Check, and Act (PDCA) framework (for more information, visit: ***http://ecs2000.reitaku-u.ac.jp).***

The Natural Step Management System (TNS)

The Natural Step (TNS) was developed in 1989 by a Swedish oncologist, Karl-Henrik Robert). This strategic planning tool is founded on four scientific principles and system conditions, and has been described as the compass that guides traditionally defense, reactive management systems such as those based on the ISO 14001 standard (Burns, 1999). The system conditions, upon which the TNS management system is based, stipulate: the fair and efficient use of resources, the protection of the productivity and diversity of nature; limitation on the introduction of materials into the ecosphere at rates faster than they can be assimilated back into nature; and limitation on the consumption of finite resources. The TNS framework, designed to be integrated with ISO 14001, proposes to help organizations see their operations in a broader context, and expand the scope of the EMS from the local to the global environment (for more information, visit: ***http://www.naturalstep.org***).

SIGMA Project

The SIGMA Project (Sustainability Integrated Guidelines for Management) is a partnership between the British Standards Institute, Forum for the Future (a leading sustainability charity and think-tank), and AccountAbility (the international professional body for accountability). The initiative was launched in 1999 with the support of the UK Department of Trade and Industry. The project was initiated with the recognition that while organizations are increasingly recognizing the need to manage the social, environmental and wider economic impacts of their organizations ' activities, they are unsure of how best to act. SIGMA is based on a set of Guiding Principles that help organizations to understand sustainability and their contribution to it, and a management framework that is designed to help organizations integrate sustainability issues into core processes and mainstream decision-making. The SIGMA Guiding Principles provide a model reflecting what an organization working toward sustainability might look like, with the management framework providing the structure of the system to help achieve that vision. The principles are based on the holistic management of five different types of capital (human, natural, social, manufactured and financial) that reflect an organization's overall impact and wealth, and on accountability, by being transparent and responsive to stakeholders and complying with relevant rules and standards. The SIGMA framework is closely aligned with the existing ISO management system standards already described, as well as the accountability standard AA1000, using the Plan, Do, Check and Act model. The actual phases of the management framework are: leadership and vision, planning, delivery, and monitor, review and report. As with other sustainability-related standards, there is an emphasis on flexibility and transparency, with annual public reporting following the Sustainability Reporting Guidelines Global Reporting Initiative. It has been adopted by a number of major corporations in the United Kingdom, including Boots Group PLC, Marks & Spencer and the British Airport Authority (for more information, visit: ***http://www.projectsigma.com***).

Framework for a Sustainability Management System Standard

As noted previously, most environmental managers agree that it is impossible to maintain compliance with the myriad of environmental regulations without some form of environmental management system: the ISO 14001 EMS specification is an effective tool to help organizations manage their activities, products and services which interact with the natural environment. The same can be said for the challenge of sustainable development: it is impossible to address and effectively manage the range of environmental, social and economic issues facing organizations today without a management system. With all of the different standards and guidelines cited above, the task must appear even more daunting. Firms do not want to have to manage a suite of management systems that are not all compatible or comparable in scope, intent or applicability. In fact it is probably fair to say that many organizations are confused by the quantity and varying quality of sustainability-related initiatives now in the marketplace, and are intimidated into doing nothing.

As many more organizations decide that they must address the principles of sustainable development, there is a growing need for a tool to help them to define and address what these principles mean and how to implement them throughout their organizations. To satisfy a diverse and rapidly evolving global market, this tool must be simple, flexible and generic enough to apply to a range of organizations. As Swift (2002) commented, these standards "*act as a lighthouse, warning companies away from the rocks of non-uniform practice, and offering a beacon for shrewd business owners*".

Published by an international body such as ISO, which is known for balanced and market-accepted standards, a sustainability management system standard would likely be a tool that many organizations would feel comfortable adopting and could have a big impact on our ability to meet the challenges of sustainable development.[19] This should not and would not revoke and replace existing standards: Aligning any new sustainability management system standard with existing management systems is essential. Because of the compatible format of many existing environmental management and social engagement frameworks, those firms that already have ISO 9000, ISO 14001 and/or OHSAS 18001 compliant systems would likely have in place much of the architecture and operational culture needed for implementation of a sustainability-seeking standard.

Looking ahead, any sustainability-seeking management system standard should include the following key structural components:

- Identification of and commitment to relevant substantive sustainability principles;
- Techniques for identifying and assessing the scale and scope of the firm's direct and indirect interaction with the human and natural environment;
- Processes and systems to ensure effective operationalization of sustainability commitments and objectives, and measurable, verifiable results;
- Techniques for verification of performance and progress toward sustainability commitments and objectives;
- Techniques for stakeholder engagement and public reporting and communication.

An effective approach to sustainability management will necessarily involve all five core elements, operating in an integrated fashion, and will also be flexible and practical so that it is appropriate to a wide range of firms operating in divergent environmental, social and economic settings.

Furthermore, a sustainability-seeking management system standard should include requirements or guidance pertaining to:

- Compliance with all rules and regulations of the jurisdiction in question and relevant international norms pertaining to environmental, consumer, fair labour standards, human rights, and health and safety protection, as agreed upon through a meaningful stakeholder engagement process;
- Emphasis on the less tangible and traditionally ignored aspects of business management systems, including: credibility, trust, accountability, brand, etc.;
- Processes for effective stakeholder engagement;

[19] At its General Assembly in Stockholm, Sweden, in September 2002, ISO decided that the time had come to consider the value of developing management standards on corporate social responsibility. A report prepared and issued by ISO's Consumer Policy Committee (COPOLCO, 2002) discusses the desirability and feasibility, and supports the development of ISO corporate social responsibility standards. It reflects on the fact that there is already a number of sustainability-related standards, indicating that there not only exists a considerable degree of engagement on corporate social responsibility issues, but also that there is a recognized need for such a management system.

- Contemplating the systemic, spatial and temporal nature of sustainability, and the global reach of an organization's operations when identifying and rating the significance of environmental, social and economic aspects of operations;
- Basing objectives and targets on longer-term business objectives rather than short-term risks for incremental gain;
- Attention to the human element of the management system, including: top management support, sustainability training for employees, employee empowerment, cross-functional teams and rewards programs;
- Development, implementation, and communication of corporate social responsibility, sustainable development and corporate ethics policies, including commentary on bribery and corruption;
- Use of a robust and comprehensive set of sustainability performance indicators (both lagging and leading) and performance metrics (normalized where possible);
- Training of workforce, including executives and management;
- Life cycle assessment, to identify product and process improvement (innovation) opportunities and extract environmental and social benefit from products and services;
- Focus on continuous improvement in environmental, social and economic performance, rather than conformance with the applied systems;
- Relations with communities, philanthropy, outreach and involvement; and
- Measurement and regular reporting to the full range of stakeholders and the general public.

Such a management system standard will be insufficient by itself to ensure that a firm has developed and implemented effective ethics, community involvement and support, environmental management, accountability and transparency programs. However, a sustainability-seeking management system, incorporating the items noted above, would represent a fundamental building block for organizations that have embarked on the journey toward sustainable development. Any such standard must be inherently flexible, to embrace the different social preferences of each culture, region, or society, as well as the different characteristics of each organization. It must also be able to contemplate this diversity in a consistent, creative and dynamic manner. The standard itself should not predicate the legal, ethical, and social objectives that each organization pursues. Rather, it should let each organization determine its own objectives, and require the organization to disclose these objectives to the public so as to make it possible for the relevant community (local or international, depending on the scope and scale of an organization's operations and activities) to evaluate the organization's commitment to sustainable development.

Closing Comment

While the ISO-style of standard is certainly not the only eligible framework for a sustainability-seeking management system specifications, it has been highlighted herein due to the fact that it is predicated on the Plan, Do, Check and Act framework (which has also been adopted by other sustainability-seeking management standards and guidelines) and because they are perhaps the most legitimate, widely recognized and widely adopted of all standards bodies. Most organizations like to receive recognition for their efforts in the environmental management arena, and the external certification process associated with the ISO standards has brand recognition and provides the desired seal of approval. It seems safe to suggest that this will apply equally to firms adopting an ISO-style corporate social responsibility or sustainability standard. However, these same organizations are interested in more than just taking steps to obtain a warm and fuzzy feeling. They are interested in safeguarding their reputations and profits, and are looking to take proactive, pre-emptive actions in this regard.

The systemic nature of sustainable development necessitates that sustainability management be defined in terms of multilateral environmental, social and economic relationships. Under the definition of sustainable development, it could be argued that every individual and organization has a stake or interest in the activities of every other individual or organization throughout the world. In practical terms, however, we must focus on the means and not the ends. Enduring economic and societal growth can only be achieved by embarking on the road of sustainable development. Until such a time that a fully integrated sustainability management system standard is developed, management systems such as those defined by the ISO 14001 standard, perhaps enhanced by components and elements of other sustainability-seeking standards and guidelines, should be viewed as useful tools for promoting progress towards sustainability.

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3 A Guide to Corporate Sustainability: Reflections of Two Sustainable Development Practitioners

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Abstract

A common feature of most definitions of sustainable development is a focus on how Sustainable Development should work under ideal conditions. While such utopian descriptions can be helpful, this feature raises significant barriers to operationalizing sustainable development in the day-to-day activities of real organizations. Many rank and file employees simply roll their eyes and complain that this is just another management "flavor of the month". If you ignore it long enough it will simply go away!

This paper will examine the insights of two sustainable development practitioners with over fifty years combined public and private sector experience in the development and implementation of environmental, management and sustainable development programs. The paper will describe some of the measures that can be taken to advance the objectives of sustainable development from academic policy discussions towards successful implementation based on balanced financial, social and environmental factors. The paper will make the argument that, while maintaining a focus on the larger picture is important, it is much more important to promote a cycle of continuous improvement based on much smaller but more easily measured steps.

Sustainable development is a journey and not a destination. As companies recognize this, their long term focus inevitably shifts to ever higher levels of performance. A focus on smaller steps allows the sponsor of sustainable development programs to highlight early success and thus create momentum that can sustain the program.

Keywords: sustainable development, continuous improvement, operationalization, implementation, sustainable development policy, balanced approach.

What is sustainable development?

Over the last twenty-five years industry's understanding of environmental responsibility has evolved.

During the 1970's environmental legislation in North America and Europe was in its infancy, companies resisted the promulgation of the new rules which they perceived to be an infringement on their right to freely pursue their business interests without impediment. Industry aggressively opposed the development of new environmental laws and regulation and was reticent about complying with the laws once they were in place. Compliance was brought about through enforcement by the regulator via the legal system. A loud and vocal environmental community developed, composed of individuals and groups advocating environmental and social responsibility. Even so, mainstream business and the average person did not concern themselves with environmental issues and typically ignored or ridiculed environmentalists.

By the 1980's the environmental ethic was starting to take root in Canadian society. The first phase of environmental legislation was in place, the major opposition had worked its way through the courts and it was now clear that imposing environmental constraints on business was socially and legally acceptable. During the 1980's Canadian business was learning to cope with these new rules. Environmental affairs departments started to spring up in businesses across the country. The primary focus of these new departments was on anticipating and reducing environmental impacts and ensuring compliance with the still unfamiliar legal structure governing environmental performance. At the same time the environmental community started to gain a level of public respect that was unknown in the 1970's. The overarching environmental ethic espoused by these organizations started to become a mainstream social value in Canadian culture. By the end of the 1980's public surveys were showing "the environment" to be one of the highest priorities for the Canadian pubic, even superceding issues such as poverty and employment. The pervasiveness of the environmental ethic gave rise to the social acceptance of many new ideas that are now considered to be mainstream cultural values in North America. The first recycling programs were launched and reduced product packaging became an important factor in marketing.

During the 1990's environmental volunteerism demonstrated through public recycling programs became a centerpiece of many Canadians' social values. As Canadians began to impose a somewhat higher environmental ethic on themselves, they started to demand more from companies who share the environment with them. For the most part, concern for the environment disappeared from public surveys. Not because the average Canadian was not concerned, but because it was taken for granted that the environment was important in the same way a safety on the job site is important. Concern for the environment was so embedded in Canadian culture that it wasn't even worth mentioning on surveys. Compliance with environmental laws was taken as a given. Consumers who asked companies what they were doing to improve the environment were not interested in compliance programs and reacted negatively when company officials boasted of their good compliance records. The way companies approached the environmental issue started to be perceived as a form of social contract … a measure of the company's respect for its neighbours even more than a measure of the company's respect for the environment.

At first this blending of environmental and social issues was perplexing to Canadian business. The environmental affairs groups that had sprung up during the 1970's were primarily staffed with technical specialists and for the most part were ill-equipped to manage the shift in expectations being thrust upon them by their growing list of stakeholders. Even more problematic was the complete lack of language and metrics necessary to define the "socio-environmental" phenomenon they were confronting. It was clear that this ill-defined issue involved the reduction of environmental impacts, but there was much more to it than this.

In 1987 Gro Harlan Brundtland chaired a United Nations Commission that began to bring clarity to this issue with the publication of the landmark report "*Our Common Future*". Within this report the Brundtland Commission coined the expression "Sustainable Development" which was defined to be:

> *… development that meets the needs of the present without compromising the ability of future generations to meet their own needs*[1]

This report began to place some context around the tension between environmental and social issues and between economics and social issues. The full implications of this enlightened thought process have yet to be realized.

During the 1990's many Canadian companies started to develop sustainable development policies, although for the most part these documents were simply repackaged environmental statements. This resulted in the emergence on the Canadian business scene, of the Sustainable Development specialist. Although many of these individuals had their roots in environmental practice, a foundation in science or engineering was no longer mandatory. Many of the sustainable development professionals had strong backgrounds in the social sciences or economics. Throughout the 1990s these specialists worked to achieve a more thorough understanding of the implications of sustainable development in Canadian business. As their understanding grew from the seeds planted by the Brundtland Commission it became clear that sustainable development was an integrated concept incorporating environmental, social and economic factors. Furthermore the balance between these factors, in some manner, has a profound effect on the success of businesses in Canada. The full implications of this effect are still being evaluated.

Towards the end of the 1990's these concepts were starting to percolate upwards through the management structures of Canadian businesses, with mixed results. Some companies embraced these concepts and began to restructure their business practices to more fully respond to the implications of the balance proposed in the sustainable development equation. In other companies, managers were outraged, believing that incorporating further social and environmental factors in their decision-making would limit business growth. These companies started to minimize and disband their sustainable development departments. A third group of companies began to treat sustainable development as a public relations exercise, reducing and even eliminating their internal practice of sustainable development while maximizing their publicity programs.

Companies that do not currently practice sustainable development and the publicity-hound companies are taking advantage of the average Canadian's poor understanding of sustainable development. These companies do so at their peril. Just as the environmental ethic grew from a small minority of environmentalists to become a mainstream Canadian social value, sustainable development will grow over the next few decades to become just as significant a

[1] World Commission on Environment and Development, Our Common Future, Oxford University Press, 1987

social value. The cycle will follow a similar pattern and will ultimately become normal business practice.

Based on our experience over the last twenty-five years it has become clear that success in business really does depend on the social license to operate granted by society. Companies that fall out of favor start to decline economically and either deal with the imbalance or fail. Environmental performance of companies is a key element of this social license but it is not always the greatest part of the balance. Factors such as customer relations, the treatment of employees, equity issues, management ethics, etc. are in many cases more important.

Just as anti-littering campaigns and laws were the harbingers of today's Environmental programs and standards, so is environmentalism the harbinger of Corporate Social Responsibility and Sustainable Development.

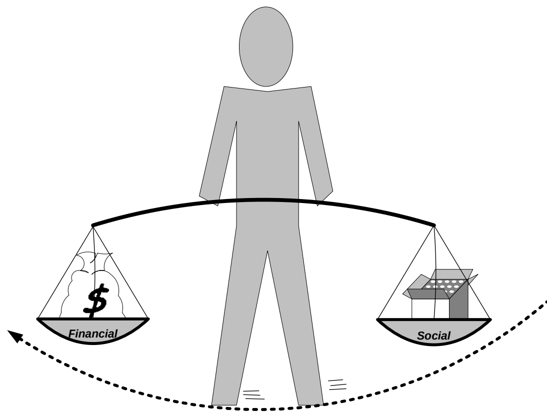
The roots of our understanding of sustainable development are in the environment, but the concept has grown to encompass a much larger and more holistic system of business analysis and decision-making. Environmental practice was only the first item on an ever-growing menu of issues contained within the sustainable development envelope. The overarching substance of sustainable development is social acceptability - the social license to operate.

Most Canadians are no longer willing to accept that this generation has the right to consume natural resources without any regard for the future. Increasingly, stakeholders are emphasizing that Canadian society is fouling our own nest. Industry is seen as the primary focus of this discontent and stakeholders are increasingly opposing the rights of Canadian business to grow in an unrestricted and unregulated manner. If Canadian business is to grow it must do so in a way that balances the needs of this generation with the needs of future generations. Only when Canadian business can convince stakeholders that this has been done to the best of their ability will stakeholders grant the companies the social license to grow. We call this phenomenon the “sustainable development imperative”. Companies that do not recognize this imperative will ultimately fail to grow. It is the job of the sustainable development specialist to sell this message inside companies and initiate proactive measures long before those companies fail. Once the sustainable development specialist, fully understands the issues that they are confronting it is their ethical responsibility to promote this understanding with the decision makers in their companies so that appropriate decisions can be made both for the company and for society at large. This is not an easy task.

In the remainder of this paper we will address some of the issues that will confront sustainable development practitioners as they continue to implement sustainable development practices within Canadian business.

The Management Dilemma

In many ways managers in modern Canadian business are like a tight-rope walker. Their objective is to move their organizations forward during very perilous times. One slip on the wire will send the manager and the organization into the abyss.



Historically, the manager only had to concentrate on balancing financial concerns, keeping costs under control, maximizing profits and contributing to the organization's progress. However, the raising social consciousness which grew out of the evolution of environmental issues over the last twenty-five years has made the manager's job much more challenging. Managers still must balance financial issues because without financial success organizations wither and die. However, this financial health must be balanced against a dynamic array of social issues which are site specific, differ for each organization and which grow and change over time.

As the manager walks on the tight-rope they carry a pole with fiscal issues suspended on one end and a package of social responsibilities suspended on the other. These must be finely balanced or the manager will start to lose footing. In the best case progress is temporarily halted as the manager readjusts the pole, gains a better sense of their footing and then starts to proceed forward once more. However, in the worst case, the manager totally loses control of the pole, loses footing and falls. Projects die before they can be approved and businesses fail.

In addition to recognizing and developing solutions to a very complex matrix of issues, a dilemma that most managers face is that tackling social issues can be very expensive. This can have the momentary impact of putting the financial elements out of balance and perhaps impeding perceived progress, a very frightening prospect for most managers.

To understand this fear one must understand the making of a manager in Canadian business. Although it is a common myth that "true" managers graduate from business schools, for the most part managers in Canadian business are created by the organizations that employ them. Generally, they are university-educated professionals who have demonstrated strong abilities in one element of the company's core business: engineering, finance, human resources, etc. They are usually very good at this one element of the business and have had much career success based on this ability. They are generally demanding, self-confident, and through experience, politically savvy. It is almost certain most of them have not had to manage social issues to any extent over the course of their career, or if they have, they have viewed them as momentary bumps on an otherwise smooth road. When they reach senior management, suddenly it becomes important that they become fluent with many different facets of the business. However, even at this point they are unlikely to consider stakeholder issues as anything more than an annoyance that must be ignored or mitigated. Unlike the cartoon caricature of managers, these are typically very bright, successful people, but they are people who are learning to cope with a range of issues well outside of their training and experience. These new issues are costly and do not seem to have any immediate link to their own personal success or the success of their organization. The logic that made the manager a success is being challenged by the evolution of Sustainable Development. They have trouble believing the message and have a tendency to shoot the messenger.

<u>So what are these social issues?</u>

There is a broad range of matters which we loosely classify as social issues. These issues have always confronted Canadian business but historically have been managed intuitively by Canadian business leaders. Those companies that got it right tended to be very successful while those that didn't failed to flourish.

The issues vary depending upon a number of factors:

- Location,
- The businesses environmental footprint,
- The products produced by the company,
- Competitors' behaviour,
- The philosophies of the current government,
- Disputes between various levels of government,
- The environmental sensitivity of the local population,
- Proximity to a university,
- The degree to which local governments support social issues,
- The level of union activity,
- Age of the workforce,
- Cultural make-up of the workforce,
- Gender split within the workforce,
- And more.

Some of these issues are internal company issues while others are broader social issues. Even though these factors may seem to have very little connection with each other, the factors all have influences on the way a company's stakeholders perceive and respond to the company's business activities.

To compound the problem, stakeholders are not a homogeneous group with one set of values. In reality, companies confront a broad range of stakeholder groups with diverse and competing interests.

To achieve success, managers must balance all of these elements in a way that creates three primary groups of stakeholders:

1. A large group that is very supportive of the company's activities,
2. A group that, under other circumstances would vocally oppose the company's activities, who are nonetheless content that they have been heard. Although they don't generally agree with the company's activities they will not aggressively oppose them. The attitude of this group can range from indifference to quite acceptance.
3. A group that will always say no, who have actively participated and whose influence has been limited through the process. Through active engagement with this group the company has confronted their issues and has taken all reasonable steps to address their concerns. Other stakeholders see that the company has acted in good faith and does not lend support to this group. Generally the intention with this group is to shift as many as possible into higher levels of acceptance.

The primary difference in today's business environment is the growing expectation of individuals and groups that they have the right to intervene in a company's activities. They have a right to express their opinion and they demand to be heard. Since the 1970s legislation in Canada has recognized these rights, and in many cases requires companies to cover the costs of the stakeholder's intervention.

When a group of stakeholders is dissatisfied with the company's response they react in a number of very predictable fashions:

- They stop buying the company's products and encourage others to do the same,
- They bring action in the courts,
- They generate anti-company publicity, sometimes with great success, and
- In the more extreme cases they demonstrate at corporate events, picket company facilities and generally obstruct the company's affairs.

In the past, the general public has questioned the respectability of these actions and in some cases has viewed the behaviors to be legally actionable. Not so any longer. Today, these behaviors are commonplace and are viewed in many quarters to be heroic acts.

Today's managers operate in an environment where they can no longer rely on their intuition to manage these corporate environmental and social responsibilities. Inability to adequately confront these factors, or at least be perceived to be attempting to do so, results in spectacular, public and very embarrassing failures.

These social issues combine to create the new business climate, where sustainability is the watchword. To grow a business in this climate, managers must effectively identify and respond to stakeholder expectations, incorporate changes to the business that truly reflect sensitivity to these issues, all the while managing the financial integrity of their organization. This is the purview of sustainable development.

Sustainable Development: Timing and Verifiability

One of the larger problems confronting the sustainable development practitioner is the discontinuity between the timing of social issues and the normal financial reporting cycles of business. Social issues can take a long time to emerge, mature and fully impact business activities. Today's problems are quite often rooted in actions taken by the company a number of years previously. Even worse, social issues can be created by ongoing corporate behaviors that are ingrained in the company's culture and transparent to its employees. Since there are no obvious effects, there is no immediate incentive to correct the behaviors.

Conversely, corporate financial performance is not only measured and monitored routinely but is also compared to estimates and goals. It is common to report financial results monthly, quarterly and annually. Managers' performance is normally assessed on their ability to deliver results on the same business cycle.

It is much less common to report corporate financial success on a three or five year cycle. Some companies prepare five year plans, but the plans are only used for reference and are not typically used to monitor corporate performance or reward employees.

These discrepancies result in a significant disincentive to traditional managers to respond to social issues and embrace sustainable development practices. The results of sustainable development are quite often realized over a longer cycle which is out of sync with the traditional financial management and reward cycle of Canadian business. Adherence to the longer viewed sustainable development cycle is seen by many managers to be career limiting.

The results of sustainable development are also difficult to demonstrate. In business, sustainable development embodies a significant element of risk management. Successful risk management prevents bad things from happening. However, it is very difficult to prove that any particular action contributed to preventing the dreaded event. Managers question whether sustainable development practices have had any material success since it is difficult to quantify the beneficial effects of avoiding a negative outcome. It is easy to question whether the event would have ever occurred and therefore question the spending on sustainable development.

Trust

Before the invention of electronic marine navigation instruments, a sentinel was stationed in the ship's crow's nest. They had a clear and unobstructed view of the waters around the ship which was not available to the captain or the rest of the crew. The captain had to trust the sentinel and be willing to act on his directions or the ship could flounder. This is fundamentally the same role as the modern sustainable development professional. The sustainable development professional looks out of the corporate bubble. They act as the company's sentinel, always on the lookout for evolving risks and opportunities and forewarning the company's leadership of troubled waters – and a course correction or clear passage ahead – and steady as she goes.

The company sustainable development specialist has a number of roles. Some of these functions are not readily understood by managers not versed in the sustainable development ethos. The sustainable development professional must:

- Track and understand evolving environmental and social trends,
- Analyze the impact of shifting social trends on the current and forecast business activities of their employer,
- Communicate their findings within the company,
- Recommend improvements to company practice and direction that anticipate the identified social trends and place the company in a position to better manage or profit by the change in social values, and
- Educate other managers and employees about sustainable development to better prepare the organization to understand and implement their recommendations.

Most importantly the sustainable development professional must engender trust with the rest of the company's leadership, rank and file employees and with external stakeholders. With trust comes receptiveness to their recommendations. The fundamental question facing most sustainable development professionals is how to create this trust.

This is not an easy question. As we have previously discussed, sustainability issues are foreign to traditional corporate managers. These issues do not present the prospect of immediate reward and they have the image of being soft and non-measurable. Conversely, the sustainable development professional must fundamentally believe in the rights of stakeholders and the long term risks presented by failure to address stakeholder issues. In this regard sustainable development professionals can be very different from the other managers within the company.

It is a fine line that the sustainable development professional treads. From the inside of a company they can be perceived to be “too green” - environmentalists in suits that present an internal threat to the order of the company. From the outside they can be perceived to be “too corporate” - company hacks that mouth the right things but have no power or authority to deliver the goods. The sustainable development professional must develop the skills to be fully fluent in both quarters, able to communicate effectively both in the board room and in the living room and able to translate the issues into language easily understood by both parties. If the sustainable development professional learns these skills and applies them effectively they can start to earn respect and trust in both quarters. Unfortunately, this is a dynamic balance and the specialist must always be ready to manage the perception that they are misleading one party or the other with the aim of promoting their own position. This is not an easy job. It takes a unique blend of social skills, education and thick skin to pull it off.

Primarily, the sustainable development professional is retained by a company to be the social conscience for the corporation. In many cases however, once the professional is on staff they are viewed with skepticism since the professional’s advice is often outside of the experience of other managers on the leadership team. The advice may be interpreted by other managers as a personal challenge to their ethics and they can respond in aggressive and personal ways.

One way around this issue is to consistently remind the company leadership that sustainable development is a risk management activity. The risks that the professional identifies do not represent their personal values but rather are a professional assessment of potential outcomes based on training and experience. Even with this, the professional may often have to face the brunt of the frustration of the company’s leadership and remain calm when they are being accused of being “too soft”, “too green” or “too left-winged”.

Remaining calm in the face of this frustration is a key element of growing trust. A calm demeanor communicates professional confidence in one's position and will often diffuse a sensitive situation.

Working on the Inside: Continuous Improvement

The discontinuity between traditional management cycles and the sustainable development journey is one of the primary threats to the credibility of a sustainable development initiative and the manager responsible for it.

The sustainable development practitioner must disaggregate sustainability issues in a way that creates greater continuity with normal business cycles. One key to success in applying sustainable development within an organization is the ability to break issues down into bite-sized pieces. Fortunately, this is a process that is very familiar in Canadian business - the Continuous Improvement Cycle.

Continuous improvement is based on the idea that problems and opportunities can be better managed when a number of well defined steps are followed. These are:

- Assess
- Plan
- Implement
- Evaluate

It is a fundamental percept of this process that issues can be broken down into pieces that are more easily managed over a short period; monthly, quarterly and annually. Challenges and opportunities are analyzed and action plans prepared. A schedule is set for delivering on the actions and progress is monitored on an ongoing basis. At the end of a cycle, progress is evaluated, the overall program reassessed and new plans are developed for the next cycle. What is important is that each cycle represents an improvement over the last in a continual fashion.

The value of continuous improvement to sustainable development cannot be overstated. The extended duration of sustainability issues makes them appear to be overwhelming to the average company employee. It is not uncommon for the issue to be seen as far too large to be managed by an individual department within the company.

Large social issues are outside of the scope of the average employee. This perception can lead to a significant level of cynicism when sustainable development initiatives are broached within the company. Sustainable development may be seen by many rank and file employees as the newest management “flavor of the month”. Cynicism leads to indifference and creates the view that if you ignore sustainable development long enough it will simply go away.

One way to crack this cynicism and indifference is to apply a continuous improvement philosophy to the design of sustainable development initiatives. Break the issue down into segments that can be managed by individual employees and departments within the company. An example of how this might work with a larger sustainable development issue is outlined in the box.

When larger sustainable development objectives are segmented in this way the average employee can immediately see how they can contribute to achieving the objectives. The measurement system can be used both to plan the next stage of the program and as a mechanism for rewarding employees who contribute to the success of the program.

Conclusion

The sustainable development professional is always faced with balancing internal and external expectations. As always, the sustainable development professional must promote this balance with patience and constant reinforcement that progress is made one step at a time. The most important measure of sustainable development is not the immediate delivery of some utopian vision but rather continuous step-by-step improvement. Sustainable development is a journey and not a destination.

An Example

Breaking Issues Into Bite-Sized Pieces

Based on sustainability considerations a company has decided to meet 15% of its electricity requirements from renewable sources such as wind and solar power.

Normally, rank and file employees would feel disconnected from this decision and may not feel any commitment to helping the company achieve this objective. The view would be that the initiative is being managed by senior managers and the procurement departments of the company.

In a sustainable development organization a different view would prevail. First, the underlying reasons for making the decision would always be kept in mind. Perhaps this initiative was primarily designed to address concerns from some stakeholders that the company should be doing more to promote renewable energy development. In this case, the sustainable development company would ensure that rank and file employees understood this reasoning and were prepared to discuss the overarching issues with their customers and colleagues from other companies.

As and example, one group of employees who generally feel very removed from large corporate policy initiatives are the Call Centre staff who answer the telephone and are the front line in addressing customer and stakeholder concerns. These people may feel no commitment to the proposed policy on renewable energy procurement. This can be very bad. They may receive phone calls from concerned stakeholders. In responding to these queries the lack of commitment may be communicated to the stakeholder who will perceive it to be a corporate lack of commitment. To the outsider, every member of the staff is the face of the company.

To address this, the company should establish a set of objectives for each part of the organization covering the renewable energy procurement policy. For the Call Centre staff these may be:

- Politely and efficiently answer general questions about the renewable energy procurement policy,
- Direct more detailed questions to those professionals within the company who have a deeper knowledge of the technologies being considered, and
- Satisfactorily address customer queries in less than twenty-four hours.

Question and Answer summaries can be prepared in advance and the Call Center staff can be briefed on the issue.

The overall renewable energy objective is supported by ensuring that stakeholders are always treated with respect and demonstrating to the public that the company is knowledgeable about and committed to its renewable energy policy.

This approach breaks a very large issue down into bite-sized pieces that can be managed by rank and file employees. The rank and file is not responsible for the overall issue they are only responsible for that piece of the issue that is in their direct control. They can commit to this piece of the policy. The overall success of the policy is built on successfully delivering on the smaller parts.

4 Environmental Sustainability through Knowledge Management

Anne Papmehl

Abstract

Innovative management practices in sustainability often result from the deft utilization of an organization's intellectual capital, also known as knowledge management. This is easier said than done, but it should not be surprising as we shift from the industrial age to the knowledge economy. Knowledge is the new means of production and environmental sustainability is a logical place for its application.

This chapter examines how six Canadian organizations with an official environmental or corporate social responsibility agenda are leveraging their collective corporate intelligence to become environmentally sustainable and achieve competitive advantage. How do they deploy their human, structural and relational capital—the three established constructs of intellectual capital (IC)[1]—to develop innovative products, processes, systems and management practices that minimize the environmental footprint while maximizing operating efficiency and cost savings?

These six case studies represent a cross-section of industries and sectors: science and technology, hospitality, manufacturing, financial services, energy and forestry. We shall study the companies' respective applications of IC in their pursuit of environmental sustainability and how and whether these practices are making them better knowledge managers.

This chapter expands on an earlier article from the author, entitled Kyoto Capital, published in the July / August 2003 issue of CMA Management.

Keywords: knowledge management, innovation, sustainability, systems, leverage, application.

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[1] As defined by the IC field's scholarly pioneers: Karl Erik Sveiby, Leif Edvinsson and Hubert St. Onge. For an overview, see, A Brief History of the ICM Movement," by Patrick H. Sullivan, 2000: http://www.sveiby.com/articles/icmovement.htm.

Introduction

Two parallel revolutions are transforming business practices and wealth creation: one is the knowledge revolution and the other is the transition to a sustainable global economy. Increasingly, in both the workplace and marketplace, there is evidence of convergence and integration of these two revolutions.

For example, in September 2003, the Asian Development Bank created the new position of Vice-President of Knowledge Management and Sustainable Development.[2] The Dow Jones Sustainability Group Indexes cite knowledge management and human capital development as evaluation criteria for inclusion in the sustainability indexes.[3]

Lorinda R. Rowledge makes a compelling case for the mutually beneficial integration of knowledge management and sustainable development, stating that knowledge management "ought to be informed by and contribute to the development and realization of environmentally and socially responsible business strategies and practices." Similarly, she argues: "The pursuit of sustainability as a lever for sustainable competitive advantage contributes to creating strategic knowledge, new core competencies and strategy innovation." Moreover: "A sustainable industrial system adds new content and process requirements to the corporate knowledge management system."[4]

In the arena of environmental sustainability, knowledge management is a critical lever for turning a mission statement into an operational reality. This chapter examines how six Canadian companies are using knowledge management in their pursuit of environmental sustainability, and how and whether their respective environmental innovations are changing the way they manage knowledge.

Knowledge management in this chapter refers to the management of intellectual capital along its three established constructs—human, structural and relational capital. Some brief explanation on how these three constructs apply within an environmental sustainability context might be helpful to the reader.

Human Capital refers to the collective talent, expertise, education and embedded knowledge of a company's employees. Human capital drives the innovation, research, thinking and ideas behind a company's sustainability pursuits, but to leverage it, a company must have it. How do SD companies attract and retain human capital, and does the presence of an SD mandate play a role? What measures are sustainable companies using to ensure that their human capital functions at optimal level? What are their training and development initiatives around sustainable practices? What type of

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[2] See: press release: www.adb.org announcing the appointment of its Vice-President, Knowledge Management & Sustainable Development, G.H.P.G. van der Linden. This is a newly created position and Mr. van der Linden is its first incumbent.

[3] See: http://www.sustainability-indexes.com/htmle/assessment/criteria.html - Criteria and Weightings for Corporate Sustainability Assessment: human capital development and knowledge management/organization learning are ascribed ratings of 1.8 and 3.0, respectively.

[4] *Knowledge Management for Sustainable Value Creation.* Paper presented at the 1999 Greening of Industry Conference, Chapel Hill, North Carolina. May be viewed on Web: http://www.ekosi.com/samples/km.pdf.

organizational culture helps sustainable companies derive maximum benefit from their human capital? How are these companies putting the knowledge, talents and ideas of their human capital to sustainable benefit?

Structural capital refers to the structures, systems and technologies that a company uses to store, manage, share and flow knowledge. As new knowledge is acquired through sustainability research and operational pursuits, new knowledge capture systems are needed. What systems and structures are sustainable companies using to capture, systematize and share this new knowledge? Are their sustainability pursuits leading them to discover new knowledge management systems and technologies?

Relational capital (formerly known as customer capital) refers to the knowledge embedded in the value chain through a company's relationships with customers, suppliers, regulators and any other external entity or stakeholder. Stakeholder engagement, though inclusive of both internal and external stakeholders, is nevertheless a form of relational capital that is common to many sustainable companies. How are sustainable companies using their relational capital, particularly their stakeholder engagement initiatives, to learn, teach, share and exchange knowledge?

As a separate entity, knowledge management is strategically significant to profitability, and the majority of Canadian CEOs and senior managers recognize this, at least in theory. At the practitioner level, however, statistics reveal a different story.

According to the Saratoga Institute, part of the human resources research and consulting arm of PriceWaterhouseCoopers in San Jose, California, the standard voluntary turnover rates across all industries in Canada is 15 per cent, with the involuntary turnover rates (death, disability or firing) at 5 per cent. In total, twenty percent of knowledge assets are leaving the company each year. (Papmehl, 2004, p. 26)

Ironically, the reason for these high voluntary turnover rates, as elicited from exit interviews, has to do with knowledge worker employees feeling that they are using only a fraction of what they could offer. They leave, largely because they feel there are better opportunities elsewhere, suggesting that knowledge workers derive satisfaction from challenging and using their minds.

Preliminary studies suggest that a company's sustainability mandate or branding might be a factor in attracting and retaining top knowledge workers and that talented workers are motivated to contribute more of themselves to a company that has an exciting mission, where people feel they are making a difference. (Willard 2002, pp. 34-37; 41-43)

Might sustainable practices, by their very IC-intensive nature, be a channel by which a company develops superior knowledge management abilities? Conversely, does a company's superior ability to manage knowledge help it to become more environmentally sustainable?

One feature of sustainable development practices is each unit of analysis extends to include the entire life cycle of product or service across an entire extended value chain. Value chain management and problem solving engage both the deep and broad thinking of the company's individuals (human capital), which in turn leads to new findings, discoveries and information which can be assembled and systematized into various management structures and tools (structural capital). In addition, value chain management also tends to rely heavily on stakeholder engagement (relational capital) both internally through people communicating across departments, divisions, plants and teams and externally, through communication and interaction with suppliers, customers, NGO partners, government, industry associations and residents of local communities.

Another feature of sustainability practices is viewing environmental problems as business problems. Michael Porter of Harvard University has argued that analyzing business problems through an eco-lens encourages innovation and resource productivity.[5] This does not always necessitate a large research and development (R&D) investment; sometimes a simple and cost effective idea or innovation can yield significant benefits. Thomas Stewart (1997, p. 67) draws attention to this fact, though not in a sustainability context, citing General Electric CEO, Jack Welch, on small "i" ideas yielding up to 6 to 7 per cent yearly productivity gains. Small ideas and measures have a place within a sustainability framework as well.

In some cases, a sustainable innovation may achieve many benefits or solve many problems at once. For example, as a result of trying to minimize its use of raw materials, the company might discover a new process that is safer, less time consuming and reduces energy use. In attempting to reduce greenhouse gas emissions, it might also find ways to save money. By looking at ways to manage waste more effectively, the company may discover previously untapped markets and new sources of revenue.

Additional knowledge discoveries may be found, concomitantly, such as improved organizational learning, new ways to systematize knowledge, new ways to approach problems, new data to add to the company's data base, better training and development strategies, technology transfer and new management strategies.

New sustainable discoveries in business may also have an effect on the external world. In his discussion on Fourth Era Corporate Environmentalism, Carl Frankel (1998, p. 83) calls for corporations to attack un-sustainability externally as well as internally: "To adopt the worlds problems as their own—that is one of the great leaps forward of fourth-era corporate environmentalism." How are Canadian sustainable businesses using their innovative capacity to change the world around them?

The six case studies presented here represent a cross section of industries and sectors: DuPont Canada (Science and Technology) Fairmont Hotels & Resorts (Hospitality), Husky Injection Molding Systems Ltd. (Manufacturing) RBC Financial Group (Financial Services), Suncor Energy Inc. (Energy) and Tembec (Forestry). Owing to their tendency to overlap, I have avoided discussing the three elements of IC in a prescribed sequence, opting instead to let the discussions evolve organically.

DuPont Canada

Headquartered in Mississauga, Ontario, DuPont Canada is a diversified science company, with customers across Canada and in more than 40 other countries, and

[5] Frankel, Carl. *In Earth's Company: Business, Environment and the Challenge of Sustainabilty.* Gabriola Island, British Columbia: New Society Publishers, 1998. p. 126.

approximately 1,200 employees. In 2001, the company formalized a set of sustainable growth goals, which it plans to achieve by 2010. These goals include: deriving 25% of revenue from non-depletable resources, reducing material intensity, driving eco-efficiency throughout its value chains, adopting cleaner technologies and reducing greenhouse gas emissions.

While the footprint aspects of sustainability (health, safety and the environment) are a long-established part of the company's core values and culture, DuPont now sees itself walking the bridge to sustainability's opportunistic side: taking advantage of emerging markets and meeting the needs of people around the world. The company is attempting to integrate this into its corporate culture by using the footprint aspects as a learning platform to encourage employees to think about new approaches to sustainable growth and by bringing the innovation flavour of sustainability into its hiring and recruiting efforts.

While DuPont has a history of hiring people whose values match those of the company, a factor which the company credits for its low voluntary employee turnover, the add-on innovation value is expected to be a determinant in attracting highly productive and innovative human capital, who can help the company carry out its sustainable growth agenda.

Innovative thinking around sustainability is recognized through the annual Sustainable Growth Awards. The majority of award recipients are either small teams or individuals with small innovations or measures that result in large productivity gains. The company acknowledges a preference for larger number of small-scale projects as opposed to a small number of large-scale projects, believing the former to be more representative of the innovation cultural shift.

Another way that DuPont is influencing this culture shift by shifting its portfolio of businesses from resource intensive to knowledge intensive businesses, directly incorporating knowledge management into its sustainable growth framework.

In 2002, DuPont added the first of such businesses to its roster: the Food Risk Management Group™, which consults to the food and dairy industry on food spoilage and safety. While fairly environmentally sustainable to begin with, the business unit faced the challenges on the knowledge side in terms of creating systems and managing processes that a) capture people's knowledge and b) translate it into a respectable market offering. The business unit overcame this challenge by integrating sustainability thinking and taking a more holistic view of customer needs.

By mapping the entire supply chain, from the customer back, to determine all possible sources of food contamination, the unit's head discovered additional uses for the technology such as in food packaging, refrigeration, and worker safety consulting, as well as a more comprehensive understanding of the type of expertise needed by the customer and in which format the expertise would be most helpful. In addition to selling the knowledge of the mapping technology, the unit has mapped out all possible areas of interface between the company and customer and them put them into a knowledge-capture system.

Where a business opportunity requires a knowledge management component, the company is taking the initiative and can speak of best practices, of which the preceding story is an example; however, the company is not yet at the point of translating and cross-fertilizing these systems throughout the entire organization, or using these systems to manage all of its knowledge around any particular industry.

In terms of relational capital, DuPont has committed through its 2010 goals to pushing the boundaries of traditional stakeholder interaction and collaboration on all three bottom lines of sustainability. Internally, the company uses its Marketing for Growth network, attended by the sales and marketing people several times a year, to showcase new businesses and opportunities. Four employees attend the annual sessions of the Sustainable Enterprise Academy (SEA), affiliated with York University's Schulich School of Business.

An external advisory council was launched in 2003, consisting of members from academe, civil society, government and the company's value chain partners, to bring an external perspective to the company's strategy development. To help the company meet its goal of sourcing 10 percent of its energy from renewables by 2010, the company has started working with outside organizations like VisionQuest Wind Exchange, Suncor and Ontario Power Generation.

DuPont is also putting its knowledge and discoveries to didactic purposes with external stakeholders. For example, the annual Sustainable Growth Awards, in addition to being an innovation incentive, are a means to share learning and best practices outside of the company. A partnership with the Ontario Science Centre, designed to encourage innovative thinking among young people, is being used to educate on some of the sustainability aspects of DuPont's "Miracles of Science" motto.

Fairmont Hotels & Resorts

Formerly known as Canadian Pacific Hotels & Resorts, Fairmont Hotels & Resorts is a North American operator of luxury hotels and resorts in Canada, the U.S., Mexico, Bermuda, Barbados and the United Arab Emirates. The hotel chain employs 10,000 people across Canada.

In 1990, while operating under its former name, the hotel chain initiated Phase I of its Green Partnership Program in all of its Canadian hotels, with the objective of promoting property level improvements in the four operational areas of waste management, energy conservation, water conservation and purchasing.

A 1997 internal follow-up audit determined the company had met and in some cases surpassed its original goals. In 1998 the hotel introduced Phase II of the program, much of which is externally focused, to areas such as community outreach, preservation of endangered species and habitat rehabilitation. The following operational initiatives are now more or less brand standard across Canada, with many individual hotels undertaking additional greening initiatives of their own:

Waste Management: Paper use reduced by 20 per cent; recycling boxes in each guestroom across Canada, donates used soaps, towels and furniture, as well as unclaimed lost and found items to local charities; and, purchases items such as milk, cream, cereals and sugar in bulk.

Energy Conservation: All lighting retrofitted from incandescent to compact fluorescent bulbs; rooms equipped with water efficient shower-heads and tap aerators, standard temperatures set for all domestic hot water tanks.

Water Conservation: Low flow showers, taps and toilets; optional towel and linen exchange programs to conserve water, energy and detergents.

Purchasing: Seeks to purchase environmentally friendly products such as unbleached kraft and recycled paper, biodegradable soaps and shampoos, replacing aerosol products with ozone-friendly alternatives; alliances with local organic growers for the purchase of organically grown foodstuffs; and, negotiates with suppliers to eliminate and reduce excess packaging.

How did Fairmont use its intellectual capital to bring these changes about? At the beginning of Phase I, a chain-wide employee environmental survey was circulated to all of the company's employees, asking them a) how they felt about introducing a green program and b) to contribute environmental stewardship ideas.

With the help of an external consultant, the company developed a Plan of Action, putting many of the employee ideas and suggestions into practice. While Fairmont's human capital was a significant driver behind these greening initiatives, only a small percentage of that human capital consisted of knowledge workers. The majority of useable ideas were contributed by front line people—floor maids, doormen, chefs, banquet managers, security and service personnel—non-knowledge workers who nevertheless had the capacity to contribute ideas and make suggestions.

The Green Partnership Program was the mechanism, which captured and catalyzed the employees' embedded knowledge, by encouraging environmental leadership at each employee level and by implementing employees' suggestions.

A formal structural capital element ensured and continues to ensure an ongoing flow of ideas. Each property has an on-site Environmental Committee or Green Team, consisting of volunteer employees, who commit their time, energy and divergent perspectives in helping the hotel achieve integrated environmental stewardship. Any employee, regardless of level (management or front line) may volunteer.

It is perhaps the strict guidelines that the Teams must follow which account for their success.

Attempts are made to keep Team membership manageable (restricted to ten people) and diverse, consisting of representation across departments: housekeeping, laundry, grounds and recreation, engineering, kitchens, purchasing, communications and general management.

Each Team consists of a Chairperson, elected annually by the Green Committee, who assumes the role for a minimum of one year. The chair also assumes an official second title of Environmental Champion, also for one year. This individual plays a critical role in implementing, promoting and supporting the hotel's initiatives, and is expected to take significant responsibility for ensuring that the hotel meets its stated environmental goals as well as hotel-specific and corporate objectives.

Through this one position, the hotel leverages a fair amount of relational capital in its sustainability pursuits. The environmental champion is required to communicate and raise awareness of environmental issues among employees, as well as develop relationships with environmental champions on other properties, and serve as leader, manager, information gatherer, communicator, motivator and ambassador.

Fairmont relies heavily on the environmental component of its Intranet site, known as the Green Web, to communicate its green initiatives to all of its employees. The Green Web lists approximately 200 environmental initiatives that Green Teams can undertake. The site also serves as an incentive to keep the motivation high among its employees. When the 1997 audit revealed that the Teams were starting to run out of steam and ideas, the hotel followed up with an incentive program as part of Phase II, called "Seeing the Forest AND the Trees." The hotel that contributes the highest number of environmental initiatives in one year receives a one-week, all expenses paid eco-exchange trip for all ten Green Team members. In the past few years, winning hotels have completed over 100 environmental initiatives in one year.

Many of these greening initiatives require a strong relational capital component, involving collaboration with various stakeholders—suppliers, customers, charitable agencies, recyclers and environmental groups. Fairmont coalesced the findings of its extensive stakeholder engagement work carried out in 1990 into a handbook, called The Green Partnership Guide: A Practical Guide to Greening Your Hotel (first published in 1990, followed by a second edition, with foreword by Dr. David Suzuki in 2001). The Guide is available to all hotel Green teams and employees upon request, as well as other businesses or interested individuals. The guide takes readers through the entire greening process such as: how to organize to succeed, specific goals to a greener planet, greening one's meetings/conferences and events, preservation of endangered species and outreach programs, and education on environmental issues such as habitat destruction.

<u>Husky Injection Molding Systems Ltd.</u>

Located in Bolton, Ontario, Husky Injection Molding Systems Ltd. is a designer, manufacturer and supplier of injection molding equipment for the plastics industry. The company also provides services in the form of factory planning, customer training, integration of production systems and project management for turnkey factories. Operating manufacturing facilities in Canada, the United States and Luxembourg, in addition to services and sales offices in over 100 geographies, the company employs approximately 3,000 people worldwide, 1,400 of which are in Canada.

Though recognized internationally for its progressive practices around environmental sustainability, Husky views sustainability is an extension of its founder and president, Robert Schad's basic philosophy that business success is rooted in doing things right—having the right facilities, producing a superior product, treating customers well and giving employees the tools to do their jobs.

As a producer of injection molding machines, Husky's main innovation drive is product innovation. This drive is closely aligned with Husky's sustainability mandate—a more innovative product consumes fewer resources, corresponding neatly with the sustainability agenda, but is also less expensive to produce and costs less to the customer, fitting into the business agenda.

This consciousness at the top has created a culture that integrates sustainable practices into nearly every facet of the organization: hiring employees who, in addition to being knowledgeable, qualified and capable of innovative thinking, also share the company's values; seeking out suppliers with environmentally-responsible products and practices; and, weaving eco-efficiency principles into the design of its factories and facilities. The company occasionally seeks out new best practices, visiting and studying other sustainability practitioners and benchmarking itself against them.

Believing that the work environment and productivity are strongly connected, the company treats its people (human capital) well. Initiatives such as natural day lighting, good air quality, proper shift schedules, employee wellness programs, a subsidized cafeteria that serves healthy, organic food and on-site day care yield payback in terms of better performance from the company's employees and serve to attract high quality talent.

Unlike a Coca Cola or Bell, where brand recognition is in the product, Husky's product is little known outside of its own industry. Outside of the plastics industry, Husky's reputation is based on its values and sustainability best practices, as opposed to its product. The values, culture and progressive work environment are strong selling points, and are powerfully communicated by the human resources department, and are vital to its recruiting efforts.

There is a high expectation that employee personal values align with those of the company. Candidates are patently asked during job interviews about their volunteer work and whether they drive fuel-efficient vehicles. While critics may regard these initiatives as intrusive, Husky finds that by hiring people whose values align with those of the company, it ensures a richer base of productive human capital who will contribute ideas, thinking and innovation, to fulfill both the sustainability and broader business agendas.

The company rewards employees for their personal initiatives through an incentive program called Greenshares. Through Greenshares employees can earn company stock by performing environmentally and/or socially responsible deeds, such as carpooling or bicycling to work, purchasing a hybrid car, replacing their gas lawn mowers with hand mowers or volunteering in the community.

In terms of generating ideas around innovation, Husky is not a big "suggestion box" company. The president holds employee roundtables every six weeks, soliciting their ideas and suggested improvements. The minutes, along with answers to any issues that arise from the meeting, are distributed to all Husky people following the roundtable. There are no 'employee of the month' or 'rewards for ideas' initiatives. A strong culture of teamwork prevails and the contribution of ideas through teams is part of each employee's job—whether directly related to the specific sustainability agenda or to the broader business agenda.

The company reports that its use of structural capital is one area that could use improvement and sees the value of having global access to knowledge. One of its challenges has to do with parallel initiatives in different locations worldwide that could be much better coordinated; however, with its small size and global dispersion, it would be difficult and costly to build the infrastructure and have them properly connected to the organization.

Through its relational capital, Husky is promoting sustainability in an instructive way. Having sales and service as one entity puts the company much closer to the customers. Because the company is a supplier of premium equipment and has to sell value, customer relationships are focused on customer needs.

The demand for sustainability services is not high; however, because sustainability is Husky's modus operandi, it will incorporate environmental and sustainable practices into its clients' factory design, independently of being asked.

For example, Husky is building a new Technical Centre in Shanghai, reported to be the most energy efficient building in all of China of its kind. Though the energy efficiency benefit is not being requested by the community, Husky is bringing it to the community as an ancillary benefit, anticipating the enormous energy problems and costs in China. The company also has active community interaction programs, and recently involved the local residents in the design of its new facility in Vermont.

In terms of partnerships, the company reports it has fewer than its peers, largely because of time constraints: each employee has an operational job on the side. However, senior people share the company's sustainable learning by participating in conferences, workshops and speak to university and college students enrolled in environmental studies courses on an ad hoc basis.

RBC Financial Group (RBC)

RBC Financial Group (RBC) is a financial service organization, employing over 60,000 people worldwide and 30,865 people in Canada. Since adopting an official "Policy on the Environment" in 1990, the company has been branded seven times by Ipsos Reid Polling as one of Canada's most socially-responsible companies. Most recently, in July 2003, RBC adopted the Equator Principles, a set of voluntary social and environmental guidelines for financing projects in developing countries.

The foundation of the company's environmental sustainability component is environmental risk management, established in 1992.[6] That year, RBC established an environmental risk management group, consisting of three employees. The group was charged with the task of developing policies to manage environmental risks in lending, as well as providing environmental expertise where required on specific deals. In 1994-95 the bank hired an external consultant to perform a comprehensive Environmental Management System (EMS) gap analysis, from which an EMS was developed, principally to manage the bank's owned real estate.

[6] Following a number of well publicized cases in the U.S., including the Fleet Factors Case (May 1990), in which a U.S. Court of Appeals ruled that a bank could be held partly liable for cleanup costs on the grounds that it had been loosely associated with the management of the company, the banking industry in North America adopted environmental risk management strategies. See Frankel, 14.

Today, the Environmental Risk Management Group leads the bank's environmental practices, but two other functional groups have environmental impacts and influences: Real Estate Operations, which oversees health and safety and environmental issues within the bank's rented and owned buildings and the Strategic Sourcing Group, which is responsible for sourcing services and products providers for the bank, including evaluating them on their environmental aspects.

Led by the Environmental Risk Management Group, which also oversees the bank's responsible lending practices, the three departments play a role in coordinating and developing RBC's environmental programs. Environmental initiatives of the Environmental Risk Management Group are discussed with senior management through an Environmental Management Committee, while those of the two other departments tend to come from middle management knowledge workers and front line people. Different groups see the need for different practices and typically engage the Environmental Risk Management Group to implement them. Many ideas for these initiatives derive from comparisons with best in class, typically by examining the environmental best practices of leading European financial institutions.

While the company does not formally measure how many people are attracted to the company's corporate social responsibility (CSR) mandate, of which environmental sustainability is a piece, and how this affects its attraction and retention of human capital, it does report anecdotally that many new hires have been attracted to RBC's strong overall CSR positioning.

Though there is no bona fide environmental consciousness that permeates the organization from the top down, there are pockets of it throughout. However there is a strong, overall CSR consciousness, and the firm sees the potential in enhancing the environmental side by creating a culture of conservation and environmental awareness outside of the Environmental Risk Management Group.

While real estate and procurement are active pieces of the firm's environmental management strategies, the principal one is credit and risk, and the culture around it is strong. New account managers receive environmental training when they join the organization and the Environmental Risk Management Group trains the environmental risk managers, by visiting various units and geographies yearly to instruct on policies and procedures and ensure that new managers know where to find information. In addition, lending officers receive a small amount of environmental risk management training as part of their overall training.

RBC relies heavily its corporate Intranet to communicate policies and maintain training tools on its environmental risk management practices. The company also relies on environmental performance indicators, albeit through a rather low-tech system at present, consisting of placing quarterly or annual information on a spread-sheet and updating manually.

The bank also maintains data-bases containing all transactions that the bank has reviewed on a year by year basis, in addition to shared directories—lan drives—where all of the environmental risk files and folders and electronic project documentation are stored and accessible to all members of the Environmental Risk Management Group.

Though there are currently no formal stakeholder engagement initiatives on environmental sustainability, RBC has plans to implement them in the future. However, the company has engaged with stakeholders on an informal basis to implement some of its ecological initiatives. The FLAP program, for instance, is a collaborative effort between RBC and the World Wildlife Fund (WWF), to help migratory birds avoid collisions with buildings in downtown Toronto.

RBC also leverages its relational capital through cross-sectoral information exchanges; for instance, looking at examples of companies with whose good environmental progress and initiatives might be applicable to a financial institution, and exchanging stories on implementation.

RBC is a member of several cross-sectoral organizations, including the Conference Board of Canada's Business Network on the Environment and the National Round Table on the Environment and the Economy (NRTEE). Globally, the firm is a member of the United Nations Environment Program–Finance Initiative (UNEP-FI), which consists of financial institutions internationally. Through these memberships, the company is able to exchange information, share learning and communicate its own environmental sustainability initiatives.

Thus far, the firm reports no new knowledge management systems as a result of its environmental sustainability initiatives, but feels they could come about in the future. Though top of its class within the banking sector, the bank lags behind other sectors in terms of integrated environmental sustainability, likely as a result of having less of an environmental impact, other than through lender liability, default risk and reputation risk.

Suncor Energy Inc.

Suncor Energy Inc. is an integrated energy company, focussed on developing the Athabasca oil sands, the world's second largest petroleum resource. It employs 4,000 people across four major business divisions.

Suncor embarked on its sustainability journey shortly after becoming a public company in 1992. Being in the carbon intensive fossil fuel industry, issues of climate change and sustainability bear significant weight, especially in light of the company's increasing production schedule to meet increased consumer demand. Daily oil production is expected to be half a million barrels by 2010 to 2012.

At the same time, the company faces the prospect of a carbon-constrained future. To deal with these challenges, Suncor is developing a parallel path: attempting to reduce the environmental impact of its fossil fuel business while also researching and supporting the growing renewable energy industry. This twin mandate affords opportunity for innovative practices and thinking in many different areas of the company's business.

While the field and research laboratories are obvious places for Suncor's innovative discoveries, the company expects sustainable thinking among its human capital at every level. The Vice President of Sustainable Development leads a small team of individuals to help the businesses and individual employees integrate sustainability into their day-to-day activities.

Many human capital innovations stem from the company's substantial efforts in stakeholder engagement. As the company ventures into new and different areas of employee training and development, stakeholder engagement continues to play a role. Some recent examples are the Life Cycle Value Assessment (LCVA) training program for Suncor's engineers with the Pembina Institute for Appropriate Development and in-house Aboriginal awareness and cross-cultural workshops for employees, many of which are conducted by First Nations people. Additionally, the company has developed a Stakeholder Relations Tool Kit for employees, which was developed through the combined input of a First Nations Chief, employees and stakeholder groups. The company is in the process of developing training sessions to complement the Guide.

On the energy production side, ideas for technical innovation originate from multiple sources: an engineer spotting a new development in the literature or academic community or a team of employees who collaborate on a new idea together. In the oil sands, many operational transformations and improvements have evolved over time. Some examples are: shifting from bucket wheel extraction and conveyors to move the oil sands to trucks on shovels, which has yielded substantial efficiency improvements in plant operations; integrating energy requirements with a co-generation facility on the site, which enables all energy to be derived from waste heat from the co-generation facility; changing from mechanical movement of oil sands to slurrying, which saves energy.

Not all of Suncor's technological innovations originate with Suncor; many originate with external research agencies that the company has partnerships with. Suncor has an internal team that monitors developments on the outside world and the research realm. It is also using the venture capital market to find new technologies, through its investment in an emerging energy technology fund managed by Zurich based Sustainable Asset Management (SAM). The fund invests in early stage technologies like tidal power, wave power and advancements in wind and solar technologies. Apart from being an investment, the fund is also a means by which Suncor can identify potentially viable technologies for future adoption.

In terms of structural capital, Suncor has created an Intranet web based Technology Forum that enables sharing of knowledge from the technology field between engineers across the company. Suncor's employee members of that network are encouraged to make others in different areas of the company aware of their experiences in developing new technology solutions. This serves the dual purpose of helping the company to avoid implementing incorrect or inefficient technologies at its facilities, as well as provide a means by which the entrepreneurial spirit of individual employees can get legs. Through the forum, an individual may test an idea or engage others to work on a project.

The company's enormous growth mode and thirty to forty year learning curve in the oil sands has resulted in a great deal of knowledge, much of which is difficult to structure or systematize, because it either resides in the employees, or is embedded in the design of the facilities and the way the company runs its business.

One of Suncor's proclaimed areas of expertise is "problem solving on the fly," hard earned knowledge that comes from experiences such has having a plant in the oil sands freeze at –45 degrees C, for example.[7] When operating a complex industrial operation—where mining extraction and refining are all interconnected and on the same site—there are endless combinations of problems that can occur. With no textbooks or reference manuals to refer to, employees in the early days at the oil sans learned to solve problems through trial and error. While this presents a barrier to the firm's structural capital, it is an obvious strength on the human capital side.

Promoting sustainability through its relationships with customers and suppliers is still early days for Suncor. The company has initiated workshops with select groups of suppliers on greenhouse gases and energy efficiency. As a result, some suppliers have initiated related activities of their own: assembling internal audit teams, hiring energy managers and setting GHG reduction targets. Suncor has started to integrate LCVA into supply chain decisions and is working with suppliers on aboriginal business development, ethical sourcing, health and safety and workforce training.

The company nevertheless recognizes the utility of stakeholder engagement in order to gain multiple perspectives and diverse thinking. Research partnerships, as mentioned earlier, are an important vehicle to that end. One example is the CO_2 Capture Project (CPP), a joint venture with international industry partners and governments, including the U.S. Department of Energy, Norway and the United Kingdom. The company is also advancing some specific research of its own in this area, that includes looking at injecting CO_2 into coal reservoirs to enhance production of coal bed methane, while locking waste CO_2 into the coal seam.

The BIOCAP initiative, involving a network of researchers at universities across Canada, is another example. The project is researching how to enhance the biosphere's carbon absorption ability and how biomass might be used as a source of renewable energy.

Closer to where it operates, Suncor works with local and regional groups to gain knowledge on how to reduce its environmental footprint. For example, by engaging with local first nations trappers and environmental groups, the company developed a way to alter its seismic line construction so that wolves do not gain an advantage over caribou populations.

One innovative relational capital practice that breaks with tradition is Suncor's willingness to engage with stakeholder groups that might hold opposing views and values on a wide range of issues such as environmental NGOs and residents of local communities. The company seeks out diverse opinions and perspectives from varied stakeholders to gain more knowledge, insight and technical information, which it can then apply to problem solving and finding innovative solutions.

As a result of its sustainability drive, Suncor is forcing itself to think more broadly as an organization than it otherwise would, and to pay close attention to trends and issues that affect not only the company, but also the industry and country, and asks itself some rather difficult questions: "How does the company fit into the national and international scene?" "What technologies could be real alternatives to hydro carbon fuels?" "How does one reconcile Canada's hydro carbon resources with the climate change issue where there is potential for a carbon-constrained future?" As much as these questions

[7]Such incident actually occurred in the early 1990's, causing the facility to temporarily suspend all operations.

challenge the firm's intellectual capital, they are also a conduit to new knowledge and innovations for the company, and a motivating force to drive continuous improvement in sustainability.

Tembec

Tembec is an integrated forest products company, which produces wood, pulp and paper products. Headquartered in Temascaming, Quebec, the company employs 10,000 people and operates over 55 manufacturing units in the provinces of New Brunswick, Quebec, Ontario, Manitoba, Alberta, British Columbia, as well as in France, the United States and Chile.

While an environmental policy has been in place since inception in 1973, the company's shift to proactive, integrated environmental stewardship gained headway in 1999 and centers on two specific environmental programs: Impact Zero® designed to reduce the environmental impact at the firm's manufacturing facilities and Forever Green® to promote environmental protection and sustainable forest management.

Since 1999, Tembec has made strides in environmental innovation and stewardship, reducing greenhouse gas emissions by 26% below 1990 levels, and committing to eliminate all fossil fuel use at its processing facilities by 2008. By 2005, the company plans to have all of its forestry operations certified by the Forest Stewardship Council.[8]

The current climate within the forestry industry (ongoing U.S. lumber disputes, rising Canadian dollar and commodity price swings) coupled with many of Tembec's facilities and operations being situated in remote northern areas, present inherent barriers to attracting human capital. Despite these challenges, Tembec reports that employee turnover rates are low, jobs are filled, and the company is attracting high caliber employees from other organizations, believing that its perception as a stable and environmentally proactive company play a role. New positions, such as technology transfer specialists were created in 2003, reflecting a need for a more diverse expertise as the company grows.

Employees receive approximately 40 hours of training per year, given at the regional level because the industry operates within local contexts. Some of this training is in environmental sustainability and involves a strong collaborative component, such as partnering with environmental NGOs to train employees on issues like wildlife habitat protection or with First Nations people on cultural awareness training.

While R&D drives many innovative discoveries, the company expects contributions towards environmental thinking, innovation and productivity from employees at all levels, much of which is leveraged through regional operating groups. The technology transfer people within each group are charged with provoking discussions and implementing ideas for small measures that increase productivity, some of which have multiple benefits.

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[8] An international body that accredits the organizations that certify whether a company's forest products are sustainably managed and harvested.

For example, one employee's idea to reduce tire pressure on the trucks and trailers hauling wood has allowed for longer hauling seasons, less gravel to build forestry roads (reducing costs) and less disruption to the area because the reduced tire pressure allows the roads to re-vegetate faster.

The more the company engages with external stakeholders and constituents and attempts to find ways to overlap interests, the greater the need for comprehensive information about the resources in the areas in which it does business, and the more the need to structure and systematize this information.

The company is currently updating its forest inventory information to reflect vast changes over the past decade. Whereas the main concerns were once the size and composition of the forest, today they include environmental and aboriginal issues, new communities diversifying their business interests through tourism, non-timber forest products and bio-energy type industries.

By its R&D, regional operating groups and stakeholder engagement efforts, the company is generating a plethora of new information and knowledge. Having the systems to manage this knowledge and information was an area of acknowledged weakness, which the company feels it is now overcoming through its Forest Research Partnership, established in 2001.

The Partnership consists of Tembec, the Canadian Ecology Centre, the Canadian Forest Service (a federal government organization) and the Ontario Ministry of Natural Resources.[9] The primary thrust of the FRP is to identify technology and techniques to allow Tembec to reach its objective of increasing its annual allowable cut (AAC) by ten percent within ten years, which must be done in an ecologically sustainable manner, while also reducing operational costs, improving wood fibre utilization and enhancing future fibre quality.

Through this partnership Tembec gains access to federal and provincial governments' scientific resources as well as a means to help it coalesce and manage its new findings and learnings. Benefits accrue to the other partners as well. Tembec brings focus and money to research initiatives, and advances both governments' agendas of catalyzing forestry R&D in Ontario and Canada. CEC provides an interface with other stakeholder groups and the public at large that the other three organizations would not have working alone.[10]

Mirroring eco-efficient processes, the partnership works in a closed-loop system or cycle: identify the research needs; find partners to do the work, monitor the work, engage a variety of participants in the work; take the research findings and distill them into usable and relevant facts for practitioners, bring the practitioners in to talk about the findings and discuss implementation.

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[9] This initiative may signify preliminary steps towards a trend of Sustainable Development Consortia, or what the Japanese call "keiretch." These consortia consist of loosely linked companies that share expertise, technology, capital and other resources. See Frankel, pp. 67-68.
[10] Forestry Research Partnershp Strategic Plan. p.6.

The adoption of voluntary standards like ISO 14001 and the FSC have added extra detail and increased procedural requirements that now make it unfeasible to photocopy large documents to send back and forth.

For internal sharing of information, the company relies heavily on its Intranet to post action plans across various work units, and uses video conferencing to link people from its various facilities across Canada to exchange and share corporate information on best practices and environmental sustainability.

In terms of relational capital, there are a number of ways the company leverages internal knowledge. For instance, employees from different disciplines at the corporate level are responsible for trying to link the operating units together with examples of best practices of ideas on how to address issues. An environment committee, consisting of representatives of each of the operating groups, reports to the company's Board of Directors. Each operating group is required to report to the Board quarterly on its successes, weaknesses, failures, best practices, non-compliance and citizens' complaints.

External stakeholder engagement occurs at many levels, particularly with First Nations, residents of local communities and ENGOs—groups whose views on forest management often differ with those of the company. Like Suncor, the company leverages this relational capital to find innovate ways to solve problems. The company also engages with customers and suppliers to educate and generate discussion on sustainability issues. Since 2001, the company has undertaken the following stakeholder external engagement initiatives in that regard:

- Environmental information habitually included in dialogues with customers. (The company is currently in the process of developing a general presentation to bring to corporate level key customers. The presentation covers forestry practices, FSC plans and progress, Tembec's work on forest management issues and will be also used as a means to generate discussion on customer needs and interest in this area.)
- Had Monte Hummel of World Wildlife Fund and Tenise Whelan of Rainforest alliance address Tembec's lumber customers at a Canadian Lumberman's Association event in Montreal.
- Had John Riley of Nature Conservancy Canada and Richard Donovan of SmartWood address its paper/paperboard customers at PaperWeek in New York City.
- Presented Tembec's Environmental program to key customers in the magazine business: Rodale Press and Time Warner.
- Coordinated a field tour of its forestry operations in Northeastern Ontario for Home Depot.

Conclusions

As the preceding case studies demonstrate, innovative practices around sustainability derive from varied sources: research laboratory, teams working together, shop floor, informal brainstorming sessions, employees pondering deep and probing questions, stakeholder consultation, supply chain analysis, trial and error and sometimes plain common sense.

While certain sectors such as science and technology, manufacturing and energy tend to emphasize sustainability innovation through R&D efforts, driven by knowledge workers, others like banking and hospitality may engage both knowledge and non-knowledge workers contributing smaller but no less significant ideas towards sustainable practices.

The preceding case studies exhibit some common traits: a top down consciousness towards the environment (or corporate social responsibility) which informs the culture, decisions and operations; structures that give employees a degree of freedom to innovate, think and contribute suggestions to sustainability; and, management that actively listens to its employees and implements and rewards their suggestions. In addition, there is a tendency to hire people who share the company's values around sustainability and a strong emphasis on stakeholder engagement.

In contrast to traditional command and control structures, where information and communication flow from a central hierarchy downward, sustainable companies in general tend to flow information/knowledge from the extremities (external stakeholders) upward. These practices are reflective of an overall transition to more democratic, holistic and integrative ways to manage people and processes, and a recognition that the company must look beyond its own backyard to find solutions. From a pure knowledge management perspective, there are practical reasons for this. The world has become too complicated for senior management to mange on their own; they must rely on the skills, education and competence of employees at all organizational levels.[11]

Within a sustainability framework, the leveraging of human capital in this way is crucial not only to environmental problem solving but to finding the economic value added to sustainable initiatives. While some environmental problems are complex, requiring substantial R&D expenditures, deep thinking and analysis, others can be surprisingly simple, discovered by soliciting feedback from customers, suppliers or front-line employees, which often yield great financial benefits for the company.

The company needs to draw on a range of human capital, both internal and external, for new knowledge and perspectives, which in turn enrich the firm's knowledge base. Conversely, without engaging the entire stakeholder base, a company has limited sources of knowledge available that can be leveraged to environmental sustainability and innovation. In the cases of Suncor and Tembec, a blatant willingness to work with groups of opposing interests is stretching their knowledge capacities even further, as well as the commitment to find innovative solutions.

The company's internal thinking is also stretched as it considers—in addition to technical and operational challenges—questions of a more philosophical nature and its organization's role in the broader scheme: how sustainability issues, trends and legislative changes affect not only itself as a company, but its industry and country.

[11] In their report, "Leadership for Tomorrow, Playing Catch-Up with Change," Prem Benimadu and Judith Gibson make this point the following way: "Value creation today requires a culture that fosters the development of leaders, thinkers and innovators among the rank and file," p. 2

As all six companies have shown, sustainable thinking and practices breed knowledge, though managing this new knowledge is challenging. With vast amounts of new knowledge being discovered at a fast pace, coupled with day-to-day responsibilities, the capture and systematization of new knowledge might not always keep pace. Nevertheless, the companies surveyed in this chapter recognize the value of their new sustainable knowledge and the necessity to have capture systems for it.

In the absence of comparative studies, it is difficult to ascertain whether sustainability practices are leading companies to become better managers of knowledge. However, by its very nature, environmentally sustainable thinking employs extended knowledge inputs, which result in extended knowledge outputs, as Figure 1 below illustrates.

Figure 1

Knowledge Inputs

- Research
- Value Chain Analysis
- Stakeholder Engagement
- Internal Communication
- Thinking, Planning, Executing
- Culture of Each Employee as Contributor and Innovator

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Knowledge Outputs

- New Learnings
- Debriefings
- Improved Competencies
- Discoveries and Innovations
- Improved Processes
- Solutions that Solve Many Problems at Once
- New Recordable Data and New Ways to Capture it

Extended knowledge outputs do not necessarily signify superior knowledge management, but they do indicate a strong tendency to leverage knowledge assets. As discussed at the beginning of this chapter, businesses in Canada (and North America) suffer a paradoxical problem of being unable to retain the talent necessary to competitive advantage as a result of not fully leveraging it. It would appear that the dexterous integration of sustainable development with knowledge management provides a significant opportunity to help solve not only global environmental problems, but also fundamental business problems of human capital attraction and retention that are vital to success in the knowledge economy.

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5 Industrial Relations as a Factor in Environmental Sustainability

Winston Gereluk

Abstract

This chapter presents the case for good industrial relations as an essential component of environmental sustainability in the workplace, by approaching it within the broader context of the 'social dimension' or 'human side' of sustainable development. It refers to workplace-related goals that were established in Agenda 21 (1992) and updated in 2002 at the World Summit on Sustainable Development (WSSD) in Johannesburg, South Africa. The WSSD also shifted the focus from top-down action by national governments to a fuller involvement by groups in civil society, and established poverty eradication as a priority, to be achieved through employment creation. Workplaces are centres of both production and consumption and actions that begin in this context have significant potential for 'spill-over' into domestic behaviour. As participation of workers is the key to success of any workplace change, the potential contribution of trade unions and joint action through healthy union management relations is examined.

The strengths and weaknesses of various approaches to workplaces and civil society are explored and illustrated, including:

- partnerships and 'voluntary agreements';
- a growing corporate social responsibility (CSR) movement;
- international agreements, standards and codes created a for this purpose;
- government action, regulation and standard setting, including public services;

Socio-economic security concerns demand that appropriate planning and assurances, and in particular, a 'just transition' as a precondition to a buy-in by workers and their communities.

Key words: social dimension, industrial relations, labour practices, voluntarism, voluntary agreement, corporate social responsibility, core labour standards, just transition.

Industrial Relations as a Factor in Environmental Sustainability

This chapter will explore the role that good industrial relations must play in an integrated strategy to achieve environmental sustainability in the workplace. In this examination, environmental sustainability will be presented within the broader context of sustainable development, with good industrial relations analyzed as an essential aspect of its 'social pillar' or 'dimension'. The implications of such an approach for strategic planning will be illustrated with actual cases and instruments that have been created for this purpose.

The importance of industrial relations was acknowledged in Agenda 21 (UNCED), the original agenda for sustainable development mapped out by nations of the world at the 1992 United Nations Conference on Environment and Development (Earth Summit I) in Rio de Janeiro, Brazil. It was reinforced ten years later at the World Summit on Sustainable Development (WSSD) in Johannesburg, South Africa in September 2002, when governments not only agreed that good industrial relations must be part of any efforts to achieve sustainability in the workplace; they also recognized that opportunities and challenges for good industrial relations are created wherever organizational planners accept environmental sustainability as part of their mission.

Both the J*ohannesburg Plan of Implementation (JPOI)* and the *Political Declaration,* the two major outcomes of the WSSD, set out the social goals of poverty eradication and decent employment as top priorities for sustainable development, taking into account standards established in the International Labour Organization's (ILO) *Declaration on Fundamental Principles and Rights at Work*. Amongst other targets, they called for an increase in the number of collective agreements to improve performance through participation of workers and their trade unions towards sustainable development, and asked governments to ratify and implement ILO conventions relating to workers rights and freedom of association, if they had not already done so. Finally, they offered solid support for the principle of tripartism, asking governments and employers to establish joint (employer/ worker) or tripartite collaborative mechanisms at the workplace, community and national levels to deal with safety, health, and environment[1].

Industrial Relations and the Social Dimension of Sustainability

As a practical matter, industrial relations refers to the creation, interpretation and application of rules governing the employment relationship and the organization of work. As *an academic subject*, it focuses on the 'rules governing employment, including how the rules are made, changed, interpreted and administered', as well as 'the study of processes of control over work relations' (Clegg 1975). Its relevance becomes apparent when environmental sustainability is placed within the broader context of sustainable development, which draws attention to all three pillars of development - environmental, economic and social – with the understanding that strategic objectives in all three must be included public policy and organizational planning. Before Johannesburg, sustainability management was largely focused on balancing narrow environmental objectives with economic and financial demands.

In its most basic form, the integration of social objectives in planning requires that attention be given to *the 'human side' of development,* a side that has been ignored by

[1] Amongst other sections, *JPOI* 9b and 150, *Declaration* 25, and Agenda 21, Chapters 28 and 29.

far too many engineers and planners in the past. The broad content of this Dimension can be found in such documents as the Philadelphia Declaration, the OECD Guidelines, the Social Compact, and the Stockholm Accord, with perhaps the clearest and most time-bound found in the Millennium Development Goals, which called for the eradication of extreme poverty and hunger in the world. (World Bank)

In Johannesburg, this side of development finally received due attention when nations of the world isolated one aspect, poverty eradication, as the central social priority for the next decade.[2] Poverty, they said, was asocial product of unsustainable patterns, and creation of decent, income-producing employment was the key to solving it, as for the majority of the world's people, employment and work-related income provide the means for accessing essential goods and services, and joining the socio-economic mainstream of society. In the process, attention was drawn to key indicators of decent work and good industrial relations, as well as to such factors as gender and age, as youth and women are increasingly being relegated to low-paid, marginalized work in our global economy. Integration of such priorities into environmental and economic planning, furthermore, requires attention to the 'human side' of trade and investment. It was in this spirit, that the European Environmental Bureau (EEB) joined in Dublin with leaders of the European Trade Union Confederation (ETUC) and European Social NGOs (Social Platform) to urge the EU Presidency to launch a major programme of public investment in goods and services combined with social, environmental and employment goals at the 2004 Spring Summit of the European Community.

What is particularly significant about the Johannesburg agreements is that they called on governments, for the first time, to promote sustainable development by providing an enabling framework for action by groups in civil society, including employing organizations. A noteworthy example of the type of integration that was contemplated can be seen in the *Flower Label Programme (FLP)*, which includes a complete set of guidelines relating to labour, social and health & safety standards, use of pesticides and chemicals, and environmental protection standards. According to the FLP *Guide*, 'Companies improving working conditions by adopting these standards will benefit from enhanced consumer acceptance and improved market position. (Flower Label Programme 1995).

Unfortunately, until Johannesburg, government efforts made little progress in this respect, as employment and industrial relations aspects were typically left out of sustainable development planning. In Canada, one has only to look at the terms of reference established for the National Round Table on the Economy & Environment to see how the 'human side of development', and industrial relations in particular, is almost totally absent. (NRTEE)

Approaches to Sustainability Management in the Workplace

Workers' stake in environmental sustainability goes far back in history, as industrial development has always entailed risks to health, safety and community environment for those engaged in production, whether they worked as slaves, serfs, independent producers, or wage employees. Unsustainable forms of production that emerged in the

[2] References to poverty eradication appear throughout the WSSD outcomes, but particularly in JPOI #6

Industrial Revolution were responsible, in fact, for some of the earliest working class movements in both workplaces and communities (Gereluk & Royer 1997).

It was not surprising, therefore, that workplaces were targeted for attention in Agenda 21, and again in Johannesburg. As centres of production and consumption, not only do they provide opportunities for cleaner, community-friendly production, resource conservation and the reduction of waste; they also contain great potential for ‘spill-over’ into domestic patterns of consumption. A starting point for workplace action, however, must be good industrial relations, as parties will only be able to transcend causes of conflict, and capitalize on opportunities to for cooperation if they enjoy a good working relationship.

This approach to workplace action partly explains the focus on the two of the Major Groups identified in *Agenda 21*. Chapter 29, for example, defines the role of workers, who “will be among those most affected by the changes needed to achieve sustainable development” and of “trade unions, which have experience in dealing with industrial change, have a vital role to play.” (Keating, 48) Chapter 30 refers, amongst other things, to ‘enlightened business leaders’ ‘fostering openness and dialogue with employees and the public and are carrying out environmental audits and assessments if compliance with environmental laws and regulations.” (Keating, 49) By the WSSD, initiatives undertaken by these parties had clearly demonstrated the potential to create more sustainable patterns of production and consumption, develop more responsible consumers and agents of change, achieving a positive impact in both environmental responsibility and financial performance. In Canada, unionized companies such as Suncor and Fairmont Resorts led the way in showing that sustainable development is compatible with a healthy bottom line.[3]

Suncor provides a particularly good example, as in 2003 it was one of seven Canadian companies to qualify as a ‘Triple Crown winner’, marking it as a top performer in the FTSE4Good Global Index, the Dow Jones Sustainability Index, and the 2003 Corporate Knights Best 50 Corporate Citizens in Canada. (EM&R) The integration of all three pillars of sustainable development is constantly emphasized in Suncor’s policies and management systems, to which it extends materiality in the form of concrete performance indicators, regulatory requirements and stakeholder needs and expectations. Suncor gained national prominence in 2003, when it broke ranks with other energy companies to support the ratification of the Kyoto Accord by the Canadian government. In this, it was joined by the Ft. McMurray, Alberta local of the Communications Energy & Paper Workers’ Union of Canada (CEP).

The primary message is that good industrial relations are vital to sustainability, because any plan to implement meaningful change in the workplace necessarily involves workers, and where they exist, their representative unions. To this the WSSD added that, given the complexity and magnitude of the transition to sustainable patterns of production and consumption, action by national governments is not sufficient; civil society must become involved everywhere, including the workplace. A broad consensus has been reached amongst trade unions, business and NGO’s, for example, that such voluntary initiatives

[3] Suncor’s Annual Report for 2002, for example, declares, “*long-term growth is not sustainable by financial performance alone. As we invest for future growth, Suncor is also investing in communities to build healthy vibrant places to live and work, and in new technologies to reduce our environmental footprint*.” P.1.

or agreements (VA's) must be included with government regulation and standard setting in the mix of solutions. Such instruments as the *OECD Guidelines for Multinational Enterprise*, furthermore, contemplate that international action can broaden and deepen the participation of stakeholders upon whom progress toward sustainability depends. At a special meeting of the social partners called by the UN Commission on Sustainable Development (CSD)[4] in 1999, it was agreed that voluntary agreements would fulfill this mandate if they were:

- Supplemented or strengthened government-based regulations and standards;
- Encouraged research on VA's by such intergovernmental bodies as the OECD or the ILO;
- Supportive of concrete change to workplace performance, including joint development, monitoring and reporting; and
- Strengthened by education and training to improve on workplace monitoring, record-keeping, and reporting mechanisms.

This focus was tailor-made for North America as 'voluntarism', or the intention to limit government oversight in rule-making and implementation, has always been a central feature of our system of industrial relations. (Weiler 15-64) In fact, the principle that government would enable collective bargaining, but not determine any of its objects, was firmly established in the series of Charter challenges that followed the enactment of the *Canadian Charter of Rights and Freedoms* in 1982, and was articulated in particularly clear language in such Charter challenges as *Dolphin Delivery* (1984) and the 1987 reference to the Supreme Court concerning Alberta's *Public Service Employee Relations Act.*[5]

Collective bargaining has already produced a number of models and best practices for this type of industrial relations. One of the earliest was provided by environmental agreements in Germany's chemical industry. In March 1987, for example, the German Mining, Chemical & Energy Union (IG BCE) and the Associations of the Chemical Industry achieved a Chemical Industries Social Partners' Agreement on Environmental Protection, followed later that year by the formation of a 'Company for Information of Works Councils concerning Environmental Protection in the Chemical Industry' (GIBUCI). A Declaration empowered works councils to conclude agreements on environmental protection, with rights of access to information on environmental issues and participation. It called for improved monitoring of chemical substances, more responsibility for economic councils and health and safety committees, and a joint Union-Association body to provide information and training, and ongoing discussion to promote change. The 1987 Declaration was made possible by a long tradition of Social Partnership that underlies German Basic Law, based on Freedom of Association, worker participation in development, and the social welfare state. 'In November 1997, this

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[4] The multistakeholder consultation in Toronto Canada in 1999 arose out of the CSD1998 Dialogue Session on "Business & Industry".

[5] *Dolphin Delivery Ltd. v. Retail, Wholesale & Department Store Union, Local 580* (1984); *Reference Re Public Service Employee Relations Act (Alta.)*, [1987] 1 S.C.R. 313

approach to social partnership was strengthened by a new agreement, 'Chemical Industries Social Partners' Agreement on Responsible Care'. (Heins)
In Sweden, the Tjänstemännens Centralorganisation (TCO or Swedish Confederation of Professional Employees) joined with Swedish environmental organizations to define standards for IT equipment that led to the highly-successful TCO certification of computers based on a checklist that is now accepted globally. This environmental labelling initiative has now become a *de facto* standard all over the world, as the TCO has signed certification agreements with over a hundred international computer display manufacturers and suppliers. Almost 3,500 models now bear a TCO label signifying adherence to the world's strictest requirements for both environment and user-friendliness. It shows what can be accomplished through alliances between trade unions, environmental organisations and research institutes, and exemplifies how unions can act both locally and globally to influence consumption and production patterns for sustainable development. The TCO has since gone forward with other initiatives targeting the workplace and community; the most recent concerning standards for safe, socially-friendly mobile phones. (Boivie)

In 1995, Brazilian trade unions concluded an agreement with employers and their national government for workplace action to advance sustainable development objectives through good industrial relations. The *National Tripartite Agreement on Benzene* demonstrates how worker involvement is crucial to strategies for Agenda 21 objectives, at the same time as it advances the goal of harmonization of chemical classifications and uses worldwide, in which trade unions have also been central players. The 'Benzene Accord' requires companies and sub-contractors to carry, store, use or handle benzene and its mixtures and derivatives in a clearly-prescribed manner; to register its use with the Ministry of Labor; and to ensure that a proper "Program of Prevention" is being instituted in every workplace where benzene occurs. Worker and trade union participation is mandatory at every stage. This groundbreaking agreement has grown from its early stages, when benzene contamination was first discovered, to national implementation, because of determined efforts by Brazil's trade union centrals, government officials, and employers in the metal and petrochemical industries. (Freitas & Gereluk)

As a call to action, then, the WSSD framework for joint employee-employer action throws out a challenge to all groups in civil society, and particularly to the ones with the capacity to lead the process of change – corporations, trade unions, local authorities, and NGO's. They must play a more active role to fashion solutions to the complex problems of sustainability in work and community life that are emerging in a globalizing business world, with its patterns of supply chains, trade, investment and financial decision-making. The key point is that sustainability management depends on participatory approaches, as opposed to the top-down governance styles of the past. In the workplace, this denotes a departure from the unitarist and Taylorist solutions of the past to innovative solutions that involve the participation of those most affected by today's development patterns.

The Problem with 'Partnerships'

Ever since the Financing for Development Conference in March 2002 in Monterrey, Mexico and preparatory meetings for the World Summit in 2002, partnerships have assumed a leading role in strategies to implement sustainable development outcomes.

UN General Assembly Resolution 58/129 (December 2003) confirmed 'Type II' partnerships between governments and major groups as a key technique for organizing and funding projects. According to Principles agreed in a pre-WSSD meeting in Bali, these should be arrangements to: [6]

- integrate the economic, social, and environmental dimensions of sustainable development in their design and implementation;
- involve a range of significant actors, including, NGOs, international institutions, regional groups, national governments and private sector partners;
- involve local communities, with a 'bottom-up approach'; and
- have tangible, measureable results.

Some of the best models for such 'sustainability partnerships' have been relatively modest. The Canadian Union of Public Employees Local 474 of school custodians, for example, participated in a collaborative effort to reduce consumption of water and electricity in Edmonton's Public Schools. Beginning in 1986, students and staff were taught to reduce usage by shutting off lights, turning down thermostats, controlling fans, and closing taps, etc. When combined with a retrofit in 1991, the 183 schools were able to reduce natural gas consumption by 31 %, electricity by 22%, and water by a remarkable 60%, because of this program. Not only have joint efforts between the custodians, teachers and students resulted in savings of millions of dollars; the sustainable development lessons that have been experienced personally by thousands of school students and staff will lay the basis for more responsible consumption of water and utilities at both work and home, for years to come.[7]

On a national scale, a collective agreement concluded between GM Canada and CAW-Canada in September 2002 contains extensive provisions for Joint Workplace Environmental Committees. Committee members are given time off work to attend monthly meetings, make recommendations regarding environment, recycling and energy conservation, and engage in activities to promote programs relating to the environment. Union representatives have rights to information, raise issues, receive environmental training, and develop and deliver educational materials for their members. In addition, the Agreement provides for a CAW Environmental Representative at a number of plants to support Corporate and plant environmental matters, and additional provisions are made for joint efforts by the Regional Manager for Environmental Services and the CAW National Health and Safety Coordinator. (CAW/TCA) Such agreements are much more than statements of intent; they are legally-enforceable. However, their major significance, is that they occur in the context of a broader agreement whose *raison d'être* is good industrial relations, provided explicitly and in detail throughout the agreement.

As another example, the Communications Energy & Paperworkers Union spearheaded a broad-based coalition to move Canada towards its Kyoto targets. *KyotoSmart* advocates

[6] The Bali Principles are the basis of UN General Resolution 58/129, retrieved on March 20, 2004 at http://www.un.org/esa/sustdev/partnerships/bali_guiding_principles.htm

[7] Based on interview, March 25, 2004 with Doug Luelman, President, Canadian Union of Public Employees, Local 474.

an integrated implementation plan to shift the Canadian economy and society to lower greenhouse gas emissions in a manner that ensures potential benefits are fully realized. It was prompted by concern that that too little incentive has been provided to industries and groups to move the Canadian economy towards sustainability, and calls for consultations with provinces, territories, industry, environmental NGOs, trade unions, and other stakeholders, led by an administrative body with the necessary transparency, accountability and credibility to ensure a high degree of effectiveness. The coalition includes: Canadian Wind Energy Association, Communication, Energy and Paperworkers Union, David Suzuki Foundation, Federation of Canadian Municipalities, Government of Manitoba, Greenpeace, Interface Flooring Systems, International Institute for Sustainable Development, Iogen Corporation, Manitoba Hydro, Ministère de l'Environnement du Québec, Pembina Institute for Appropriate Development. (Kyoto Smart 2003)

Partnerships have been widely criticized, and are still suspected by many, as there are no concrete definitions, agreed set of practices or standards to ensure that initiatives submitted to the UN CSD actually promote sustainable development in general, let alone the social pillar that civil society groups have worked for. Partnerships must imply, as a minimum, joint decision-making, information-sharing and implementation. However, many of the firms that can properly lay claim to achievements in sustainability have little to say about meaningful employee participation. Bristol-Myers Squibb, in its 2003 *Sustainability Report*, for example, points to an impressive list of achievements in all respects, including a commitment to a number of core labour standards, generous employee benefits and programs. Nowhere in their report, however, is there a mention of an industrial relations strategy to involve employees in decision-making or implementation. This is true of the majority of sustainability reports. One exception is Suncor Energy, which in its 2003 R*eport on Sustainability*, refers extensively to the participation of its employees, and extends credit to their representative trade unions, in particular, the Communications Energy and Paper Workers Union, Local 777.

The concept of partnerships appears particularly overextended when it is applied to the realities of work, as there is little in most employment relationships to fit its spirit or intent. Employers embracing the concept invariably encounter a 'management dilemma' between their need to maintain control, on the one hand, and to encourage the 'participation' that partnerships imply, on the other. As well, companies that engage employees in partnerships in one area are likely to insist on management control in another. For example, some of Canada's best companies have insisted on implementing alcohol and drug testing programs, which are criticized by trade unions as totally unacceptable, a violation of human rights and dignity, and on the point of partnerships, destructive of mutual trust and cooperation. (CEP 1993)

Partnerships have been criticized globally by such union leaders as the Neil Kearney, General Secretary of the International Textile, Garment and Leatherworkers Federation for being too general in nature and meaningless in practice, at best a public relations exercise, and at worst, a 'fig leaf' for continued exploitation. In leveling his charges, Kearney has pointed to the textile, clothing and footwear industry, where a great many manufacturers boast corporate codes of conduct, but are still guilty of supporting 'sweatshop labour practices', as production continue to migrate to countries where the lowest wages combined with the highest incidence of human rights violations provide an opportunity to cut labour costs. (Firoz & Ammaturo)

As an industrial relations term, however, the concept of partnership can be applied to the thousands of *de facto* arrangements that have occurred between employers and employees, or their trade unions in workplaces around the world. In fact, the 2.5 million collective agreements in existence today provide perhaps the best working examples of ‘partnerships’ as proven models for action on issues relating to work and production. The most successful of these have placed an emphasis on capacity-building training and education as a means for raising awareness and building the capacity of workers, employers and trade unions for environmental and economic planning for sustainable development.

The Role of Trade Unions

An industrial relations strategy pursued within the framework of partnership requires an understanding of trade unions, which despite negative publicity and a marked decline in many countries, have served as vehicles for dialogue, co-operation, and negotiation with employers and social partners at the local, national and international level. Trade unions were born, in large part, in a struggle for sustainable workplaces and communities, and this historical mission continues to make them one of the major proponents of the social dimension today. Their prime function is to negotiate rules for industrial activity that promote and protect the interests of their members and benefit working people in general. The main instrument is the collective agreement, a legal contract between employers (or employer associations) and free trade unions acting as bargaining agents for units of workers. Many of these agreements already contain ‘green’ or 'sustainability' clauses that are increasingly being incorporated into 'Best Practice' models for sustainable production and consumption.

Trade unions have more to offer than collective agreements, however. With networks that encompass hundreds of millions of workers on millions of worksites and a historical tradition of joint workplace education and action trade unions, trade unions:

- continue to participate in thousands of joint worksite health & safety programmes through joint committees, many of which have expanded their mandates to include sustainable development, and qualify as effective models for joint decision-making involving workers and employers, often with the surrounding communities;
- have experience in assessment, information flow and effective planning and the handling of disputes, and more recently, these have led to advances in participation principles in such areas as: “right-to-know”, “whistle-blower” protection, the “right to refuse dangerous work”, and the “right to refuse work which harms the environment”;
- are the largest single providers of informal adult education in the world, with sustainable development components in their programmes that effectively reach workers; and
- have extensive experience in using negotiated workplace agreements as springboards to sustainable consumption in personal and community life.

The Spanish unions UGT and CC OO have demonstrated how joint workplace programs can spill over into the community. Their energy transformation initiatives, part of a

European union plan to work with governments, NGOs and consumers to break the link between economic growth and environment damage, while guaranteeing access to energy and quality employment. They collaborate with national and regional councils in campaigns with documention and educational activities, to substitute fossil fuel with renewable energy. These are supplemented by initiatives in European Works Councils; e.g., a Work Council Commitment to Mitigate Climate Change involving 170 work councils to reduce energy consumption and GHG emissions, and an agreement with 45 town councils, trade unions, employer associations, universities and the Transport Authority to rationalise access to 700 workplaces with more than 80,000 workers, as well as numerous agreements for single companies and workplaces. (Hernando)

Finally, attention is turning to workplace assessments as a vehicle through which trade unions and employers can translate broad sustainability objectives into terms that are appropriate to and measurable in the workplace. The Workplace Assessment (WA) builds on a tradition established by (amongst other precursors) the EMAS in Europe, which created an important role for workers and their representatives in environmental management of an enterprise. It refers to a process whereby trade unions and employers in one or several worksites work together to assess workplace performance according to agreed checklists of environmental, occupational and social criteria. Outcomes of assessments can lead to joint plans of action to identify and resolve problems ranging from the simple, single issues (e.g., energy usage and waste) to the complex (e.g., matters related to technological innovation, travel and lifestyle patterns or employees, industrial relations, etc.) They can likewise be of short duration or stretch over several years to fulfill complex objectives. In summary, WA's are an effective way for employers to work with workers, their trade unions, and NGO's in: joint target-setting, monitoring, record-keeping, and workplace implementation; setting of priorities at specific worksites or across sectors; reporting on progress; and consolidating targets established by the ILO,UNEP, OECD etc. into workplace checklists for separate regions, sectors and functions. (ICFTU/TUAC 2003)

Agreements, Standards and Codes

With the search for Sustainable Development now over 15 years old, and Agenda 21 well into its second decade, there is no shortage of instruments and guidelines for good industrial relations and environmental sustainability. A seminal article produced for the International Labour Review in 1999 differentiated between two classes of instrument: (i) *codes and labels*, which "form part of a broader set of initiatives which seek to inform and influence consumers, business partners, investors and/or the media in regard to particular enterprises social goals and achievements", and (ii) *investor initiatives* which, by contrast, are "part of a range of activities aimed a influencing enterprise decision-making and, in this case, enterprise adherence to codes and labels." Both are voluntary initiatives that rely on market incentives rather than regulatory compulsion, or more precisely, address a mismatch between regulatory forces and evolving economic structures, by capitalizing on corporations', 'vulnerability to exposure.' (Diller 100) Some of this 'vulnerability' surfaced in April 2004, when ExxonMobil, one of the largest energy companies in the world, agreed to include a statement of intent to uphold the core labour standards set out by the ILO *Declaration on Fundamental Principles and Rights at Work* in its 2004 Citizenship Report. Exxon agreed, as well, to engage in dialogue and information sharing with groups led by Amnesty International, including several trade union and retirement funds. (AFL-CIO)

Such instruments of Corporate Social Responsibility (CSR) as the Ethical Trading Initiative, the Global Compact and the OECD Guidelines for Multinational Enterprises (to name just three), consistently employ terms relating to work and the workplace derived from ILO Conventions. In fact, guidelines for good industrial relations that are occurring in the current CSR movement signify some of the most dramatic gains in sustainability management. They occur, furthermore, right when changing patterns of development ('globalisation') are having the effect of putting working conditions back into competition and drawing the attention of industrial relations scholars and practitioners to supply chain issues, the dual labour market, and extended producer responsibility, etc. Such initiatives as the U.S. Fair Labour Association, which bring standards of responsible management to the arena of international trade have focused demands on retailers, particularly in the clothing and footwear sector, to ensure that their goods are produced by plants which respect basic labour rights, and to 'level the playing field' for those companies that intend to do the right thing by respecting human rights.[8]

The Global Reporting Initiative, launched in 1997 to enhance sustainability reporting, brings business, non-profit groups, accounting bodies, investor organizations and others together to build and win consensus on reporting guidelines. The *GRI Sustainability Reporting Guidelines*[9] include performance indicators on labour practices and human rights founded on such internationally-recognized instruments as the *ILO Conventions* and the *Tripartite Declaration Concerning Multinational Enterprises and Social Policy,* and the *UN Universal Declaration of Human Rights*.[10] The GRI develops and applies social standards in collaboration with workers, trade unions, companies, government, NGO's, investors and consumers, and accredits qualified organizations to verify compliance at the plant level. The labour standards provided in the OECD *Guidelines for Multinational Enterprises* are perhaps the most consistent with the ILO Conventions, the UN's *Universal Declaration of Human Rights* and the *Convention on Rights of the Child*. To a greater or lesser degree, a large number of instruments agree on core terms, indicators or criteria, which taken together, can be fashioned into a preliminary 'Code of Labour Practices' containing audit categories denoting the following guarantees, protections and freedoms as vital to the sustainable workplace and employment relationship. It would include:

- *Freely-chosen employment*; e.g., freedom from forced, involuntary labour, prohibition against indentured or wage-retention forms of retaining workers;
- *Freedom of association*; e.g., the right to organize into trade unions of the workers's choice, a willingness to negotiate and work with trade unions, etc.;
- *Occupational health, safety & environment*; e.g., safe, hygienic working environment, o.h.&s. training, accommodation, facilities, potable water and other amenities, etc.;
- *A ban on child labour*; e.g., prohibition on recruitment, policies and programs for education and care, enhanced terms and conditions for young adults, etc.;

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[8] Retrieved August 27, 2003 from http://www.fairlabor.org/all/about/index.html

[9] Retrieved September 20, 2003 from *globalreporting.org/about/brief.asp*
[10] Retrieved September 20, 2003 from *http://www-ilo-mirror.cornell.edu/public/english/standards/norms/sources/mne.htm*

- *A living wage*; e.g., regularly paid wages, at regional or national standards, information on wages and deductions, prohibition of deductions for disciplinary reasons, etc.;
- *Working hours* that comply with industry, regional or national standards, with a daily and weekly maximum, and days of rest, etc.;
- *Freedom from Discrimination* in hiring, compensation, access to training and self-improvement, promotion, retirement, on basis of age, gender, marital status, etc.;
- *Regular Employment* according to norms for permanent, full-time employment, with a prohibition on 'escape' through such means as contracting-out, home-working, etc.; and
- *A Ban on Harsh, Inhumane Treatment*; e.g., physical abuse or treatment, or threat thereof, sexual or other forms of harassment or abuse, etc.

The extent to which ILO core labour standards have been incorporated into indices and agreements by the CSR movement may surprise some. These standards are provided by such traditional instruments as ILO Conventions and Recommendations and besides being important in their own right; have also served as 'enabling rights' in that they create conditions which allow access to other important workers' rights. The *Freedom of Association Convention (#89),* for example, protects the right of workers to form trade unions to counteract the arbitrary rule of the employer, altering the balance of power in the workplace, and making a crucial contribution to democracy. Indeed, the exploitation of workers and violation of other human rights is often directly linked to the denial of this right. The freedom of workers to protect themselves gives them the power to ensure that other such abuses as child and forced labour, discrimination, and unsafe conditions do not occur in the workplace. (Howard & Gereluk)

Since Freedom of Association is probably the most contentious of all guidelines in CSR instruments, implying support for trade unions and collective bargaining, it is worthwhile to note the style of worker involvement that is contemplated. Trade unions exert a direct influence on the labour market by creating and asserting rights for the workers they represent, as well as for working people in general. They have been instrumental in extending gains achieved through collective bargaining to other workers by demanding state intervention in the labour market. Laws governing pay, working time, health and safety, and human rights have the effect of taking human labour out of the realm of competition. Collective bargaining is so closely-linked to ethical standards in employment that exploitation and abuse of workers can very often be linked to an absence of independent trade unions. It takes international efforts to set guidelines for human rights which have traditionally been used to protect individuals and communities from abuses by the state, and to apply them to companies.

Transnational IR Agreements for Sustainability

International framework agreements and European Works Councils are two particularly good examples of IR strategies that are beginning to affect the environment in which strategic decisions for sustainability are made by are extending workplace gains in one country to others. Collective bargaining, which originated at the enterprise level, has now evolved into company-wide and sectoral agreements between Global Union Federations and some of the world's largest transnational corporations. These typically address the role of joint health, safety and environment committees, works councils and safety (and environment) representatives, as well as providing for education, training, and information exchange. One of the first such agreements was signed in 1988 with Danone, a French multinational in the food sector, by the International Union of Food, Agricultural, Hotel, Restaurant, Catering, Tobacco and Allied Workers' Associations. (Steiert & Hellman) A recent revision allows Danone to reduce its capacity, but protects the employment of workers, thus providing a model for addressing restructuring at a global level. Since then, a large number of global agreements have been signed; e.g., the International Chemical, Energy, and Mining Federation has recently concluded agreements in the mining industry which secure the right of a trade union to monitor a company's global performance, and address breaches with corporate headquarters – a significant departure from earlier codes of conduct which lacked monitoring and enforcement procedures (ICEM 2002).

The European Works Council Directive demonstrates how trade union structures evolve to meet the challenges of globalization. Since it was passed in 1996, some 600 European Works Councils (EWC) have arisen between employer and workers in firms operating in Europe. Once established under national law, EWC's have the legal right to be informed and consulted on the economic and financial situation of the business, its likely development, probable employment trends, introduction of new working methods, and substantial organizational changes. Companies do not have to be European, nor need the host state pass enabling legislation. If a threshold number of employees is reached in Europe, a "special negotiating body" (SNB) must be established, consisting of representatives of all the employees in the EEA Member States in which the undertaking has operations to negotiate an agreement that will apply to all undertakings and employees. Research conducted into the Works Councils indicates that they increase trust between parties, employee involvement, understanding of management decisions, a positive corporate culture, and evidence of a company's concern for its employees. (European Trade Union Institute)

At the same time, workplace parties have cooperated at the local, national and international levels to achieve a globally-harmonized system of chemicals classification and labeling that addresses not only individual chemicals, but mixtures, as well. (ICFT/TUAC, 2002, 12) Implementation includes observance of the precautionary principle for all new products, with hazard communication, labels and Material Safety Data Sheets supplemented by education and training of workers. As well, a global implementation system for dealing with Persistent Organic Pollutants (POPs) and a new, strengthened, and globally harmonized system for the testing of new substances prior to their introduction into workplaces is evolving with improved evaluation of short- and long-term human and environmental toxicity, carcinogenicity, mutagenicity, endocrine disruption, reproductive effects, persistence, bio-concentration and bio-accumulation, and other human and environmental effects.

Since poverty alleviation has been given top priority as a goal in the social pillar of sustainable development, attention must be given to formal agreements and projects for international cooperation by trade unions and Canadian companies to advance the well-being of people elsewhere in the world. Suncor Energy, for example, is extending the charitable efforts in Canada under its Energy Foundation, while the Canadian Steelworkers and the CEP promote international solidarity through Humanity Funds. The Steelworker Fund, for example, is based on a negotiated check-off at 1 cent/hr, which began in 1985 as an initiative to help Ethiopians caught in drought and war. It has since expanded to over 530 locals, with matching grants from the Canadian International Development Agency (CIDA), to support projects to develop links with unions and community groups in countries like Chile, Mexico, Bangladesh, Guatemala, and Mozambique. Programs include: relief activities, long term development projects, member education, worker exchanges, and a program to broaden the understanding of Steelworkers in Canada. The Fund also supports campaigns with other trade unions and social partners for aid and development policies, labour rights and fairer trade. (USWA)

The Role of Governments in Workplace Sustainability

Even though the WSSD calls for workplace and social innovation within a framework of ‘voluntarism’, it provided clear direction that government must play a leading role in sustainable development. While they have demanded a greater role in development, civil society groups hold firmly to the conviction that it is the proper role of government, not private interests, to maintain standards defining the public good. Democratically-elected governments must maintain standards of social responsibility rather than leaving these to private interests.

For this reason, trade unions and other civil society groups favour participatory instruments that include government, and more specifically, have insisted that governments must provide an enabling framework for good industrial relations. On the one hand, this requires regulatory systems, including inspections and enforcement that extend beyond environmental concerns, and on the other, public policy favouring trade unions and worker rights as an essential component of sustainability. Furthermore, in reaction to the privatization projects of the last few years, civil society groups renewed their call for government and the public sector control to ensure equitable provision of such essential services as water, sanitation, and infrastructure. (Anti-Privatisation Declaration) Local authorities, in particular, must be given the necessary resources to promote participatory activity in workplace and community.

In this regard, trade unions have been particularly vocal in decrying the lack of commitment of government to core labour standards, given insufficient and deteriorating protection for worker rights. Governments, they say, have a duty to defend democracy as a key aspect of sustainable development, however trade unions are today being assaulted in even the most democratic countries. (ICFTU/TUAC 2004) The ICFTU’s *Annual Survey on Violation of Trade Union Rights,* a country-by-country review of how these rights are respected, provides evidence that that the stain of anti-union repression is spreading. The Survey, they say, illustrates the devastating effects which crude free trade has on workers’ rights. Not only are trade union rights being suppressed; legitimate protests are often harshly repressed, at the same time as efforts to engage in meaningful dialogue with governments or employers prove futile.

Socio-economic Security as an Aspect of Environmental Sustainability

History has provided workers and their communities with ample reason for concern about development, as in the past, they have borne a disproportionate share of the social cost arising out of unsustainable patterns. The ‘jobs v. environment’ debate has solid grounding in a history in which development has left a bitter legacy of pollution, resource depletion and social disease, even where sincere assurances were provided by those promoting change. To a great extent, this explains why workers are concerned about the impact which transition to sustainability may have on their lives, however much they agree with the mission itself. If sustainability is to be accepted in either the workplace or community, this concern must be addressed with solutions that are realistic and patently equitable; this may be the 'key' to environmental sustainability.

The International Labour Organization has led the way in this regard with research and publications that examine the guarantees of basic socio-economic security required for a smooth transition to sustainable workplaces. The ILO I*nFocus Socio-Economic Security Programme (SES)*, in particular, has provided the following definitions for socio-economic security:

- *Labour market security* Full employment policies backed by macroeconomic policy;
- *Employment security* Protection against arbitrary dismissal, hiring and firing;
- *Job security* A niche designated as "occupation or "career", with clear skill levels, craft boundaries and job qualifications;
- *Work security* Protection against accidents and illness at work, through safety and health regulations and limits on work time, unsociable and night hours;
- *Skill reproduction security* Right to gain and retain skills, with apprenticeship, employment training, etc.;
- *Income security* Protection of income through minimum wage laws, wage indexation, social security, and progressive taxation;
- *Representation security* Right to a collective voice in the labour market, with independent trade unions and employer associations, and state protection of rights.

The central role that employment plays in the lives of most individuals and communities means that any plans to transform production and consumption patterns must be accompanied with policies to reduce unemployment, tackle social inequality, facilitate adjustment to economic reform, ensure adequate pensions, and other measures to preserve living standards, and minimize disruption to those directly affected by transition to sustainability. In this respect, Just Transition is becoming a major industrial relations issue as business and governments in North America prepare for environmental sustainability. As a recent OECD Paper on *Environment and Employment* pointed out, such a policy can provide a guarantee of equitable distribution of costs of a change, at the same time as it provides the basis upon which working people and their communities can be convinced to work for such change.

Measures that may be taken for alleviating the short-term impacts of a change in environmental policy on employment in some sectors or regions include: the integration of environmentally motivated reforms with broader fiscal reforms, the early announcement of the policy change and long-term policy-commitments, active labour market policies targeted at the workers negatively impacted (e.g. assistance to provide higher education or undertake vocational training). (OECD 2004, 74)

In short, workers who are threatened by job loss or dislocation cannot be expected to support moves towards sustainability unless they know that they will be adequately supported. This means assurances of sustainable jobs in all affected sectors, combined with subsidies for wages of workers displaced from higher wage industries. As well, support will be needed to ease transition to new employment through career planning and advice, with displaced workers receiving preferential hiring in emerging industries. Protection of income cannot be a short term affair, furthermore. It must potentially accommodate a period of several years, during which workers must be able to maintain their status as employees, with an option to "bridge" pensions and other benefits, where feasible. Finally, education and training for career development must include full subsidization for a maximum of four years at full living wages, including the right to pursue educational directions that may not lead to ‘quick employment’. Only if such components are in place can workers be expected to support transition plans promoted by government and industry. The ICEM has taken the lead in defining the following components of a complete Just Transition Program:

- Workers and their representatives play an active role, as they have knowledge and expertise with regard to the industrial processes and problems;
- Governments take leadership by ensuring that a detailed analysis of employment impacts and adjustment are available for every program and regulatory change, and allocating funding specifically to worker adjustment and assistance;
- Regulatory approval for all plans, including a local adjustment plan and provision for adequate funds as part of any environmental impact assessment process;
- Communities and local governments play a vital role in Just Transition planning to ensure appropriate investment in needed infrastructure and essential services;
- All levels of government collaborate with employers, trade unions and community groups to develop economic strategies for transition, supported by development programs, enabling technology, development of new industries, and regulatory and financial incentives for conversion;
- Investment in research and development of alternative technologies support sustainable patterns of production and consumption, with new value added local production, and worker or community-based enterprises, especially in single industry communities; and
- Enhanced provision for skills and retraining in the transition in sustainable industrial strategies, with public education systems partnering with employers and trade unions to tailor education and training to best fit worker and community needs. (ICEM 2001)

Planning and Financing Just Transition

Planning for sustainability requires research into the impact of any changes on jobs and the workplace, based on credible research that will determine which employment transition programs are most appropriate to the range of occupations, industrial sectors and regions that will be affected. In this regard, the Labour Management Committee of the OECD, which includes the Organization's Trade Union Advisory Committee (TUAC) and its Business and Industry Advisory Committee (BIAC), have undertaken positive initiatives to translate the OECD's sustainable development strategy into workplace terms. Their research addresses climate change implications specifically, but their findings will be equally true of other areas of environmental sustainability. There are now calls on the ILO, and other international agencies can do to address the implications for job security and job creation of the various environmental measures that are being considered.

One thing is certain; transition will only be deemed 'just' if the interests that have profited from unsustainable patterns are involved in meeting the costs of mitigation. The Canadian Centre for Policy Alternatives has proposed a number of broad mechanisms that can both promote sustainability and create capital for Just Transition in the energy field, including: (Marshall)

- Eliminate existing subsidies to conventional energy producers to free up capital to fund Just Transition and other action, and to level the playing field for renewable energy sources and energy efficiency innovations. Given current subsidies to non-renewable energy production, many governments could immediately find millions of dollar for Just Transition. This policy option can and should be used in conjunction with any other strategies for decreasing greenhouse gas emissions.
- Apply a carbon tax to fossil fuel energy sources. Given concentration levels in the energy industry, administrative costs associated with such a tax would be minimal. The impact of this tax could be combined with a policy for emissions trading.
- Decide whether to make the system voluntary or mandatory, with fixed amount of – or cap on – emission permits. Auctioning of emissions permits could generate revenue for many purposes, including a Just Transition programme.

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Section II: Market Based Instruments

II Market Based Instruments

Klaus Bellmann
Udo Mildenberger

Our economies use the natural environment in two different ways. On the input side of industry we utilize nature's resources as inputs to produce materials, energy, goods and services. On the output side industry and consumers treat nature as a sink for the deposition of solid, liquid, gaseous and other emissions. With increasing environmental damage, people gradually perceive nature's limited availability to satisfy the growing demand on natural resources and on space for waste disposal. If one has to balance the books, nature is on the loser’s side – precious goods are given in exchange of worthless waste.

People's claims on their ways of living have a large impact on the quantity and the quality of materials and energy we consume and on the speed at which we exploit the environment. Due to dwindling resources and increasing environmental stress one has to take note of how natural resources have to be used: Formerly, a free of charge or low cost potential factor, nowadays the natural environment has become a scarce consumption factor. Consequently, the consumption of natural resources has to be taken into account as external costs and to be internalized into socio-economic accounting systems. The negative feedback effects drive us to develop strategies and measures to avoid or reduce environmental impacts for sustainable development.

The paper in the second part of the book (Market Based Instruments) offers a theoretical framework for the analysis of tactical and strategic implications of emission trading and comparable market-oriented instruments given the competitive situation of firms.

The theory oriented paper "Role of Market-Based Instruments in the new business paradigm" by Luciano Azzolini and Anshuman Khare discusses general opportunities for the use of market based policy instruments to gain competitive advantages for a firm. The paper begins by stating that the scientific discussion with respect to the strategic business response to environmental regulations is typically solely descriptive and generally non-theoretical. Therefore, the authors want to close the theoretical gap by developing a prescriptive, theoretical model for the strategic application of market based policy instruments. The main idea of this model is to link individual actions of firms to collective action through the market and link the market to the ecosystem.

Based on a short review of Porter's Five Forces model (the theoretical framework of the analysis), and a review of market based policy instruments in general, the authors discuss the value of the strategic application of these instruments in a new business model, called "smart firms." To clarify the relationship between market-based policy instruments, stakeholders and core organizational competencies, or in other words, to clarify the source of competitive advantages for a smart firm, the authors distinguish three different assessment levels – tactical, strategic and visionary. A typology of a firm's response to market based incentives is developed in which firms are classified by one of four categories – Laggard, Grabber, Thinker and Achiever.

While Laggards prefer regulatory models that accept pollution as the price of progress, Grabbers benefit by their willingness to try inexpensive environmental fixes that save money and are industry standard. Laggards and Grabbers are doomed to the same evolutionary fate if they cannot evolve their industrial competitive world view and strategically alter their way of doing business. Thinkers see waste as operational inefficiencies, lost value, and potentially a significant liability. Therefore Thinkers will strategically use their environmental advantages to their competitive benefit. The most sophisticated response type is Achiever. Firms at the Achievers level see themselves imbedded in ecology of businesses that use each other's outputs for survival. Their frame of reference transcends linear industrial models of production and in the process radically shifts the competitive rules governing industry sectors. Achievers are keenly aware of their total value generation and are always trying to increase their resource productivity and their ability to capture value.

6 Role Of Market-Based Instruments In The New Business Paradigm[1]

Luciano Azzolini
Anshuman Khare

Abstract

This paper attempts to develop a prescriptive theory/model for the strategic application of market based policy instruments. The research paper documents the development of command and control regulatory instruments and provides a normative account of their use by businesses for competitive positioning. The paper then reports the development of Market Based Policy Instruments (MBI) and explains their prospective defensive and offensive strategic applications based on Porter's Five Forces model of industry analysis. Finally, a prescriptive model that describes the strategic application of MBI is provided based on the preceding analysis.

It is assumed that successful firms will not shy away or avoid future regulatory instruments but use them to their competitive advantage. That competitive advantage will come from core firm values that emphasize dramatic increases in resource productivity, the elimination of waste, the use of solution-based business models, and reinvestment in the natural capital. The strategies and tactics that will guide the evolution of "laggard" firms into "achiever" and "enviropreneurial" firms is not precisely mapped out, but there are a number of tools, tactics and strategies that firms can use. All of them are applicable depending on the managerial maturity of the firm and its capacity to extend its environmental management practices, strategy and vision throughout its organization and to its constellation of relationships. Firms looking for unique competitive advantages should consider using market based regulatory instruments to differentiate their products and services to overcome seemingly impossible market entry barriers, reduce operating costs, and turn waste into profit.

Keywords: market-based instruments (MBI), competitive advantage, environmental differentiation, economic sustainability, enviropreneurial firms.

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[1] **Role of Market Based Instruments in New Business Paradigm** (co-author Louie Azzolini): Published in the Journal of Environmental Assessment Policy and Management Vol. 6 No. 3 (September 2004) / pp. 311-338.

Introduction and Background

Western civilization has treated nature like an infinite warehouse that freely gives up its resources to firms willing to pay the cost of moving them out of the warehouse. Environmental regulations helped us organize the removal of resources from the warehouse and their later reintroduction as waste. Regulations, it seems alleviated our worries, at least temporarily, about our management of the warehouse. Reality is, the warehouse is finite and no matter how nicely it is emptied, or how carefully it is refilled with the residue of human value, it is treated like a warehouse and its contents improperly valued. Altering the human value ascribed to the resources in the warehouse using policy instruments such as Market Based Instruments makes firms reconsider the relationship of those resources to the creation of value, and ultimately competitiveness. This paper attempts to show that the relationship of firms to the environment can be altered using MBIs, and that ultimately, the most competitive firms will not exist outside of the environment but become an integral part of it. How quickly and effectively a firm can integrate itself into the environment will depend on its competitive paradigm.

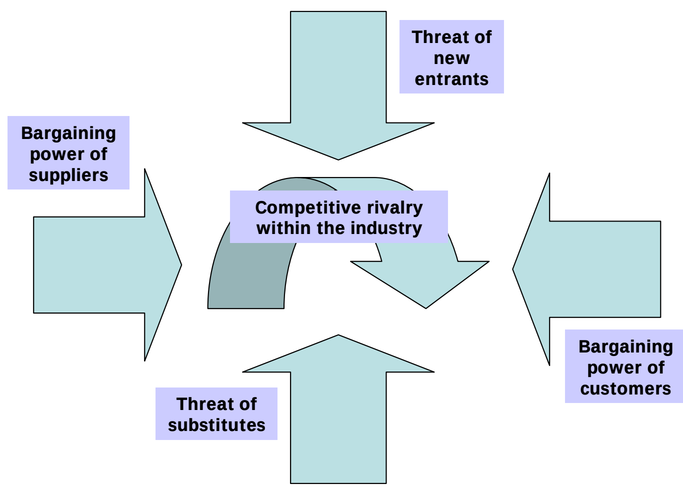
Literature respecting the strategic business response to environmental regulations is limited, usually descriptive, and rarely theoretical. Most journals speak of business complying with regulations and the law and then exceeding them to gain an advantage in marketing or cost structure. Forest L. Reinhardt's *Down to Earth* (1999) provides the most recent thinking on how firms can strategically reconcile shareholder value and environmental performance. This paper will further examine the major business responses to MBIs using Porter's Five Forces model of industry analysis as the analytical template.

The literature on the MBI emerged in the late 1960's when John H. Dales (1968) published, *Pollution, Property and Prices,* and proposed as a solution to pollution that regulators grant corporations permits to pollute. Central to the theory was that permits were tradeable; therefore, supply and demand, and not government would set their price (Wahl, 2002). Government set or "capped" the total amount of pollution allowed, then issued "tradeable" permits for each unit of pollution permitted up to the cap. This monetizes pollution and provides business the choice of paying the credits or paying internal measures to reduce pollution emissions, which ever is cheaper. As a firm reduces pollution emissions below its legal requirements, it can subsidize costs by selling credits (Wahl, 2002). The significant role of MBIs in the Kyoto Protocol, the United Nations Framework Convention On Climate Change (1992)(United Nations, 1992), and the U.S. Clean Air Act Amendments (1990) (U.S. EPA History Office, 2003) suggests MBI are the preferred regulatory instruments for transnational and inter-jurisdictional management and regulation of environmental pollutants.

There is no literature on the strategic use of market based policy instruments. As such throughout the preparation of this paper extensive use of on-line knowledge data bases was made. The results of the extensive on-line literature collection, analysis and synthesis were filtered through Porter's competitive industry model and then strategic MBI competitive opportunities were extracted.

Figure 1 depicts Porter's five forces model (Porter, 1980) which recommends that corporate strategy meet the opportunities and threats in the organization's external environment based on an understanding of industry structures and the way they change. Porter identified five competitive forces that shape every industry and every market. These five forces determine the intensity of competition and hence the profitability and attractiveness of an industry. According to Porter, the objective of corporate strategy is to modify the competitive forces in a way that improves the position of the organization. Based on the information derived from the Five Forces Analysis, management can decide how to influence or to exploit particular characteristics of their industry (Recklies, 2001).

Figure 1: Porter's 5 Competitive Forces



Market Based Policy Instruments

"Market based policy instruments are regulations that encourage behaviour through market signals rather than through explicit directives regarding….These policy instruments, such as tradable permits or pollution charges, are often described as "harnessing market forces", because if they are well designed and implemented, they encourage firms (and / or individuals) to undertake efforts that are in their own interest and that collectively meet policy goals" (Stavins, 2000; pp. 01). Stavins (2000) adds, "by way of contrast, conventional approaches to regulating environment are often referred to as "command-and-control" regulations," which regulate public policy matters such as pollution control by setting uniform standards that everyone must adhere to. The most common type of command-and-control regulations are technology or performance based. This basically holds all firms to the same target. However, costs for controlling pollution for example, can vary significantly between firms and between industry sectors. Therefore, costs can vary enormously between firms and sectors; all in an effort to achieve a uniform level of pollution from each firm. The implied statement is that because everyone has to meet the same output objectives, in the case of pollution, uniformity mean fairness. Unfortunately, this detracts from the primary goal of regulations which is to manage and improve to collective good by managing individual actions. The beauty of market based instruments is that they can significantly influence individual firm and collective industry sectors to take actions for their own benefit that also benefit the broader public good. This happens because the emphasis in the case of pollution is removed from the individual firm to an industry sector or sectors. Now, the collective ability of firms and individuals to manage their own contributions to goals or targets established through political will, as is the case with Kyoto Protocol, becomes the basis for either making or losing money; and that is guaranteed to shape behaviour.

Review of Market Based Policy Instruments

The first government-backed pollution trading programs were introduced in the United States during the mid 1970s by the US Environmental Protection Agency (USEPA) as a means of combating the high cost and rigidity of traditional legal approaches—limits set on emissions, court procedures for non-observance and fines for infringement. At its most basic, companies participating in a pollution "cap-and-trade" program within a particular sector of the economy agree to cap or limit their pollution emissions in return for an allocation of tradable pollution. There are a finite number of allowances issued by the US Government based on the total cap on emissions for all companies participating. Participants receive tradable allowances equal to their emissions target, or cap, for the year ahead. Companies can choose to sell the allowances received in the marketplace, or buy additional allowances in the marketplace, subject to cost or availability constraints.

The USEPA allowed these credits to become transferable and hence tradeable (United Nations, 1995). Today, there are markets for dirty water and methane (Murphy, 2002). The U.S. trades wetlands, water pollution, and fishing rights, and in what could be a huge expansion of the environmental market, the Bush administration's proposed clear-skies legislation would stiffen requirements for SO_2 emissions and create national markets for mercury and NO_x (there are already regional NOx programs). Market based policy instruments are however not an American concept or adapted only for open and free market economies. China and Slovakia for example, have SO_2 cap-and-trade programs and they are being implemented at the scope of entire cities in efforts to curb pollution and improve the health of their inhabitants. In South America Chile trades total suspended particulates and implemented city wide pollution trading schemes to reduce air born pollutants. Oceana, Australia, a non-Kyoto signatory, has a renewables trading market in, for electricity created from renewable resources like the wind and the sun. Canada trades SO_2, NOx, and VOCs (Murphy, 2002) and is considering significantly expanding the use of market based instruments subsequent to Canada's ratification of the Kyoto accord.

Now, with the commoditization of pollution, caps on total permissible pollutants in air sheds throughout the world, it is a short leap for the entrepreneurial mind to find ways of making money from market based regulations. Enter the brokers. Brokers in New York today can trade 30 types of air and the business is thriving with companies looking to trade to manage their risk exposure fearing future regulations and needing hedges to cover the regulatory risk which can be potentially devastating (Gardner, 2002). Brokers estimate the worth of the SO_2 market at $4 billion a year and growing; and trading in carbon emissions could grow somewhere between $75 billion and $145 billion annually according to the world's No. 2 reinsurer Swiss Re (Gardner, 2002). To facilitate investments, brokers, investors and chartered accountants are already developing products (e.g., investment funds) and services (e.g., carbon counseling, trading and brokerage of emission credits) to help firms address climate change risks and opportunities. Beth Schneider, Chair of the American Institute of Certified Public Accountants and the Canadian Institute of Chartered

Accountants Joint Task Force on Sustainability Reporting hopes that once accountants obtain the knowledge specific to emissions trading, there is no question their skills can be applied to this market (Glenn and Beech, 2002).

Karmali et. al. (2000) state that companies must approach the strategic management of green house gas (GHG) emissions as they would any other asset or liability on their corporate balance sheet. These considerations become even more important when considering that “[t]he banking industry in the past decade has put more weight on environmental issues and [environmental] impacts as part of its business and lending policies…. and that lending departments have brought on environmental advisers to help assess prospective loans, contaminated collateral and cleanup plans” (Pratt, 2002; pp. 01). In fact, most business leaders openly recognize that they must embrace the likelihood that carbon emission constraints will become a reality and actively manage the concomitant likely impact on corporate performance and shareholder value (Karmali et. al., 2000).

Strategic Application of Market Based Policy Instruments

Transformational leaders with strategic vision will take advantage of MBIs and position themselves as leaders in an emerging global economy dominated by resource scarcity. MBIs are a stepping-stone to an emerging business frontier that will transform natural capital’s waste into an asset with unique tradeable commensurable costs. Consider that “[o]nly about 1% of all materials mobilized to serve America are actually made into products and still in use six months after sale” (Lovins et. al., 2000; pp. 18). Now imagine firms having to pay to take back those unused unwanted products and the wastes used to manufacture them – all 99% of them. MBIs are a first step in a new business model; smart firms know that and are acting on that knowledge. They know MBIs will create new challenges and opportunities and are striving to find what MBIs mean to the firm, its stakeholders, and its competitors; and what the answers to these questions mean to the firm and its competitive advantage. Smart firms create new frameworks for understanding new problems.

Smart firms expand Freeman’s (1984) proposition that stakeholder analysis considers the actions of business units in terms of how key stakeholders are affected and what the firm plans to do to mitigate any negative impact on them. It also considers how stakeholders can contribute to a firm’s environmental performance. Stakeholders are legitimate contributors to the outcome of an organization. Legitimate stakeholders represent issues that are relevant to the firm and maintain accountability to those with legitimate interests to affect the firm. That is, they have power. Relevant legitimate stakeholders also contribute running an organization more responsibly, or significantly influencing the organization’s affairs, or others stakeholders. Key stakeholders in Porter’s five forces competitive model include company owners/shareholders/investors, employees, customers, business partners, suppliers, competitors, government regulators, any organization that has the potential to influence entry or exist from the industry sector, influence the nature of the competition within an industry sector, and those that have the potential to enable, facilitate or enforce switching of product inputs or product substitution.

To understand how MBIs, stakeholders, and core organizational competencies fit together, the smart firm compares itself to its stakeholders and competitors in order to assess its tactical, strategic and visionary values.

Tactical Assessment

Reinhardt (1999) believes there are five basic approaches to reconciling shareholder value with environmental performance:

1. Environmental differentiation to improve firm performance and capture the additional value from consumers.
2. Managing competitors by forcing their environmental management costs to increase marginally faster then they would otherwise.
3. Reducing costs within the firm by improving the environmental operational efficiency of the firm.
4. Redefining markets is a significant way to gaining competitive advantage and involves changing the way firms in an industry compete.
5. Managing environmental uncertainty and risk more effectively is inherently in a superior competitive position.

Strategic Assessment

Menon et.al. (1997) suggest that the strategic use of environmental rules can happen at a corporate level, business unit level and function specific level. That is, their conceptual framework presumes tactical, strategic and mission level use of environmental regulations. Menon et. al. (1997) see regulatory compliance with environmental regulations as a basic way of improving the economic performance of a business unit, because efforts are generally narrowly bounded and are driven by individual intrapreneurs within the firm. Menon et.al. (1997) go on to suggest that firms which integrate and coordinate environmental regulations and use them to develop broad environmental objectives/strategies across business units, department, companies etc. are better positioned to create a distinct differentiated competency. Finally, they suggest that firms with an enviropreneurial mission, vision and values are positioned to lead industry sectors and transcend the notion of environmental regulations.

Visionary Assessment

Rugman et. al. (1998) provide the conceptual framework necessary to define and bound the scope of individual firm environmental initiatives. The Rugman et.al. (1998) framework adopts government regulations as an explicit “sixth force” to Porter’s basic “five forces” model. Their adapted framework also provides a resource-based perspective on “green” strategies in an international context where firms can develop either “localized” or “internationally transferable” “green” capabilities.

Assessment Tool

Smart firms will develop tools for assessing its stockholder’s tactical, strategic and visionary positioning with respect to MBIs. **Table 1** provides a simplified assessment tools to help managers understand how prepared their firm and its stakeholders are for MBIs at tactical, strategic and visionary levels.

Smart firms do not simply react to MBIs. They understand that MBIs are rooted in a different conception and understanding of how people and business can relate to the physical environment. Smart firms do not attempt to reshape the philosophical basis for

MBIs; but they try to understand the tactical, strategic and visionary implications of MBIs, and apply that knowledge to ensuring the sustainability and success of the firm. Smart firms improve and innovate tools they use to understand their competition and stakeholders.

Table 1: A simplified assessment tool for MBIs

<table>
<tr><th colspan="6">Regulatory Positioning Decision Space</th></tr>
<tr><th>Firm Response to Environmental Regulations</th><th colspan="5">Pollution Control Costs</th></tr>
<tr><td></td><td>Depreciation on environmental investments (end-of-pipe or process-integrated)</td><td>Operational costs of environmental investments (energy, raw materials, staff etc.)</td><td>Admin. Costs associated with achieving environmental compliance</td><td>Expenditures on research and development related to new environmental technologies</td><td>Environmental taxes, fees and fines</td></tr>
<tr><td>Development of green capabilities</td><td colspan="5" rowspan="9">Each column/row intersection creates a decision space.
Each decision space has value, strategy and tactical level management implication. The accumulation of decisions in those decision spaces produces a general view of a firm’s regulatory competitive positioning. Each column/row intersection can also be linked to each of Porter’s (1980) five forces model to see how other firms are positioned with respect to the same sector regulations.</td></tr>
<tr><td>Senior management commitment to environmental performance</td></tr>
<tr><td>Integration of environmental issues in strategic management</td></tr>
<tr><td>Participation of environmental managers in strategic planning</td></tr>
<tr><td>Employee training and participation</td></tr>
<tr><td>The degree of functional coverage</td></tr>
<tr><td>Internal environmental reporting</td></tr>
<tr><td>External environmental reporting</td></tr>
<tr><td>Application of some form of life cycle analysis</td></tr>
</table>

Strategies based on 19th and 20th century competitive and regulatory models are maladapted for 21st century regulatory and competitive conditions. For example, we commonly think of mining as an extractive industry with massive tailings (waste material produced by the mining industry) and waste rock piles as the price of progress. A 21st century strategic mining model would not build a mine but grow one, and it would use abandoned mine tailings as free sources of rich, high concentrated growth medium – Phytomining for the uninitiated. Phytomining is the use of metal-accumulating plants to return an economic profit from waste rock. To date only nickel, thallium and the precious metals (gold, platinum and palladium) appear to be likely candidates for Phytomining. In parts of the world we use a daisy called *Berkheya coddii*. This plant grows to nearly 2m high and may contain up to 2% of its dry weight as nickel. A South African mining company cleaning up parts of their land with *B.coddii*, recently recovered some of this metal as nickel buttons. Plants can also be made to accumulate metals such as lead and gold (Phytomine Environmental Limited, 2001). Strauss (2002) reports that Inco Ltd. plans to farm the yellow flowering bushy alyssum on an island of Sulawesi on land naturally rich in nickel. The metal rich crop it plans on harvesting will contain two per-cent nickel.

Moore (1996) writes that the new paradigm requires thinking in terms of whole systems – that is, seeing your business as part of a wider ecosystem or community of co-evolving, innovating participants. He presented the notion that economies are ecosystems and enterprises are species that both collaborate and compete. This is now hitting mainstream business thought, emerging as an idea whose time has come. Using Moore's ideas, Inco's new mining method is an emerging element in a new business and environmental ecosystem that redefines the nature of mining and competition in the mining sector. Inco is evolving, seeking visionary improvements in its mining methods and redefining what mining means, and will in due course, redefine a system business and environmental relationships that will enhance its strategic position.

Inco is not alone though. Hot on its heels is Tech Cominco Limited (Tech Cominco). This small mining and metals company, headquartered in Vancouver, Canada with assets totaling approximately $5 billion recently announced the successful development of a new, low-cost process for the direct extraction of zinc metal from sulphide ores. The new process, patents pending, is known as the HydroZinc™. It involves bioleaching of ore in heaps with naturally-occurring bacteria, followed by neutralization, solvent extraction, and production of metals once put in solution or liquefied by electrowinning. The HydroZinc™ process, a direct ore to metal process which does not require grinding and flotation of the ore, can produce zinc with total direct operating costs of 20 cents per pound. The process is applicable to a variety of zinc ores. The hydrometallurgical process is environmentally sound and free of sulphur dioxide handling and emissions[2].

The power of simplicity shown by Inco and Tech Cominco is just the start. Firms like Swiss Water ™ are providing decaffeinated coffee beans without using chemicals such as methylene chloride and ethyl Acetate. Both are chemicals that are used to decaffeinate coffee. Swiss Water™ as probably guessed, uses water to decaffeinate coffee beans and is branding itself as the supplier of coffees that are decaffeinated using the 100% chemical free SWISS WATER® Process. The potential production and pollution savings are significant.

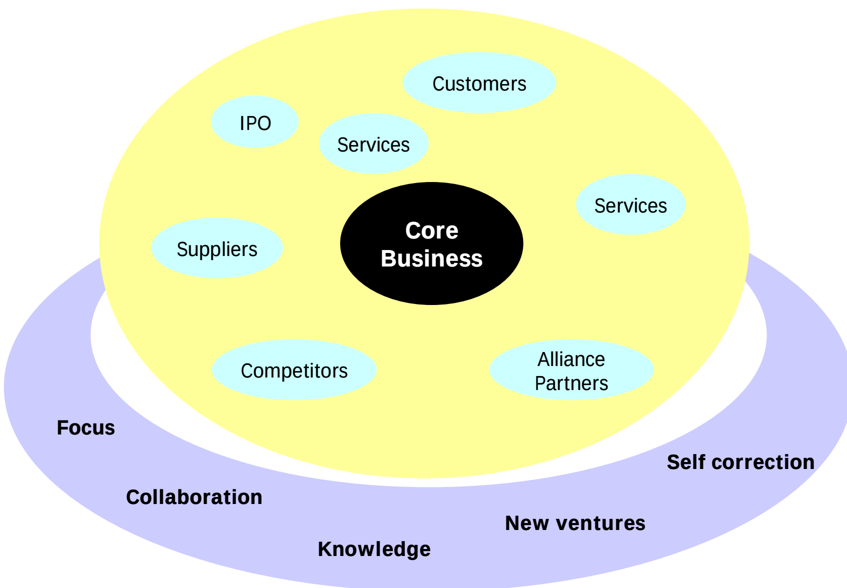
[2] More information can be found at Teckcominco website: www.teckcominco.com.

Georgantzas and Dunham (n.d.) suggest that firms must break free from their preconceptions of strategy formulation and implementation. That is, a firm cannot achieve competitive superiority using strategic and operational activities only. It must redefine its vision of itself and its future. Inco has managed to break free from its mining preconceptions and in the process has redefined its mining strategy, and its competitive possibilities ranging from new suppliers, buyers, and substitutes. Inco is not unique. Real-estate companies, other mining companies, water companies are looking to green development to create unique lasting customer value that actually creates more value naturally with time. Tech Cominco, Swiss Water™, STMicroelectronics, the Royal Dutch/Shell Group, and the Carrier Corporation are redesigning production processes, corporate strategies, and learning how to compete in resource restrained service economy. They are beginning to free themselves from old competitive ideas and are exploring new ways of successfully competing in resource restrained economy. They have broken free not because they wanted to, but because MBI regulations were escalating the risks and costs of doing business, and new ways of doing business were found.

MBIs also add costs where they did not existed before. For example, a firm having to pay for the right to release CO_2, where before the right existed without any cost to the firm. By linking a firm's economic decision making directly to resource scarcity or a pollution logistics issue, the decision makers are now forced to reflect and take into account ecological and environmental realities. Consequently, those previously free environmental rights emerge as costs. This reversal is generous considering government's declaration of the environment as a free "public good" made it possible for industrialists to impose the appalling costs of pollution upon the men, women, and children whose persons and property were invaded with impunity. Furthermore, the absolution of polluters from responsibility for the costs of their activities meant an absence of any economic incentives to develop non-polluting technologies (Williams, 1987). Pollution was accepted as the price of progress. Bill payable by the environment! MBIs bring the costs back to where they belong and act as economic and environmental management tools that reintroduce elements of private property into the economic and environmental debate.

A firm's pollution production and consumption costs are either passed onto the buyer/consumer, or, ways found to provide consumer value at lower environmental and consumer cost. The cheap answer is to pass the costs onto the environment, and that is what we have chosen to do; but even that answer has reached it limits because we refused to believe the environment's limited capacity to accept our pollution debts. Enter MBIs. They change the competitive landscape and reward those that consume fewer global resources, or produce less waste in the creation of consumer value. MBIs combined with 21st century organizational models such as the constellation organization (see **Figure 2**) and infused with fresh strategy ideas such as the one proposed by Georgantzas and Dunham's (n.d) would radically alter how firms compete. Undoubtedly, management would focus its attention on efficient strategy designs that eliminated increased adversity or protectionism. That is, facilitate the development of constellation organizations and bring systems thinking tools to strategic planning in order to understand, analyze, design, and communicate the complexity inherent to the dynamic systems in which we all live and work; or, put another way, recognize that the economy, and by extension the environment, is not a zero sum game, and that the success of the system predisposes success of its participants.

Figure 2: The Constellation Organization



The competitive landscape is changing and for an insight into what it might look like in the not too distant future a conceptual model is prepared to explain and group individual firm responses to MBI.

Sector Level Strategic Considerations

The new competitive paradigm connects firms and their relationships to the environment along a management spectrum starting with laggards and concluding with achieving firms.

Laggards do not want to run their businesses differently. Anything that gets in the way of their business, is at best ignored, or at worst, politically, legally, or economically coerced to relent. These laggards are not necessarily poorly run businesses, but they are significant “drags” to change because their business models are successful.

Grabbers, as the term implies, tactically grab low hanging economic gains made possible using environmentally conscious management practices. Turning off the lights at night, using energy efficient light bulbs, and encouraging employees to work at home periodically, are simple examples of what grabbers do. Grabbers integrate environmental management practices when stakeholders demand it, or, when there are direct economic gains possible within acceptable payback periods. Grabbers are environmental tacticians that introduce uncomplicated environmental management policies that do not require strategic level management input.

Thinkers operate at a strategic level of environmental management and believe that inefficient management results in waste, and that strategic environmental management enables strategic competitive advantage. Thinkers blend the best of the industrial mindset and an emergent mindset. They understand the rationale for market based incentives and the price tag they create for previously free environmental “services”. They know that nature’s warehouse is finite, and that proper pricing of nature’s store is necessary for their efficient allocation and their strategic competitive advantage. Thinkers do not just turn off the lights; they redesign the lighting system. Thinkers move beyond immediate problem resolution to higher level analysis and evaluation with the aim of improving competitiveness.

Achievers function in a business paradigm where environmental and business realities are indistinguishable, and where firms compete to occupy niches in the business ecosystem. Using the lighting example, turning off the lights is a tactic for reducing energy consumption; redesigning the lighting system is strategic response to reducing energy consumption; dispensing with the need for mechanical light emitting devises and replacing them with organic light emitting paint is visionary. This visionary response would take a previously mechanical wasteful approach to light production and replace it with a new organic niche with practically zero cost. This visionary business approach puts the firm into the environmental warehouse and changes how firms look at what they produce and consume. It also forces them to go beyond Porter’s two dimensional competitive model to complex multi-dimensional competitive models that better reflect an achieving firm’s environment.

Laggard firms will accept pollution as cost of doing business. Achievers on the other hand will see their inputs and outputs as profit centers. This paper next explores the practical competitive tools currently available to help laggards evolve into achievers.

Competitive Adaptation

Firms will initially try to adjust their competitive positioning by influencing Porter’s five competitive forces (Porter, 1980). That is, firms will attempt to reuse proven strategies to accommodate new costs introduced by MBI. As old strategies falter and competitors begin to fail, surviving firms will find themselves with the option of evolving their competitive strategies or joining their failed competitors. Many firms will not be able to competitively evolve and they will disappear. Firms that decide to change the way they operate will closely examine their relationship to the natural world and find ways of reducing resource input and transformation costs. Surviving firms will use incentives provided by MBIs to create differentiated, cost focused products and services and evolve their consumption and production functions in the process. These surviving firms that truly engage the possibilities provided by MBI will eventually shape society’s future organizational and production paradigm based on ecological interdependency, evolution and competitiveness.

Adaptation of Porter’s competitive forces model helps explain how MBI can affect sector competitiveness. For example, MBI can influence the cost and availability of firm inputs, and their substitutes; alter sector entry and exit channels; and, influence the perceived and actual consumer value. According to Porter’s model of competitive forces, MBI constitute part of the “external” environment that firms must manage successfully in order to compete effectively. According to Porter the threat of new entrants results in more product or service in the market place, lower prices and increased competition. Strong buyers can buy inputs for less, and in turn, sell for less, increase quality demands, expand service requirements, and foster competition between sellers. Strong suppliers can raise costs of inputs, reduce final service/product quality and reduce availability of supplies. Attractive substitutes on the other hand limit the size of potential markets, limit profits and generally impose a ceiling on prices.

A firm's response to the introduction of MBI will vary depending on its relative positioning along a competitive spectrum ranging from that of the "laggard firm," to that of the "achiever firm." Laggard firms will view MBI as a threat and cost to business. Achiever firms will literally transform their production service paradigm to avoid MBI costs and to secure the most differentiated lowest cost position. The path to "enviropreneurialism" will pass through four competitive stages as depicted in **Figure 3**. They are discussed in the next sections.

Figure 3: Typology of MBI Competitive Responses

	Laggard	Grabber	Thinker	Achiever
Environmental Value Definition	MBI laggard with high customer and share value entropy.	MBI grabber looking for easy environmental value through cost savings.	Mixed use of industrial and post industrial competitive tools – mix between grabber and achiever.	Strong MBI firm and evolving e.g., Inco's new Phytomine
Environmental Model	Legal compliance.	Environmental protection.	Resource management.	Enviropreneurial.
MBI Response Strategy	No MBI response.	Operational, tactical response to MBI.	Tactical and strategic response to MBI.	Visionary, strategic and tactical response to MBI.

Industrial Firm **Enviropreneurial Firm**

Laggards

MBI laggards will refuse to take MBI seriously. They will argue that Nature's inputs should cost no more then their extraction costs or royalty, plus a reasonable profit. The actual natural resources should remain free. Besides, they will argue that there are regulations in place to protect the environment and they are doing what they have a right to. What MBI laggards do not understand is that social and economic management systems evolve to reflect knowledge and emergent realities that if not addressed may threaten the very basis of system functioning. For example, even laggards pay a Value Added Tax (VAT), or if living / operating in Canada, a Goods and Services Tax (GST) on the market value of goods or services purchased. Its introduction in Canada challenged people's understanding of taxation in general and the reasons why the tax system needed fixing when it seemed to work fine. The GST raised issues about redistribution of the tax burden, and uncertainty and concern about its potential negative impact on the economy. The introduction of the VAT and the GST provides an excellent example of the implementation challenges faced by supporters of market based incentives. Many will see MBIs like the VAT and GST and consider it a general tax that applies to the cost of extracting resources from the environment or putting pollution into the environment. MBIs are not taxes, they are pollution substitutes that are fully avoidable and if used strategically, profitable. When significant changes occur, such as the GST, there is resistance, mistrust, and political consternation. MBIs are not taxes; however their implementation spawns resistance, mistrust and political consternation. Not because MBIs are inherently poor policy instruments, but because they have the potential to impact every enterprise, in every sector of the economy and possibly alter existing competitive relationships.

Strategically, MBI laggards are unwilling or unable to become MBI competitive. These firms will continue to pass along their environmental regulatory filings to their environmental consultants or department and expect them to tactically address environmental matters. MBI laggards will use advanced command and control competitive tactics. That is, MBI laggards will continue using industrial tactics by defending against competitive forces and securing customers by advancing value propositions based on price, product quality and/or product differentiation. Laggards will control their structural cost drivers by trying to capture scale economies, learning and experience curves, capturing locational advantages and by improving the value chain. Value chain improvements could include product simplification, shifting to less capital-intensive or streamlined operations, relocation of production facilities to be closer to suppliers or consumers, more vertical integration.

MBI laggards do not see any value in pursuing an environmental differentiation strategy believing its continued focus on traditional competitive strategies such as purchasing and procurement cost managment, product research and development, outbound logistics optimization, distribution and marketing management. Laggards focus only on changing product features that lower costs, raise performance, or enhance consumer satisfaction based on current production processes and interrelated company systems. Laggards strive to find customer value through operational efficiencies, cost management, and product enhancements to maximize perceived value. The laggard believes that all its sectoral competitors are operating with similar technological, managerial, supplier, consumer and substitute considerations.

Grabbers

Firms that aggressively grab environmental opportunities will shift their strategies towards a higher and more complex level of environmental management. Grabbers are fundamentally rational, and will use rational tools to achieve MBI objectives. That is, they will seek utilitarian solutions based on notions of technological optimism. The grabber approach to MBI accepts their use in an industrial mode of production where the focus is on squeezing operational effectiveness out of each process step in the supply chain, from procurement, manufacturing to customer support. The Japanese are known for their operational effectives and their ability to defy conventional management theory by being able to simultaneously increase product quality and reduce product cost.

Grabbing decreases suppliers' power because it lowers firm input demands and increases renewable resource consumption. From a competitive standpoint firms that gather low hanging MBI fruit will use their company intelligence gained from internal audits, inventories and baseline accounting of supply inputs, resource use, competitive alternatives and substitutes to challenge management to reduce waste to zero, or close to it, and simultaneously create customer value. Something the Japanese auto industry has proven achievable.

The grabber represents the leading edge of the current firm responses to command and control regulations and they follow Reinhardt's (1999) five tactical and strategic approaches to leveraging regulations for competitive advantage.

A postindustrial model will build on natural capital fueled by MBI competitiveness and will shift the competitive arena into a new realm. MBI are the platform from which a grabber firm moves into the realm of the thinker.

In summary, the Grabber see the problem as too much waste / pollution to manage. It considers environmental degradation as an economic externality. This shapes its competitive response which can be best described as:

- Protection through laws and regulations. Do the least required by law, litigate when challenged, and impacts on the environment are an accepted cost of doing business. In addition, it is viewed as the legitimate right of the firm to pollute if capital is created and used.
- Technological optimism is the over exuberant expectation that human ingenuity will fix environmental problems before they become serious. It is a "make the money today" and figure out how to "fix up the environmental problem tomorrow" approach to business that relies on yet undeveloped technological solutions to justify irrational behavior.
- Pollution reduction and control is a way for grabbers to save money. Improved management and control reduces waste and associated costs. Better management and control become simple ways of improving firm performance.
- Reducing quantity and toxicity of wastes is simple and effective way of saving money. Toxic wastes are toxic to balance sheets in the litigious environment firms operate in. Eliminating their use, or finding viable alternatives is acceptable if only for public image, licencing and regulatory considerations in some jurisdictions.

Thinker

Thinking firms recognize MBI and understand that there is no free environmental ride. Thinking firms recognize that natural resource inputs have a public ecological value. That ecological value is defined or measured by, for example, the clean water generated by drainage basins, carbon sequestration provided by trees, flood protection provided by riparian vegetation. Thinking firms understand that ecological systems provide "free" public and private goods that would have a public cost if they were to be replaced by industrial systems. For example, clean water freely provided by a watershed would have a cost if the watershed was replaced with a water purification plant. MBIs reintroduce a market value for those environmental services and the environmental components underlying those services, namely the ecosystem.

The idealized thinking firm becomes coupled to the ecosystem that supports its productive services through MBIs and its competitive strategy begins to mimic its ecological supply chain. For example, Cargill Dow, a joint venture by the agricultural giant (Cargill) and the chemical company (Dow), is manufacturing biodegradable and recyclable plastics from corn sugars. The company already makes environmentally friendly packaging for Sony products and pillow stuffing for Pacific Coast Feather. The Company acknowledges that its fate is tied to how many products it can make from renewable resources. The company opened a $300 million facility in Blair, Nebraska last year that makes packaging material, plastic cups and film wraps (Roston, 2002).

The practical thinking firm will try to dramatically increase resource productivity, eliminate waste or make waste profitable, and shift from product to solution-based business models. From an economic standpoint MBI will alter a firm's direct, hidden and contingent costs. How costs are managed will impact the firm's competitive positioning in its industry sector. The thinking firm will embody the rational utilitarian mind of a grabber and reach for the achieving firm's success.

MBI will change what firms pay for their raw materials and their productive capital assets. Some inputs may become more expensive, others less expensive. This will make firms look for alternative production inputs that when in the production process result in the creation of firm or consumer costs; that is, management's consideration of the material inputs will also include pollution rights that must be purchased in the open market. Previously unaccounted waste disposal costs and recycling revenue streams should encourage firms and consumers to seek substitute products that mitigate disposal costs, or that feed recycled materials back into their production stream. MBI will also introduce conditional costs for either the firm or the customer. These contingent costs might decrease the value of the product or make other products more attractive. Firms choosing to avoid MBI considerations may face loss of customer goodwill, and business interruptions from concerned stakeholders, especially if the firm is monopolistic or quasi-monopolistic. Finally, MBI costs will likely fluctuate with ecosystem productivity loss and resource depletion. This will leave firms more exposed to substitute rivals, and increase their hedging costs to manage long term cost and supply risks.

From an environmental standpoint, MBI will change how firms consider material and energy consumption, local impacts, regional impacts and global impacts. MBI will impact how products are designed, assembled and packaged, and products with more materials will have more pure MBI costs. This will encourage firms to maximize the customer value to material consumption ratios. MBI will also impact the lifetime costs of products and influence what types of current and potentially hazardous inputs might go into a product. The contingent and risk costs would have to be reflected on balance sheets and in annual revenue streams. Energy costs money; with MBI, dirty energy will cost more, the energy needed to operate a product, and the amount of energy used over a product's lifetime will factor into the firm's production and carrying costs. Consider for example that it is now possible to use US economic input/output tables for life cycle analysis. There is commercially available software that provides a traceable result that's representative of US industry using US federal databases for environmental releases, resource consumption, and industrial ecology. For example, LCNetBase allows one to slice life cycle inventory results by pollutant, by supplier tier, and by industry[3].

From a local standpoint, products that are not recyclable will likely have steeper MBI costs and where non-recyclables impact local government costs; firms may be required to pick up part of that cost. At a regional level, product outputs or products themselves that impact multiple jurisdictions (e.g. acid rain) might be subject to specific MBI that return those costs back to the originating firm. Finally, firm outputs that have global impacts, such as ozone depleting substances or CO_2, will be caught by international MBI agreements such as the Kyoto Protocol.

Some MBI activists go so far as to suggest transferring the public ownership of natural capital by giving emission rights (part of the entitlement of property ownership) or "environmental shares" to citizens. Companies and other polluters then would have to buy the environmental shares (pollution rights) from citizens. For the citizens this creates additional income. The emission rights should be regarded as environmental shares and can (must) be traded. The idea of speculating with these shares is attractive from a "green" point of view. While radical, this is the type of thinking that will influence a firm's future. Cutting edge firms will evolve beyond industrial management systems to ecological management systems. Industrial management systems rely on 19th century concepts of competitive advantage, and production such as capital, land, and labor; and perhaps human capital. The industrial management system is lifeless. It uses brute force and high energy to transform raw natural resources in human consumables. Ecological management on the other hand is complex, non-linear, and expert at finessing and co-existing with existing ecological processes to create human consumables. These are the future ecological and competitive achievers.

In summary, the Thinker's problem is related to poor management of resources. It considers environment as externality which needs to be internalized. Therefore, the competitive response of the Thinker is

- Monetization of environmental "services"
- Getting the price right
- Technological optimism/clean technology
- Resource conservation + waste & pollution prevention
- Life cycle materials choices
- Manage competitors by forcing their environmental management costs to increase marginally faster then they would otherwise.
- Reduce costs within the firm by improving the environmental operational efficiency of the firm.
- Redefine markets is a significant way to gain competitive advantage
- Manage environmental uncertainty and risk more effectively is inherently in a superior competitive position.

[3] For more information one can refer to the Earth Shift website: http://www.earthshift.com/products.htm

<u>Achiever</u>

Achieving firms reject the simplicity of industrial models of competitiveness, the incomplete concept of customer value by focusing on the disconnected objective relationship between producer and consumer, and financial performance as the primary measure of individual firm success. Nor do achieving firms consider the suppression of competitors, sectoral domination, and the controllability of outcomes as healthy, desirable or acceptable. Achievers also reject the idea that competition is bound by clearly defined industries. For example, the farming industry will not compete with the mining industry. Achiever firms understand the industrial concepts, processes, structures, relationships, but look forward and embrace a new vision of an achieving sustainable future.

Achieving firms focus on relationships, cooperation, survival, and diversity. "As Bill Joy of Sun Microsystems says so aptly, "the goal is not to win at someone else's game, but rather to change the game to one that you can win"" (Joy in Moore, 1996; pp. 54). Moore (1996) adds that the "presumption that there are distinct, immutable business within which players scramble for supremacy is a tired idea whose times past…. The designation [industry] itself is simplistic…. the label is not much more than a crude grid used to compare and contract businesses, a fiction conjured up by policy makers and regulators…" Business is a subset of the human order, and people create the labels and lenses used to describe and understand that order. If people change their understanding of their environment, it makes sense that the lens used to understand business would also change. Ehrenfeld (2000; slide #15) eloquently states that "[p]possibilities are empty, created by the declarative power of human language and are unconstrained by the limits to action created by following deterministic rules based on the past." The achieving firm's business framework respects limits / carrying capacity, appreciates the nature of evolutionary threats and seeks to mimic nature as a sustainable metaphor (Ehrenfeld, 2000).

Sometimes there is a fundamental discontinuity between the way we want the world to work, and the way it actually does work. Sometimes, the answers to these contradictions lie not in the rules human beings create, but by-rules for action derived from the world itself. These rules, if widely accepted by others, become a paradigm for social (institutional) action. What is needed is a new paradigm that causes value as defined by marketing principles of price, cost, and derived human satisfaction to align with environmental value as defined in the economic world of supply, demand, substitution and scarcity. MBIs are the bridge between the value of sustainability and the economics of scarcity.

This new management paradigm enables executives to see reality unfolding as industry structures evolve, and sometimes decay rapidly; to understand the need for co-existence and co-operative competition in order to ensure the survivability of the firm, and to embrace continuing innovation and co-evolution. Management within the ecological paradigm suggests that firms should pursue a differentiation strategy from competitors. To exploit a niche before a competitor fills it. The focus of the ecological paradigm is on the dynamic and interactive nature of competition for external resources. Much of the empirical research using this paradigm focuses its activity at the industrial level. This approach has been useful for its longitudinal evolutionary perspective to indicate variables influencing founding and failure of organizations.

Grow your mine, bio-accumulate your gold, genetically engineer your living house[4], mulch your curtains[5]. The possibilities are as limitless as the human imagination. The rules of value creation do not change. What changes are the strategies used to create, identify, communicate and ultimately satisfy them. Nature's raw resource inputs are still needed (food to create value), alternative sources of food will exist (suppliers), and there will be competition from other firms looking for the same food (competition). The rules of firm output will change radically. Achiever firm output becomes the food for others firms and consumers, and the quality of the food produced contributes to another firm's existence and evolution. Other firms in the business ecosystem will compete to provide their food (threat of substitutes) to the firms and consumers that need it. Waste is no longer just a cost of doing business – it is unused, unprofitable output. It is certain death for the firm. The achieving firm will serve nature without sacrificing profitability and MBI will harness people's self-interest so that they can act in ways that sustain rather then destroy natural capital. The achieving firm will derive its MBI success by developing business and competitive relationships that mimic ecosystem relationships.

Summarizing, the problem encountered by Achievers is that the scale of development is inconsistent with long-term ecology and firm survival. Their competitive response can be best listed as follows:

- Dramatically increase resource productivity (i.e., shareholder value).
- Emphasize the elimination of waste, and the full and total value capture of all resource inputs through closed loop production systems.
- Emphasize solution-based business models where flows of services That is, create shareholder value by continually adapting to changing consumer expectations of quality, utility and performance.
- Reinvestment in the natural capital assets that enable firm processes. Hence investing in the raw natural materials that sustain economies.
- Substitute renewable for nonrenewable energy sources
- Ensure recyclability of non-renewable materials
- Eco-efficiency
- Design for the Environment
- Strongly interdependent and systems-oriented
- Cycling material stocks

[4] Adam Lewis Environmental Studies Center, Oberlin College: A building like a tree. A building that not only cleans its own wastewater and produces more energy than it consumes, the Lewis Center has also become a magnet for campus activities – attracting students with its combination of visionary design and comfortable connection to nature. (Source: http://www.thenextindustrialrevolution.org/context.html)

[5] A leading U.S. commercial fabric firm teamed up with a textile mill in Switzerland and McDonough-Braungart to design and produce an upholstery fabric so toxin free that the local garden club uses factory trimmings as mulch. When Swiss inspectors tested the mill's effluent, they thought their instruments were broken-the water leaving the factory was as clean as when it entered. (Source: http://www.thenextindustrialrevolution.org/context.html)

- Cascading energy utilization
- Improve the metabolic pathways of industrial processes and materials use
- Create loop-closing industrial ecosystems
- Transform "wastes" into useful by- or co-products
- Product-based - focus on product life-cycle
- Reuse
- Remanufacture
- Materials-based - focus on industrial organization
    - End-of-life product materials recycling
    - Recovering and using by-products as feeds
    - Integrated industrial communities (Industrial symbiosis)
- Reduced material intensiveness or dematerialization
    - Market function, not product
    - Packaging design
    - Product system life extension
    - Reusable
    - Appropriately durable
- Material life extension – recycling
- Material selection
    - Use of recycled materials vs. virgin materials
    - Toxics reduction and elimination
- Efficient distribution/transportation
- Dematerialize industrial output
- Creating new action-coordinating structures
- Cooperation versus competition
- New forms of economic coordination

In his comparison of industrial and ecosystems, Moore (1996) concludes that competition exists among business ecosystems (inter-sectoral) and for leadership and centrality within a particular ecosystem (intra-sectoral), where economic performance is a function of how the firm manages its alliances and relationships within the network that constitutes its ecosystem. "This all suggests that the central game of strategic management is moving from managing oneself to leading a community of allies. It is not enough to have a business model for one's firm. Executives must become ultra sophisticated at developing business models for their respective [ecological] communities" (Moore, 1996; pp. 57).

Figure 3 presents a summary of discussions above. How firms progress from laggard to achiever is unknown, as are the specific organizational structures that firms will evolve into in order to remain competitive. What is evident, is that in the future, firms will resemble the farms that preceded the industrial complexes of the 20th century in that firms will operate within a complex interconnected ecosystem of production and consumption with no waste where survival of the land the water and the natural resource inputs that drive the system are paramount to survival of the productive system.

Competitive firms recognize the possibility of resource scarcity and the effects of MBI. They also know and appreciate that the new economy reflected by MBI is one that reflects shifting societal priorities and changing business models. The strategies and tactics that will guide the evolution of laggard firms into achiever environpreneurial firms is not precisely mapped out but there are a number of tools, tactics and strategies that that firms can use. All of them are applicable depending on the managerial maturity of the firm and its capacity to extend its environmental management practices, strategy and vision throughout its organization and to its constellation of relationships.

Competitive Darwinism

Laggards create and dispose too much waste and are unable to conceive operating without wastes. They prefer regulatory models that accept pollution as the price of progress. They are frozen in evolutionary time and refuse to adapt to changing environmental and economic conditions. Laggards believe they are not the cause of any environmental problems because they are complying with regulations. They cannot comprehend a world outside of their own competitive systems, and their very existence almost seems rationale and justification for their world view. Laggards believe technology will solve firm created problems so that their existence and their economic reality can remain intact. Laggards prefer end-of-pipe pollution solutions to pollution, or even better pollution dilution solutions. Shaky ground to say the least.

Grabbers want economic and environmental gains with no pains, and if getting stakeholder buy is an added benefit all the better. Grabbers are more sophisticated then laggards, and they benefit by their willingness to try inexpensive environmental fixes that save money and are industry standard. Grabber firms, like laggard firms, are also doomed to the same evolutionary fate if they cannot evolve their industrial competitive world view and strategically alter their way of doing business.

Thinkers see waste as operational inefficiencies, lost value, and potentially a significant liability. Thinkers will strategically use their environmental advantages to their competitive benefit. They will try to manage their competitors, redefine markets, suppliers, buyers and substitutes as well as continually reduce environmental overhead and risk. Thinkers blend the best of the industrial mindset and an emergent mindset that is more in tune with the environment. Thinkers reach higher into the tree of environmental consciousness to find environmentally competitive fruit by strategically altering firm management orientation to the environment. Thinkers like their predecessors are also doomed to history if they are unable to disentangle their industrial competitive consciousness from their environmental consciousness. Firms that manage to evolve their thinking mindsets will transcend sectoral competitiveness and imbed themselves into an ecosystem of firms that are inexorably imbedded into the environment and each other.

Achievers no longer work through an industrial mindset and are unconstrained by that competitive frame of mind. Achievers see themselves imbedded in ecology of businesses that use each other's outputs for survival. Their frame of reference transcends linear industrial models of production and in the process radically shifts the competitive rules governing industry sectors. Achievers are keenly aware of their total value generation and are always trying to increase their resource productivity and value capture. Achievers actually reinvest their gains into their suppliers, consumers and maybe even their competitors because they accept the collective strength of the ecology of firms transcends any single firm. Achievers really are designing for extended product / service life and are linking technology, ideas and possibilities across industry sectors and rediscovering the possibilities that lie outside of narrowly defined mind sets. Achievers will use a variety of tactics and strategies to achieve their visions of a zero cost output combined with long-term sustainable growth. Think of a tree. It pays zero for the water it uses, the soil it displaces or the sunlight energy it captures, yet it grows and provides a multitude of services and products to its ecosystem. It competes with other trees and in the process defines its optimal role and purpose in an ever evolving system of change. Replace tree with firm and that is the possibility that Achievers seek.

Conclusion

Environmental regulations can affect a firm's competitive positioning by changing its relationship to Porter's five forces, and by altering its cost structure, risk exposure, and, by extension, its competitiveness. Environmental regulations create pollution control costs. "The total costs of pollution control are defined as the sum of annual depreciation on environmental investments (end-of-pipe or process-integrated), the operational costs of environmental investments (energy, raw materials, staff…), the administration costs associated with achieving environmental compliance, expenditures on research and development related to new environmental technologies, environmental and taxes, fees and fines" (Verbeke et.al, n.d.; pp. 3).

MBIs link individual actions to collective action through the market, and link the market into the ecosystem. Initial results suggest MBIs work as shown by various examples in this paper.

MBIs are gaining acceptance and their use is growing. Many business leaders have now openly recognized that they must embrace the likelihood that MBI constraints will become a reality and actively manage the resultant impacts upon corporate performance and shareholder value (Karmali et. al., 2000). This will create uncertainties for firms bringing implications for their financial performance.

The new economy reflected by MBI is one that reflects shifting societal priorities and changing business models. Kelly (1998) describes how the principles governing the world of the soft (e.g., service) will soon command the world of the hard (e.g., consumable products, objects). It is a radical future view, but it paradoxically embraces the fundamental premise of Lovins et. al. (2000). MBIs are a stepping-stone to an emerging business frontier that will transform wasted natural capital into an asset with unique tradeable commensurable costs. MBI are economic and environmental management tools that add costs where they did not exist before, and link firms into resource scarcity or pollution problems at an ecological level.

MBI are the leading edge of management within an ecological paradigm that will see mines grow their concentrate, bacteria bio-accumulate gold, clothing added to gardens as mulch, nano-machines growing your photo-reactive carpet so it changes color according to light intensity, organic paint on walls that purify the air, micro-neighborhood hydrogen turbines, local water purification systems, local geo-thermal conductors. A new worldview of how people, the economy and the environment can co-exist. MBI links the three together through the common law principles of accountability, responsibility, and the free market. There are tactics and strategies that firms can use to prepare for the changes that are coming. The smart firms are already preparing.

It is no longer enough for firms to comply with environmental laws and regulations. Society is demanding much more and is willing to accept environmental policies that are mediated by the market. That is why governments are turning to the market to strengthen the alignment of environmental and human values. MBI are risky for the status quo because they can radically alter the competitive playing field demarcated by porter's five forces by fundamentally altering how firms relate to the environment and how they account for the environmental resources and services consumed, and ultimately discarded in the business process. That is, MBI add costs where none existed before, and forces firms to fundamentally change the way they do business if they want to survive. Pessimists will argue the goals of concurrent environmental and economic sustainability are best addressed by the current free market economic model that has created sustainability issues to begin with. Reality is that a fundamental realignment of human values as expressed by the costs paid for environmental goods and services is necessary. The market is a human invention that fundamentally influences human and firm behavior. The market does not exist outside of the human mind. The environment however exits irrespective of market laws. Therefore, if society accepts the idea of having competitive firms operating in a free and open competitive marketplace, society will have to introduce environmental value and cost into the marketplace by using policy instruments such as MBI. Firms adapting to environmental regulations is common place, and the introduction of MBI will add another dimension to the adaptation of business to the environment as mediated through the market. This adaptation is certainly achievable and there are business strategies, tactics that can position firms to not only survive but thrive, and tangible examples are provided throughout this paper.

Limitation on Scope and Future Research Opportunities

As mentioned in the abstract of the paper, this paper attempts to develop a prescriptive theory/model for the strategic application of market based policy instruments. The paper reports the development of Market Based Policy Instruments (MBI) and explains their prospective defensive and offensive strategic applications based on Porter's Five Forces model of industry analysis. Finally, a prescriptive model that describes the strategic application of MBI is provided based on the preceding analysis.

The objective is to capture the dynamics of the new business paradigm which is emerging and is expected to transform and transcend old industrial and technological visions. The authors do not get into the argument whether markets or governments will drive environmental changes, but look at the new business paradigm where MBIs will play a critical role. As a next step, the authors plan to establish the validity of this prescriptive theory/model by examining selected organization from the mining sector in Northwest Territories of Canada. A quick review shows that firm behavior can be categorized as described by the prescriptive theory/model.

The development of the model and validating it using real life examples has been kept separate to give due importance to each of the two parts through two separate research papers.

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Section III: Resource Perspectives

III Resource Perspectives

Klaus Bellmann
Udo Mildenberger

In the first paper of the Resource Perspectives section "Energy Efficiency in Electric Utilities: An Opportunity for Restorative Economics at SaskPower" Monica Curtis and Anshuman Khare discuss the challenges and opportunities of demand-side management techniques for electric power utilities. By using SaskPower as a concrete integrated electric utility example, the authors demonstrate that demand-site management techniques offer the chance to blend environmental objectives with financial and customer oriented objectives.

The authors define demand site management as encompassing any activity undertaken by a supplier to alter demand in order to reduce the suppliers costs. Although this definition contains two fundamental sorts of demand-side approaches, conservation (intentional use of less energy) and energy efficiency (higher rate of yield out of every unit of fuel and energy appliance) the paper is focused on energy efficiency. Based on the conviction that in modern, restorative economies utilities will sell efficiency rather than power the authors explore environmental and market place challenges facing electric utilities, and suggests ways existing energy efficiency efforts can be leveraged.

Five infrastructure issues are pointed out as essential for an efficiency driven business strategy:

- Advanced metering and/or load profiling for all customers;
- Billing and meter reading practices that provide timely, meaningful usage information to end-users;
- Electricity rates that incorporate the environmental cost of the fuel;
- Services that address barriers to customer energy efficiency; and
- Investment policies that facilitate investment in energy efficient equipment within customer facilities.

The second paper "Sustainable Development Issues and Strategies for Alberta's Oil Industry" by Roger Harris and Anshuman Khare is a critical assessment of the current state and the future of one of Alberta's main economic sectors, the oil industry. This industry generated and still generates tremendous economic, social and environmental impacts. Some of them are, without a doubt, very positive but some others (especially the environmental impacts) are highly critical. Green house emissions and global warming are the most discussed and best known examples of these impacts.

Starting from a short description of the background of the oil industry the authors assess selected macro- and microeconomic issues as well as environmental and sustainability issues. Based on this analysis, five generic strategies are presented which enable oil companies to be successful in the future. The basic idea of all these strategies is the conviction that the oil industry will steadily be forced to adopt tougher operational practices that protect the environment. As a consequence, environmental strategies will gain more and more importance. As a conclusion the authors state that "Sustainability will require oil companies to rethink their business strategy." Profitability will also be a 'conditio sine qua non' for an oil company but only those companies will survive (or at least will be successful) which also address a host of environmental issues within their business strategies. Only some of these issues are directly reflected in the financial bottom line, but nevertheless these issues are critical to long-term success and/or long-term survival.

The third paper, "Integrated Forest Management in the Boreal Mixedwood Forest – A Review of Policy and Management Implications in Alberta" by Michael L. Byl, reviews the process on developing an integrated forest management plan as an approach to achieve sustainable forest management. The demand for deciduous forest products has increased eightfold in Alberta over the last 15 years. As well, the attitudes toward ecologically based management have changed in this period. But changes in governmental policy, legislation and regulations do not appear to have kept pace. Based on the case of two independent forest companies the author analyses embarrassments and impediments in the process of integrated forest management planning to evaluate what changes (if any) are required.

In this case, DMI operates a pulp mill. The company is provided (by agreements) with deciduous annual allowable cuts. The Forest Management Agreement holder DMI has to develop a Detailed Forest Management Plan every 10 years for the landbase used and a complete timber supply analysis. Canfor operates a sawmill with a quota to harvest conifer timber on two units of DMI's landbase. The company could not perform long term planning because DMI has the land management responsibility. Due to interrelated economic interests the two companies started discussions on joint long-term planning. After preparatory discussions the companies signed a partnership agreement in 1995 and set up a joint planning committee. The planning process started from scratch to find out how existing rules may affect integrated planning. The author describes the planning as a communication network and learning process involving the Ecological Public Advisory Committee. Different scenarios showed clearly that the objectives and values of all participants could not be met, so a middle ground had to be achieved. In June 2001 the forest management plan found governmental approval after a revised submission.

The concluding remarks point out that the present tenure system appears to be a major roadblock for integrated forest management. Furthermore the lack of data significantly impedes and delays modeling and decisions. But the primary barrier may lie within the attitudes of companies, foresters, and managers.

Generally cost-saving is a driving incentive to conserve energy. In an application to social housing, Scott McKay and Anshuman Khare argue in their paper, "Awareness Development for an Energy Management Program for Social Housing in Canada", and to take advantage of this mechanism to reduce adverse environmental impacts. The authors set up a detailed approach for an Environmental Information and Management System within the framework of strategy, marketing, and implementation.

Five elements are pointed out to be essential for strategic environmental management:

- Senior managers will have to make environmental management a prime business issue and communicate the financial and public relations benefits to stakeholders;
- The use of an environmental audit system is important to evaluate the existing management system, to review practices and to evaluate the effectiveness of measures;
- Adequate performance measures will be critical to control the improvement process because you can only control what you can measure;
- The environmental information and management system has to set strategies, policies, objectives, and organizational structures and is responsible for managing the business;
- Social housing organizations will have to report regularly results of the energy and environmental management program to the stakeholders to facilitate strategic decision-making and to ensure the awareness of energy management programs.

Though cost savings will be the driving force of the energy management program the long term benefit will be in reducing green house gas emissions of the residential sector to which social housing contributes 6 % in Canada.

Brenda Johnston, Michael C. Mayo and Anshuman Khare add the last paper to this section, “Hydrogen: The Energy Source for the 21st Century”. After a short overview of alternative fuels for vehicles, the authors assess hydrogen as a viable future option to reduce environmental pollution and climate change.

Hydrogen has effectively been used pure or mixed with natural gas to substitute for gasoline and diesel fuel in internal combustion engines. A quite different approach is the hydrogen fuel cell which creates electricity via 'cold combustion' of hydrogen and oxygen. The authors put this technology in the center of their study. With the benefit of zero emissions (except water vapor) by vehicles, come considerable challenges that have to be overcome before widespread public acceptance and automotive application of hydrogen. Much progress has been achieved with private and publicly funded research programs concerning production and handling (storage, distribution, safety), but final solutions are not yet at hand.

With global examples for governmental and industrial programs and achievements the article gives a wide-ranging overview and detailed information about the state of the art in the development of hydrogen-based fuel cells. Hydrogen production technologies from renewable or fossil resources are assessed as well. A Canadian example of the development of hydrogen-based fuel alternatives rounds the set of examples.

The authors close with a roadmap for sustainability to define an evolution which integrates social, environmental and economic factors and considerations. They argue for tax levies on the sale of gasoline to strength reduced consumption. The additional tax revenues should be provided for funding research institutes and for tax incentives to develop productions methods for hydrogen from natural gas as well as safe storage and distribution systems in industry.

7 Energy Efficiency in Electric Utilities: An Opportunity for Restorative Economics at SaskPower[1]

Monica Curtis
Anshuman Khare

Abstract

Utilities can realize direct financial and environmental benefits and provide increased value to shareholders and customers by implementing demand-side management. Demand-side management (DSM) can cost less per kilowatt-hour saved than it would cost to generate the same amount of electricity; energy conservation reduces the need for the large capital expenditures required to generate capacity, making it a viable alternative to traditional supply solutions. It may also improve the efficiency of transmission and distribution assets and reduce operating and maintenance costs.

To deliver DSM, utilities can employ awareness/information programs, energy management and technical and training services, financial incentives, and tax measures. These may be implemented through voluntary programs, regulation, government expenditures, or new business ventures. Because utilities typically have a lower discount rate than most of its customer businesses, utility DSM is more cost effective than DSM in alternative business models.

Using SaskPower, a vertically integrated electric utility in Saskatchewan, Canada, as an example, this paper demonstrates how selling efficiency rather than power offers utilities both a supply option and a business opportunity. SaskPower can accrue financial and environmental benefit, while meeting and exceeding customer and stakeholder expectations. This paper discusses the challenges and opportunities demand side management represents for electric utilities.

Keywords: energy efficiency, energy conservation, restorative economics, electric utilities, Kyoto Protocol.

Note: All monetary values are in Canadian dollars, unless otherwise noted.

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[1] This is an updated version of the paper titled **Energy Conservation in Electric Utilities: An Opportunity for Restorative Economics At SASKPOWER** (Monica Curtis and Anshuman Khare): Published in TECHNOVATION, the International Journal of Technological Innovation and Entrepreneurship, England – Vol. 24, No. 5 (May 2004) / pp. 395-402. (TECH 910)

Defining Restorative Economics

Hawken (1993) defined the challenge facing integration of environmentally preferable products and practices into current economic structures when he concluded:

> "Without doubt, the single most damaging aspect of the present economic system is that the expense of destroying the earth is largely absent from the prices set in the marketplace." And, "We need to rethink our markets entirely, asking ourselves how it is that products which harm and destroy life can be sold more cheaply than those that don't."

The restorative economy "will be one in which some businesses get smaller but hire more people, where money can be made by selling the absence of a product or service, as is the case where public utilities sell efficiency rather than additional power, and where profits increase when productivity is lowered" (Hawken 1993). Brown (2003) has furthered this concept, referring to the "eco-economy" as one where both economic and ecological information is embedded in market signals. "If (the market) tells the ecological truth, it minimizes the information that individual decision makers need to make an environmentally responsible decision" (Brown, 2003, p.236).

Utilities, energy service providers and energy service companies (ESCOs) have long been interested in energy conservation and energy efficiency, alternatively as a demand side management (DSM) strategy or as a customer communication and corporate branding initiative. Baker-Stariha (1993) defined DSM as encompassing any activity undertaken by a supplier to alter demand in order to reduce the suppliers costs, including energy efficiency, load management, load shifting and load growth, but is predominately used in reference to load management and energy efficiency. There are two very different sorts of demand-side approaches. "Conservation is the intentional use of less energy (say, by turning off some lamps or radiators) which always means less of the good things that energy brings (like light and heat). Energy efficiency, in contrast, means squeezing more of the good things that energy makes possible out of every ounce of fuel and energy appliance…while conservation may or may not be a good idea, efficiency is always sensible" (Vaitheeswaran, 2003, p.83).

Ratification of the Kyoto Protocol, or some equivalent international effort to address environmental degradation worldwide, will attach an environmental price tag to electricity, and other goods and services. Customer energy conservation, DSM and green power pricing offer mechanisms to the utility industry to contribute to a restorative economy.

While there is a growing body of work on the role of utilities in distributed generation, the hydrogen economy and green power pricing, less consideration has been given to the opportunities associated with demand side management. Using as an example SaskPower, an integrated electric utility serving the people of Saskatchewan, Canada, this paper explores environmental and market place challenges facing electric utilities, and suggests ways existing energy efficiency efforts can be leveraged to address, in part, the challenge of selling efficiency rather than power.

The Opportunity

Customer energy efficiency and DSM offer benefits to electric utilities, including financial and customer advantages.

Financial

Successful DSM programs report a cost of $0.02 to $0.04 per kilowatt-hour (kWh), as compared to $0.04 to $0.07 for natural gas or wind generation, and $0.10 or more for many new technologies including solar power projects. Energy efficiency can offer a cost-effective alternative to new generation for meeting load growth requirements.

There could be benefits to reductions in demand, if the reductions apply at the time of the system peak, effectively reducing it. This would allow the company to delay capital investments in new generation. The challenge is that, except for a select number of industrial customers, most electric utilities in North America have limited data regarding individual customer impact on system peak.

Reductions in energy could be beneficial if they enabled a reduction in fuel use, specifically natural gas, delivering significant cost savings. Reduced demand or energy in specific locations where the transmission or distribution system is currently operating near capacity, such as in remote areas, could delay costly capital investments to re-enforce the system and may reduce emergency maintenance costs.

Customer energy efficiency does represent lost revenue to the utility. The associated losses vary by customer class. On a cost per kilowatt-hour (kWh) basis, residential customers generally represent the greatest loss, industrial customers the least. On a total volume basis the opposite is true. Residential customer efficiency has the least impact on utility sales and industrials the greatest.

While it is essential to understand the value of lost revenue associated with demand side management, this cannot necessarily be considered a cost component of DSM initiatives. Many customers will undertake energy efficiency improvements with or without utility involvement, reducing revenue from that customer. However, on a system-wide basis, DSM shifts energy use from existing users (the customer improving efficiency, thereby using less) to new users. Revenue to the utility for the existing generation asset is unchanged while the cost of adding generation that would have been required to serve the new user is either eliminated or delayed.

Customer

Opportunities for energy efficiency exist with every customer segment. Industrial customers may be further segmented into mining, primary manufacturing, food & beverage, secondary manufacturing and oil and gas production. Energy use in this segment can be categorized as process energy, used directly in the production of the final product, and service energy, including space heating, ventilation, air conditioning, lighting and pumps for service water. An extensive study of industrial energy use in Saskatchewan, conducted by the Saskatchewan Energy Conservation and Development Authority (SECDA, 1995) concluded that process energy represents 76% to 94% of energy use in Saskatchewan industrial sites, while service energy accounts for 6% to 24%.

Electricity usage in large and small commercial facilities is similar, with heating, ventilation and air conditioning representing 56%, lighting 36%, and office equipment 6% (SECDA, 1994).

Utilities have high credibility with customers on energy topics (Egan and Joyce, 2001). Electric and gas utility employees are welcomed into customers' houses (Egan 2001). Utilities have the opportunity to use the positive relationships that exist between their employees and customers. Customer service activities that use a corporation's major retail asset, its employee's expertise on energy matters, to address consumer concerns with saving energy can be expected to increase customer satisfaction and loyalty.

Environmental Challenge

"After all, the needlessly dirty and inefficient way we use energy is the single most destructive thing we do to our planet. Whether it is the burning of coal in industrial power plants, or the felling of tropical forests, mankind's quest for energy is never-ending. It is also essential to modern life. The key to a sustainable future for mankind is to make that energy use clean and carbon-free as well – and a sensible long-term climate treaty could be the first step in that direction" (Vaitheeswaran, 2003, p.155).

Ratification of the Kyoto Protocol, or some equivalent international effort to address environmental degradation worldwide, will attach an environmental price tag to electricity, and other goods and services. According to Environment Canada research (2000), 24% of emissions come directly from electricity generation, 35% from industrial production, 15% from transportation, 5% from buildings and the remaining 22% from all other human activities. The National Energy Board (2002) reports that almost 80% of Canada's green house gas emissions are linked to energy production or consumption.

Clearly, Canada, and the rest of the world, must start using less coal, oil and natural gas, much of which is being used to produce electricity. This represents a fundamental change to the Canadian economy, business structures and individual lifestyles creating challenges and opportunities related to technology, regulatory, economic and competitive and market structures.

As a primary source of emissions the energy industry needs to be a leader in the development of a sustainable, restorative economy. Opinion leaders, ranging from *The Economist* to the Energy Policy Institute, the International Monetary Fund to the Organisation for Economic Cooperation and Development (OECD) are concluding that market forces offer the best way to spur energy efficiency and sustainable development (Brown 2003). The economy depends entirely on the earth's natural support systems. If these deteriorate, the deterioration of the economy cannot be far behind. Introduce the proper price signals, so that individual decision makers have the information needed to evaluate total costs, and they will make environmentally responsible decision.

The challenge lies in getting the price signal right. As Brown (2003) explains, ecosystems (fisheries, forests, rangelands and croplands) provide both goods (fish, trees, food) and services (water management, carbon fixation). For an economy to be sustainable both the value of the goods (raw materials) and the services to society need to be calculated and incorporated into market signals. Ecologists and economists working together could determine such market signals. "Although calculating services is not a simple matter, any reasonable estimate is far better than assuming that the costs are zero, as is now the case” (p.79).

Business Challenge

The electricity industry can be described as consisting of three businesses:

- Wholesale or generation;
- Transmission and distribution or wires; and
- Retail or customer service.

The challenge facing utilities is that “the historical structure of the energy market has created a very small number of large utilities whose role is to supply energy, and whose profitability is increased by supplying ever more of it. The utilities are simply not structured to supply energy efficiency investments even though these could be profitable” (Jacobs, 1993, p.157). The electricity industry in North America is moving towards competition in the wholesale and retail components of the business. As these become traditional commodities, utilities move from vertically integrated to independent organizations. Margins can be expected to decline and there would be less opportunity for integrated resource planning. Utilities would be left with even less flexibility to invest in alternative energy and conservation.

ESource reports, “Starting in the 1970s when the term “negawatt” was coined by Amory Lovins, and stretching through the 1980s when utility commissions instructed utilities in many jurisdictions to conduct integrated resource planning,”(Special Core Report, 2001, p.2), DSM, energy conservation, energy efficiency and energy management became standard components of the utility agenda. In the mid-1990s electricity industry restructuring began with the establishment of competitive wholesale markets across North America and predications of competitive retail markets replacing the traditional regulatory regimes within a decade. It was thought that over time, as market forces replaced regulators in the role of price setting authority, spending on politically mandated programs like DSM would decline (ESource, 2001). This assumed that the market would not begin to include the environmental costs associated with electricity into wholesale prices.

Contrary to those predications, the establishment of retail electricity markets is floundering, energy costs for both natural gas and electricity are rising and there is a growing recognition within the utility industry of the serious impact environmental issues will have on the cost of electricity produced from fossil fuel. As Vaitheeswaran (2003) outlines “what ordinary people want are energy services like cold beers and hot showers, not energy for its own sake. Once the goal of policy is defined that way, it becomes clear that meeting people’s needs by saving fuel can often be smarter than building ever more power plants, pumping out ever more oil or cranking out ever more electricity… “negawatts” are often cheaper than megawatts” (p.322).

As improvements in energy efficiency are decoupling economic growth and energy use, utilities can no longer be guaranteed to grow their business through new generation. The role of energy efficiency in generation planning, customer communications and business development is being reconsidered.

Market Place Challenge

In a 1994 EPRI Journal study Lemarre concluded that despite the onslaught of technology developments, promotional campaigns and utility-sponsored rebate programs energy efficient technologies have not been widely adopted (Lemarre, 1994). This remains true today. Energy efficient technologies that have been universally adopted, such as T8 fluorescent lighting for commercial applications and higher efficiency residential appliances, have been driven by regulation rather than voluntary adoption. Customers identify three primary barriers to adopting energy efficient alternatives: financial, lack of information and ease of use.

Electricity pricing does not include environmental costs, therefore electricity generated from fossil fuel, and other high-environmental impact activities, cost less in the market place than renewable energy and demand side management. This creates financial barriers to the adoption of energy efficient alternatives related to return on investment, higher initial cost and competition for capital.

There are also no direct price signals for either electricity or energy conservation. Electricity use is metered at the time of consumption. Depending on the class of customer and type of metering, meter reading may take place monthly, bi-monthly, quarterly or annually. Customers are billed monthly using a mix of actual and estimated consumption values. Unlike reading a price tag, there is no immediate feedback to alert customers to the cost of their activity. Billing data is aggregated so consumers have no information as to the consumption or cost related to specific appliances, equipment or activity, therefore lack information to evaluate alternatives and make choices regarding use.

In addition to a lack of information on the current cost of electrical consumption, electricity customers generally lack the awareness, knowledge and resources in time, people and expertise to determine environmental impact and conduct technology and payback analysis. SECDA (1995) report barriers related to ease of use include lack of locally available product, lack of installation and maintenance support, compatibility with existing systems, and changes in operating practices.

To motivate consumer action, environmental problems need to become personal. Today, the environmental problems associated with individual household, business or industry electrical use are very remote from the final consumer of the product. Jacobs (1993) observes it cannot be expected that poorer people will buy more expensive products if they have a choice, simply in order to prevent a distant or future external cost. And it is not obvious that affluent shoppers will make buying decisions based on the interests of distant or future people.

"Green capitalism" as defined by Jacobs (1993) assumes that market forces, driven by consumer demand, will compel industry to offer environmentally responsible alternatives at competitive prices (p.41-44). For consumer demand to drive industry,

- Consumers must have sufficient information to be able to make informed decisions.

- Consumers need to be offered a choice to express their environmental preference. If all products are equally damaging, consumer preference cannot be exercised.

It is clear that based on the lack of specific usage information and the barriers to adoption of high efficiency technology identified by electricity consumers, including residential, agricultural, commercial, institutional and industrial customers, the market place does not today have the ability to compel electric utilities to adopt environmentally preferred product.

To move toward a restorative economy the market needs to send a power signal that the environment matters, and "there is no more powerful signal than price (Vaitheeswaran, 2003, p.193).

<u>Current Utility Energy Conservation Programs</u>

Despite the business and market place challenges, an examination of energy management programming available from the 20 electric utility members of the Canadian Electrical Association (2000), the 17 utility participants in Canada's Climate Change Voluntary Challenge and Registry (2002) and the 88 US utilities tracked by the Edison Electric Institute (Rosenstock, 2001) demonstrates that energy efficiency is a small but valued component of utility customer service activity in North America. Current energy efficiency programs provide a foundation from which utilities can begin to sell efficiency.

Services are available for residential, agricultural, commercial, institutional and industrial customers. Programs can be categorized into three areas – (1) Awareness/ Information, (2) Energy Management/ Technical and Training Services and (3) Financial Incentives/ Tax Measures.

Awareness/ Information

These programs typically include energy saving tips, information on building systems, energy efficient products and electro-technologies, and assessment tools such as residential and business energy audits. Delivery channels consist of on-line self-service applications, publications and toll-free telephone advisory services. A limited number of utilities provide staffed energy conservation resource centres. It is estimated that information alone can garner a 5% to 7% decrease in electrical consumption.

Energy Management/ Technical and Training Services

These programs comprise of a wide range of technical, financing and training services. Comprehensive energy analysis, facility auditing, engineering, design and project management, financing, high efficiency and electro-technology product sales, technology training for maintenance staff and awareness training for building occupants, power quality analysis, and advanced metering and related energy tracking and load management software, and consulting are common components. Morgan (2001) reports that a very limited number of utilities are beginning to offer energy outsourcing, a concept whereby the utility packages energy management with commodity services. The energy service provider installs, owns and maintains heating, ventilation, air conditioning and/ or lighting equipment in a facility and sells back to the customer chilled water, steam or lumens instead of electricity.

Energy management services are delivered through a variety of channels, from utility-owned energy service companies (ESCOs) to utility sales and customer service supported by subcontracted engineering and construction firms to alliances and partnerships with ESCOs, financial institutions, architects and engineers. Industry experience suggests comprehensive energy efficiency retrofits or energy outsourcing reduce electricity use in participating facilities by 25% to 40%.

Financial Incentives/ Tax Measures

These programs include equipment give-aways, equipment rebates, tax exempt financing, demand response programs that pay customers to either reduce curtailable loads or shift to stand-by generation, and advanced metering combined with electricity price signals such as real-time and time-of-use rates. There are also a very limited number of market transformation programs that pay incentives to manufacturers and retailers to encourage the design, production and promotion of higher efficiency equipment in the market place. These services are delivered through the utility sales and customer service channels and are often combined with energy management services.

Strategy

Energy conservation continues to be a customer service issue, with almost all customer efficiency programs being delivered by the retail or customer service divisions within utilities across North America. However, that emphasis is changing. A growing number of companies are citing customer energy conservation as one strategy within a corporate sustainable development program. The role of customer energy management as a source of greenhouse gas emission (GHG) reduction is of growing importance. For Canadian utilities reporting GHG reductions, customer energy efficiency as a percent of total reductions ranges from a high of 43% for BC Hydro (2001) to 21% for EPCOR (2000), 8% for Manitoba Hydro (2001), 2% for ATCO (2000) and Nova Scotia Power (2000), and 0.78% for SaskPower (2001).

A 1999 evaluation of DSM programs in Massachusetts found that in addition to direct energy savings and reduced customer bills, DSM programs resulted in increased customer awareness of energy efficiency opportunities, greater local availability of efficient products, better product reliability and lower prices for efficient products, improved design and engineering specification for new construction, improved building codes and standards, changes to customer purchasing requirements and local economic development through direct jobs in energy efficiency (Nadel, 2000). The study also determined that “large-scale energy efficiency programs operate…at an average cost of US$0.03 per kWh, well below the cost of supplying electricity” (p. 10).

Mechanisms for Restorative Economics

To hold an economy within sustainability constraints firms and households must alter their behaviour in such a way that “their combined impacts on the environment remains within the overall targets set” (Jacobs, 1993, p.122). Various economic instruments can be employed to influence and direct behaviour. Jacobs (1993) identifies four key instruments: voluntary mechanisms, regulation, government expenditure and financial incentives (p.122-123). While electric utilities have limited opportunity related to regulatory and government expenditures, they can support voluntary efforts and deliver financial incentives.

Voluntary Mechanisms

Voluntary mechanisms “can be defined as all those actions unforced by law and un-persuaded by financial incentives which individuals, groups and firms take to protect the environment” (Jacobs, 1993, p 134). Electric utilities can support voluntary actions by customers in a number of ways.

The first is through the provision of information. Providing information about the environmental impact of electrical generation, transmission and distribution helps consumers recognize the impact of their consumption. Advanced metering and usage data on the utility bill assists customers in understanding how they are using electricity, as does energy audits. Utilities can also provide information on energy efficient alternatives, including cost-benefit analysis, engineering and design considerations, product availability, operating and maintenance impact, life-cycle cost and associated emission reductions.

Utilities can support voluntary mechanisms through promotion of complementary programs such as energy use labeling. In Canada these include EnerGuide labeling for homes, appliances and equipment, the Environmental Choice Program Ecologo certification for products with lower toxic components than standard equivalent products and Energy Star labeling for higher efficiency equipment. Information can be delivered through advertising, customer services and sponsorship of school energy conservation programs.

Regulation and Government Expenditures

Regulation encompasses any “administrative measure taken by government which has the backing of law” (Jacobs, 1993, p.136). There are two principal types of environmental expenditures that government can take; “actions taken directly by government…and subsidies or grants provided by government to private organizations and households”. Governments can also remove existing subsidies and grants to level the playing field between all energy sources, traditional fossil fuel based energy, renewable energy and DSM, allowing the market to choose the technology.

While electric utilities are not governments, therefore cannot set laws or direct government spending, most electricity producers in Canada are Crown corporations, so are an administrative option governments can use for policy implementation and program delivery. For example, electrical inspections departments within utilities ensure compliance with the National Building Code. This responsibility could be extended to include monitoring minimum energy efficiency ratings for electrical equipment. New buildings need to apply for power early in the planning process; as an early point of contact for new construction, utilities could assist administer government programs such as the Commercial Incentive Building Program, which provides grants for applying whole building design to new construction projects. They could also assist customers in accessing government subsidies such as the Energy Innovators grants for energy efficient retrofits to institutional buildings.

Utilities can further demonstrate leadership by improving the efficiency of their own facilities and using renewable energy sources to supply their energy needs.

Utilities can also provide direct subsidies and pricing mechanisms to support alternative energy and conservation, sharing the benefit where customer efficiency enables the utility to reduce operating costs or delay costly system investments.

Financial Incentives

Financial incentives "are designed to make environmentally damaging activities less attractive by making them more expensive" (Jacobs, 1993, p.138), and may include:

- Taxes, to discourage undesirable behaviour by making it more expensive;
- Tradable permits, making environmentally damaging activities illegal without a specially created right, which must be bought and can then be traded; and
- Refundable deposits, rewarding environmental care by returning the deposit and penalizing damage by withholding it.

Environmental taxes and tradable permits are two viable economic instruments for delivering energy related financial incentives to the market. "The principle difference between the two is that with permits, government set the amount of a given activity that is allowed, such as the harvest from a fishery, and let the market set the price of the permits as they are auctioned off. With environmental taxes, in contrast, the price of the environmentally destructive activity is set by government in the tax rate and the market determines the amount of the activity that will occur at that price" (Brown, 2003, p.248). The key to environmental taxation is comprehensive tax reform, shifting taxation from specific economic inputs, such as income or labour, to specific environmental harm. Vaitheeswaran (2003) concludes that direct environmental taxation is cheaper than technology specific mandates, assuming those revenues are recycled to taxpayers.

Because utilities are the point of origin for energy entering the market, utilities can, and should, have a significant role in providing price signals and purchasing mechanisms to the marketplace that indeed make more environmentally damaging activities less attractive and make energy efficiency investments viable.

The onset of competitive electricity markets is creating a need for responsive price signals. Traditionally electricity pricing was set based on the average annual cost of service allocated by customer class. While it is still the basis for most utility rate schedules, interval-metering technology and load profiling is providing utilities and energy users with data to enable development of pricing mechanisms, such as time-of-use and real-time pricing, that provides consumers with timely price signals, enabling users to change their behaviour based on price. Utilities need to further refine pricing to provide incentives for reducing consumption.

Utilities can also provide incentives through energy efficiency investments. In an analysis of the electricity market in the UK, Jacobs (1993) demonstrates that role. The same energy conservation measures undertaken by different economic actors in the market place have different total price tags. This difference is due to the discount rate of different sectors. The discount rate is a measure of the timescale within which an investor wishes to recoup the cost of the investment. Cutting energy use usually requires some kind of investment in energy efficient equipment or materials that have an upfront cost. Energy utilities have rather low discount rates, typically 10%, so are prepared to wait five to 10 years for an investment to earn a net profit. Investor owned and other companies may require payback periods of only two to three years, while small businesses and households may simply not have the capital available to make the investment at all. Jacobs (1993) further illustrates that "at the typical utility discount rate many energy efficiency investments are already profitable at the current price of energy…it has been estimated that the UK could cut its projected carbon dioxide emissions for 2005 by approximately 170 million tonnes by such measures…which at the (utility) discount rate wouldn't cost society anything at all" (p.157).

The American Council for an Energy-Efficient Economy has confirmed this concept. In an analysis of DSM activity by state, Nadel (2000) reports that the top five states dedicated 1% to 2% of utility revenues to energy efficiency programs and saved the equivalent of 6% of electricity sales, reducing consumption by about 200 billion kWh (p.5), while maintaining competitive prices and positive balance sheets.

Energy savings financing and energy outsourcing are two mechanisms available for electric utilities to invest in customer energy efficiency. Energy savings financing involves the utility underwriting energy efficiency retrofits in a customer facility; the customer repays the cost of retrofits from the energy savings and the equipment is turned over to the customer at the end of the repayment period. Energy outsourcing involves the utility installing, owning and maintaining heating, ventilation, air conditioning and/ or lighting equipment in a facility and selling back to the customer chilled water, steam or lumens instead of electricity.

Conclusion

Impact on Utility Infrastructure

In a restorative economy utilities will sell efficiency rather than power. This transition in business strategy will require a different infrastructure within the utility:

- Advanced metering and/ or load profiling for all customers, enabling analysis of operational changes on both facility cost and consumption, and on utility system efficiency;
- Billing and meter reading practices that provide timely, meaningful usage information to end-users;
- Electricity rates that incorporate the environmental cost of the fuel, providing accurate cost information to consumers;
- Services that address barriers to customer energy efficiency, including information, financial and human resources and expertise; and
- Investment policies that facilitate investment in energy efficient equipment within customer facilities.

SaskPower

SaskPower is an integrated electric utility, serving the people of Saskatchewan, Canada. It is a Crown corporation; a Board of Directors manages it, with Cabinet approval required for key policy, financial and energy pricing issues.

The sole shareholder, the Province of Saskatchewan, expects SaskPower to deliver financial and social benefits to the Province. The Corporation's mandate as outlined in the Power Corporation Act (1950) is to deliver reliable, safe and cost-effective power to Saskatchewan.

SaskPower serves a geographic area of 526,600 km^2; delivering electricity to about 430,000 residential, business and industrial customers in Saskatchewan and exporting to electric utilities across North America. The company has a total generating capacity of 3505 MW, including coal, natural gas, hydro and wind power, with 75% coming from fossil fuels (2003 Annual Report). Due to the size and sparse population of its service territory, the company operates the largest transmission and distribution system in Canada, serving three customers per circuit kilometer of power line. The Canadian average is 12 customers per kilometer. With annual revenues of $1.2 billion, $3.2 billion in assets and over 2300 employees, SaskPower is one of the largest companies in Saskatchewan.

Opportunity for SaskPower

SaskPower is well positioned to begin to make the transition toward a restorative economy. It is already investing in interval metering for the top 200 customers and load profiling for mass-market customers. It has limited information and energy management services in place and offers energy savings financing to institutional and large commercial customers. The next step is to expand these services such that the market impact becomes significant.

Based on the experience cited by the American Council for an Energy-Efficient Economy, investing 1% of electricity revenues represents a $10.8M investment for SaskPower. Assuming this investment would reduce electricity sales by 6%, this would save 1023 gigawatt hours (GWh) of electricity, representing a fuel cost saving of $15M to $23M based on the 2000 gas price. This alone would create a net financial benefit to the organization.

In addition SaskPower can expect new revenues from efficiency services and benefits related to improved customer satisfaction and reduced greenhouse gas emissions. Investing in customer energy efficiency through energy management programs, energy outsourcing or sharing efficiency gains achieved through advanced metering and associated load shifting of both process and service energy delivers cost savings to customers and environmental benefits for all.

This analysis demonstrates that selling efficiency can deliver financial, environmental and customer benefits to electric utilities.

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8 Sustainable Development Issues and Strategies For Alberta's Oil Industry[1]

Roger Harris
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Abstract

This paper discusses the sustainable development issues for the Alberta oil industry and suggests strategies for its long-term survival. While oil and gas are finite resources, Alberta's massive non-conventional reserves are a virtual assurance that it can meet all the fossil fuel demands for Canada and its export market in the foreseeable future. This makes it a sustainable resource in practical terms. Despite its large economic contribution, this industry will face many challenges to remain viable over the next 50 years. Large investments will be required and it must improve its public consultation process and environmental record if it is to become sustainable. In recent years, stakeholder pressure, tougher regulations and better enforcement has made the industry more environmentally friendly, but its track record suggests that continued regulation will still be required.

There is a growing realisation that sustainable development can no longer remain a low priority for those organisations with aspirations for long-term survival, and this makes it a bone fide strategic issue. Concern over environmental protection has become a critical issue for the industry, and must be addressed in terms of the natural regenerative capacity of the environment, and the legitimate need for an economically viable sector. As such, sustainable development inextricably links environmental protection with economics and stakeholder interests.

In the longer term, competition from less polluting alternate fuels is likely to intensify and this will force contraction of the industry and a loss of market share. This smaller, more competitive environment of the future will likely favour those companies that can best integrate growth with a low cost strategy and environmental protection. As such, size is likely to be important insofar that it usually correlates with financial resources and the ability to achieve economies of scale.

Keywords: sustainable development, oil industry, Alberta.

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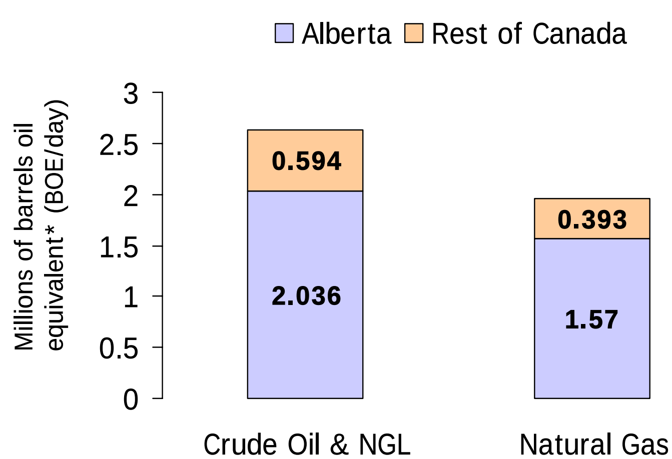
Industry Background

Crude oil and natural gas, collectively known as the oil industry, has emerged over the last century as the world primary fuel source. Its production and use have generated tremendous economic, social and environmental impacts, though these have not always been positive. The industry is made up of three components: the upstream sector, responsible for exploration and production, a transportation or mid-stream sector, and the down-stream sector which refines and markets oil, gas and their derivatives. Most people are only familiar with the later, and it is this sector that is mostly scrutinized in the debate over gasoline consumption, green house emissions, global warming and alternate fuel technology. But the upstream sector faces many of the same challenges and others that are unique to that environment.

Figure 1: Year 2000 Alberta Crude Oil & Natural Gas Production



(*): 1 million cubic feet of natural gas is equivalent to 100 barrel of oil equivalent (100BOE).

Source: Lunan, 2000.

The Canadian oil industry began in 1949 with the Leduc discovery in Alberta. Figure 1 shows that the Province's production has grown to a current level of over 2 million barrels per day (bpd) of crude oil and natural gas liquids (77% of total Canadian production) and almost 16 billion cubic feet per day (bcf/d) of natural gas (80% of total). The product stream of the upstream sector is conventional crude oil, bitumen, synthetic crude, natural gas and natural gas liquids. Conventional crude is made up of light and heavy components, and the cut-off between the two is a density of 970 kg/m3. Bitumen is an extremely viscous, heavy crude that can be converted by high temperature catalytic reactions into synthetic crude that has most of the physical characteristics of conventional crude oil. Bitumen is produced by surface mining (tar sands production), while deeper deposits are produced by thermal methods such as high-pressure steam injection. Natural gas liquids (NGL's) are the condensable liquid phase components of natural gas streams. Refineries convert these crude oil mixtures into liquid fuels, lubricants, solvents, greases, waxes and tars. Natural gas on the other hand, is a primary fuel but is also used extensively as feedstock for the petrochemical industry.

Table 1: Markets for Alberta's Crude Oil and Natural Gas (1998)

	Crude Oil Thousands barrels / day	**Natural gas** Millions cubic feet / day
Alberta	397.5	1950.0
British Columbia	41.5	136.5
Saskatchewan	115.7	429.0
Manitoba	3.2	282.8
Ontario	97.5	2593.5
Quebec	0	516.7
Domestic Markets	**655.3**	**5908.5**
Western US	222.7	2583.7
Mid-west US	693.8	2057.2
Eastern US	54.1	1998.7
US Exports	**970.6**	**6639.6**
TOTAL ALBERTA PRODUCTION	**1629.9**	**12548.1**

The export markets for Alberta's oil and gas is shown in Table 1. The data was obtained from the Alberta Energy and Utilities website (www.eub.gov.ab.ca). Canada is self sufficient in its energy needs, and 60% of the Provinces conventional crude oil, over 80% of its conventional heavy crude and bitumen, and 53% of its natural gas production is exported to the US. That market is therefore of critical importance to the industry and is a primary determinant of its future prospects. Domestically, the oil industry has become a mainstay to the Alberta economy and an important contributor to the national economy. But these economic benefits come from investments which must now compete with other opportunities in other provinces and overseas. As such, sustainable development of the industry in Alberta will require continued close collaboration between government and industry.

The Western Canadian Sedimentary Basin (WCSB) is the primary geological target for exploration in Alberta, but with over fifty years of development, it is now maturing, and discoveries are getting harder to find and are less prolific than in the early days of development. However, enormous potential exists as coal gas, in gas hydrates, and in the Athabasca tar sands. These non-conventional reserves will require very large capital commitments to bring into production, and they will be technically challenging. Unless these megaprojects are carefully managed, their sheer size could also potentially result in large-scale environmental degradation.

At the other end of the scale, an average Alberta oil well today produces only about 40 bpd, less than half of the global average according to the Alberta Chamber of Resources, and there are many better production opportunities overseas. Many foreign governments are increasingly receptive to the idea of joint ventures and foreign-controlled production contracts with smaller companies, many of them Canadian. Scarcity of investment capital and discoveries of large reservoirs world-wide make international energy investment highly competitive despite the logistical and geo-political risks, and so globalization of the industry has given Alberta producers investment options that were unavailable as little as five years ago. Domestically, the East Coast, the Arctic and NE British Columbia also hold promise for very large reserves and excellent development opportunities, and these regions are already competing with Alberta for investment capital.

Despite its shortcomings on environmental protection, the Alberta industry still serves as a good model for progress and has been an important competitive advantage in securing foreign leases for Canadian companies. But individual companies with poor track records continue to undermine industry image and have forced regulation, especially for environmentally sensitive areas. Poor environmental consciousness and a lack of commitment to compliance have been problems in the past, and the industry continues to be criticised by interest groups for ignoring legitimate health and environmental concerns, its railroading tactics, and operational practices which continue to pollute the environment (Marr-Laing, 1999). This has resulted in stricter regulations, which has had a critical role in improving the environmental impact of industry activities. Still, many sustainable development issues remain unresolved: stakeholder issues, release of green house gases, health and habitat impact, and pipeline spills are the most important, but odour, noise and aesthetics are also concerns.

This paper focuses on the upstream sector and discusses its sustainability within the framework of the three economic functions of the environment: provision of resources, assimilation of wastes and providing “quality of life” (Jacobs, 1993). In particular, the linkages between the economic benefits, depletion management, environmental impact, and industry regulation will be explored. Industry critics such as the Pembina Institute for Appropriate Development have successfully raised sustainability as a “front burner” public issue, and in so doing, they have become quite influential in setting public policy and regulations. Their criticisms therefore need to be taken seriously as the long term survival of the Alberta oil industry is threatened unless greater action is taken to balance its business interests with the significant social and environmental impact of its operations. As such, sustainability should be a key concern for producers and this paper provides a rationale for such a strategy.

Economic Benefits

Oilweek, an industry publication, estimated direct employment in the oil and gas industry in 1999 at 36000, and the Petroleum Communication Foundation reported in 1998 that the industry employed some 450,000 people, directly and indirectly. There is therefore a large employment ripple effect. The Alberta Chamber of Resources has estimated oil and gas have contributed more than $12 billion dollars to the country’s net balance of payments, and in Alberta, $108 billion have been paid by industry in royalties and land sales. In the current fiscal year, the industry is expected to generate $8.7 billion in government revenues, representing 37% of the total. As a result, the Alberta Heritage Fund now stands at $12 billion dollars, the Province has a $5 billion budget surplus, social spending has increased, the debt is now just $12 billion dollars and can be paid off in as little as 3 years, and there are prospects for major tax reform. Thus the industry is a major contributor to Alberta’s prosperity and the Province arguably enjoys the highest per capita standard of living in the country. But the economic impact does not end there: Alberta is the second largest contributor of national transfer payments and thus contributes directly to the national standard of living. And Alberta’s lower debt and taxation has served as a model for economic reform in the rest of the country, including the Federal government. There will be long-term benefits from this in the form of lower interest and taxation rates, and improved social programs. Alberta's oil industry activity has also resulted in national energy sufficiency, an especially important achievement in light of global price and supply volatility. This is additionally important given the geographic spread of the country and its strong dependence on transportation. Thus, directly and indirectly, the Alberta oil industry is a major contributor to the national wealth, and quality of life in Canada.

Economic & Stakeholder Issues

While exploration and production result in a myriad of economic spin-offs, the wealth created is not equally distributed. Shareholders and people employed in the oil industry benefit the greatest from this prosperity, while other "mainstream" Albertans receive indirect benefits through the economic ripple effect. But aboriginal groups have historically failed to benefit to the same extent as the others. The redistribution of wealth is an egalitarian principle that is important in global sustainable development (Jacobs, 1993), and is gaining acceptance. However the redistribution of "oil" wealth to aboriginal groups in Alberta remains a highly contentious issue.

Aboriginal groups make the argument that companies continue to operate on their traditional lands with impunity and without their input, degrade their environment, disrupt wildlife habitat on which they depend, and offer only limited training and development opportunities. They do not share in the wealth created and yet suffer as a result of its pursuit. These are valid concerns. Jacobs (1993) used the term "externality" to describe such groups who have suffered environmental depravation as a result of resource exploitation. They bear the full environmental cost in terms of "quality of life". Since none of the producers or employees and service providers bear any immediate environmental cost as a result of the exploitation activity, there is no vested interest on their part, except for an ethical obligation and Provincial regulations, to be environmentally friendly. This aligns with Porter and van der Linde's (1995) contention that in the absence of any self-interest, regulation is necessary in order to achieve environmental protection. Aboriginal groups also argue that they also have constitutional entitlement to benefits from all industry activity on their traditional, though publicly owned, lands. Therefore this has become an issue of aboriginal rights, and is well beyond the jurisdiction of individual producers.

Rural residents who must co-exist with thousands of wells that are drilled each year in rural Alberta are another externality group. This level of industry requires thousands of acres of productive land be set aside for wells, facilities, access roads and pipeline right of ways. The amount of land that is required to satisfy the industry's needs defines its ecological "footprint" and there is a strong correlation between it and environmental and health risks from spills, leaks and fugitive emissions. In addition, odour, noise and dust from oilfield traffic often degrade the environment for residents who live near wells and processing facilities, and wildlife habitat is sometimes significantly compromised. Some rural residents also object to the reduction in aesthetic beauty of the countryside from oilfield facilities. Therefore, the quality of their life is impacted, and oil company personnel who are unappreciative of the lower tolerance to these environmental factors may inadvertently trivialise these legitimate concerns and increase the level of mistrust.

There are no easy resolutions to these issues, but they reflect a growing concern and debate over stakeholder rights vis-à-vis exploitation of natural resources. These must be addressed in a systematic way if sustainability of the industry is to be achieved, and is a good example for how ideological thought cannot be separated from the discussion of sustainable development. What can be said is that things are improving, insofar as producers acknowledge their obligations to these stakeholder groups. However, this new approach has probably had more to do with recent changes to Provincial regulations rather than any natural conciliatory “change of heart” by individual producers. Nevertheless, the toughened public consultation requirement has resulted in a more balanced approach to development by inextricably linking the development of oil and gas to the protection of aboriginal and other stakeholder interests. Without a resolution to these issues however, projects will be delayed or cancelled and in the extreme, disrupted by physical confrontation.

Reserves and Depletion

Because oil and natural gas are non-renewable resources, conservation, supply and reserves are critical to any strategy of sustainability. Fortunately, Canada is not only self sufficient in energy sources, it exports over half of its production to the US, the world largest economy. Thus, by itself, US demand more than doubles the depletion rate of Canadian reserves. The depletion rate of Alberta’s conventional reserves has exceeded the finding rate for several years, and at year-end 1998 the Alberta Energy and Utilities Board (AEUB) reported proven conventional oil reserves of just under 2 billion barrels of conventional oil and 44.1 trillion cubic feet of natural gas. At 1998 production levels, this represented about 5 years of conventional oil reserves and 9 years of natural gas reserves left to be produced. (The ratio of reserves to production rate is known in the industry as the reserve index). While the low reserve index of conventional oil is a concern for the industry, the remaining reserves still represent an enormous amount of wealth, and so exploration activity in WCSB continues unabated, aided in large part by better exploration technology and an improved price environment. However, exploration and development costs are exacerbated by a number of regulations that restrict access to reserves, including unresolved aboriginal treaty rights and buffer zones around national parks (Alberta Chamber of Resources, 2000). But the industry needs to take some of the blame for this: its cumulative environmental impact has been high and it has a negative image with many of its stakeholders. Therefore public consultation, transparency and improvement of operations, and compliance are now critical success factors. But since the industry is viewed as whole, individual producers with poor environmental track records can create a misleading public perception that the industry does not do enough to protect the environment. This perception converges to reality when objections from individuals and interest groups trigger costly delays in drilling and development plans. Deferred or cancelled projects are in no one’s interest; there is a high economic cost to companies who forego or forfeit revenues, the surrounding communities from which labour and services are drawn, municipal administrations to whom taxes are paid, and the Provincial government who are unable to collect royalties. Against this economic cost is the equally compelling need to protect the environment and stakeholders’ interests. Thus, environmental performance and industry image are increasingly important in accessing reserves, and the extent to which exploration in the WCSB will continue to add reserves will depend on the overall investment risk, a better public consultation process and improved environmental performance.

In 1998, AEUB published data estimated initial conventional oil reserves of 15.7 billion barrels. The current estimate of 2 billion barrels of conventional oil reserves remaining therefore suggests a state of depletion of about 87%. This decline has been a driving force for industry to consider the massive deposits of non-conventional oil and gas in Alberta. The Athabasca tar sands is estimated to hold more than 175 billion barrels of oil that is economic with current technology (Lunan, 2000), representing almost 240 years of supply from Alberta at current production rates. Two tar sand plants currently in operation are producing about 317000 barrels/day of synthetic crude and capacity expansion plans currently underway will increase this to over 500,000 barrels/day by 2005. In addition, another $25 billion pool of investment has been announced by various other producers, with the expectation of raising synthetic crude production levels to some 2 million barrels/day in Alberta over the next 10 years.

There are also vast reserves of natural gas locked up in shallow hydrates buried under the Arctic permafrost and a similar potential for coal gas. Natural gas is becoming the preferred fossil fuel source for industry in Canada and the US, faced with meeting their Kyoto targets. It has better combustion characteristics, lower environmental impact, and security of supply now that additional pipeline infrastructure is being built. Further, natural gas is insulated from OPEC price manipulation. These considerations are expected to generate long-term exploration and profitability for natural gas producers in Alberta.

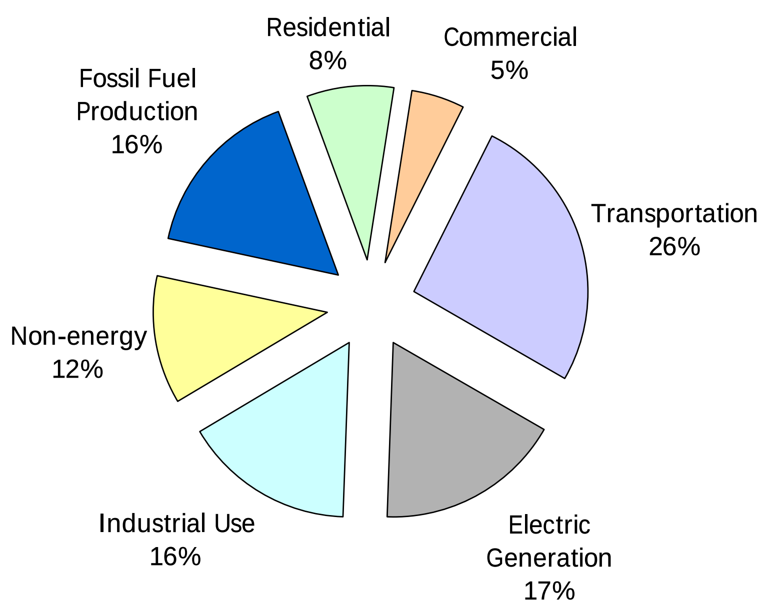
While exploration adds the bulk of reserves, a small but important contribution comes from extending the productive life of depleted fields. The royalty payment system is a sliding scale based on price and production rate: the lower each one is, the lower the royalty payment. This has provided sufficient incentive to continue production from marginal and formerly suspended wells, and so develop new reserves. As fields become depleted, larger companies with higher fixed costs exit and leave the “tail-end” production to smaller companies. There is an important incentive for these junior companies to be active, as they produce and extend reserves, pay royalties and provide employment opportunities that that would not occur otherwise. There has been proliferation of these small and “micro” companies that now occupy the “tail-end” production niche and as a group, they make a significant economic contribution. However, high debt loads, lack of awareness, or short-sightedness cause some of them to be non-compliant and many of them merely seek the advantages of high commodity price while it lasts, without any long-term environmental strategy. Thus, on the one hand, this exit strategy of the major producers has an important economic role, but at the same time it adds to the environmental liability of the industry as not all junior producers have the intent or the financial resources to meet increasingly higher environmental standards. It is these cases that reinforce the argument by critics that the industry cannot be trusted with self-regulation.

Environmental Impact of Production Operations

Canada produces only about 2% of global greenhouse gases, but fossil fuel production accounts for 16% of the country’s total (Figure 2).

While production and exploration activities result in economic benefit, it also creates significant environmental impact as summarised in Table 2. Flared and vented gas, critical sour wells (containing high levels of poisonous hydrogen sulphide gas), odour, noise, spills, habitat impact and ground water contamination are all potential hazards, and the industry has had some serious occurrences of pollution in the past. Of these, one of the most important is the impact of raw gas emissions that are both hazardous to health in a direct way, and contribute to global warming. Carbon dioxide and methane emissions are the most important pollutants from the upstream sector vis-à-vis global warming, but gas emissions from flares, vents and process exhausts also release a cocktail of poisonous gases including known carcinogens such as benzene. Nitrous oxides and gaseous sulphur compounds contribute to acid rain, and low levels of hydrogen sulphide are linked to reproductive disorders in cattle (Marr-Laing and Severson-Baker, 1999). Thus, gas releases are of major public concern and in 1996, Alberta formed a task force called the Clean Air Strategic Alliance (CASA) to investigate and recommend changes to reduce air pollution from the upstream sector. Flares have long been a contentious issue for rural residents, and according to the Pembina Institute, there were 5240 flares in the Province in 1996 which burned 175 million cubic feet of solution gas (gas produced along with oil and historically been considered a waste product) or 8% of the total solution gas produced. Another large volume of raw gas is vented from the casings of oil wells. Vented gas is particularly destructive to the environment as its contains high methane and ethane content, which have 20 times the global warming potential of carbon dioxide. Their explosive potential is of course another hazard. CASA's recommendations of a 90% reduction in benzene emissions from gas processing equipment by 2000 and a 25% reduction in the volume of gas flared by 2001 was adopted by the AEUB in 1999. The longer-term target is to achieve a 70% reduction in flaring and fugitive emissions below the 1996 levels, by the year 2007.

Figure 2: Canada's Greenhouse Gas Emissions



Source: Fitzgerald, 1998.

Table 2: Primary Environmental Impacts

Industry Act / Practice	Physical Impact	"Quality of Life" Impact
Flaring	Greenhouse gases (CO, CO2) Trace amounts of toxic chemicals	Aesthetics (flares), odour
Casing Vents	Greenhouse gases (methane, ethane and other hydrocarbons) Trace amounts of toxic chemicals Soil contamination around wells Explosive potential	Odour
Spills	Habitat destruction Ground / surface water contamination	Aesthetics (stained landscape, stressed / dead vegetation)
Production Operations	Noise, dust, increased traffic Contaminated soil and surface waters from drips and leaks	Aesthetics (production facilities), odour

Oil and produced water are also toxic. Produced water typically contains high chloride levels, and oil contains polycyclic aromatics including benzene derivatives, and heavy metals. All of these are toxic to the environment and contaminate soils during pipeline failures, and from drips and leaks from surface equipment. Surface run-off from such contaminated sites may also contain a lethal mixture of lubricants, glycols, amines and other toxic chemicals that are poisonous to vegetation, destroy wild life habitat and contaminate ground water supplies. As such, pipeline leaks and process spills are a second major source of contamination from the upstream sector.

The Impact of Industry Regulation

The Alberta Energy and Utilities Board (AEUB) regulates the industry. Its overall mandate is to ensure orderly development of oil and gas resources in the Province, including a public consultation process that requires producers to address stakeholder concerns. It is the agency that licenses all wells and projects, maintains production records, reserves estimates and a current geological database. It collects Crown royalties, arbitrates disputes over resource ownership and is responsible for enforcement of environmental protection regulations. Industry associations such the Canadian Association of Petroleum Producers (CAPP) and the Canadian Gas Association (CGA) work closely with the AEUB to ensure that industry has input into proposed regulations. Recently, the public voice is also being heard through environmental and special interest groups.

The role of regulation is an important one and has led to an orderly development of the resource. Part of this success is due to public ownership of the resource, so that there is a "built-in" incentive to conserve and develop it with a long-term view for the public good. Without it, there would be chaos, greater waste and more pollution as some companies seek short-term, least-cost solutions to their operations, and ignore their impact on the environment. Enforcement of the regulations is therefore a critical function of the AEUB and a progressive enforcement approach is utilised which includes authority to shut down non-compliant operations.

However, a common criticism by industry is that the regulations are often unclear or ambiguous, and there are too many overlapping jurisdictions leading to costly delays and increased overhead costs. There is also increasing concern over field inspections that sometimes fail to strike a proper balance between the letter of the law and the degree of non-compliance. The group made up of small producers may be particularly vulnerable to this, as they represent a higher risk of non-compliance due to their limited financial and human resources. In any event, even-handedness and consistency in the application of regulations remains an issue for producers. There is also criticism from environmentalists that staff cutbacks have left the AEUB with too few resources to enforce the regulations, a situation that has led to de facto self-regulation (Marr-Laing and Severson-Baker, 1999). The implication is that the industry cannot be trusted with self-regulation, and while this may have been true in the past, the industry recognises that it must do a better job to police itself and to improve its environmental performance, a process that has already happening. So far the upstream sector is two years ahead of scheduled reduction in flaring and has achieved a 50% reduction in benzene emissions from 1996 baseline levels (Alberta Chamber of Resources, 2000). However, the pace at which this has occurred suggest that this improvement may have had more to do with meeting new regulations rather than with innovation, or a new strategic way of thinking by producers. But in any case, the overall result has been a large reduction in green house gas emissions and increase revenues from conserved gas. This further supports Porter and van der Linde’s (1995) justification for regulation in order to achieve environmental protection.

There is also a strong need for government to streamline its regulatory process, and the AEUB needs to upgrade its inspection capability to keep pace of an expanding industry and to improve its approach to regulatory enforcement. While regulation and enforcement has a critical role to play, over-regulation and delays in approvals could make the industry less competitive in the long run. This is not a trivial issue when producers are seeking the best return for their investment and have other options outside Alberta or overseas.

Environmental protection is regulated through limits on gaseous emissions, environmental protection requirements for storage tanks, and spill containment. There are also rigorous requirements for spill reporting, clean up of spill areas and for site restoration. At the same time, resource conservation is achieved through regulations that now require gas conservation and improved operating practices that specify well spacing, maximum production rates, and maximum allowable gas-liquid ratios on individual wells. These measures ensure the industry operate to maximise recovery of the resource.

Before a project or critical well is authorized, a public notice must be posted, and anyone who has a bona fide concern can file motion to object. The project will not be authorized by the AEUB unless the producer and stakeholders resolve their differences, but arbitration and even legal action can be used as last resorts. This gives any group, which may include rural residents, environmental groups or aboriginal communities, considerable leverage to ensure that their concerns are addressed. Because this process can cause excessive and costly delays, oil companies have become very sensitive to stakeholders concerns, leading to much better consultation and due diligence.

The cost of environmental compliance varies widely and depends on the nature and scope of a company's environmental deficiencies. The worst case scenario typically involves a "tail end" operation with low production in a mature field with old, perhaps poorly maintained equipment. The cost to bring such an operation into compliance could potentially make it unprofitable, and force its closure. In addition, the requirements to clean up contaminated sites and to abandon wells at the end of the property's productive life has the potential to drain the financial resources of many smaller companies. Even for larger companies, the legacy of environmental liability at many sites are a cause for concern, especially when these properties are sold to smaller producers as tail-end production. There are a large number of inactive wells and facilities whose owners cannot be located or who are unable or unwilling to comply with their abandonment obligations. As a result, the AEUB now require all producers to post "bonds" against their non-producing wells and inactive facilities to ensure there are sufficient funds for this at the end of the property's producing life.

In addition to the cost of bringing their operations into compliance with existing standards, the regulations themselves are being revised to raise the standard of compliance. Critics argue that these do not go far enough to adequately protect the environment. But the industry cautions that the biosphere's natural capacity to assimilate environmental waste, as well as the need for a financially viable sector that continues to be major contributor to the economy, must also be taken into account. This debate is far from over, but it is certain that because of tighter regulations, better enforcement, public pressure and a changing business ethic, the industry is much cleaner today than in the past, and by all measures, at least as profitable. However, the balance between environmental protection and profitability is likely to continue to shift in favour of the environment, and therefore the industry must be prepared for increasingly higher costs for environmental protection in the future. The debate also underscores the need to include all stakeholders' interests in any discussion of sustainable development, and in particular, there can be no separation between the need for environmental protection and the need for economic viability.

Sustainability Issues

In 1987 the World Commission on Environment and Development issued its Brundtland Report, which defined sustainable development as that which "meets the needs of the present generation without compromising the ability of future generations to meet their own needs." However, there are many critics of the concept of sustainable development as it relates to the exploitation to non-renewable resources and there is a degree of cynicism over the oil industry's attempt to promote it as a bona fide business strategy. Part of this criticism is due to the failure of many companies to adequately articulate the issue, particularly in respect of how sustainable development of a finite resource can even be accomplished and at what cost to the environment. As a result, it is often misrepresented and trivialised as a public relations ploy. This is unfortunate, because notwithstanding its public relations benefit, sustainable development of oil and gas addresses the self-interests of the industry, and is therefore a legitimate and strategic business need. As such, it should be pursued in its own right.

The criticism that there is inconsistency in the concept of sustainability of a finite resource is not well founded within the context of Alberta's oil and gas industry, because while depletion outstrips addition of conventional reserves, much still remains to be drilled and produced. More importantly, the Province's massive non-conventional reserves are a virtual assurance of energy supply for the foreseeable future. Further, technology improvements will continue to extend the limits of economic viability of these resources, and so while Alberta's fossil fuels are indeed finite, they are certainly long-lived. We do not yet know the overall limits of these resources because we have not yet encountered them. Thus, in practical terms, Alberta's oil and gas reserves are a sustainable resource.

Both producers and industry critics agree that the environment has intrinsic value because it is an integral part of the biosphere that supports life and bio-diversity, and therefore must be protected for future generations. But the environment's ability to absorb and assimilate wastes is often understated. For example oceans, trees and soil are vast carbon sinks that remove carbon dioxide emissions. Many critics who oppose further expansion of the industry argue that the current generation must compromise its own needs in order to ensure the needs of future generations are met. They therefore advocate less consumerism and a more "back-to-nature" life style. While this may have a possible ideological appeal, a life style change is only necessary to the extent that the limits of environmental capacity are not exceeded. Similarly, an industry is sustainable as long as its overall ecological impact is substantially lower than the environment's capacity to assimilate its wastes (Jacobs, 1993). As such, sustainability does not preclude growth and prosperity. But it must balance the economic benefits with its social and environmental impact. This is a critical principle that links the obligation to ensure environmental protection for future generations with the equally compelling notion of economic prosperity and social well-being for current generations, and is a concept that is consistent with the Brundtland Report. It recognises that we live in a non-ideal world where industry and human activity cause environmental damage, but it also recognises the capacity of the environment to assimilate wastes, within limits.

Two important related issues arise from this. The first is that environmental regulations ultimately limit ecological damage by the industry, and so the role of enforcement is justified. The second issue is that it is necessary to consider what are the safe limits of environmental damage, a principle that is inferred by regulations that limit, not eliminate, pollution. One aspect of this that has gained notoriety is the ongoing scientific (and political) debate over the link between fossil fuels, global warming and its effects. There is mounting evidence that greenhouse gases from fossil fuels is the primary cause of the global environmental change (Weaver, 2001), although human activity only accounts for 3-4% of global CO2 levels (the remainder occurs naturally from plant decay and respiration). The complete resolution of the science may be years away, but given the scope, time scale and potential impact of such changes, it is necessary and prudent that the oil industry should be regulated to minimise all aspects of its ecological impact.

Within this framework, it is possible to sustain the viability of the oil and gas industry, but major changes will have to occur. According to the Canadian Association of Petroleum Producers (CAPP), fossil fuel production accounts for about 16% of Canada's green house gas emissions, with the upstream sector accountable for about half of that (Fitzgerald, 1998). The Kyoto Protocol requires Canada to reduce its emissions to 5% below 1990 levels, or 530 million tonnes of CO2 equivalent, by the year 2010. It is unlikely that this target can still be met, given the current pattern of energy usage. Nevertheless, a wide variety of new technologies are becoming available that will help the upstream sector achieve its emissions targets and at the same time improve its cost structure. The required reduction in carbon dioxide emissions may require a change in the level of gasoline consumption, as transportation accounts for 26% of the total emissions (Figure 2). A carbon tax has been suggested as a way of achieving this. But Canada has a strong dependence on transportation systems because of its geographical spread and fossil fuels are inelastic commodities with no immediate possibilities for substitution. Thus, a carbon tax in Canada will merely increase fuel prices that the public already perceives as being high, and generate additional government revenue without substantially curbing consumption. And, it would occur at a time when there are already large government budget surpluses. Further, without government rebates, a carbon tax would not correlate to income, and this would run counter to the notion of fairness in taxation based on ability to pay. As such, there would be very little public support for a carbon tax in Canada, placing the government in an untenable position. At the same time, because of its national economic benefits and in the interest of national energy sufficiency, governments at all levels have a high vested interest in the sustainability of the upstream sector. But political interference has occurred in the past when in the 1980's, the Federal Government tried (unsuccessfully) to control the price of oil in Canada. This precipitated serious supply disruptions and created a political fallout that is still evident today. The industry must therefore recognise this as a possible sustainability issue and be prepared to deal with it again in the future.

Macro Economic Factors

Population growth and general global improvements in economic well being will continue to drive demand for energy, but sustainable development requires this increase be offset by a concurrent reduction of environmental impact. Even with the maturing of the WCSB, the medium term North American demand for fossil fuels is assured by Alberta's vast non-conventional reserve base, albeit requiring massive injections of capital. But whether these longer-term investments are made, or deferred, will depend on the outlook for commodity prices, competition from Mexican and Venezuelan heavy crude in the US market, and environmental impact of development. Some of the market variables will depend greatly on how attractive the investment climate is in Alberta, compared to all the other options. Thus, the government must play a critical role if the industry is to achieve sustainability.

Canada is a preferred source of energy by the US because of security of supply that is guaranteed by the NAFTA trade agreement, and the two markets are becoming increasingly integrated. The long-term viability for natural gas is assured, provided non-conventional natural gas sources are developed. This fuel is challenging oil for dominance because of its better combustion characteristics and lower environmental impact. Nevertheless, a case can also be made for sustainable oil development, simply based on larger reserves and lower finding costs. But oil's outlook will also be very much dependent on the industry becoming "greener". The sustainability of the Alberta oil and gas industry will ultimately be decided by the balance between market forces, the extent of environmental protection required for exploitation of there resources, how the global warming issue is resolved, and the fuel mix required to achieve this.

In the longer-term, competition from alternate, non-polluting energy sources such as hydrogen and solar energy will likely reduce market share for both oil and gas. The World Energy Council estimates that by 2050 at least six fuel sources will make up the global energy mix, no one with a market share larger than 30% (Alberta Chamber of

Resources, 2000). In the near term however, the biggest challenges to sustainable development in Alberta are likely to come from stakeholder demands to be part of the process to ensure the benefits are more equally distributed, and particularly, public demands for improved environmental performance. It is unlikely that sustainability will be achieved through voluntary industry compliance and restraint, and strong AEUB regulation and enforcement will remain critical. The potentially high cost of environmental protection in the future makes it unlikely that very small producers will be able to afford environmental compliance without royalty rebate assistance or other subsidies. With these prospects in mind, it seems likely that only those organisations that can afford, and demonstrate an unequivocal long-term commitment to environmental protection will survive and prosper.

Formulating a Generic Strategy

Although the strong economic impact of oil development activity in Alberta cannot be denied, the industry is steadily being forced to adopt tougher operational practices that protect the environment. As such, environmental strategy is no longer a secondary consideration for producers. The Alberta oil industry is becoming cleaner and it is improving its public consultation process, but much remains to be done to achieve sustainability. The nature of competition will change – currently, there is competition for investment dollars and for mineral rights. This will remain so in the future, but in addition there will be competition from alternative sources of energy that will likely result in shrinkage of the oil industry, although this still many years away. Still, it is critical that companies with a long-term view develop a strategy to remain a viable business in a shrinking market. In the current market, producers can sell all that they can produce, but a smaller market with less demand will likely result in a reduction of commodity prices due to overabundance, and cost competitiveness will therefore become a critical success factor.

To prepare for this future, the following generic strategies are proposed. These will be justified in the section that follows based on market trends, reserve mix, cost structure and environmental impact.

- develop a diversified portfolio to hedge against commodity price volatility. Production from the WCSB is likely to continue to decline and so heavy oil and gas (and tar sands for larger companies) must be pursued.
- develop a low cost production strategy that can be sustained, to insulate the company against low product prices. This will require investment in new technology, and innovative operating and conservation practices.
- pursue growth, but profitably, as sustainability will favour companies of larger size who can afford environmental protection, and benefit from economy of scale.
- Recognise the growing importance of environmental impact, and scrutinize all operations to ensure environmental protection and compliance.
- ensure the public consultation process is taken seriously, and build a positive relationship with all stakeholders to reduce lengthy and costly delays in projects.

How organisations address their environmental strategy is important, from both a sustainable development perspective as well as a competitive advantage point of view. In the latter case, a comparative advantage might be obtained if a firm is able to formulate a more efficient environmental strategy than its competitors. Using a model proposed by Bellmann and Khare (to be published), there are three levels at which organisations might respond to their environmental challenges: reactionary, strategic and life cycle. A reactionary response waits for a crisis to occur and therefore precludes any meaningful strategy. A strategic response is one that is driven by business considerations primarily, but considers the ethical obligations for environmental protection. A life cycle approach on the other hand is a response based on corporate values, which are the drivers for business decisions. Each company will have a different set of circumstances and resource limitations to deal with, and the decisions they make will be within their own unique cultural context, but the principles suggested should improve their chances of "staying in the game". Whatever the strategy, financial stability, low cost competitiveness and environmental protection are likely to be the prime differentiators for success in the smaller petroleum upstream sector of the future.

Market Trends

Alberta's currently produces over 15 billion cubic feet/day of natural gas and 2 million barrels/ day of crude oil, of which 317,000 barrels/day is synthetic oil, and over 800,000 barrels/day is heavy oil and bitumen. This mix, as well as the size of the energy market, is expected to change dramatically during the next 50 years. With population and economic growth, the World Energy Council envisions at least a 50% increase in global demand for energy, with a fuel mix made up of at least 6 different sources, none of them with more than a 30% market share. A separate analysis based on a "most likely" future scenario forecasts an energy mix in the year 2050 consisting of no more than a 10% contribution each from crude oil and natural gas (Franchi, 2001). At present, fossil fuels provide an estimated 90% of North America's energy needs, but most studies predict its market share to shrink continuously over the next century.

With over half of its production exported, the US market is of critical importance to the Alberta industry and future fuel selection trends in that country will have a high impact. A recent US study by the National Petroleum Council reported that US demand for natural gas is forecast to increase by a third in the next 10 years to 29 trillion cubic feet per year. Alberta has a 13% share of that immense market, and with the emerging preference for gas over oil, natural gas production is expected to see steady growth during this period. Alberta is likely to sell all the gas it can produce, provided pipeline infrastructure keeps pace with gas development, but it will face much competition in the US market from Alaskan and Gulf of Mexico gas.

With a reserve index of just 5 years, conventional oil from the WCSB will make an increasingly smaller contribution to the overall energy mix. Oil from newly developed eastern Canadian offshore is producing at over 110,000 bbl/day, and will likely displace conventional oil from WCSB within a decade. However, heavy and synthetic oil production from tar sand projects in Alberta is expected to see rapid growth that could approach 2 million barrels per day in the next 15 years (Canadian Natural Resources Limited, 2000). Environmental pressures from fossil fuel use will force substitution to non-carbon fuels such as solar and hydrogen. As a result, there could be lower demand for crude oil in the North American market that would drive prices down and reduce or curtail development.

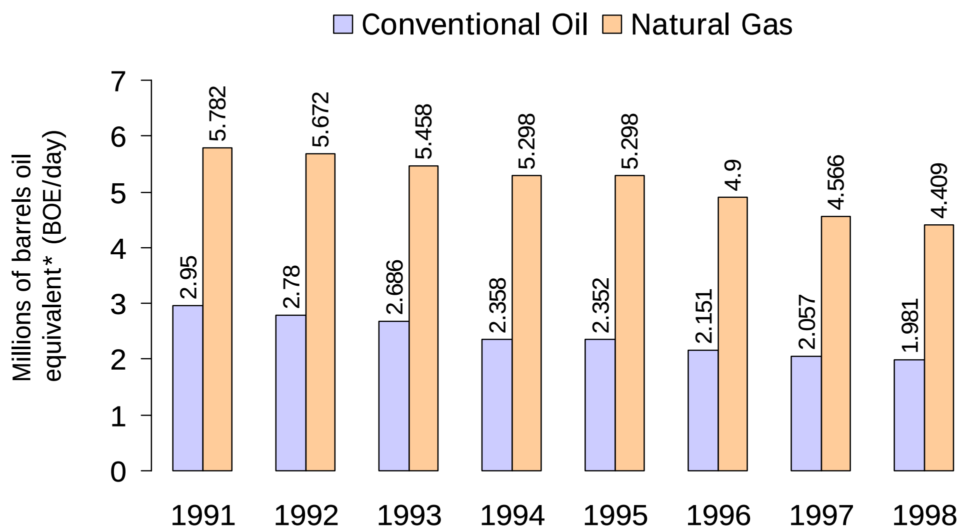
The profile of producers will likely also change. Only large, profitable producers have the financial resources to pursue tar sand development, due to the massive capital investments required. As production from the WCSB declines, the larger companies will exit and leave the tail-end production to smaller companies, a transition that is already evident. These smaller producers confine themselves to conventional oil and gas, including the primary production of heavy oil (that is without using higher cost secondary recovery methods, such as steam injection). Given the outlook for conventional oil from WCSB, small producers that do not have significant gas portfolios will not be viable as their oilfields become depleted. Those that are gas-weighted have a better chance, because of the outlook for gas. Nevertheless, long term sustainability for producers favour medium sized and large companies with diversified portfolios.

Reserves Mix

Reserves are the life-blood of the industry, but it is very important to have the right mix. There is a large, secure supply of natural gas in Alberta that can now access the vast US market. Besides its better environmental characteristics, natural gas is a natural hedge against volatile oil prices and also a viable source for emission-free hydrogen, and a potential candidate for gas-to-gasoline conversion. Therefore demand will stay high and its prospects are good. As such, a company is at risk if its portfolio does not contain a significant proportion of gas reserves.

Figure 3 is AEUB data of remaining conventional oil and natural gas reserves for the period 1991 to 1998. The decline of the conventional reserve base in the WCSB is evident, and the average pool size is getting smaller. Companies will continue exploration if they have reasonable assurance of finding reserves at a cost that will give them an acceptable rate of return, but accessibility to these reserves is getting more difficult, and the risk and cost of finding them is increasing. It is therefore becoming more common for companies, even smaller ones, to hold heavy oil in their portfolios. However, because of density and viscosity differences, there is a price differential between heavy oil and conventional oil. This is often quite volatile, as the market dynamics for heavy oil are different than those for conventional oil. It is not uncommon to have a large spread between the two, which may make heavy oil less attractive from a cash flow perspective and a very significant risk in a low price environment. Further, heavy oil needs to be diluted with a light hydrocarbon in order to meet pipeline specifications. Significant volumes of this diluent may be required, and it is almost always a higher-price refined product. This reduces cash flow further. So, heavy oil production requires a low-cost strategy that many smaller companies are unable to fully exploit because they do not have the same economy of scale of larger producers. While finding costs of heavy oil are generally lower compared to conventional oil (because of shallower depths and lower geologic risk), overall, heavy oil operations carry significant risk, and for many smaller companies, the volatility in price differentials and lower cash flows is simply too risky. However, Alberta will depend increasingly on heavy oil reserves to satisfy US demand. Production is expanding and the line up for new heavy oil and tar sand projects includes many newcomers, reflecting growth strategies that are necessary for long term survival. But tar sand reserves will require billion-dollar investments, and the development timeline for these projects is very long and sensitive to changes in commodity pricing.

Figure 3: Remaining Proven Reserves (1991-1998)



(*): 1 million cubic feet of natural gas is equivalent to 100 barrel of oil equivalent (100BOE).

Source: Alberta Energy & Utilities Board, 1998.

Smaller companies simply do not have the financial resources or risk tolerance to pursue these kinds of developments, and so for as long as it lasts, conventional oil will attract the smaller players who cannot afford to get into heavy oil and tar sands projects. But this potentially excludes them from long term viability, unless they are strongly gas-weighted. The requirement for heavy oil as a replacement for conventional oil reserves therefore effectively places a lower limit on the size of companies that can survive the growing transition from conventional oil to heavy oil and gas, and differentiates long term survival candidates from those with limited prospects.

Cost Structure

Companies cannot control the price of oil and gas, and so long term profitability can only be achieved by a strategy that maintains a low cost structure. While it is not difficult to be profitable in a market with high energy prices, a dependence on price alone is a dangerous strategy given the historical volatility of commodity prices. So companies of all sizes which are not mindful of their costs, may well become primary candidates for failure in a depressed market. Large companies are best positioned to benefit from economies of scale; those who are low cost producers in addition, are the ones most likely to prosper in the smaller, more competitive market of the future. On the other hand, companies of all sizes who are over-reliant on commodity prices to be profitable are unlikely to survive.

Size is likely to be achieved as much through the drill bit as by acquisitions and mergers, a trend already evident in today's market. Often there is a considerable lag between share prices of publicly traded producers and true underlying performance of the sector.

Therefore, in the current favourable price environment there are many attractive acquisition opportunities represented by companies who are highly profitable but have “soft” share prices. Another, more focused, growth strategy is to purchase individual properties in an existing core area in order to reduce costs through operational synergies.

Several emerging technology streams and improved operational practices can also help companies lower their costs. Examples are seismic processing technology that help explorationists to better define drilling targets in deeper, more complex reservoirs. Improved drilling technologies such as more efficient drill bits, and horizontal drilling have allowed the industry to improve their exploration cost structure, and add reserves more cost effectively. There are similar opportunities in the operational side of the business. For example, gas conservation and electric co-generation reduce both environmental impact and operating costs. In particular, gas conservation has had a large impact. The old practice of venting hydrocarbon gases from well casings is being replaced by cost effective gas conservation schemes that employ small wellhead compressors to gather and sell this resource, instead of wasting it. Where no pipeline infrastructure exits to do this, an alternative is to use this gas as fuel for on-site electrical generation, thereby reducing a major operating expense for producers. The Clean Air Strategic Alliance task force estimates that these existing technologies would reduce the volume of gas flared by as much as 30%. A further 30% could be reduced if mini-turbine technology, currently being developed, proves effective. However, changes to the current deregulated power supply will be required to enable small producers of electric power to “net meter” (get credit for the power they produce to the grid) or to use the power they generate at a different site in the grid. New gas conservation regulations have played a leading role in this new direction, but high power and fuel costs have also been strong drivers. In thermal projects, waste heat from produced fluids is being recovered, thereby reducing fuel costs for process heating, and innovation developments in fuel substitution for steam generation will reduce operating expenses further. There are also new lower-cost substitutes for diluents that are being exploited, and development of economical field-scale hydro-crackers. These are processing units that “crack” bitumen and heavy oil into lighter components and so negate the need for diluents. On a larger scale, conversion of heavy oil into better-priced, synthetic crude and the development of gas-to-gasoline technology are ways that well financed (large) companies will add value and diversity to their product streams. The economy of scale of these projects is such that the unit production costs of tar sand operations now rival those of some conventional oil producers. However, the enormous capital outlay for these projects, and even the availability of tar sand leases themselves, makes an effective barrier to entry to all but the largest producers. Even so, employment of technology and innovative operational practices are tactics that all companies can and should be using to make themselves more cost competitive.

In addition, overhead costs can be further improved by using computer technology in a wide range of business applications such as procurement and invoice management. Significant cost structure improvements also come from the use of alliances, from out-sourcing work processes that are not core to the business, and from progressive management styles and systems that motivate higher employee productivity, and align business decisions and actions with overall strategy. These are part of what constitutes company culture – they are very difficult to copy and therefore confer a particularly strong competitive advantage to those organisations that can effectively use them to improve the way they operate.

Environmental impact and Externalities

Environmental impact of upstream operations is well established and was discussed in a previous section. Flared and vented gas are hazardous to heath and a primarily source of greenhouse gases, and spilled oil and produced water are hazardous to habitat and ground water supplies. As well, many oil and gas operations produce odour and noise. Environmental protection and quality of life are often the source of much antagonism between rural residents and aboriginal groups on the one hand, and producers on the other. As the recent Ludwig case (Weber, 2000) of oilfield sabotage in north-western Alberta underscores, some stakeholders are prepared to take extreme measures to defend their interests, and so producers who ignore the legitimate concerns of rural residents, increasingly put their operations at risk. There are also the additional unresolved claims by some aboriginal groups for compensation and work guarantees.

For its part the AEUB is very sensitive to the growing political pressures of residential stakeholders, environmentalists and citizens coalition groups to do something. As a result, there has been a recent upsurge in regulatory action, and this makes it all the more important for producers to have a proactive stakeholder strategy of their own. However, given the environmental impact potential of the industry, its reactive approach to stakeholder concerns and its historically poor track record in environmental protection, regulation and enforcement appear to be necessary in order to prevent further ecological damage.

Before individual producers move towards a sustainable operation, it will be necessary to for them to recognise and acknowledge their impact, “green up” their operations by complying with regulations and in general recreate a much better image. The latter should not be a trivial consideration, because image and perception may well make the difference between access to reserves or project failure. But since the industry is viewed as a whole, non-compliant producers are likely to undermine the good efforts of those that operate to higher standards. It is therefore necessary for the industry to help police itself, and it makes strategic sense for individual produces to cultivate a positive relationship with their stakeholder groups. Indeed, this is emerging as a very important function for the industry. But to build credibility, companies must as a minimum, proactively respond to all stakeholders’ concerns and demonstrate that they are protecting the environment. Good business practice requires that this strategy become a higher priority than in the past.

Concluding Remarks

Sustainability will require to oil companies to rethink their business strategy. Those that are in for the long haul can no longer afford to focus just on maximizing profits. Profitability is critical of course, but producers must also address a host of issues that are not reflected in the financial bottom line, but which are no less critical to their long-term survival. Due to global warming, the upstream petroleum sector is likely to become smaller in the next 50 years as cleaner fuels gain market share. While Alberta has vast resources of fossil fuels, oil from the Western Canadian Sedimentary Basin will continue to decline, to be replaced by heavy and synthetic oil from tar sand developments. But since natural gas will be the preferred fossil fuel due to its lower environmental impact, companies that do not have significant gas portfolios are unlikely to do well. A low-cost strategy will be critical to remain viable in a smaller market with reduced demand, and with potentially lower product prices, and survival is likely to favour larger companies that have the financial resources to acquire a diversified portfolio and to proactively protect the environment. Size is therefore important, insofar as it tends to correlate with overall financial strength. And while environmental protection does not preclude growth, it will continue to can be a significant cost to producers. Effective public consultation will also be equally important, and the industry must remain on guard against political interference and push Provincial and Federal governments to clarify and resolve aboriginal claims to the resource. Therefore, the key components of a generic sustainable strategy for the industry are growth with a diversified portfolio, improved cost competitiveness achieved through a low cost strategy, better environmental protection and a proactive approach to all stakeholder issues. Those companies that have sufficient financial resources for the long haul, and who can best integrate these strategies into their businesses are the ones that are most likely to remain viable decades from now.

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9 Integrated Forest Management in the Boreal Mixedwood Forest

A Review of Policy and Management Implications in Alberta

Mike Byl

Abstract

Forest management in the boreal mixedwood forest is in the midst of change. Historically managed for coniferous trees the emphasis has been changing as deciduous tree usage increases. The expectations have also changed with the belief that sustainable forest management of the boreal forest will be planned. In Alberta over the past 15 years there has been only one major policy change in forestry policy and regulations. Forest tenures issued in Alberta over this period have focused on deciduous resources. With the historic conifer licenses, management and policies, tenures tended to separate management of the deciduous and conifer resources. More recently there has been concern as to how companies can integrate forest management of the species and achieve sustainable forest management under current government policies, regulatory environment and tenure system.

This paper demonstrates the successful integration of forest planning for achieving integrated forest management plan using a case study of Canadian Forest Products Ltd. (Canfor), a conifer licensee, and Daishowa-Marubeni International Ltd. (DMI), a deciduous licensee. Positive attitude and cooperation between participating companies are paramount to success, while government regulations are not as restrictive as perceived.

Keywords: boreal mixedwood forest, integrated forest management, forest policy.

Introduction

The boreal forest is the largest of Canada's nine forest regions occupying 77 percent of Canada's forested land (NRC 2001). In Alberta and northeast BC it contains huge expanses of conifer and deciduous forests. Navratil et al. (1994, p.1) states that "boreal mixedwoods occupy about 600 000 km^2 of the forest landbase of the prairie provinces and northeastern BC." The boreal mixedwood forest is an area that has a combination of deciduous and coniferous trees over the landscape. This combination can include variations in species composition, species age, species height, and species distribution. Macdonald (1996) describes a boreal mixedwood site as land that has the climatic, topographic, and edaphic conditions to support mixedwood stands.

Deciduous boreal tree species include trembling aspen (Populus tremuloides Michx.); balsam poplar (Populus balsamifera L.); black cottonwood (Populus trichocarpa Torr. & Gray) and birch (Betula spp*.).* The boreal conifer tree species include white spruce (Picea glauca (moech) Voss); black spruce (Picea mariana *(*Mill) B.S.P.); jack pine (Pinus banksiana Lamb.); lodgepole pine (Pinus contorta Dougl.); balsam fir (abies balsamifera (L.) Mill); and tamarack (Larix laricina (DuRoi) K. Koch).

Deciduous and mixedwood forest management is still relatively young in the boreal forest when compared to coniferous forest management. Historically, forest management in the boreal forest has focused on coniferous species management and regeneration. Moreover, the landbase was defined as either productive or not productive for growing conifers (and could include landbase that produced deciduous stands). In some cases (e.g. Alberta), pure stands of mature deciduous timber with a conifer understory could be defined as conifer landbase for the purpose of inclusion in coniferous annual allowable cut (AAC) determinations.

More recently, the demand for deciduous forest products has increased the use of the boreal mixedwood and deciduous forests. David et al. (2001) states that over the last 15 years deciduous utilization has increased 8 times in Alberta. As mixedwood and deciduous forest use have increased, there has been growing recognition of the need for new management techniques and attitudes. Forest management has similarly changed over the past 15 years. These changes have occurred as a result of new information (i.e., research results, operational data and anecdotal information) being brought forward and society's changing values concerning management of the crown forest resources.

With changing environmental attitudes and movement towards ecologically based management, the forest industry is changing the way it manages the boreal forest. Andison and Kimmins (1999, p19) note that "boreal mixedwood management issues have broadened in response" and now "encompass questions of biodiversity, long-term productivity, utilization, adequacy of regeneration standards, and tenure arrangements".

Given the changes in how forest management is undertaken and forest management viewpoints concerning the boreal forest and forest policy, changes in regulations appear to have not kept pace.

In Alberta there has been one major change in policy / regulation since the advent of deciduous utilization. Many minor changes have occurred as the government has recognized the need to include deciduous and mixedwood management in the *Forest Act* or related policies. The one major regulation change, affecting regeneration standards in 2000, was to accommodate deciduous and mixedwood management. This change addressed the definition of deciduous and coniferous stand types and how these fit with the reforestation standards and the projected future mature forest. The revised regeneration standards have not been well received by industry and have since undergone a peer review. Beck et al. (1989) noted that there was a need for policy change since present policies were based on historic conifer management and did not recognize the value of aspen. It could be stated that today's policy and tenure documents do not recognize the need for integrated forest management within the boreal forest. It must be noted that the Alberta government recognizes this need, but has not developed policy to accommodate it. Baskerville (1988; pp. 7) states that "there is a general failure to build a logically consistent linkage from the policy level, through the management level up to the implementation level in the forest. These three levels are commonly constructed independently."

While there have been many new forest tenures issued in Alberta and BC for deciduous harvesting rights and management, there has been little change to the laws and regulations to accommodate the differences in management possibilities (i.e. mixedwood management, sustainable forest management). What catalyst do we need for change? Forest policy and associated regulations in Alberta and BC are still based on the historical tendency to manage the forest landbase for conifer species (single species). The attitude is changing, but are the policies and regulations changing quick enough?

Forest management on most tracts of land within the boreal forest often involves more than one licensee, more than one type of tenure and utilization of more than one species. With forest management undergoing a paradigm shift from traditional single-species management (tree farm / fibre management) to integrated forest management (for multiple values and tree species - ecologically based / sustainable forest management), a change in the way planning is undertaken, and how strategic and tactical planning occurs in the boreal forest is warranted. This integrated forest management planning will have to address the issues associated with different tenures, species, mill requirements and management philosophies.

Historic forest land management philosophy typically planned and managed forests on an individual block basis. If a spruce stand was harvested, it was replaced with a spruce stand. If a spruce-aspen stand was harvested, it would also be replaced with a spruce stand. Modeling for timber supply would often assume that if the landbase (not the stand) was classified as conifer (which could range from 100% conifer volume to as little as 50 M^3 per hectare, depending on the agreement with the government), then it would be regenerated to pure conifer stands.

The purpose of this paper is to evaluate what changes (if any) are required to the Alberta *Forests Act* or related legislation and regulations that would enable integrated forest management (boreal forest mixedwood management) to occur. This will be accomplished by reviewing how two independent forest companies combined their existing tenures to produce an integrated forest management plan.

The case study reviews the process for initiating a Detailed Forest Management Plan (DFMP) for a defined landbase. This review will consider if there are any implications for existing government legislation, regulations and policies to Forest Management Agreement (FMA) holders and Timber Quota holders in implementing integrated resource management based on ecological principles. Comments regarding possible changes to existing policy, strategic planning and management will also be offered. The paper is organized to address the following questions:

- What was done and what were the management processes that enabled Canfor and DMI to produce an integrated detailed forest management plan?
- What were some of the impediments to producing an integrated forest management plan?
- What were some of the gaps or omissions to producing an integrated forest management plan?
- What is required to enable future integrated forest management work to occur throughout the province?

Literature Review

A preliminary literature review has not revealed any direct information regarding the policy implications of implementing integrated forest management on overlapping forest tenures that are operated by different companies. There are policy issues discussed in various papers though in most cases it is an aside from the real issue of the paper. Personal discussions with foresters in Alberta have suggested that there is a need for changes to tenures and legislation / policy to enhance integration of uses and management of the boreal forest. Changes should work to allow for better forest management integration and mitigate 'turf wars' over the landbase.

Armstrong et.al. (2001) discussed overlapping forest tenures and the inefficiencies and cost created in providing the various mills with their required timber supply. Though the focus of their paper was on modeling timber supply and the costs/benefits of global management (integrated forest management and operations), it was noted that there is a need to review policy surrounding planning and tenure.

Andison et. al. (1999, p 20) state "that the boreal mixedwood offers a good opportunity to develop and apply ecologically based, mixed-species forest management. The biggest hurdle for boreal mixedwood management is that there is a need to be open to change, work within the ecological system and work towards overcoming obstacles. There is a need to step back from the old approach of stand level management and move up to the landscape level."

When one looks back to 1989, when most deciduous tenures where initially being allocated, Beck et. al. (1989) discussed the current expansion in aspen utilization and forest management policy. They comment further that with increased aspen utilization and global demand for wood fibre, there needs to be an examination of forest policy that encompasses harvesting of the existing forest to creating future forests given the historic policies affected by conifer bias.

Apsey et al. (2000) discusses forest policy and says today, after almost two centuries, Canadian forest policy is a bewildering array of legislation, regulation and common practice. It is comprised of key elements devised in previous eras to realize forest concepts long since abandoned and modified at various times to meet changing needs.

The key policies that determine how the forest is used include tenure policy, yield policy (forest structure), revenue policy and land use policy. To move towards sustainable forest management and to achieve the objectives we must revise these policies to create the conditions required.

Peterson et.al. (1992) state that with the increased use of the boreal hardwoods there is requirement for change in policy. Better administration is required of the overlapping hardwood and softwood tenures. Overall, Peterson et al. (1992) feel that with the establishment of the deciduous (hardwood) users, new policy considerations are required that are free from historic conifer bias.

Alberta Forest Act and Government Regulations

Alberta forest management revolves around the Alberta Forests Act. The Forests Act is minimal as far as direction for how the forests should be managed (Schneider, 2001) but allows for the minister or designate to set policy and regulation. Current direction through the Forests Act still advocates timber supply to be determined as a perpetual sustained yield. There are several policies and regulations that lend direction to the Forests Act. These policies include, but are not limited to, the Timber Management Regulation, Scaling Regulation, Timber Regulation, Alberta Regeneration Survey Manual, Timber Harvesting Planning and Operating Ground Rules, and Forest Management Directives (documents issued by the Alberta government,). The directives are written to lend more direction to forest management as seen by the government. For example, to assist forest licensees in implementing the revised the Regeneration Survey Manual the Alberta government issued three directives on how licensees could manage the change in silviculture direction.

Changes in public values and recently released public documents (i.e. directives, papers) point forest management in a new direction shifting its focus from sustained yield timber management to the concept of sustainable forest management. Some documents in Alberta that discuss and advocate this change in management include the Alberta Forest Conservation Strategy (AFCS), The Alberta Forest Legacy, the interim 1998 Forest Management Planning Manual, and the Alberta Forest Management Science Council's report (1997) on Sustainable Forest Management and its Major Elements.

In 1994, the Timber Harvest Planning and Operating Ground Rules stated that plans were to implement the principles of sustained yield timber management. The landbase was divided into two categories, conifer and deciduous. Of this landbase and over time, previous and preceding conifer landbase (by definition) had a wide range of variation and implication to the users of the landbase depending on the forest tenure document (conifer landbase could be defined within the document). The application of sustained yield timber management, the annual allowable cut (AAC) process and the definition of landbase within a tenure document often made integrated landbase planning difficult depending on those involved (i.e. different tenures with different species).

In 1998, the Forests Act and regulations were still focused on the sustained yield concept. While the forest tenure documents and the Forests Act have not been changed the government has moved in the direction towards sustainable forest management. The 1998 Interim Forest Management Planning Manual states that the current sustained yield timber management planning is required under existing legislation but planning should move toward sustainable forest management. The 2002 draft Interim Forest Management

Planning Manual currently under review (AEP 2001) states that the focus needs to shift to sustainable forest management but again acknowledges that current legislation requires sustained yield timber management planning.

Whether this type of policy would cause legal problems by contradicting FMA documents will not be speculated but should be noted. The concept of the AFCS, i.e., sustainable forest management, that evolved as a consensus approval for how forestry and forest conservation should work together does confirm that times are changing and perhaps forest management should look at these changes. Most forestry professionals are in agreement with concept of sustainable forest management though there are still some tenure holders who feel threatened by it. In most cases there are concerns that adopting sustainable forest management could translate to decrease in harvest levels (AAC).

Alberta Forest Tenure System

Alberta has three types of forest tenure – Timber Permits, Timber Quotas, and Forest Management Agreements (FMA). Alberta's first FMA was issued in 1954. Timber permits are small volume permits for local users. Timber quotas are volume based agreements that provide companies with 20 year renewable agreements that are divided into four, five year AAC control quadrants. FMA's are long-term, land-based agreements that give the FMA holder the right to establish, grow, harvest and remove specified tree species within a defined landbase.

There are 45 quota holders in the province with AAC's that range from 494 m3/year to 974 000 m3/year. 92% of all quotas overlap with FMA's. For FMA's, there are 18 dispositions with an AAC of 13.8 million m^3/year or approximately 59% of the provincial AAC (Cook 2000). Almost every FMA has a quota holder embedded within it.

The Case Study: Background

Canfor operates a sawmill in Hines Creek in northwest Alberta quota to harvest 259 000 m^3/year of conifer timber within forest management units P1 and P2.

DMI, Peace River Pulp Division, operates a pulp mill north of Peace River Alberta. DMI operates under FMA, Deciduous Timber Allocations (DTA) and Renewable Quotas. These agreements provide DMI with a deciduous AAC of about 1.6 million m^3/year. As a part of their license document, DMI must develop a DFMP every 10 years for the FMA landbase and complete a timber supply analysis using a planning horizon of 1-2 rotations.

Canfor's quota overlaps with DMI's FMA landbase within FMU's P1 and P2 in northwest Alberta. Canfor's quota was approximately 259 000 m^3/year and DMI's volume was approximately 304 000 m^3/year within the plan area of P1(south) and P2 areas. Considering that Canfor didn't have the opportunity to plan for the long term and DMI had the land management responsibilities the two companies began discussions on joint long-term planning.

In 1995, DMI and Canfor signed a Forest Management Partnership Agreement to begin ecological management pilot on 700 000 hectares within the P1 and P2 area (DMI, 2001b). Canfor and DMI worked toward a joint management plan to accommodate their overlapping tenures and the volume requirements for their respective mills. The joint management plan is based on principles of ecologically based, sustainable forestry and depends on enhanced forest management planning within the context of natural disturbance ecology for the boreal forest.

Integrated Process

Canfor and DMI staff initiated an integrated forest management planning initiative for various reasons, some of these are noted in the following list:

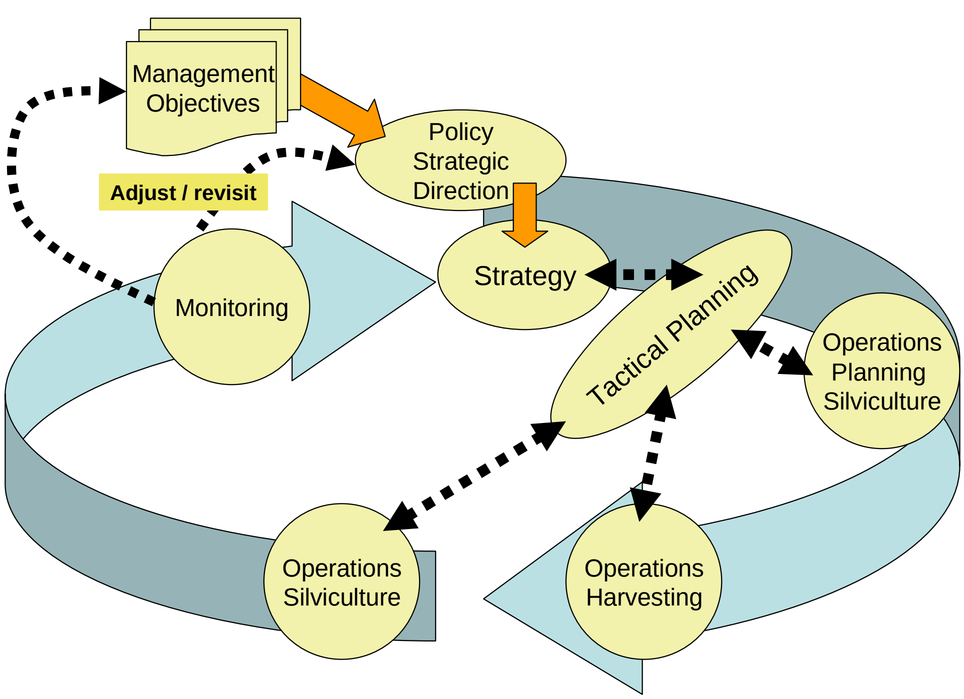
- The need for cost reduction.
- Certification issues and increased pressure from environmental advocacy groups.
- Canfor's concerns over long-term wood supply and examination of ways to minimize volume reduction impacts and opportunities to confirm the wood supply.
- Agreement with the Alberta Forest Conservation Strategy (AFCS) process and work on sustainable forest management within it's context for the FMA and quota defined land area.
- DMI's FMA document (Gov. Ab. 1999, Appendix D) statement "the intent that both the conifer and deciduous trees will be managed such that current timber allocation commitments as set out in approved management plans are maintained."
- 1994 Canfor updated Quota agreement within the P1 FMU stated that they should integrate planning and harvest operations within the FMU (AEP, 1994).
- DMI and Canfor felt that to plan and use sustainable forest management strategies would help to ensure a secure long-term fibre supply while providing stability for the environment, mills and the economy.
- With overlapping tenures, shared landbase and each company's respective volume needs, it made sense to embark on an integrated sustainable forest management plan for this boreal mixedwood forest landbase.

With the above comments, concerns and the desire to work towards sustainable forest management, Canfor and DMI began discussions on working together to produce a joint forest management plan. The intent was to use ecological management concepts in working towards sustainable forest management. This type of joint planning would advocate sustainable forest management. Moreover, it offered potential cost reduction to participants while increasing certainty in future forest management plans along with providing sustainability of their combined conifer and deciduous cuts in north western Alberta.

Historically, forest management has followed a rules-based approach, therefore leaving little flexibility, if any, for innovative management. This regulation or rules-based management inhibits innovation in forest management as the managers' goals are based on applying and meeting the rules (DMI, 2001a). Baskerville (1988; pp.9) states that "our society has come to rely heavily on regulations as the solution to all manner of problems. I believe it is impossible to manage a forest by means of regulations. At best, regulations insure a uniform approach, but the problems of forest management are not uniform." Considering the structural diversity of boreal mixedwoods and the need for innovative management, Canfor and DMI wanted to have their integrated forest management plan work on a looped (i.e. adaptive) management agendum.

The integrated forest management plan process that Canfor and DMI are working towards follows a top-down approach (Figure 1), the intent being that they would manage based on the objectives that they have set for their future forests. The management objectives would set the stage for their policy and strategic direction. From this, one could embark on strategic planning and then, tactical planning. As each operational phase has been conducted feedback is required on performance (i.e. reporting requirements) that flows back to the tactical and strategic planning phases. Here, the results must be reported so that information is available for review (e.g., comparison with defined targets and indicators) to see if adjustments are required at the tactical level or the strategic level. Adjustments can then be made in the operations or in the strategic planning (i.e. cut goes up/down, forest profile changes strategies may have to change). Information from monitoring of all activities feeds back into the strategic plan. It is further used to adjust the policy and strategic direction or the management objective. The monitoring will also provide additional information on how the objectives were met. Through the review of this information, an assessment will have to be made to determine the need for refining the management objectives.

Figure 1: Objectives Process



In late 1994, Canfor and DMI began formalizing a forest management partnership agreement within FMU P1 and P2 in northwestern Alberta. The intent was to "jointly prepare a fully integrated fibre management plan" under some of the following guiding principles (Canfor-DMI, 1994; pp. 1):

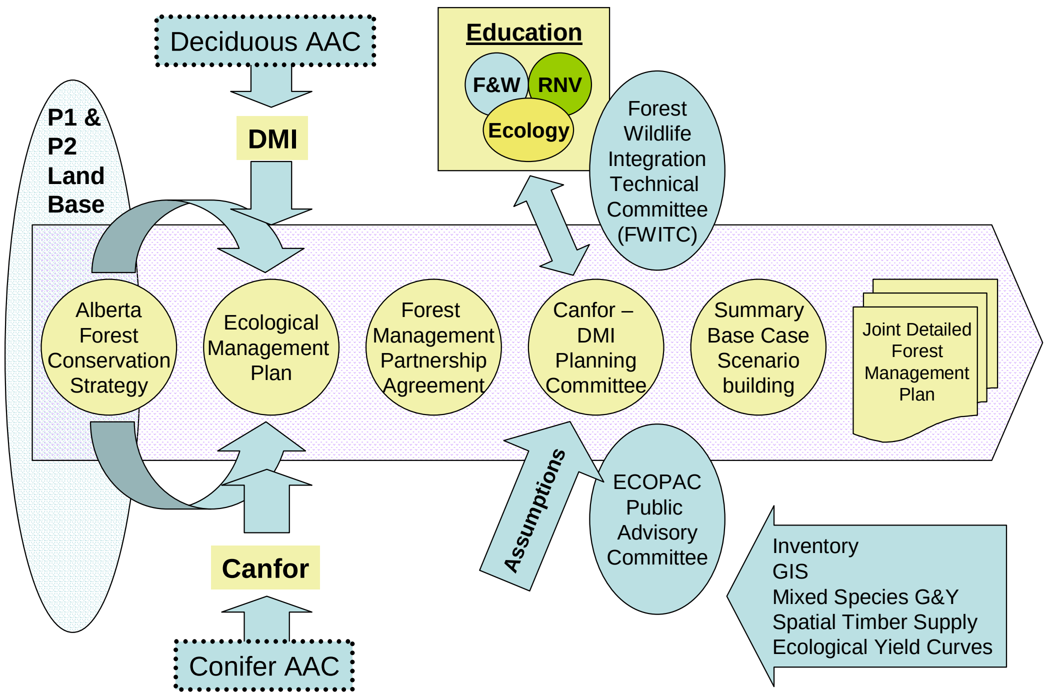
- Jointly prepare a fully integrated fibre management plan founded on principles of ecosystem management
- Management objectives and strategies developed are subject to DMI and Canfor agreement and government approval
- DMI (as the FMA holder) will take lead role in preparation of the plan
- DMI's Alberta Vegetation Inventory (AVI) for the area will serve as the sole inventory base for the preparation of the plan
- Canfor and DMI will mutually develop the necessary agreements to complete the plan such as a data subscription agreement, cost sharing agreement, a public involvement plan.
- Both coniferous and deciduous resources will be managed to the extent possible, to current commitments.
- Canfor and DMI will freely share and discuss information required for preparation of the plan while respecting confidentiality of such information.

Through this agreement, a joint planning committee was established and the DFMP process was started (Figure 2). To develop this integrated plan the joint planning committee made the assumption that the approach they would take would start with a clean slate. This meant that the ground rules, reforestation standards, AAC guidelines, and management planning guidelines would all start from scratch and existing rules would not be in effect. This was not to say that they were operating without rules in the interim, but that they would run modeling exercises to see how the rules would affect management and change the integrated DFMP they were about to undertake. Their intent was to integrate forest management on a shared land-base providing fibre and other resources using an ecologically based successional (forest structure) approach. The conifer and deciduous resources were not to be managed as separate entities, but would follow the successional pathways "managing within the range of natural variability, with limitation applied to reflect technological, economic and social constraints" (Canfor-DMI. 1995. p.2).

The integrated DFMP started with an educational process to learn about the ecological concepts that a sustainable forest management plan would entail and would require discussion. By doing this education process, it was hoped that everyone would be working with the same information and background required for the plan. This process was done with the Ecological Public advisory Committee (ECOPAC), Canfor and DMI. Dr. Brad Stelfox introduced concepts regarding managing within the range of natural variability (RNV)[A] model. Within this review of the ecological concepts, they examined the differences in management approaches from a landscape versus stand level view. This was also reviewed considering timber, fish, wildlife and ecological points of view. This

[A] Range of Natural Variability (RNV) model = Assumes that you manage for a range of stand ages, stand sizes and stand structures helped to develop the criteria, indicators and objectives for ecological management in the integrated DFMP.

Figure 2: Process Flow



To develop an integrated plan that maintains ecosystem function, broad ecological targets must be set that are based on the existing forests. Dr. Brad Stelfox compiled a northwestern Alberta biophysical report that could be used to gauge the success of the ecological approach. To move to these broad ecological targets, "the following elements (for future forests) were chosen; age class distribution, species distribution, stand size distribution and within stand structure. (Vinge, 2001)" Ecological targets and ecological framework will be monitored and evaluated with respect to how forest management proceeds and is implemented.

While working within the sustainable forest management concept, DMI and Canfor asked that ECOPAC write down those values they were trying to protect through the use of this ecological process/approach. Once through the concepts of sustainable forest management, RNV and stakeholder values a timber supply model was required that could forecast the future forest values and optimize the best solution. Given the parameters of the ECOPAC and company requirements the model would optimize for timing and combinations of operations, the end result being a plan of what to do, when to do it, and how much to do. To see how the model worked, the planning committee and the ECOPAC ran two model scenarios, one to maximize timber values and one to maximize ecological values. After running these two scenarios, the model output showed that the values of all the table members could not be achieved. At this point, work began on finding a mutually acceptable middle ground to achieve the objectives.

Completion and approval of this integrated DFMP was intended to provide for integration of operations from harvesting to silviculture.

In October 1995 DMI and Canfor sought formal approval from the Assistant Deputy Minister, Alberta Environmental Protection (AEP) for their plan to produce a fully integrated ecosystem management plan (Canfor-DMI 1995). This was requested as DMI and Canfor believed this integrated ecosystem management plan "would involve significant deviation from your department's current approach to forest management planning and forest regulation" (Canfor-DMI 1995; pp.1). This was met with positive comments from the government who were encouraged by the joint approach to plan for ecosystem management that was consistent with AFCS. It was noted that while guidelines and policies can be changed to reflect this new direction of management, if sufficient justification is given, the existing legislation cannot be ignored (AEP, 1995).

Submission of this integrated DFMP was first made in September 1999 with a revised submission in February 2001 and final approval on June 26, 2001.

Integrated Management Difficulties

Historically, this integrated DFMP process started at a time when the Alberta government had just begun the Alberta Forest Conservation Strategy (AFCS) roundtable. In 1992, the Alberta government was involved in the National Forest Strategy and co-signed the Canada Forest Accord. The AFCS process was part of the government's commitment to these documents. It should be noted that in May of 1994 an updated document of Timber Harvest Planning and Operating Ground Rules was released. This document conveyed the principle of Sustained Yield Timber Management.

Once the integrated DFMP process started there was no set process or procedure written out, the proposed end result of this work (integrated management) was that both Canfor and DMI would work towards an ecologically based forest management plan approach as was being discussed at the AFCS.

Some of the topics and process difficulties that were encountered are listed below:

- Modeling, in theory, sounded good but because of its technical nature, there was more work required due to shortfalls in the models. The two models being used were an aspatial model-WOODSTOCK™- and a spatial model-STANLEY™-. The need to adapt the models and information parameters to make the two work together became quite complex. This type of operational modeling for integrated management and use of ecological yield curves was relatively new and somewhat experimental.
- The ECOPAC was started with a general idea of what and where they would be involved, though they had no terms of reference. Their initial role was as a general advisory group representing the public.
- The planning process was sidetracked by the ECOPAC on issues concerning protected areas. Though it was agreed that these areas are required, the joint

planning committee thought that government would have to decide as to how much protection and where they (protected areas) may be. Some ECOPAC members were not satisfied with this decision and did cause some fallout within the group.

- Land base information was limited to AVI information (i.e. no ecological inventory). The initial successional yield curves developed were lacking information in determining treatments and successional pathways and resulted in government acceptance being slow and conditional. This process was another new approach that was untried and had no scientific data to back up the assumptions. Discussion between government and company timber supply analysts appears to have been lacking. The final approval process took longer than expected, as further discussions were required to understand the processes and data. At the same time, it was moving in the direction that the government was suggesting.
- Alberta government involvement at the table (i.e. as part of the ECOPAC) became more the role of an observer versus an active participant. As the process continued, it would have been better to have had recognition of their agreement (i.e. sign off) with stages of the plan as they were completed.
- Data needs were far greater that anticipated. Development of growth and yield curves did not have external reviews or government approval as they were being worked on (to help satisfy future government concerns). Some staff thought that the data input may have been prematurely terminated.

As this was a new process that seemed to make sense to those planning it, the idea of buy-in was thought to be of little concern. During the plans development (middle to last quarter) there were new interim management planning guidelines and regeneration standards that were released by the Government of Alberta. These new interim guidelines caused both internal (i.e., planning committee) and government problems with the plan. These problems included difficulties incorporating new guidelines into the plan since the plan was not following the same premise, difficulties in planning and conducting field work that was inconsistent with the guidelines; lack of fit between adaptive management principles and silviculture programs; lack of communication between DMI-Canfor and the government during the planning process (on the new planning guidelines) that resulted in a slower approval process, largely due to government's misunderstanding of the review and approval process as it pertained to the DFMP. Though the government liked the innovative approach, more communication and discussions were required to get their endorsement after Canfor and DMI had already completed the work.

<u>Process Results</u>

The DMI and Canfor Integrated DFMP for the P1/P2 areas received approval from the Alberta government on June 26, 2001. The government acknowledged and complimented the work done to complete the DFMP. Some of the notable achievements were;

- Good multi-stakeholder and timber user cooperation.
- Development of a landscape assessment through Dr. Brad Stelfox's report on land use synopsis of northwest Alberta.

- The commitment to adaptive management and work toward monitoring feedback and corrective action.
- Having a forest management strategy that considers ecological and economic objectives as a selection for a forest management strategy.
- While the DFMP was approved, there were terms and conditions imposed on the approval. Some of those include the following;
- In order to gauge the success of the DFMP, criteria and indicators will have to be developed and clarified. This will have to be completed in consultation with stakeholders and the PAC / ECOPAC and agreed to be satisfactory by the director of the forest management division.
- The use of successional pathways in the timber supply analysis presented uncertainty to the government. There was an insufficient comfort level with how the ecological yield curves were developed and this information will require further documentation of the timber supply analysis for verification.
- A schedule for inclusion of P11 into the P1 / P2 plan is to be provided.
- A performance matrix is to be developed with the government so that there is a comprehensive monitoring plan. This plan is to include specific reforestation standards and operating ground rules.

Discussion: Planning Process

Canfor and DMI methodology and thinking may have been ahead of their time and capabilities. While the process made sense to the joint planning committee, there was incomplete agreement with company staff (more on the operational side). This could be attributed to the historic rules-based management preconceptions. Adaptive management fieldwork requires inputs and adjustments as one observes and receives feedback, as operations are ongoing. This approach is very different from the rules based traditional forest

The planning committee's initial process of the educational information sessions brought everyone up to speed from the start. This starting point worked well in that it brought out the various viewpoints and biases and set up principles for participation. This process then identified the base case or background logic to be applied for management of the landbase.

As part of the planning process, the planning committee made a number of assumptions regarding how it would approach doing the business of the plan (it's rules and guidelines). A letter sent to the government stated these assumptions and expressed the concerns that the planning committee had for needing a variance to the existing rules so they could continue on with the planning process. At this time the idea of ecological management was just being accepted but existing policies made no mention of it. The concept behind the plan was valid to the government though it was not accommodated in their policies. Though the government was involved in the process, there was no active questioning as to how this would play out in terms of the final approval of the DFMP (i.e., the requirements for this plan to address possible government concerns). An enhanced and open communication process may be required, along with check points or government endorsement at defined points throughout the process in order to streamline the final approval process.

The DFMP process needs to be defined, as do the roles and responsibilities of those participating. The ECOPAC requires a terms of reference so that both the planning committee and ECOPAC know what to expect from each other. This will help to keep the process on track and focused. The lack of a terms of reference almost caused the initial process with the ECOPAC to be lost when discussions on protected areas arose.

If the government is to be involved in the DFMP process (as part of the ECOPAC) it would seem more productive that they do so as a participating member. This active participation may include talking trade offs, implementation plans, approving items throughout the process (or at least having it vetted to higher officials for review and comment). Through this active involvement the final government review should not have any surprises and approval should be timely. While this approach seems appropriate the government representatives may not want to become involved in the political leveraging that may occur.

For the planning committee, ECOPAC and government a terms of reference with check points and endorsements throughout the process will help keep the process on track and synchronous with active resolution of problems or potential problems as they arise. One could liken this to preventative maintenance versus reactive crisis management. At a minimum, new policy and directives that come forward as the plan is being developed should be discussed between the government and company representatives.

Table members should ensure that any work, tasks or data that are uncertain are addressed, resolved or referred to an expert committee for further information (where possible).

When it comes to the plan process, act on your commitments, or discuss the changes and discuss your rationale. This is an adaptive management program and it should also be working for the planning and advisory groups.

Integrated Management

From 1990 to 2002, many events occurred that affect how integrated forest management can take place. Most notably, the Rio de Janeiro Convention on Biological Diversity, the National Forest Strategy and the Canada Forest Accord were signed in 1992. These events set the stage for change in the forest industry and for public expectations on forest management in the ensuing years. The AFCS process (initiated in 1994) and its resulting document (released in 1997) along with the Alberta government’s follow up document, Alberta Forest legacy (1997) began to show the public the shift in expectations for forest management practice. The 1995 Canadian Council of Forest Ministers document “Defining Sustainable Forest Management: A Canadian Approach to criteria and indicators” set the stage for expectations for forest management. The Alberta Forest Management Science Council (AFMSC 1997) advised the government that a vision of the future forest is required to implement sustainable forest management. The Alberta government’s draft planning manual (1998) did ask for objective based management to be used while it still realized that policy asked for sustained yield management. In 2002, there is a new draft of operating ground rules in progress that again ask for objective-based management. The 2000 regeneration standards have caused some concern with what some see as forcing mixedwood management, but at the same time have opened the window to allow for global or total landbase management.

Though we have witnessed a shift in the management perspective from a sustained yield concept to the sustainable forest management concept, little has occurred within the statutes, regulations, and policies to keep up with the changes.

While the Alberta government has not substantially changed policy over the past 10-15 years, there have been many subtle changes in the directives and management guidelines. Some of these vary from 10 year spatial sequencing in timber supply analyses for all management plans to increased linkages between operations and long-term management goals. These items force the issue of integrated forest management planning. Alberta's government has made the move toward single landbase planning (integrated forest management) versus the divided coniferous – deciduous landbase planning.

The government has used various instruments as their mechanism for adapting to this change. These have included

- Planning manuals
- Directives, guidelines
- Timber supply directives
- Regeneration standards

The greatest need to facilitate the planning and implementation of sustainable forest management and integrated forest management (from discussions with forestry professionals) is to make tenures equal. To have a level playing field between overlapping tenures should help to rectify current situations where subtle business differences and species usage can have an affect on how the forest is managed. While there is a need to maintain the business interests for today, the greater need may be to ensure long-term sustainability for all businesses through improved integrated forest management and sustainable forest management.

There is some urgency to tenure reform in Alberta. As timber is committed and the fibre supply tightens up, the FMA tenure document and quota document (particularly the volumes allocated) become more important and the likelihood of integrated planning diminishes. It is perceived that some companies can use this as a business advantage (in terms of assets / value / timber volume control / timber volume access / future-potential timber supply) and feel it is better to work alone. As this occurs, there increases the possibility that the landbase is not managed for its potential sustainable production (of all values besides just the fibre ones).

While it has been recognized by Alberta government officials that there is a need for integrated management as far back as 1988 (Henderson, 1988 and Smith, 1988) one might question what has been done to integrate management? Many FMA agreements have been renegotiated and there have been many DFMP's that have been reviewed and approved.

From some of the initial intent of the forest tenure agreements to the government's intent of the day (to manage on a sustainable forest management basis), the legislation governing these agreements has not changed.

With the government's change in forest management direction (i.e. Alberta Forest Legacy, 1998 Planning Manual) toward integrated planning and sustainable forest management concepts, forestry professionals across the province seem to agree that the primary impediment to its implementation are the actual tenure documents that are held by the companies, and an uneven playing field for all companies undertaking integrated management.

Though the government doesn't have specific regulations addressing every issue to integrate management or practice sustainable forest management, one can look at this from different viewpoints: One - being a lack of direction; two - a challenge to operate, or; three - an opportunity. Some questions that may be raised regarding specific regulations could be:

- Does the current policy encourage one species or the other?
- Where do the natural succession pathways fit? Does a bias lie in the fact that the tenures offered are distinctly for different species and different terms of reference?
- Where does sustainable forest management fit in with other government policies (i.e. concerning environment, energy)?
- How will competing interests of the companies fit with integrated forest management and sustainable forest management (for species and final products along with each company marching to the beat of different drummer)?
- What is the need for joint FMA's that offer equality to the tenure holders (as far as volumes are concerned, for starters)?

The questions of sufficient data and data needs have been frequently mentioned as a roadblock to the integration process as information needs expand. This information will provide the backbone to integrated planning and will be required across the province. Information sharing is a contentious topic. Some companies have expressed concerns that sharing information might give a competitor a business edge or that the collective information, along with sustainable forest management may create a loss of volume (i.e., reduce harvest levels) when all the data are centrally warehoused. Another issue is the feeling of proprietary rights and sharing of the costs to get the information – again a business case struggle. Most foresters would share and integrate operations, the obstacles might actually come right down to personalities, job security and company philosophies.

Integrated forest management requires trust. Trust between companies and trust between the government and the companies. While we see that roadblocks are partly in the tenure system and partly in the company or personal approach to the each situation to making integrated management occur, these obstacles can be overcome.

Integrated Forest Management: Some Concluding Remarks

The following paragraphs discuss the other initial questions on integrating forest management.

The roadblocks to the Canfor-DMI integrated forest management plan were more of a technical and process related nature. From data collection to dealing with a public advisory committee. As with the Canfor-DMI example, there is a need for enhanced project management with terms of references to having key points along the way that require endorsement. The one roadblock that would appear to be critical to making integrated forest management planning is the tenure system. Though this was not the case in the Canfor-DMI process, a different management team or attitudes at either company could have used tenure documents to hinder or obstruct the integrated process. There appears to be a need for the forest management playing field to be leveled for all participants. Opinions vary on how this can be done but there is one train of thought that some direction from the government is required. (i.e. as to what sustainable forest management means for all tenures).

For the Canfor-DMI integrated forest management process, the gaps and or omissions centered around data or lack of, that were needed for making decisions. The modeling of spatial information was new and still challenging. Landbase / vegetation information (AVI) was limited to do the modeling required when the plan was initiated. Since then, data (ecological and more AVI) have been collected that have been incorporated into ecological yield curves and the models.

For the province as a whole, the landbase data are sufficient to initiate the integrated processes. This information is becoming more important to integrating plans and the government is moving ahead in making more information required for plan approval. The next hurdle is ensuring that the proper growth and yield data are available. With this growth and yield information, if one is going to move outside of normal conifer or deciduous growth and yield curves, then an open process with the government will be required. This will also ensure that the planning process does not get held up at the approval stage due to misunderstandings regarding the development of these curves. Long-term commitments from all companies and the government to continue with growth and yield work and monitoring programs is required. Further incentives will be essential to improve the knowledge base and to provide independent expert advisory panels for future forest management reviews.

To enable integrated forest management to work through out the province there is a need for commitment towards agreements that favour, sustainable forest management, integrating forest management and not volume management. The government has moved in this direction through changes in planning manuals and directives. These changes will still require more substance within the tenure document or in the regulations. The government must provide for a level playing field for all tenure holders as far as the ability to manage while at the same time provide the industry with a firm direction and expectations and a tenure system that allows it to happen. There are numerous considerations that must be given with the move to integrated management. For smaller companies with quotas one must insure that the asset of their agreement remains as such (though any changes in the volume should not be kept at zero for this sake). The cost structure and liabilities are shared equally among all users and clear mechanisms are created to allow this to occur.

Another consideration worth noting, but only briefly in this document, is the ability to undertake integrated management with the other industrial users of the landbase (in particular, the oil and gas sector). Forestry professionals across the province have raised the issue of the ability to coordinate with oil and gas as a concern to enabling integrated forest management and the goals of sustainable forest management.

Back in 1988 Smith (1988) listed a set of questions regarding policy.

- What tenure carries priority?
- Should any tenure carry priority?
- How do administrators encourage logging operations to be integrated?
- How can operations be scheduled in the same mixedwood stand when hardwood resources mature up to 40 years earlier than the softwoods?

The Alberta government has made moves to close the gap on these questions. The subtle changes are occurring that will allow integrated management. There are still other documents that could technically and legally mitigate this work. What we have is a struggle regarding the shift in forest management attitudes in the woods (or how to best manage the forest resources for all uses). Some companies are scared of losing volumes, some are scared of losing tenure rights, some are scared of losing control of what they see is their land. What is really seen is that some people are scared of change!

Alberta government involvement in any of these new planning processes should be a two-fold role, consultative and regulatory. The consultative role will facilitate the knowledge base by building on the experiences from other company program experiences while the regulatory role will facilitate adjustment to the planning process or its parameters where they foresee problems given the current policy and the proposed plan.

To enable integrated forest management in Alberta what changes are required? The case study has shown that it can be done with willing partners and with the current government direction towards sustainable forest management. Since 1994 (when the Canfor-DMI project began), the existing regulatory environment has improved the ability to move towards integrated forest management and sustainable forest management. Presently the government’s move towards integrated management has been by providing direction through the likes of planning manuals and timber supply sequencing. The final step and the most commonly noted change required (in discussions with foresters throughout the province) is that the tenure system has to change.

Integrated forest management can occur in the Province of Alberta. But to do this, the barriers, technically, do not fall within policy. The primary barrier lies within the attitudes of the companies, foresters, and managers of these associated tenures. If everyone starts with the same goal of sustainable forest management and works from that point, integrated forest management is clearly achievable. Too much posturing, corporate strategies and skeletons in the closets have caused difficulties in moving ahead (though each party will feel fully justified in their position). The processes are commencing where companies work together, as in the case of the Canfor –DMI example (but they, too, still have to work out differences in minor operational issues)

The forestry community has to come to the table with an open mind and with the same starting point, sustainable forest management and integrated management. The asset lies in the landbase (not the mills) and our ability to manage its capabilities within the range of its natural variability.

Further questions

This issue of integrated management and sustainable forest management in the boreal mixedwood forest is very complex and still many questions remain unanswered. These make for very interesting topics for future research. For example, under the issue of legislation, one could investigate how much legislation does the government or industry want or can handle realistically? One could further question if it is better to align the forest tenures so they become equal (partners in strategic tactical planning) and how far should government go in directing integrated management?

With integrated management how will global landbase planning make the difference for integrated forest management? Who is going to lead the process then? (this goes back to the tenure and equality question) How well do the existing planning tools work? With possible tenure change one might investigate how companies can maintain tenure rights if a third party group were to manage at arm's length.

With respect to sustainable forest management and integrated forest management, how far will the government be prepared to go to achieve it? How far will the companies go to achieve sustainable forest management (would they give up existing documents in favour of new ones that stipulate it)? How does and where does Alberta's other industries (i.e. energy) and crown resource ministries (i.e. Environment) fit into integrated planning?

In the end, one might question how can the crown land managers and owners (the public) be sure they are getting the most out of their resources (for all uses and for the long term)?

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10 Awareness Development for an Energy Management Program for Social Housing in Canada[1]

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Abstract

Social housing organizations compete with other social causes for limited public and private sector funding. While the environmental impact is important, it must be recognized that for most social housing organizations the most appealing aspect of an energy management program is the reduction in operating costs through reduced energy consumption. In order to secure financial resources for an energy management program, organizations will need to identify and address stakeholder perspectives in the formulation of 'marketing' strategies. The 'marketing' of an energy management program would be aimed at illustrating the substantial financial savings that can be achieved by increasing energy efficiency in social housing units. The bonus of an energy management program is the contribution towards environmental conservation and initiatives such as the Kyoto Protocol, as increased efficiency in energy usage and the subsequent reduction in overall energy consumption in social housing units contributes to reducing Canada's greenhouse gas emissions.

Keywords: energy management, energy conservation, social housing, Kyoto Protocol, environmental marketing.

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Introduction

Energy conservation is an economical and environmental issue that organizations face in today's world. For most, the concern is based more on economical than environmental concerns. However, with initiatives such as the Kyoto Protocol being discussed, governments and organizations will face a social and business responsibility to reduce energy consumption and greenhouse gas emissions.

In Canada, the residential sector now accounts for 6% of the total greenhouse gas emissions. In 1990 residential greenhouse gas emissions were 8.2% (Canada, 2001). The reduction is attributed to energy efficiency improvements in appliances, heating equipment, and the thermal characteristics of houses (AP, 2002).

On an individual basis a typical 2000 sq. ft home requires 120 gigajoules of heat to last through an average Calgary winter if built before 1990, with newer construction standards that is reduced to 90 gigajoules (Connery, 2002). The potential energy usage and cost savings for individuals can be transferred to organizations that house multi-families or individuals in row housing, duplexes, or apartments. The combined increase in energy efficiency and cost savings on a multiple factor for the number of households affected in an organization would equate to substantial energy and cost savings across the country.

Throughout Canada non-profit organizations are involved in social housing for low-income seniors and families. In many cases non–profit organizations manage the day-to-day issues of the units while provincial, federal, or municipal governments have ownership and oversee legislation. Traditionally, for most organizations, utilities have been an area where there is limited control over costs and minimum effort has been made to reduce utility consumption by residents or make older buildings more energy efficient.

Social housing in Canada is in a state of change as the federal and provincial governments review their role and change the existing funding and ownership structures across the country. The federal government is presently removing itself from ownership of units and moving towards a flat rate funding agreement with provinces and territories. Traditionally, each province has managed social housing its' own way, and there may not be any direct correlation between the operations from one province to another. Many provinces are changing their method of management to more direct municipal and non-profit involvement and ownership and less direct involvement by the provincial government. As a result of these changes, the future is likely to see more responsibility to local municipalities and boards of directors of non-profit organizations for social housing units. With a local emphasis on operations, the cost and consumption of energy is more likely to be an issue that will need to be addressed. Senior management referred to in this document encompasses the present provincial staff involved in social housing for provinces and territories that are not moving to local ownership and operations, as well as the boards and directors of non-profit organizations and local municipal representatives for areas where the shift in social housing is occurring.

An energy management program for social housing would have to consist of two distinct phases – first, "marketing" that would initiate fund raising, allocations, and approval of the energy management initiative; and second would be the "implementation and follow through" of an energy management program to reduce energy consumption and long-term utility costs. Overall, the energy management program would contribute towards resource sustainability through modifying construction standards of units and encouraging wise energy practices by residents. The major issues to be addressed during the various phases of the program would be marketing strategy, capital and resident initiatives.

For implementation of an energy management program the emphasis is on the application of environmental strategy in order to achieve energy conservation and reduce utility costs. The five elements of a successful environmental strategy are based on the work of Piasecki, Fletcher, and Mendelson (1999) in "Environmental Management and Business Strategy." This will allow for a coordinated approach to environmental management as organizations encourage commitment, implement environmental audit and information systems, identify performance measures, and report results.

Reducing environmental impacts and the footprint that we leave is a responsibility for all individuals, organizations and governments. The energy management program will present an approach to reduce utility costs and consumption, while contributing to resource sustainability and targets set in the Kyoto Protocol (Kyoto Protocol, Article 2.1.(a).(i) states that each party shall enhance energy efficiency in relevant sectors of the national economy). It will create a win-win situation for non-profit organizations, politicians, taxpayers, and the environment.

Defining Environmental Strategy for Non-Profit Organizations

Strategy in the non-profit sector is often dictated by external factors that organizations have little control over. Political will, economic conditions, public perception and reception, all contribute to the overall atmosphere that organizations must deal with. Traditionally, many social housing organizations have been reactive to these external factors rather than taking a proactive approach.

In the present political climate government spending is centered on health and education. Social housing has not been a priority and is unlikely to be a priority. In order for housing to get funds for an energy management program, it will have to align itself with the issue of 'the environment' and aggressively market the benefits to stakeholders.

Piasecki et al (1999) refer to three kinds of strategic advantages in environmental management (Piasecki et al, 1999 p 103):

1. *Opportunity advantage* – when you have an early lead in a technical skill base or approach, and when others are not yet ready to replicate.
2. *Terrain advantage* – when the convention of science and law support your direction of growth, as does your market position.
3. *Moral advantage* – when the public and the press constantly want your "corporate" position. This is about image and prestige.

For social housing, the opportunity advantage is to demonstrate a form of competitive advantage over other social causes through alignment with environmental issues and financial returns on investment. Piasecki et al (1999) refers to an environmental opportunity advantage as “When a company reinvents the traditional product rules of an entrenched industry usually dependent upon stability and slow change, then you are seeing an example of a strategy that recognizes environmental ‘opportunity advantage’” (Piasecki et al, 1999 p 103). With an emphasis on environmental construction standards and resident consumption patterns social housing will present a non-traditional approach to low-income property management. The risks, are public and political backlash for spending public funds, while the rewards are far reaching as they deal with capital improvements that will extend the useful life of buildings, reduced energy costs and consumption, and a lifetime use of good energy practices by residents (regardless of where they live).

Terrain advantage is one that has to be addressed through the marketing of the energy management program as social housing is not a top priority for governments or the public and therefore the relative market position could be described as weak. By tying the marketing campaign into moral advantage housing has a chance to improve its’ positioning. Moral advantage can be used in several ways:

- Political forces can use an energy management program as an illustration of the government participating in environmental management and contributing to worldwide targets as defined in papers such as the Kyoto Protocol.
- The public can be shown that government is serious about environmental management and is prepared to incur some costs in the short term to protect Canadian society though long-term gains in reduced greenhouse gas emissions.
- The program would show a long-term proactive perspective by the government and non-profit organizations.
- Families who move out of social housing will have learned good energy management practices to better prepare them for ‘market’ rentals – a lifetime of environmental awareness and good practices will have been introduced to a segment of the population.

Setting up an environmental management strategy involves attention to a core set of concerns originally mentioned by Piasecki et al and modified here for social housing (Piasecki et al, 1999 p 104):

- Strategically recognizing the environmental initiative through the mission statement, policies, and organizational and individual behavior. Formal recognition of the energy management program in a clear, concise language that can be understood by staff and external stakeholders.
- Modify staff functions. As part of the formal recognition of the energy program, staff duties must be changed to reflect the importance of the energy initiative.
- Adaptations to existing management tools with an emphasis on reviewing cost savings and return on investment (ROI). ROI may not be used in most non-profits, but this is a good example of where the nature of the organization changes some of it’s practices to incorporate environmental initiatives and

open the way for further operational enhancements that will allow for the organization to compete for government and private sector funding.

- Motivational programs for senior management and staff to achieve internal buy-in for operational changes and adaptation of the corporate culture to include environmental issues.
- Strategic alliances with better external relations to stakeholders who have an influence on the implementation and continuation of environmental programs. The political process in particular will have an impact on an energy management program. Political will can be viewed as an extension of four contributing factors; the political interpretation of the feelings and desires of the general public; the extension of the social responsibility of the government in it's role to act on behalf of the people; the personal interpretation by the politicians of the present situation based on their own feelings; and, the political ramifications to back or oppose a specific issue. The formation and implementation of a marketing plan facilitates the influencing of political, public, and private sector thinking.

"Sound strategic thinking allows leaders to recognize reliable business opportunities and integrate superior environmental programs" (Piasecki et al, 1999 p 95). By looking at energy management programs as a means to introduce proactive strategic thinking, housing organizations will be able to equate the "business" opportunity of reducing operating costs through energy management while participating in a socially responsible environmental conservation strategy.

In order to be successful the strategy must address the major issues of political and public perception, while timing it right so that economics favor the implementation of an energy management program. This is a new direction for many and will require a designated champion, strong internal leadership, and a marketing plan aimed at key political and public stakeholders.

Marketing

In order to get approval to commence with an energy management program that will need funds from the public purse or donations from individual and corporate sources, a marketing plan should be devised to 'sell' the benefits of energy management to stakeholders – governments, non-profits, taxpayers, politicians, and the residents themselves.

In today's political environment politicians and the public are looking for initiatives that reduce overall costs. An energy management campaign would be aimed at illustrating the substantial financial savings that can be achieved by increasing energy efficiency in social housing units. In many respects the timing for an energy management program is right as financial savings could be achieved over the long term, environmental savings could be achieved almost immediately, and initiatives such as Kyoto are drawing attention to the need for action with respect to the environment. Hurdles include convincing the public and politicians that an energy management program is a wise investment in the future, and that the public really is ready to acknowledge that environmental actions need to be acted on now.

Ultimately, the issues to be addressed for an energy management program will be whether politicians and the public can see the long-term economic positives enough to support the cost of implementing an energy management program. Is the environment that much of a priority, and are initiatives such as Kyoto Protocol going to get public and political attention?

Objectives

Internal Objectives include introducing environmental management as a key strategic direction for social housing organizations and involving management and staff in the creation of a corporate culture that recognizes and prioritizes the environment. If this is accomplished then it can be expected that every effort will be made by organizations and staff to reduce energy consumption and utility costs of social housing units, and that across the country there will be a positive impact on reducing GHG emissions. Truly committed staff can be instrumental in passing on the commitment to energy management to residents who will also have a role in an energy management program.

Financial objectives are to reduce the cost of utility consumption, provide a reasonable long-term financial rate of return on the cost of capital improvement versus utility costs, and, provide the right kind of government incentives for organizations to implement an energy management program.

Marketing objectives involve implementing a campaign to get the messages across that social housing energy management programs are worthwhile, will provide for long-term cost effectiveness, and demonstrating that due to the high number of social housing units in the country that an energy management program will have a positive affect on the environment and greenhouse gas emissions. Another goal will be to demonstrate to private industry and the public that the government is also taking steps to reduce greenhouse gas emissions in accordance to initiatives such as the Kyoto Protocol.

Action Plan

Three courses of action will be used in deploying marketing strategies:

1) Identify who the major stakeholders are, what their main concerns are, how they feel on environmental issues, and why they should be interested in energy management programs.

   Politicians react to their interpretation of public will and to opportunities for positive public relations. In this case, the marketing plan is aimed at illustrating to politicians the benefits of being seen as investing in the future for the sake of present and future generations and the immediate operating savings of reduced utility costs in social housing facilities. The key is to get politicians to see past the cost of capital work and focus on energy management programs as an investment in long-term environmental and operational savings.

   Conscious of government spending on social programs, the public is looking for responsible management of taxpayer dollars. While unsure of their total commitment to the environment, the public is willing to participate in energy management if they see a financial savings that complements the environmental benefits.

Senior bureaucrats respond to political pressure put on them for program costs and ensuring that controversy is kept to a minimum. The marketing program will need to ensure that the main message that gets communicated is that an energy management programs primary benefit is the reduction in operating costs. Through the use of the marketing plan informing and educating politicians and the public on the benefits of energy management, controversy should be minimal.

Action: Identify the main stakeholders and through the use of surveys or interviews find out what their understanding of social housing is, how they feel about it and where they feel the environment fits into societies priorities. Have relevant statistics (or estimates from a credible source) available to illustrate the cost savings in utilities of energy management programs and the positive effect of reducing GHG emissions in the residential sector. Provide written summaries to stakeholders emphasizing that an investment in energy management is worthwhile economically and environmentally.

2) Research cost implications of energy management versus not providing energy management (based on geographic economics of utility costs, and local consumption patterns).

In many cases the foundation of the justification for the energy management program will be based on consumption of utilities in the past and a forecasted savings if energy management program initiatives are acted on. Forecasted savings can be based on expected patterns of usage and behavior of capital works projects such as the performance expectations of high efficiency furnaces.

In locations where historical cost of utilities has been high or changes such deregulation are expected to occur, the forecasting can include a reference to the changes and their probable impact on the cost of utilities to the organization.

Illustrating the positive impact on present and future residents by implementing an energy management program, a local environmental impact of energy management can be illustrated and used.

Action: Prepare a spreadsheet that illustrates present consumption versus forecasted savings if energy management programs are implemented. Show different scenarios of utility costs for the future and compare this to the present consumption costs and the expected consumption costs if an energy management program is implemented. Emphasize the economic and environmental return on investment. “Return on investment is still the most common business test of validity, and many hard-nosed managers have not seen business-orientated analyses and explanations of costs and benefits of environmental initiatives” (Piasecki et al, 1999 p 14). Return on investment (ROI) can be used for non-profits, as the emphasis will be on the time required to return the initial cost of the capital in implementing energy management improvements to the daily operational savings in utilities being experienced via the changes. Through use of ROI, management will have the tool it needs to convince themselves and stakeholders of the validity of an energy management program.

3) Combating the existing negative public perception of social housing residents can be achieved by focusing on the cost savings of an energy management program to the public and the greater good to the community by improving energy consumption and reducing harmful greenhouse gas emissions. Focusing on these positive impacts will take attention away from the residents and the negative image they have.

   Action: Through the communication process in the marketing campaign emphasize the positives of energy management and the wise investment in the economic and environmental benefits to be realized by implementing an energy management program for social housing.

Stakeholder Perspectives

It is recognized that in order for an energy management program for social housing to proceed, that stakeholder perspectives and concerns have to identified and addressed. The role of stakeholders cannot be underestimated, as without buy-in from them, an environmental initiative will stall. Stakeholders can be seen as internal, external, or a bit of both depending on the situation. The ultimate goal would be for each stakeholder to see and understand the benefits for them of an energy management program.

Non-profit organizations need to see how the reduction of energy consumption has a positive impact on their budgets and the environment, and, how better energy practices impact on the comfort and life skills of their residents. Roughly one in four Canadians are allergic to contaminants found in homes, and programs such as the R-2000 building program are aimed at providing a healthier home and reducing greenhouse gas emissions through improved air tightness, alternative construction materials, energy-saving appliances, and more efficient heating and ventilation equipment (Hope, 2002).

Non-profit organizations exhibit a wide range of expertise when it comes to managing property and having technical or financial knowledge. An energy management program with its' short-term financial cost is bound to be an issue for many and the challenge will be to get organizations to see the long-term financial benefits of the initiatives. Using a modified Design for Environment (DFE) philosophy, energy efficiency of the buildings will be accomplished through technology management and resident programs.

Residents need to see how reduced energy consumption will have a positive impact on their household costs and, for families in particular, the benefits to young kids in developing good energy consumption habits for the future. Collaborations with government departments/ministries and utility companies and their consumer programs could be sought to provide material for educating residents with an emphasis on 'teaching our youth for a better future.'

Politicians need to see that reduced energy consumption has a positive effect on government budgets, utility prices, and can be spun off into an image of them 'caring about the environment and future generations.'

In many markets where deregulation is occurring (ownership of utilities is transferring from government to private industry), a benefit to reduced consumption would be reduced utility prices. This is important. Joseph Doucet, a deregulation expert with the University of Alberta, is quoted as saying “Cutting down consumption is not necessarily one of the objectives of deregulation, but it would help bring down prices” (Robertson, 2001).

The main issue that will have to be addressed is that the environmental actions will have a short-term capital cost that will produce long-term operational savings. The political focus tends to be very short term (i.e. till the next election) and therefore the challenge is to get them to agree to the positive long-term benefits of financial return on investment and protecting the environment for future generations. As noted by Jacobs, “We may simply note that sustainability is thus a commitment of some form of intergenerational equity, or the fair distribution of environmental benefits and costs between generations” (Jacob, 1993 p. 60).

It may be worthwhile to comment to politicians that energy initiatives are underway in the United States through the federal department of Housing and Urban Development (HUD) to reduce energy consumption and cost in Public Housing Authorities (PHA) in the United States (US Department of Housing and Urban Development, 2001).

Public needs to see that the use of their tax dollars on energy conservation and efficiency is wise, and has positive paybacks. “Improving your home’s energy efficiency is one of the best investments you can make, paying tax-free dividends immediately in the form of lower heating costs. Home insulation is better than just about any other low-risk, long-term investment you can make” (NRCAN, 2002).

Emphasis should be on financial "savings" (on the operational side) and the positive effect to the environment for members of the public and their families. The government perspective would be the public seeing reduced operating costs and then the 'proactive' move by the government to promote positive environmental impact actions. It should also be noted that from a public perspective the investment is good, since it is an investment that will prolong the useful life of social housing facilities and conserve valuable energy supplies. Everyone will benefit from environmental conservation.

Implementation & Review

“Strategic environmental management initiatives moved organizations from reactive to proactive…” (Piasecki et al, 1999 p 11). After completing the marketing program and funding is secured, a strategic implementation plan is required. Piasecki et al (1999) in their book “Environmental Management and Business Strategy,” note five essential elements of an environmental strategy. Applying these elements to an integrated plan for social housing units, the approach to energy conservation and reduced utility consumption will be based on:

1. The role of senior management
2. The use of an environmental audit system
3. Environmental performance measures
4. Environmental information and management systems
5. Environmental reporting and disclosure

1. The Role of Senior Management

Michael Porter finds “the environmental component the most exciting part of corporate strategy today, …”(Piasecki et al, 1999 p 10). In order to implement an energy management program, with anticipated capital costs and resident participation, senior management’s role will need to adopt to a new perspective as they face challenges including political pressure on spending, possible regulatory compliance (should an initiative such as Kyoto become activated), being firm on their commitment to follow through on energy management programs, and working with a wider range of external stakeholders than they have traditionally been exposed to. These challenges will require management to display diplomatic and political savvy and an ability to resolve disputes while maintaining the energy management programs momentum internally and externally.

An integrated, interactive environmental strategy will require management to (Piasecki et al, 1999 p20-21, modified to reflect social housing situation):

- Make environmental management a business issue that complements the overall business strategy – “When key measures are aligned with the company’s vision and focused on those activities within a given process, management objectives can be reached in a cost–effective and environmentally responsible manner.” The approach to take will be to illustrate how each major stakeholder would benefit from the energy management actions taken by the organization (see section on stakeholder perspectives), how the environmental actions would be a positive image-maker for the organization (and subsequently the politicians), and how short and long-term costs would be affected. Organizational business plans may reference the alignment of goals to environmental issues in the provincial governments’ business plans. In addressing social housing energy management, provinces’ could take a step in reducing GHG emissions as the number of units in a province may equate to the equivalent of a small city.

- Change environmental communications to reflect political realities and business priorities. Senior management needs to communicate to stakeholders the financial impacts of the actions and foster public relations benefits for taking the environmental route. Given the present political climate in many areas, environmental progress should be associated with financial 'savings' in order to be given any attention. Political pressure from different stakeholders may test the organization’s commitment to its goals. If the pressure is great enough, management must be aware that the strategy will be in danger of hitting the ‘green wall,’ a “…point at which the overall organization refuses to move forward with its strategic environmental management program, and the environmental initiative stops dead in its tracks, as if it had hit a wall” (Piasecki et al, 1999 p 11). Awareness of this possibility, rational arguments such as those listed in **Table 1**, and preparation through documentation of the environmental initiatives costs and benefits, are recommended. Reference could be given to the environmental initiative complying with government goals in reducing GHG emissions and tying this goal to business plans.

Table 1: Political and internal rationale analysis for changes

Change	Internal Rationale	Political Rationale
Institute a moderate cost capital environmental initiative involving non-profit cooperation to install low flow showerheads, low flush toilets, etc to improve insulation and draft controls.	**Control:** Moderate priced initiatives. **Philosophy:** Without incurring large capital outlays minor changes can be made which have proven environmental benefits and probable financial benefits. Low capital outlay, average financial return, positive environmental impact.	**Control**: Politically palatable because cost is not high. **Philosophy**: Shows environmental responsibility without the high capital cost. Low capital outlay, good public relations, positive environmental impact.
Major capital program to look at window and door replacements, high efficiency furnace and boiler installations, building renovations etc.	**Control:** Expensive capital outlays with long term returns on investment. **Philosophy:** Improves building life with improved energy efficiency and reduced costs. High capital outlay, good long-term financial return with reduced utility costs, positive environmental impact.	**Control:** resistance to large capital outlays. **Philosophy:** environmental concerns do not take priority over financial concerns High capital outlay, poor public reaction to spending, Long term positive effect on environment and building life are not a consideration unless economics can prove otherwise.
Resident education programs to put into place sound personal environmental practices.	**Philosophy:** part of case management philosophy and preparing residents for market housing (mostly applies to families). Financial return is low to medium, cost is minimal with partnerships, environmental impact very positive.	**Philosophy:** political concern over residents is probably minimal but some positive public relations could be used, particularly aimed at concern for future generations and the environmental impact of today's energy consumption. Since cost is low probably not an issue.

- Support and actively review the measurement of the costs and benefits of energy management programs. Be prepared to answer public expectations by satisfying key stakeholders. It will be difficult to provide preliminary estimates of savings due to the variables of how much capital work will be done and how active residents will be in conservation measures. Appropriate statistics would include the estimated reduction in consumption, planned capital outlays, estimated operational savings on a yearly basis, and the overall ‘payback’ period of any capital work.

- Making environmental management part of the business organization, and conveying a long-term commitment to this strategy to staff and stakeholders. Become a champion of the cause. In many instances the changes required would not be supplemented with additional staff and resources, and management will have to prioritize the environmental initiatives against daily operational demands. “The goal of strategic environmental management initiatives is greater integration of environmental management with the business functions of operations and staff functions” (Piasecki et al, 1999 p 13). Management could look into attaining ISO 14000 certification, as a means of validating the organizations commitment to environmental initiatives.

- If applicable, changing job descriptions to reinforce the overall environmental aspect of the business culture. “No matter how compelling a corporate vision, no matter how effective a quality blueprint, and no matter how clear a policy to integrate technology and the environment, they are of no value unless teams of individuals are personally committed to making a difference in performance” (Piasecki et al, 1999 page 159).

2. The use of an Environmental Audit System

For social housing the main purposes of the audit system would be the initial audit to identify potential capital work and evaluate existing management systems, and subsequent audits on a periodic basis that reviewed and evaluated the effectiveness of capital work done and any new or changed management systems.

The initial audit would focus on identifying large and small capital projects that would have a positive impact on the energy consumption and utility cost of the various social housing facilities. While the specifics would vary for apartment complexes versus row or duplex housing the overall intent of the initial audit would remain the same. At the same time the initial audit would evaluate any existing management systems in place as to their effectiveness in providing useful information and whether with any proposed capital changes the system would remain effective.

From the information gathered in the initial audit, a review of proposed capital work could be done based on the projected cost against potential utility savings and the estimated payback period to recover capital costs. A second aspect of the review of the audits recommendations would be to evaluate the energy consumption changes as a means of forecasting the facilities impact on the environment.

The ongoing purpose of environmental auditing is for a systematic, objective review of facility operations and practices. Future audits could be designed to evaluate the effectiveness of energy management systems implemented after the initial capital work and the results of resident participation on energy consumption.

Some provinces or municipalities may already have an energy audit system in place through the provincial or municipal government that they can access (especially if the housing units are government owned). For instance, in Alberta, the provincially run energy audit system has focused on office buildings where provincial staff work and the audits have not been used on educational, health, or social housing facilities. An attempt to get cooperation in the participation in an energy audit of the provincially owned social housing units should be pursued where applicable.

“In essence, audits may be used to bridge the transition from a focus on finding problems to a focus on confirming the absence of problems. This may be visualized as a series of three steps evolving over time from: (1) the identification of problems, to (2) the verification of compliance status, to (3) the confirmation of management systems effectiveness” (Piasecki et al, 1999 p 32). Over time it is important to reevaluate the audits as to their purpose, what and how they are evaluating and the timeliness of them. Changes to the audit process would then be done based on this evaluation.

3. Environmental Performance Measures

“Ultimately, measuring for environmental performance boils down to the fundamental questions: What to measure, how to measure, and how to communicate those measurements both internally and externally?” (Piasecki et al, 1999 p 47). In addition to the key factors identified by Piasecki et al, it should be noted that having the resources for measurement are an important factor for many non-profit organizations. While private industry has concerns about the cost of measurement, they are more likely to have the resources necessary or the ability to acquire the necessary resources than non-profit organizations working within a restricted budget.

The purpose of environmental performance measures should be to facilitate organizational change so that environmental performance improves. Internal stakeholders can see the results of the actions taken in energy management programs, and external stakeholders can feel that the benefits derived from energy management are worth the cost incurred.

In measuring performance social housing organizations will key in on the energy consumption reductions as the obvious performance measurement evaluator. In planning the measurement system organizations should also keep in mind the effectiveness of the processes they have put into place as part of the energy management program. For instance, if maintenance staff spends time recording results at the expense of regular preventative maintenance on equipment, then the efficiency of the equipment being used will start to deteriorate and negatively affect the results of the energy management program. A balance between measurement systems and daily operational processes must be reached.

Measuring cost and results are key components of performance in identifying and quantifying activities for social housing organizations. Financial concerns will be critical in justifying environmental initiatives, so the emphasis will be on the operational aspect of monitoring energy usage and the financial aspect of the cost of utilities in facilities. Projections of what the cost would have been if the changes had not been made will be emphasized to allow for relevant comparisons because of utility price fluctuations. Comparisons may also be made based on targets set through the audit process. The measurement system needs to be understandable to internal and external stakeholders, consistently reported, and perceived as being objective in what it measures. The functions and purpose of an environmental measurement system are illustrated in **Table 2**. Management will then be able to evaluate the cost effectiveness of energy management programs through the key activities of utility usage and cost through comparative analysis.

Table 2: Functions and purposes of an environmental measurement system

	Lagging Indicators	**Leading Indicators**
Measure	Comparative data showing past consumption.	Present consumption.
Approach	Show how past consumption would have a greater expense based on present utility cost.	Show present cost and usage with estimated payback period for capital work performed and reduced environmental footprint based on reduced consumption compared to past usage.
Example	Excel spreadsheet with past usage of heating and electric power by month for 3 years prior to energy management program. Spreadsheet calculates present day cost of the energy consumption.	Excel spreadsheet showing the present cost of utilities versus the calculated cost of utilities if the capital work had not been done (lagging spreadsheet) and the subsequent estimated payback period based on savings to date. Also show the reduced consumption pattern.
Strength	Easily shows what costs would be without energy management program	Allows for quick comparisons and proves financial viability of energy management programs.
Weakness	Does not detail changes that were made.	May illustrate payback period being longer than originally estimated.

“The Global Environmental Management Initiative (GEMI) Advice for Environmental Measurement Systems” (Piasecki et al, 1999 p 49) has the following guidelines that have been expanded to apply to social housing organizations:

- One size does not fit all – consider the organization’s operations, internal organization, and unique environmental impacts. Organizations will differ in the speed in which they can implement change and the physical constraints of some facilities will make some conversions un-economical. Comparisons between organizations and facilities will not be fair as circumstances are different.
- Determine whether health and safety metrics will be included in the program - health and safety factors affecting residents and staff (i.e. air quality in facilities) could be a prime factor in the marketing campaign.
- Ensure that the program is sustainable, even as the business and political environment changes - the marketing campaign should not be seen as a one-time event but should be approached as a continuous exercise by social

housing organizations (although probably pulled back to some degree or focused in a different way).

- Select metrics that drive performance - financial consideration is the main driver; reduced environmental footprint is the bonus.
- Select metrics that are understandable and compatible with the company's operations and information systems - as the chart above illustrates for social housing.
- Define performance expectations and identify who is accountable - the energy audit will define expectations. Social housing organizations will have to take responsibility for the marketing and ongoing implementation of the energy management programs. Ultimately if results are less than expected they will also have to accept responsibility for this as well.
- Get upper management support and business unit support.
- Ensure that the right people are getting data quickly so necessary actions can be taken - this is an important aspect of the marketing campaign and the environmental measurement process, and may cause problems in highly bureaucratic organizations.
- Ensure the metrics are driving the right or intended behaviour - repeated review of the data being provided and making changes if necessary.
- Get feedback on the system from employees, the public, and stakeholders.

The environmental performance measures are meant to validate the organizations strategies and vision with regards to reducing energy costs and consumption and are a valuable tool in ensuring that the organization is headed in the right direction and accomplishing what it set out to do.

4. Environmental Information and Management Systems

"An environmental management strategy (EMS) includes the overall strategies, policies, objectives, and organizational structure established to manage and sustain the business and its operations" (Piasecki et al, 1999 p 162). Through proper information and management systems housing staff and management will have the necessary tools and personnel to implement the energy management system. The EMS is only as good as the commitment of management and staff to make the energy management programs work.

The information management system is part of the process that allows for the setting of goals and strategic direction of the organization with regards to energy management. It will be the main tool for the extraction and calculation of utility consumption and cost based on comparative analysis of pre and post energy management initiatives. In many instances for non-profit organizations, information management is very basic and it has to be recognized that high level technology will not be available to assist with information gathering and that manual or close to manual information gathering will be the main method used.

For social housing, part of the environmental management strategy involves a cultural shift for organizations to incorporate the energy management programs. The changes involved to organizational systems, staff, and management behavior will take time.

Environmental Information

Using a modified Design-for-the-environment (DFE) concept (a relatively new concept pertaining to the cradle-to-grave evaluation of the environmental impacts associated with products and technologies - Piasecki et al, 1999 p 140), social housing organizations can incorporate the most successful energy management initiatives into planned changes for existing facilities and for construction of future facilities. By evaluating the energy management actions taken to date and monitoring the results of those actions decisions can be made as to whether to continue with particular capital projects.

While typical DFE initiatives are broad in scope and require an assessment of the impact of the product and processes for the entire life cycle (raw material through manufacturing, to disposal), for social housing a more workable cycle of 'cost' of labor and product, and efficiency in reducing the cost and environmental impact are the areas that an assessment would focus on. Looking at the benefits and concerns of a life cycle assessment as it applies to social housing would produce:

Benefits

- Identification of potential problems in installation of capital products – this provides the opportunity to schedule low-impact changes or cancel future capital work of this nature if problems out-weight cost.
- The decision on implementing capital work is based on an objective view of life cycle aspects of the capital product, including impact on stakeholders – to completely renovate an existing apartment building may not be feasible due to the logistics of where to move residents during renovation.
- Priorities are identified by the life cycle analysis – offering a systematic means to judge the most important energy management initiatives and their relationship to cost and environmental considerations.
- Input into capital initiatives – reviewing the future needs of the facility may show that the installation of a particular forced air system is not adequate for future facility expansion.
- Provides a blueprint for assessing the environmental impact of each capital initiative – priorities can be defined using cost and impact analysis.

Concerns

- Life cycle analysis takes time and resources that may not be available for non-profit organizations.
- Identified capital project initiatives may prove to be too costly to begin.
- Products of a capital nature may not produce the desired (or advertised) results due to variable factors in original construction etc.

- Priorities can conflict with existing staff resources or resident needs.
- The consequences or impacts of projects are complex and it is difficult to know if desired results will occur until after the fact and the initial financial outlay for even one project or housing facility could be high.

Management Systems

Due to the diverse nature of social housing operations across the country each province, territory, municipality, and non–profit organization will have to review its own method of operations and decide what course of action best fits its needs.

Formal programs exist such as Total Quality Management (TQM), a management system used to increase quality and promote continuous improvement, or total quality environmental management (TQEM) which applies TQM principles to environmental health & safety. TQEM has evolved from TQM and the Global Environmental Management Initiative (GEMI) identifies the basic elements of TQEM as (Piasecki et al, 1999 p 161):

- Identify your customer
- Focus on continuous improvement
- Do the job right the first time
- Take a systems approach

An important point brought up by Richard Wells states, "the vision for both TQM and TQEM programs…. Is to add value to customers and thereby contribute to shareholder value. In TQEM, this means satisfying not only product customers, but also our internal customers and external stakeholders" (Piasecki et al, 1999 p 163). For non-profit organizations contributing to shareholder value would be seen in the wise use of taxpayer or donated dollars. TQEM could equate to product quality of enhanced energy management in housing units through capital works and process quality through information and management systems geared to energy management programs.

The purposes of the information management system are to track the progress of energy management program initiatives against the usage prior to any construction, measure the progress against the proposed audited results, and to highlight any areas where changes or improvements can be made. Management can use the data to ensure that the changes are occurring as desired. The data management systems can impact five elements of an energy management program: planning and organization; data collection; assessment; feasibility analysis; and implementation (Piasecki et al, 1999 p 165).

Environmental health & safety programs typically rely on five interrelated information management activities (Piasecki et al, 1999 p 167). When converted to social housing energy management these translate to:

1. Knowledge acquisition – the collecting of information on past utility usage, the collection of new utility usage patterns.
2. Data warehousing – the activity of recording and maintaining knowledge in comparative charting that illustrates the changed utility

consumption patterns after energy management initiatives are implemented.

3. Data mining – selecting data warehouse knowledge to show the projected return on investments and payout periods for the cost of the work done versus the reduced energy costs. The illustration of reduced energy consumption from an environmental footprint perspective would also be illustrated here.
4. Knowledge communication – the communication of information on reduced utility cost and energy consumption.
5. Performance and compliance reporting – quantitative information to management, shareholders, and regulators (for issues such as the Kyoto Protocol), showing the energy cost saving financially and environmentally.

For social housing organizations, the key factor is proactive management for reducing utility costs, as that is where they are going to receive the most feedback from external stakeholders and support for the energy management program.

Piasecki et al mention ten strategic elements of an environmental management system (Piasecki et al., 1999 p 17-19). These elements will require social housing organizations to focus on:

1. **Organization and Staffing** – who is responsible for the energy management program planning and capital work implementation schedule, and the implementation of best practices for residents? Where applicable for social housing the government would be responsible for the overall environmental initiative planning and allocating capital dollars based on the capital work implementation schedule. Non-profits will be responsible for the implementation of best practices for residents and overseeing onsite capital work. Reporting requirements would vary based on who the housing organization is responsible to.
2. **Policies and Procedures** – where and how will environmental initiative proposals be communicated and the formal recognition of responsibility and roles. The environmental initiative proposals should be outlined in a formal written policy document giving details on the proposals and the responsibilities of non-profits to implement and monitor the energy management programs.
3. **Planning** – the government and non-profits will integrate the environmental initiatives into their business plans.
4. **Program Management Systems** – energy audits, identification and prioritization of areas of work, monitoring and reporting. Through energy audits identification of areas where work can be done will be prioritized by whichever party has control over the capital dollars and allocations. Local projects will begin, and subsequent monthly monitoring will occur either through already established reporting

channels and reports or through new reports aimed at illustrating the effect of the energy management program on consumption and costs.

5. **Review and evaluation** – follow-up audits based on the amount of work required and the time in between audits. If the monitoring process yields results that are more than 20% off targeted savings from the audit projections, then immediate audits will occur to investigate reasons for the variation. No facility will go more than five years between audits.
6. **Management Information Systems** – statistics showing previous and present energy consumption and energy cost, updated estimated payouts for capital work based on present energy consumption, targeted energy savings and payouts, and energy costs if changes had not been made will be accessible to all stakeholders. Where possible the monthly summary of results will be presented at senior management meetings and for the review of political stakeholders.
7. **Budgeting and Scheduling** – scheduling and costs of major projects to be completed based on budget limitations and relevant construction factors such as weather, permits etc. Based on the findings of the audits the capital program will be scheduled with all major projects to be completed as soon as economically possible.
8. **Communication and Outreach** – proactive communication with stakeholders on energy management program progress and results. Resident training will emphasize actions by individuals can make a difference. Through the business plan general results will be available and more detailed statistics will be available upon request.
9. **Legal and regulatory surveillance** – local building codes need to be met and in collaboration with respective federal and provincial environmental departments, (e.g., Natural Resources Canada and Canada Mortgage and Housing Corporation), every available opportunity will be made to communicate successes and to form partnerships to recommend appropriate changes in building regulations.
10. **Risk and loss management** – provinces may be required through protocols such as Kyoto to meet targeted greenhouse gas emission levels. This initiative can be a contributing factor to provincial targets. The proposed energy management program capital initiatives will contribute to updating the social housing portfolio to post 1990 standards.

Social housing organizations may be able to take advantage of accounting practices for providing management system information for the energy management initiatives, including controlling of costs, and highlighting areas where future decisions will need to be made.

The end result of the information systems is that they should provide support to the organizations energy management program through the provision of information that assists in making decisions.

5. Environmental Reporting and Disclosure

Social housing organizations will have to regularly distribute the results of the energy management program to stakeholders for continued support. To properly communicate financial and environmental benefits of the energy management program is a major challenge for organizations given the potential political impact of stakeholders. Clear, concise, consistent, and reliable communication must be made. Identify your audience and target communications to meet their needs (see section on stakeholder perspectives).

“PERI (Public Environmental Reporting Initiative) organizes environmental report content into ten major categories: company profile, environmental policy, environmental management system, releases to the environment, environmental risk management, environmental compliance, product stewardship/life cycle management, employee recognition, stakeholder involvement, and resource conservation” (Piasecki et al, 1999 p 286). It is not realistic to expect social housing organizations with limited resources to go to this extent for an environmental report. However, they should concentrate on environmental management systems, life cycle management for their housing facilities, stakeholder involvement, and resource conservation as information that should be on hand at all times in their annual report and if possible in a separate environmental report in preparation for stakeholder pressure and public relations requirements.

The concern would be a controversy with regards to using funds to improve the energy efficiency of buildings, and not get the expected results and therefore open the organization and the government to criticism for ‘wasting’ taxpayers or donated money. Since government records are accessible by the public through legislation, to hide any results would not be wise and certainly one of the strategic issues of private enterprise environmental initiatives is the lack of trust by the public to corporate efforts in improving environmental impacts. Non-profits and government run social housing organizations do not want to get involved in this lack-of-trust controversy.

In order to facilitate communication, energy consumption results should be available monthly (or minimum quarterly, based on resources) to any interested party and regular distribution to interested stakeholders should be implemented. Management will have monthly access to the results of the initiative to facilitate strategic decision-making and to ensure that they aware of the energy programs progress should questions from external stakeholders arise.

Should the results cause public misperception or a controversy then appropriate actions need to be taken. Identify the issue(s), who is concerned and who is in charge, what would they like to see, and has a workable solution been suggested. In developing an action plan to address issues, organizations should be aware of the perspective of the public and address the response based on this awareness. Political factors will be involved and the best route to take will be discussion about the issue and a development of a solution that suits all parties. In some cases the organization may make changes to meet what the stakeholders are asking for. In all cases the organization should be honest about the facts and if necessary, admit that a mistake has been made. An action plan for resolution of the issue will require the commitment of senior management.

Capital and Resident Initiatives

The energy management programs will focus on capital and resident initiatives comprising of ideas that will reduce energy consumption and improve on resource sustainability while being implemented in a cost efficient manner. Government programs, grants, and private industry energy conservation programs will be utilized to integrate into the environmental strategy and energy management programs. Some examples of the available energy wise programs are:

- Energuide for Houses Program – encourages Canadians to improve the energy performance of their homes. Homeowners receive advice from independent energy efficiency experts to improve home comfort and reduce heating and cooling costs when making home improvements (Government of Canada p 66, Third National report).
- Renewable Energy Deployment Initiative – promotes renewable energy systems for space and water heating and for cooling through an incentive that fund 25% of the cost of adopting new systems (up to a maximum of $50,000).
- Commercial Building Incentive Program to provide incentives that encourage building owners and developers to incorporate energy efficient technologies and practices into designs for new commercial and institutional buildings. (Government of Canada p.66, Third National Report)
- Energy Innovators Initiative through Natural Resources Canada has several contacts with specifics on possible programs for various sectors such as colleges, multi-unit residential, office buildings, retail etc.
- Energyline by ATCO Gas with consumer tips.
- EPCOR –Essential Tips for Conserving Energy, consumer tips.
- Energy Efficient Housing Initiative - A $35 million program where builders are encouraged to adopt the Energuide for New Houses Program. This is part of the federal government's $500-million Climate Change Action Plan 2000 (Hope, 2002).

Direct energy management actions that can be taken by non-profit organizations include (based on information available from EPCOR, Canada Natural Resources, and ATCO Gas):

- Water heater temperature should be no higher than 50 degrees C
- Set the fridge at 3 C and the freezer at –18 C for optimum efficiency
- Furnaces should be checked and serviced each year.
- Cut grass relatively high (2.5 inches or 6 cm)
- Oscillating sprinklers lose as much as 50% of what they disperse through evaporation.

Capital Initiatives

Energy audits performed on buildings would identify potential construction initiatives that will reduce utility costs, consumption, and greenhouse gas emissions. Identified capital work such as improving insulation, replacing windows, and new heating/ventilation systems would need to provide a reasonable rate of return based on the capital cost incurred in order to satisfy the public and political demand for reducing overall costs in social programs. It is important to note that in many cases the work performed may not be major in nature, but that it is through the large number of units affected by the changes that substantial cost and energy consumption savings would be achieved. Major capital work would take advantage of improved technology and construction practices to increase energy efficiency in the units after construction and improve environmental practices during construction. By improving the buildings through various capital initiatives, the overall useful life of the facility will increase creating another advantage to initiating a capital energy management program.

Government programs, initiatives, and research, provide information on energy conservation for commercial and residential purposes. Natural Resources Canada, website (NRCAN, 2002) illustrates air movement and typical leakage sites for a home. The U.S. Department of Housing and Urban Development (HUD) and Natural Resources Canada (NRCAN) provide information on energy conservation research and available environmental grant programs. Other sources of research such as the Government of Canada, “Third National Report on Climate Change” (2001) provide information on the scope that housing effects the environment (e.g., the residential sector accounts for 6% of Canada’s green house gases).

The cost factor may detract from the overall benefit of the initiative (which is long term cost reduction and conservation of energy), and so every effort must be made to get stakeholders to have a long-term perspective of environmental strategies to do with energy conservation. Organizations should detail possible project initiatives and if possible an estimated cost savings with each project.

It should be noted that one third of a homes total heat loss happens through windows and doors and that many proposed projects might not be expensive by themselves if looking at one unit, but the cost will be relative to the volume (the benefit is also relative to the volume and this point should not be ignored).

Design for Environment (DFE) could play a large role in the future development of social housing as organizations have an opportunity to design new facilities that will take into account environmental and management issues from the design of the facility through construction and ultimately use. Standards can be set up by government agencies that spell out the different construction considerations for organizations to review at the start of a new project.

The capital cost may be spread over several years. In an effort to make individual projects as economical as possible, non-profit organizations could seek labor and material discounts from local suppliers through actions such as donations, work in kind, free publicity, etc. If possible organizations could look at ‘teaming up’ to get bulk discounts on materials. Many of the steps to reduce heat loss do not involve major capital renovations.

Information on examples of possible capital work (which would be identified in the environmental audit stage) are summarized from ATCO Gas Customer Service Energy Tips (2002), EPCOR Energy Depot (2002), Natural Resources Canada Office of Energy Efficiency (2002):

- By upgrading a standard 60% efficiency furnace to a mid-efficiency 80% furnace a 25% savings would be achieved on energy usage, and a 37% energy savings could be achieved by upgrading to a 95% high-efficiency furnace. For a typical residential consumer 70% of gas consumption each year is for space heating (furnace) and 30% is for water heating. Upgrading the furnace to a high efficiency model could save $500 annually (depending on local utility costs).
- Windows – want high (above 0.70) solar heat gain coefficients, and air leakage rate of 0.01 to 0.06 cfm/ft. (Halyard Consulting, 2001). Includes weather stripping, caulking and installing storm windows. Effectively draft proofing a home could save up to $150 /year.
- Doors – install new weather stripping around the whole doorframe and new door sweeps on the bottom of the doors.
- Insulation – all the way down in the basement (many building codes have only half way down), no insulation in the basement can cost up to $260 more in heating costs. Based on energy audit replace or increase existing insulation in walls and attics/roofs.
- Installation of low flow showerheads (can save up to $100 on the water heating bill), and flow reducer devices on taps. Bathrooms represent 63% of total indoor water use.
- Installation of new low flush toilets that use 50-80% less water per flush as most units toilets are more than 10 years old.
- Installation of programmable thermostats (and instruction on how to use properly).
- Replace 100 watt bulbs with 28 watt compact fluorescents – they last ten times longer, give the same light and save $29 in electricity costs over the life of the bulb (note that this may have been done in some apartment buildings).
- A bathroom fan with an automatic humidity sensor runs the fan just long enough to remove excess moisture, then turns off to save electricity.
- Upgrading the water heater to a higher efficiency model and save over $90 in water heating costs annually.
- Fridges account for 11% of the average households energy each year. A typical fridge today uses 70% less energy than one made in 1984 for savings of $75 /yr (based on the price of electricity). Note that many fridges have been replaced over the years but attention should be given to the purchase of more energy efficient appliances, not necessarily the cheapest ones.
- The new generation of appliances can decrease energy use by as much as 50% (AP, 2002).
- Conversion to solar heating or wind-generated electricity would be dependent on the energy audit findings, and given the financial climate right now it is recommended that these expensive capital projects be analyzed locally for economic viability.
- Self-cleaning ovens save energy because they are better insulated.

The above points are all aimed at assisting organizations to move from a lower level to a higher level of energy efficiency to save on utility costs and consumption. Not all points need to be acted on, as long as the organization realizes gains in reducing energy consumption in the steps it does take. Other avenues and steps not listed could be taken based on each organizations particular situation.

Resident Initiatives

Education and promotion of tips to conserve energy and reduce utility costs would occur through collaboration with utility companies, residents, non-profit organizations, and government departments. Where possible, counseling on energy practices will occur on a one-on-one basis. In other instances, pamphlets, posters, ‘community meetings’ and other means of mass distribution of information would be utilized to ensure that residents are exposed to information on how they can reduce their energy consumption. While it will be difficult to predict the initial effectiveness of a resident education program, past experience has shown short-term success in programs that are initiated for issues such as water conservation during the heat of summer and reducing electrical consumption during prime usage hours in winter. Specific programs would be initiated to promote environmentally friendly consumption practices that residents could utilize throughout their life, with particular emphasis, on ensuring that the children of families are exposed to and taught sound environmental practices.

Using information from local utility companies, education and promotion of energy conservation practices with residents will require collaborative efforts between public and private sectors. Educational tools such as presentations and pamphlets will be available for residents and government or non-profit consumer education programs may be utilized to communicate the energy management program.

Non-profits with life skills counselors could utilize them as the teaching source. By using existing materials and enlisting the cooperation of utility companies, government ministries, and existing staff with non-profit organizations additional operating costs for the resident component of the energy management programs will be minimal.

Private industry has implemented consumer education programs on reducing home energy costs. Companies such as ATCO Gas have websites with energy tips aimed at informing consumers of actions they can take to reduce household energy cost and consumption. Energy call-in lines are also utilized for initiating contact with consumers on energy management practices. It is very difficult to measure the success of these programs as in many cases households will have an energy evaluation done on their home, and the recommended energy retrofit measures may be implemented over a long period of time or may not be acted on at all. The utility company is most likely not informed of any actions that a consumer does take.

Examples of resident initiatives that could be taught in a resident energy management program are available from utility companies and the federal government (e.g., ATCO Gas Customer Service Energy Tips, EPCOR Energy Depot, Natural Resources Canada Office of Energy Efficiency).

Conclusion

Major gains in addressing and implementing energy management programs for social housing could be made if the following statements are well understood and result in suitable actions as discussed throughout the paper:

- That non-profit organizations recognize that social housing is competing for government funding and private and corporate donations against other social causes.
- That an energy management program for social housing consist of two distinct phases; first, 'marketing' to sell the benefits of an energy management program to stakeholders, second, implementation and follow through on actions to reduce energy consumption, long-term utility costs, and contribute towards reduced green house gas emissions.
- That the implementation of an energy management program consists of the following elements: outlining senior managements role, the use of an environmental audit system, environmental performance measures, environmental information and management systems, environmental reporting and disclosure.
- That senior management (politicians, bureaucrats, municipal representatives, non-profit organizations board of directors and managers/directors) commits to an energy management program and oversees the necessary changes to staff functions and priorities, and the organizations operations.
- That organizations identify and address stakeholder perspectives in the formulation of strategies for an energy management program.
- That the implementation of energy management focuses on the key areas of capital work on facilities, and, resident initiatives promoting energy wise consumption practices.

Social housing units contribute to the 6% of greenhouse gas emissions that is attributable to Canada's housing industry. Environmental initiatives such as the Kyoto Protocol, will end up placing an emphasis on governments and organizations to be responsible in reducing energy consumption and greenhouse gas emissions. An energy management program will allow social housing organizations to participate in Canada's efforts to reduce its greenhouse gas emissions.

Non-profit organizations and most government departments are in a work environment that emphasizes fiscal responsibility. The implementation of an energy management program for social housing units will create an opportunity for organizations to reduce their daily operating costs through savings on utilities and extend the useful life of the facilities they manage through capital improvements.

Recognizing that social housing is in a competitive situation for financial resources with other social causes, an energy management program will begin with a marketing campaign that is focused on 'selling' stakeholders on the financial and environmental benefits of the initiative. The challenge will be to get stakeholders to see that the long term benefits of an energy management program out weight the short-term costs of any capital work required.

The cornerstones of the energy management program will be capital projects as identified in the energy audits and education and promotion of 'wise' utility use by residents.

Though collaborations between non-profit organizations, government departments, private industry, and utility companies a difference can be made in the energy consumption of social housing units in Canada. While the cost savings in utility usage will be the original factor that the energy management programs success is based on, the true benefit of the program will be the long term environmental impact of social housing organizations reducing energy consumption and greenhouse gas emissions.

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11 Hydrogen: The Energy Source for the 21st Century[1]

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Abstract

In a quest to improve air quality many experts are supportive of using hydrogen as the fuel of the future. More recently, two other key objectives of several nations have been instrumental in accelerating development for an alternative fuel, independence from foreign oil and securing renewable, affordable energy sources.

Most experts suggest that hydrogen as an alternative fuel has the elements to address all three of these concerns. In its purest form there are zero emissions, the supply is endless and production may use a variety of energy sources, including renewable.

The purpose of this paper is to explore and understand the challenges related to moving to a hydrogen-fueled economy. The efforts of some countries and leaders in the automotive sector are reviewed as they strive to develop the technology and find possible answers to production, storage and distribution challenges.

There are many opinions on how best to proceed. Some favor moving directly to a hydrogen infrastructure, while others advocate transitioning by using hydrogen fuel cell technology. While the problems of migrating to hydrogen are complex, there is no doubt that hydrogen is the energy source for the 21st century.

Keywords: alternative energy source, hydrogen economy, hydrogen fuel, fuel cells, automobile.

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Motivating Change

Pollution is threatening life on earth through accelerating climate change and by aggravating a range of serious health problems. The primary source of pollution is emissions from a growing number of motor vehicles.

Today, according to a United States consumer survey (Aizcorbe et. al., 1997), vehicles are one of the most widely owned assets. The same survey indicates that more than 85% of US households owned one or more automobiles. Even in urban areas where cities invested millions of dollars in mass transit in hopes of reducing traffic congestion and its related environmental problems, the public has been reluctant to give up the freedom and independence of the private vehicle.

There is no doubt that gasoline powered vehicles emit toxins that contribute to poor air quality and related health problems. Air quality in the United States, is measured by the Environmental Protection Agency (EPA, 1998) and tracks six main pollutants – Nitrogen Dioxide, Ozone, Sulfur Dioxide, Particulate Matter (formed by a combination of sulfur dioxide, nitrogen dioxide and other particle emissions), Carbon Monoxide, Lead.

The increased exposure to air pollutants has long been linked to a significant rise in serious health problems. Short-term exposure may cause eye irritation; sore throats and shortness of breath while longer-term exposure can lead to cancer, heart problems and other life threatening diseases as exemplified by the growing incidence of asthma among children.

The pollutants come from many sources such as factories, power plants, cars, buses and trucks. Vehicle emissions contribute much of the nitrogen dioxide, carbon monoxide and lead. Non-road engines and diesel vehicles contribute as well.

Another major environmental concern is the amount of gases such as carbon dioxide, methane and nitrous oxide that are released into the atmosphere daily causing greenhouse gases. Greenhouse gases (GHG) are primarily produced from burning hydrocarbon fuels. These gases trap heat, which many believe leads to globally warming and ultimately to the instability of the entire ecosystem.

All projections indicate that vehicle miles traveled throughout the world are expected to continue to grow at a rate faster than the GDP and population growth (Faiz, 1993). As a result, the transportation sector's contribution to GHG is not expected to experience any significant decreases as long as the internal combustion engine remains the power source for private transportation.

The combination of climate change and health concerns have led to increased pressure on both car manufacturers and refining companies from government agencies and environmental groups to reduce the amount of pollutants created by vehicles. It is becoming clear that without alternatives to fossil fuels, life on the planet may become unsustainable.

Alternative Fuels

Alternative Fuels Data Center (2003) lists the following most common alternative fuels which are known and have been put through some kind of commercial use:

- **Biodiesel** is a domestically produced, renewable fuel that can be manufactured from vegetable oils, animal fats, or recycled restaurant greases. It is safe, biodegradable, and reduces serious air pollutants such as particulates, carbon monoxide, hydrocarbons, and air toxics.

- **Electricity** can be used as a transportation fuel to power battery and fuel cell vehicles. When used to power electric vehicles (EVs), electricity is stored in an energy storage device such as a battery. EV batteries have a limited storage capacity and their charge must be replenished by plugging the vehicle into an electrical source. The electricity for recharging the batteries can come from the existing power grid or from distributed renewable sources such as solar or wind energy.

- **Ethanol** is an alcohol-based alternative fuel produced by fermenting and distilling starch crops that have been converted into simple sugars. Feed stocks for this fuel include corn, barley, and wheat. Ethanol can also be produced from "cellulosic biomass" such as trees and grasses and is called bioethanol. Ethanol is most commonly used to increase octane and improve the emissions quality of gasoline.

- **Hydrogen** (H_2) will play an important role in developing sustainable transportation in the United States, because in the future it may be produced in virtually unlimited quantities using renewable resources. Hydrogen has been used effectively in a number of internal combustion engine vehicles as pure hydrogen mixed with natural gas (Hythane), and in a growing number of demonstration fuel cell vehicles. Hydrogen and oxygen from air fed into a proton exchange membrane (PEM) fuel cell "stack" produces enough electricity to power an electric automobile, without producing harmful emissions.

- **Methanol**, also known as wood alcohol, has been used as an alternative fuel in flexible fuel vehicles that run on M85 (a blend of 85% methanol and 15% gasoline). However, it is not commonly used as such because automakers are no longer supplying methanol-powered vehicles.

- Domestically produced and readily available to end-users through the existing utility infrastructure, natural gas has become increasingly popular as an alternative transportation fuel. **Natural gas** is also clean burning and produces significantly fewer harmful emissions than reformulated gasoline or diesel. In addition, commercially available medium- and heavy-duty natural gas engines have demonstrated over 90% reduction of CO and particulate matter and over 50% reduction in NO_x relative to commercial diesel engines. Natural gas can either be stored on board a vehicle as compressed natural gas (CNG) at 3,000 or 3,600 psi or as liquefied natural gas (LNG) at typically 20-150 psi.

- **Propane** or **liquefied petroleum gas** (LPG) is a popular alternative fuel choice because an infrastructure of pipelines, processing facilities, and storage already exists for its efficient distribution. Besides being readily available to the general public, LPG produces fewer vehicle emissions than reformulated gasoline. Propane is produced as a by-product of natural gas processing and crude oil refining.

- **P-Series** fuel is a unique blend of natural gas liquids (pentanes plus), ethanol, and a biomass-derived co-solvent (MTHF). P-Series is made primarily from renewable resources and provides significant emissions benefits over reformulated gasoline.

- **Solar energy** technologies use sunlight to produce heat and electricity. Electricity produced by solar energy through photovoltaic technologies can be used in conventional electric vehicles. Using solar energy directly to power vehicles has been investigated primarily for competition and demonstration vehicles. Solar vehicles are not available to the general public, and are not currently being considered by OEMs for production. However, solar vehicles have been developed and used in several competitions.

Of these alternative fuels, hydrogen is arguable the most commercially viable option. In the remainder of this paper we will assess what Hydrogen means as an alternative power source for vehicles, describe the current state of fuel cell technology, provide examples of what is happening at the global, industrial and organizational levels as well as outlining the next steps in the development of alternative fuels.

The Case for Hydrogen

Hydrogen is one of the most abundant elements in the universe. It is an odorless, colorless, tasteless and non-poisonous gas. It is a renewable resource found in all growing things. When burned in an internal combustion engine it produces almost zero exhaust and the only by product is water. The space program has used hydrogen for years in its electrical power system (EPS). The hydrogen fuel cells provide electrical power to the shuttle and the by-product; water is consumed by the crew.

A key characteristic of hydrogen is that it is not a primary source of energy, but like electricity it must be manufactured. Hydrogen can be produced by several different methods using alternative energy sources such as solar, natural gas, methane and gasoline. Hydrogen as a gas can be transported over long distances via pipelines as cheaply as electricity (Hoffmann 2002; p. 9). At the receiving end, the hydrogen would be converted into electricity.

In addition, hydrogen as a chemical fuel has a much broader span of applications than those using electricity (Hoffmann, 2002; p. 9); and it does not pollute. As a fuel alternative, hydrogen has been supported in some circles since as early as the 1930s; however, progress and acceptance has been slow.

Hydrogen, can be generated from a variety of energy sources, such as gasoline, natural gas, methanol, solar and wind. The supply is endless and, depending on the production process, will not rob the earth of any more non-renewable resources. What is driving the move for the next generation of fuels? According to Seth Dunn, author of Hydrogen Futures, Toward a Sustainable Energy System, (2001), there are three major factors:.

Energy Security

The question is not so much about whether oil will continue to exist, but whether there will be sufficient supplies at affordable prices. For countries such as the United States, who import a large percentage of their oil, availability and price are big considerations. As oil reserves continue to be depleted, it is clear that independence from the oil producing countries is an important objective for many nations.

But when will the supply run out? While there are varying opinions on the time frame, there does appear to be a consensus that the remaining world oil supply is not sustainable. The US Department of Energy states that oil production will not peak until close to 2040 while the work of other geologists claim that this will occur as early as 2010 but no later than 2020 (Rifkin, 2002; p. 14).

Several models have been developed to estimate how much of the global supply remains. While there are many forecasts, the numbers merely divide the experts into optimists who believe we have thirty plus years remaining versus pessimists who believe we have much less time.

Roger Billings of the International Academy of Science (2001), while highlighting the concern over the increased levels of carbon dioxide in the environment, also references the United States dependence on imported oil. One benefit in finding an alternative fuel is the potential to lower dependence on current trading partners. Billings states that the transportation sector consumes 64% of the total oil used and as such presents the greatest opportunity for improving air quality by using alternative fuels. According to Billings, hydrogen fuel cells are the best technology available today that offer the promise of a solution to the problems caused by the internal combustion engine.

Fuel cells are a proven technology and have been providing electricity to the space program for some time. While NASA focuses on reliability versus cost, an automotive fuel cell must be affordable as well as lightweight and compact in order to fit within the constraints of the engine compartment of vehicles. Billings maintains that the practical implementation of hydrogen for vehicles is dependent on the development of an automotive fuel cell system.

Pollution

Most industrialized nations continue to experience higher than acceptable limits of pollutants. On a worldwide basis, air pollution contributes to 500,000 premature deaths annually (Dunn, 2001; p. 22). Large urban areas are at the greatest risk of increased health problems due to the level of emissions. Since it is expected that the number of vehicles will continue to increase, emission levels will also grow despite efforts to improve pollution systems. If transitional vehicles are phased in using cleaner fuels such as methane, natural gas or hydrogen fuel cell technology, then the reduced levels of emissions will remain fairly constant. An aggressive launch of vehicles capable of running with clean fuels can result in dramatic emission reductions.

Peter Hoffman, author of Tomorrow's Energy and the Prospects for a Cleaner Plant, is a clear supporter of hydrogen. In 2001, the EPA reported that the transportation sector accounted for 76.6 percent of US carbon monoxide emissions, clearly the greatest contributor to air pollution (Hoffmann, 2002; p. 103). Like many others, Hoffman believes that hydrogen is the logical and almost ideal fuel to address vehicle emissions. He states: “the only thing coming out of the exhaust pipe would be harmless water vapor which would immediately return to nature’s cycle of fog, clouds, rain, snow, groundwater, rivers, lakes and oceans. The water would be split again for more fuel” (Hoffmann, 2002; p. 9).

Climate Change

As noted by both Hoffman and Dunn, the higher the levels of carbon dioxide in the environment, the hotter the temperature. As an example, the planet Venus, thick with carbon dioxide is extremely hot, while Mars has a thin atmosphere resulting in very cold temperatures. Evidence abounds that changes in weather patterns have already begun. The average global temperature rose 0.6C degrees during the twentieth century with the 1990’s being the warmest decade (Dunn, 2001; p. 23).

In 2001, the Intergovernmental Panel on Climate Change (IPCC), a United Nations agency, stated: “for about a thousand years before the Industrial Revolution, the amount of greenhouse gases in the atmosphere remained relatively constant”. Once the industrial revolution began, the amount of carbon dioxide in the atmosphere has increased by 30%. It continues to increase at a rate of 0.4% per year, driven mainly by the combustion of fossil fuels and deforestation (IPCC, 2001; p. 92).

The activities of humans and their use of land has arguably been the main contributor to a changing climate. Weather has become more severe with increased occurrences of floods, droughts and the effects of El Nino which changes normal weather patterns. As the IPCC outlines, different scenarios leading to lower emissions will depend on a range of policy choices. This will require a redirection of resources involved in energy development versus expanding current resource depletion approaches.

It is ironic that the majority of development resources today are directed at traditional fuels versus funding the quest for viable alternatives. The billions of dollars major oil companies spend on extraction and refining processes far exceeds the investment in research and development of alternative fuels. As several experts have noted, we could be well into the migration to a hydrogen environment within ten years if government and industry were really motivated to make it happen.

Consistent with other writers, both Dunn and the IPCC outline short and long-term solutions for reducing the amount of carbon dioxide in our atmosphere. Natural gas may play a key intermediary role as does renewable energy sources such as wind, water and solar. Most agree that the ultimate step is the transition to hydrogen as a source of energy. IPCC firmly believes that having a near zero-emission hydrogen energy system would provide society with the ultimate capacity to achieve deep reductions in the CO2 emissions and help make it possible to limit the CO2 level in the atmosphere to twice the pre-industrial level.

To summarize, it appears that exploiting Hydrogen is a positive step in moving toward the next generation of fuels given the three major factors cited by Dunn (2001).

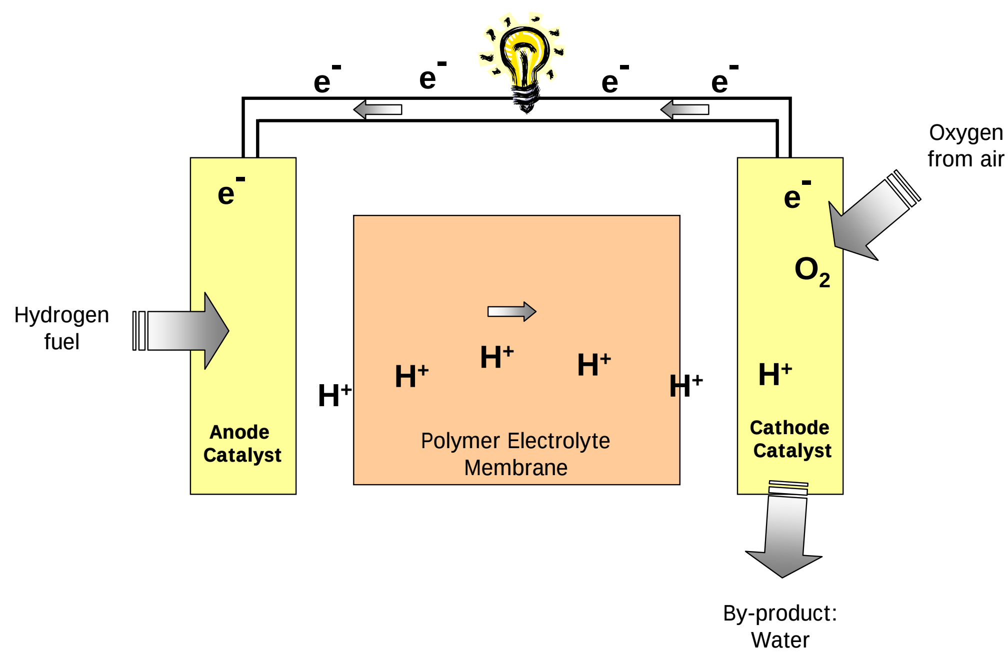
Hydrogen Fuel Cells

Operational Characteristics

The Fuel Cell was first developed by William Grove, a Welsh judge with intense scientific curiosity. In 1839, Grove was experimenting on electrolysis (the process by which water is split into hydrogen and oxygen by an electric current), when he observed that combining the same elements could also produce an electric current. Other scientists paid sporadic attention to fuel cells throughout the 19th century. From the 1930s through 1950s Francis Thomas Bacon, a British scientist, worked on developing alkaline fuel cells. He demonstrated a working stack in 1958. This technology was licensed to Pratt and Whitney where it was utilized for the Apollo spacecraft fuel cells (Fuel Cells Canada, 1999).

Fuel cells create electricity via an electrochemical process combining hydrogen and oxygen. They operate similar to a lead-acid battery but they do not require recharging. The cell will continue to produce electricity as long as it has a supply of fuel. **Figure 1** illustrates the process.

Figure 1: A simple view of H_2 Fuel cell



Breakthrough Technologies Institute / Fuel Cells (2000) explain the process:

> "In principle, a fuel cell operates like a battery. Unlike a battery, a fuel cell does not run down or require recharging. It will produce energy in the form of electricity and heat as long as fuel is supplied.

A fuel cell consists of two electrodes sandwiched around an electrolyte. Oxygen passes over one electrode and hydrogen over the other, generating electricity, water and heat.

Hydrogen fuel is fed into the "anode" of the fuel cell. Oxygen (or air) enters the fuel cell through the cathode. Encouraged by a catalyst, the hydrogen atom splits into a proton and an electron, which take different paths to the cathode. The proton passes through the electrolyte. The electrons create a separate current that can be utilized before they return to the cathode, to be reunited with the hydrogen and oxygen in a molecule of water.

A fuel cell system, which includes a “fuel reformer”, can utilize the hydrogen from any hydrocarbon fuel - from natural gas to methanol, and even gasoline. Since the fuel cell relies on chemistry and not combustion, emissions from this type of a system would still be much smaller than emissions from the cleanest fuel combustion processes.”

Fuel Cells Canada (1999) lists the following advantages of the fuel cell technology over conventional energy sources:

- Fuel cells produce energy through electrochemical conversion of the fuel. Therefore they produce zero or very low emissions, depending on the fuel used.
- Fuel cells produce power at efficiencies much higher than conventional power systems such as the internal combustion engine. This efficiency contributes to the environmental benefits of the fuel cell.
- Fuel cells have few moving parts and thus require minimal maintenance, reducing life cycle costs of energy production.
- Fuel cells operate efficiently at part load and in all size configurations.
- Fuel cells are modular in design, offering flexibility in size and efficiencies in manufacturing.
- Fuel cells can be utilized for combined heat and power purposes, further increasing the efficiency of energy production.

The Challenges

As stated earlier, adoption of Hydrogen has been slow. We will now examine the five factors slowing adoption.

Production

Most hydrogen production today is for commercial utilization and is produced either onsite at oil refineries or by companies within the chemical sector. The most common production method is steam methane reformers (SMRs) which, by using steam, reforms natural gas. Once reformed, the hydrogen becomes feedstock for oil refining and other applications such as plastics, resins and solvents. One disturbing factor noted by the US National Renewable Energy Laboratory is that the hydrogen producing plants using SMR technology contribute significantly to greenhouse gas emissions since carbon dioxide is the dominant gas released. The current industrial production methods using SMR technology is very expensive.

Hydrogen can also be produced from using coal as feedstock and this alternative is getting a lot of attention in places such as China and India. The concern with this approach is that methods for sequestering the released carbon must be developed. Several companies are pursuing these production methods but commercialization is not expected in this decade (Dunn, 2001).

Most auto manufacturers are taking a more indirect approach to developing hydrogen technology. The direction taken has been to develop reformers that will produce hydrogen from gasoline or methanol. Some, like Dunn, think that this approach will be a costly mistake. There is a risk of manufacturers locking in to mass-producing an inferior product that will be replaced as the shift to hydrogen occurs.

As highlighted by Dunn (2001), several scientists advocate a more direct approach, which would use the current natural gas infrastructure. Natural gas is the cleanest fossil fuel and is often the fuel of choice over existing alternatives. Dunn is a promoter of routing natural gas to fuel stations, converting the gas to hydrogen, which in turn would power vehicles equipped with fuel cells. This provides a medium to transform the existing distribution fuel channel for automobiles into a channel to manage hydrogen. As costs come down, investment in the hydrogen infrastructure will increase. The group also advocates that there needs to be a major shift from fossil fuel hydrogen production towards renewable sources. This is the *only* way to ensure production can be sustained.

One of the most promising production approaches is the use of electrolysis in water, which creates hydrogen and oxygen atoms. Currently this method uses electricity, which makes large-scale production expensive in most areas. However, if the electricity was replaced with a renewable energy source, not only would the cost be significantly reduced the result would be a clean hydrogen cycle. Various tests are being conducted in different parts of the world using wind, solar and geothermal power.

There is much debate over which production method is optimal for large-scale commercial output. While countries and companies are exploring different alternatives, all are in very preliminary stages.

Storage

Hydrogen, due to low density, creates significant storage challenges. In the industrial sector, hydrogen storage has been addressed through the use of salt caverns, aquifers, underground pipelines or in cylinders if compressed.

The big challenge is to find a viable solution for carrying hydrogen on board vehicles. The constrained space of the auto coupled with the logistics of how to store or what type of container to use has puzzled auto manufacturers for a long time. Some concepts that various parties have under evaluation are compressed gas in tanks, metal hydrides, and cryogenic liquid storage or on board extraction from gasoline or methanol.

None are ideal solutions from either an engineering or economics perspective. There appears to be strong opposition to the extraction process as many view this as a sellout to the big five oil companies. But in the interim this may very well be the only viable approach until better storage technology is developed. This would allow fuel cells to be phased in without enormous costs to society. The premise is that by the time practical storage technology is developed, fuel cell power plants will be commonplace and their acceptance to pure hydrogen should be relatively painless (Hoffmann, 2002).

Distribution

Once the hydrogen has been produced and stored, it must be transported to the end user. If hydrogen is produced onsite at the fuelling station, then the logistics around transportation become a non-issue.

Today most hydrogen used in industrial settings is transported via pipelines. While the initial capital cost is significant, there are opportunities for cost sharing among the interested parties. This is currently often the case where a pipeline will be developed using the resources of many users. Liquid hydrogen is hauled using tanker trucks but this may not be a cost effective approach for distribution to mass refueling stations.

Safety

Hydrogen, like all fuels has combustible properties, which when handled properly is as safe as the others. It also has some unique characteristics It is non-toxic, unlike gasoline in higher concentrations. Compared to gasoline or natural gas, hydrogen is flammable over a wider range of concentrations, but due to its buoyancy, it dissipates much quicker than either in a spill.

Hydrogen does not puddle like gasoline eliminating the potential of fire. Even if hydrogen does ignite, it does not radiate heat. Since it escapes from leaks rapidly, storage areas should be well ventilated and monitored continuously to detect and manage leaks.

Industrial production of hydrogen has been in existence for over four decades and the safety record is a good one. As with any type of fuel, understanding the chemical properties and following safe handling and storage procedures is a key to an accident free environment. Many organizations such as the Compressed Gas Association and the American Society of Mechanical Engineers publish safety standards. Guidelines for distribution are issued by the Department of Transportation and the National Fire Association publishes storage requirements.

Public Perception

For many, there is a cause-effect relationship between hydrogen and the Hindenberg disaster in 1937. Popular belief led to the conclusion that the explosion was caused by the ignition of the hydrogen gas, which was used to lift the air ship. In 1997, Bain Addision, a retired NASA scientist published the results of a study indicating that the explosion was the result of the ignition of iron oxides and aluminum that had been painted on the ship's outer skin. The airship did not explode as most believed; it caught on fire (Dunn, 2001).

As the hydrogen usage starts to spill over into the public arena, inaccurate perceptions must be addressed. Government, hydrogen producers and the auto industry will all have a key role to play in communication and education. In California, the California Fuel Cell Partnership, as one of their key objectives is to increase public awareness. The Organization also has an educational outreach program tailored specifically to middle and high school students to teach them about fuel cells and alternative fuels.

The auto industry also appears to have taken a leading role in educating the public as well as targeting the educational system. General Motors, Toyota, Ford and several others all have educational kits to assist teachers in explaining the technology.

To summarize, **Table 1** reviews the major costs and benefits of commercializing Hydrogen fuel. To link the conceptual development of Hydrogen as an alternative fuel to current practice, we will now discuss how Hydrogen is being developed on global, industrial, and organizational levels.

Table 1: Hydrogen Fuel Cells – Cost Benefit Analysis for going to Market

OBSTACLES	BENEFITS
Efficiency A reformer or fuel processor is required that will convert some energy source into hydrogen. Once a reformer is added, the efficiency drops to about 30 to 40 percent versus close to the 80 percent delivered by pure hydrogen (for details see www.Science.howstuffworks.com). It should be noted that the internal combustion engine using gasoline ranges between 10 to 16 percent (for details see www.fuelcells.org).	**Efficiency** Fuel cells utilizing reformers are on average 30 to 40 percent more efficient than internal combustion engines. The factor will vary depending on the energy source chosen.
Cost to produce According to McKinsey Quarterly (2002), on average, depending on the manufacturer, a fuel cell cost ranges from $500 to $ 2,500 per kilowatt produced. The internal combustion engine's cost ranges from $30 to $35.	**Noise** Virtually noise free – noise levels in cities could be drastically reduced.
Size and space The bigger the cell, the more weight the vehicle will have leading to sluggish performance. When reformers are introduced, the space requirements increase.	**No moving Parts** This will lead to lower maintenance costs.
Maintenance issues Mass marketing of fuel cells will require a new industry of trained technicians to provide service in addition to the tools required to perform the maintenance work.	**Response** The fuel cell has the ability to give almost instant response

OBSTACLES	BENEFITS
Range Until recently, a fuel cell vehicle (FVC) had limited range.	**Emissions** Water vapor is the only tailpipe emission.
Public acceptance Will be slow due to: 1. the perception of safety issues 2. the desire to not give up the comfort of the internal combustion engine 3. disbelief that the damage to the environment could be reversed to some degree 4. perceived government interference	**Independence** Provides the path for global energy independence and hope for third world countries.
Standardization Outside of Japan and the European Union reaching agreement on fuel cell standards, there does not appear to be any other effort among governments or manufacturers. This apparent lack of operating and manufacturing standards could lead to difficulties in developing a uniform support structure.	**Multiple energy sources** Hydrogen can be produced using multiple energy sources; possible ones are natural gas, methanol, gasoline or even renewable sources such as solar or wind.

Global Examples of Developing Hydrogen-based Fuel Alternatives

Many countries have some form of ongoing activity to reduce emissions. Clearly some are far more advanced and proactive than others. For the most part, this has been driven by government intervention as new laws are passed in efforts to clean up our environment. However, not many countries have experimented with adopting Hydrogen as a source of energy. In this section we look at the experience of Iceland, Canada, the US, Japan and Germany who have taken a lead in exploiting the benefits of Hydrogen as an energy source.

Iceland

Iceland is one of the most proactive countries in pursuit of a hydrogen based fuel alternative. The government has taken an active role with the intent of becoming the first country to replace traditional fossil fuels with fuel cells.

Bak (2003a) reports that a joint venture company Icelandic New Energy (INE) was formed in May 1999 between the Icelandic Holding Company VistOrka hf, Shell Hydrogen, Norsk Hydro and DaimlerChrysler to study and develop use of fuel cells and hydrogen as energy in Iceland with the objective to study and develop the use of hydrogen, hydrogen-carriers and fuel cells as energy systems in various fields of application in Iceland. The first task of INE was to create a project that would explore the possibilities of hydrogen in Iceland. This led to the concept of the ECTOS project, which was finalized by the end of 2000.

The project involves a Shell hydrogen retail station where hydrogen will be produced, stored and distributed. Iceland will use their abundance of geothermal and hydroelectric energy to produce the hydrogen.

Over a two-year period, starting in April of 2003, three buses powered by compressed hydrogen will be tested. Refueling, which is one of the major stumbling blocks in moving to a new fuel alternative will be at the Shell station.

The contained size and severe weather make Iceland a good test bed which, if successful, should benefit many other countries.

Iceland is driving for complete self-sufficiency with the government's vision to have the hydrogen transformation complete by 2050. This is a country that is in a state of readiness for change as major transformations are not new to them. They made the shift for space heating from oil to geothermal between 1940 and 1975. If any country understands the impact of a major infrastructure shift, Iceland certainly does.

Bak (2003a) writes that as the ECTOS project combines environmental and technological aspects, it is the first step in a foreseen transition to a hydrogen-based economy in Iceland. The main objectives of the project are:

- to gain experience in establishing a new infrastructure, interacting with the regenerative electric supply system;
- to estimate cost and timeframe of integrating a new infrastructure for the fuelling distribution system of the future;
- to contribute to creating a CO2 neutral public transportation system;
- to gain public acceptance of using an alternative energy source to power the transport system, independent of fossil fuel supplies;
- to analyze the life-cycle analysis of the equipment (buses and the filling station) and the fuel production chain.

The move to a hydrogen alternative does not appear to carry the same stigma in Iceland as it does in other countries. In a recent survey 93% of the respondents supported the move from fossil fuels to hydrogen (Bak, 2003a). The technical, financial and political communities in Iceland see this development as a stepping stone towards their ambition as a self-sufficient energy provider for all human activities on the island.

Canada

Canada's foray into fuel cell technology began in the early 1960's. Early research into the development of fuel cells was carried out at the University of Toronto, the Defense Research Establishment in Ottawa, and at the National Research Council - also in Ottawa. Most of this early work concentrated on alkaline and phosphoric acid fuel cells. In 1983, Ballard Research (discussed in Section 6.0) began the development of a Polymer Electrolyte Membrane fuel cell under a contract with the Defense Research Establishment in Ottawa. Over the past twenty years, Canadian companies, with some government support, have developed a world-leading position in the development and commercialization of fuel cells and related products (Fuel Cells Canada, 1999).

Fuel Cells Canada (1999) continues to play a critical role in this process with its mandate for

- "Promoting the Canadian fuel cell industry in the global market;

- Enhancing the industry's profile with Canadian governments to encourage a national strategic approach to fuel cell industry development;
- Facilitating demonstration projects that allow fuel cell companies to test and perfect their pre-commercial fuel cell technologies;
- Promoting fuel cell technology and its economic and environmental benefits;
- Advancing communications, information sharing and networking between member companies;
- Facilitating the development regulations, standards and codes that support the safe and widespread application of fuel cell products;
- Providing direction on skills development and course curricula at Canadian educational institutions."

In addition to Ballard Research, Stuart Energy is rising to the forefront of fuel cell technology, with the objective of building hydrogen-refueling stations. To date they have built nine and most recently showcased a mobile hydrogen energy refueling station during a road rally for fuel cell powered vehicles in California.

While the Canadian government has provided funding for various fuel cell technology initiatives, there are some who feel Canada missed opportunities to remain at the forefront. David Crane, a leading journalist for the Toronto Star, in an April 18, 2001 article was critical of the government's lack of effort to bring fuel cell technology into the mainstream market. As he highlights other countries such as Japan, the United States and Europe are actively promoting the Canadian developed technology while support for the fledging industry from the Canadian government lags (Crane, 2001).

The Canadian Government has laid out a plan to ensure the country remains one of the forerunners in developing the hydrogen economy. The Government estimates that by 2011, global demand for fuel cells would reach $46 billion and employ over 150,000 people. By the year 2021, the industry could reach over $2.6 trillion (Fuel Cells Canada, 2003).

The Roadmap (Fuel Cells Canada, 2003) identifies how Canadian companies, institutions and governments can plan their investment decisions, industrial development activities, and research and educational programs to accelerate the commercialization of fuel cell and hydrogen technologies, which hold significant potential for environmental benefit and economic opportunity. The industry-led Roadmap is the result of the collaborative work of over 45 organizations across the fuel cell and hydrogen sectors, spearheaded by Industry Canada and national industry association, Fuel Cells Canada, and facilitated by PricewaterhouseCoopers, the world's largest professional services organization. The Roadmap identifies four key steps to be taken for the Canadian fuel cell industry to extend its leadership position in this emerging technology. They are:

- stimulating market demand;
- improving product quality while reducing costs;
- gaining increased access to capital for growth; and
- creating a support infrastructure.

While the government has pledged $500 Million over the next five years to improve the climate and support fuel cell technology, critics say this is not enough compared to investments made by other countries where funding averages $200 million annually. There is a concern that without sufficient backing, many of the small companies currently engaged in developing fuel cells will not be able to remain viable until revenues start flowing in, which may take several years. The major concern is that these businesses will migrate to other countries, possibly to the United States where investment dollars appear to be more easily attained. As a result Canada would experience a significant loss of technical expertise.

The major Canadian hub of activity for developing fuel cell and related technologies is British Columbia. With the help of the Federal government, the province bought three fuel-cell bus engines from Ballard Power Systems to use in a pilot program. However this appears to be the extent of introducing hydrogen powered vehicles into the Canadian market. While Ballard currently has about fifty vehicles using their hydrogen technology, most are in other countries, such as Japan and the United States.

United States

The Clean Air Act of 1990 was the formal recognition by the United States that both fuel composition and type were critical factors in moving to lower vehicle emissions. The Act stated explicitly that changes to fuels coupled with modifications in vehicle technology were required in order to reduce air pollution (EPA, 1999).

The passing of this Act began the debate over the merits of petroleum-based fuels versus alternatives. At the time, with the transportation logistics designed for gasoline and diesel fuels in addition to relatively low cost, most critics felt the transitioning to alternative fuels, if one could be found, would be cost prohibitive and unlikely to happen.

The initiative did not mandate the move to alternative fuels, but it did provide a roadmap for moving to cleaner fuels. For the nine metropolitan areas with the highest levels of pollution, the act laid out reformulated gasoline specifications as well as a timeline for toxic emissions reductions. Participation by other cities was voluntary. The California Pilot program was an outcome of the Clean Air act, which outlined phasing in some of the toughest emissions standards to date.

At the time the Clean Air Act became law, California had the most severe levels of air pollution. As a result, they have been the most aggressive in pushing towards a hydrogen economy. The California Business Council with members from both the refining sector such as BP and other companies devoted to developing hydrogen work together to promote the alternative to gasoline.

The State is also home to the California Fuel Cell Partnership (CaFCP), which is a voluntary, collaborative effort of auto manufacturers, government, fuel cell companies and energy companies to bring fuel cell powered vehicles into mainstream America. In 2003, the partnership plans to have up to 60 fuel cell vehicles in operation. There are also plans to provide additional hydrogen fuelling stations, continue public education through trade shows and activities, provide educational kits to science teachers and prepare for more aggressive rollout of vehicles in fleet operations during 2004 and beyond (California Fuel Cell Partnership, 2002).

The Partnership news release (California Fuel Cell Partnership, 2002) articulates that "during 2003, the California Fuel Cell Partnership and its members will:

- Begin to place FCVs in the hands of fleet customers in California by CaFCP members;
- Operate up to 60 fuel cell vehicles, together accumulating up to 265,000 miles;
- Place additional hydrogen fueling stations;
- Promote fueling station interoperability (i.e., common fit and use among vehicles);
- Develop and implement a First Responder training program targeting vehicle and fueling demonstration communities;
- Coordinate with other fuel cell vehicle programs worldwide and begin to promote consistent data collection and evaluation for bus programs;
- Expand outreach to the California public through multiple public events and activities, directly familiarizing at least 500,000 people with fuel cell vehicle and fueling technology opportunities and challenges;
- Distribute 1000 teacher learning kits to middle and high school science teachers;
- Prepare for a broader rollout of vehicles and fueling in real-world fleet operations during 2004 and beyond;
- Work closely with the environmental community via the CaFCP E-Team to promote common goals."

Developing hydrogen technology in the United States received an enormous boost in January 2003 when the US President announced research funding of $1.2 billion in his State of the Union Address. The proposal builds on the "FreedomCAR" initiative introduced by the President in 2002. The broadened project will make the dollars available over the next five years to develop the technologies and build the infrastructure needed to yield a lower cost to produce, store and distribute hydrogen. A very aggressive target of the program is to have fuel cell cars cost competitive with gasoline vehicles by 2010 and by 2020 most Americans will be driving fuel cell powered cars. While the speech referenced the need for cleaner air and climate change, it was also made very clear that another key objective was to reduce the country's dependence on imported oil. The US Department of Energy (2003) has estimated that this program could reduce oil imports by 11 million barrels per day by 2040. The US Department of Energy (2003) website reports:

> "President Bush announced a $1.2 billion FreedomCAR and Fuel Initiative to reverse America's growing dependence on foreign oil by developing the technology needed for commercially viable hydrogen-powered fuel cells - a way to power cars, trucks, homes and businesses that produces no pollution and no greenhouse gases. The Initiative will invest $720 million in new funding over the next five years to develop the technologies and infrastructure needed to produce, store, and distribute hydrogen for use in fuel cell vehicles and electricity generation. Building on the FreedomCAR

> (Cooperative Automotive Research) Initiative, which was launched in January 2002, President Bush is proposing a total of $1.7 billion over the next five years to develop hydrogen-powered fuel cells, hydrogen infrastructure and advanced automotive technologies.
>
> “Together, the FreedomCAR and Fuel Initiative, through partnerships with the private sector, develop new vehicle and fuel technologies and infrastructure needed to make it practical and cost-effective for large numbers of Americans to choose to use fuel cell vehicles by 2020. These initiatives will dramatically improve America's energy security by significantly reducing the need for imported oil. At the same time, it is a key component of the President's clean air and climate change strategies.”

The original FreedomCAR initiative signed in 2002 created a partnership with automakers to advance research into developing the technology. This new program works in parallel with the original one to develop cost effective production capabilities. Both refineries and chemical companies are eligible to receive funding as well as R & D initiatives as they work together to find lower cost production and storage alternatives (US Office of Transportation Technologies, 2002).

Japan

The following commentary on Japan’s experience with Hydrogen fuel cells are based on a presentation made by Okano (2003) at the PATH Hydrogen Workshop in Mexico in February 2003.

Japan is completely dependent on imports to supply its demand for oil. With 88.4% of oil imports in 2001 coming from the Middle East, Japan, much like the United States wants to increase energy security and reduce dependence on imports. The country has been very aggressive in pursuing alternative fuels as well as being home to Toyota and Honda, who are two of the leading manufacturers of prototype hydrogen driven cars.

The Ministry of Economy, Trade and Industry (METI) who oversees the transition to hydrogen and fuel cell technology has requested $256 (US) million for the 2003/2004 fiscal year for Research and Development of fuel cell technology. This is a considerable increase from the 2001/2002 budget of $183 (US) million.

The Japanese path to a hydrogen economy faces the same hurdles as other countries. In February 2003, Japan’s hydrogen strategy was presented at the PATH Hydrogen Workshop in Mexico. Obtaining public acceptance and developing a low cost infrastructure were identified as key issues to overcome. The METI has set very aggressive targets of 50,000 fuel cell powered vehicles to be on the road by 2010 and 5 million vehicles by 2020. Currently Toyota, Nissan, Honda have fuel cell vehicles on Japanese roads. The Japanese government has five vehicles on lease, four from Toyota and one supplied by Honda (Okano, 2003).

There are currently three hydrogen filling stations in Japan and five more planned for 2003, which makes the country a good test bed for collecting real road data. In March of this year, General Motors was granted approval by the Japanese government to drive their liquid hydrogen fuel cell vehicle on public roads. By 2020, METI has set a target of

4,000 refueling stations throughout the country. As a comparison, today there are 53,000 gasoline stations in Japan (Okano, 2003).

Okano (2003) reveals in his presentation that Japan has also launched a three year project to validate twelve residential fuel cells. Participants in this project are EBARA Corporation, Sanyo Electric, Shin-Nisseki, Toyota Motor, Mitsubishi Electric and Toshiba International Fuel Cells.

Okano (2003) reveals that though Japan has made good progress, like other nations "it recognizes that:

- Fuel cells still have technical to be solved for commercialization.
- Cost reduction is a key issue for fuel cells and Fuel Cell Vehicles (FCVs)
- Many energy resources are available to produce enough hydrogen fuel for FCVs.
- Practical technologies for various hydrogen refueling stations will be established by 2004.
- Deregulation, codes and standards are very important for market introduction of hydrogen.
- Hydrogen infrastructure should be established with government support according to expansion of uptake of FCVs.
- Public acceptance for hydrogen is very important."

The Japanese government recently announced that they have reached an agreement with the European Union to have identical specifications for automotive fuel cells and other next generation transportation technologies (Eye for Fuel Cells, 2003).

This is a significant event for Japan as it ensures that Japanese built vehicles can be sold in Europe. There is no such known agreement today between the United States and Japan, which may pose some trade barriers at a future date.

Germany

According to a newly published survey by Fuel Cell Today (Geiger, 2003), almost 2,800 employees are working in more than 350 organisations in Germany on fuel cell related activities.

In the 1950s, companies such as Siemens and Varta had started working on alkaline fuel cells (AFC). Many fuel cell demonstration initiatives have been first set up in Germany. Today, the country's fuel cell industry is among other leaders such as Japan, the USA and Canada.

This survey is similarly structured to other surveys about various applications, technologies and geographical areas. It evaluates the activities of all German companies and organisations which have shown an interest in fuel cells.

Fuel Cell related activities are mainly focused in only four south western states of Baden Württenberg, Bayern, Hessen and Nordrhein-Westfalen. This is partly because of the interest of the governments of these states and also because of the concentration of industry and resources in this area which should allow fast growth in this area.

Federal, regional (state) as well as local governments encourage research. The companies involved are Ballard, Daimler Chrysler and Fraunhofer Institutes. Federal support comes from the Federal Ministry of Economics and Labour and the Federal Ministry of Education and Research. Supported by the Federal Ministry of Environment they run the future investments program called *Zukunfts Investitions Programm* (ZIP). Germany also invests in fuel cell generated electricity for stationary sources.

Each region (state) allocates money for Fuel cell and hydrogen research. For example, since 1997 Bayern has set aside € 50 million while Nordrhein-Westfalen has used € 40 million. German companies and research organisations receive an estimated € 80-90 million in funding each year and money from the European Union's frame work programme counts only for a third of this sum (Geiger, 2003; p.9).

The survey also examines all fuel cell activities in relevant sectors and states, highlights funding issues and points out the key players and projects as well as future developments. Some examples summarized from Gieger (2003) are:

- Munich Airport Demonstration Project (1999-2006) has a budget of € 42 million. Partners in this program are MAN, Ballard, Proton Motors, Still and Linde. Smaller partners are ARAL, Bayerngas, E.ON, FMG, GHW, Grimm, HDW, HEW, Mannesmann, Neoplan and Siemens. The project demonstrates the use of hydrogen fuelling system and the daily use of fuel cell and hydrogen powered vehicles at Munich Airport.

- Clean Energy Partnership (CEP) Berlin is a Federal government project with 9 other companies. This is similar in concept to California Fuel Cell Partnership. Participating companies are ARAL, BMW, Daimler Chrysler, FORD, MAN, Opel, Berlin Transit Agency and Linde. The project's main objective is to demonstrate the use of hydrogen as a fuel.

- Clean Urban Transport for Europe (CUTE) is a European project with a budget of € 18.5 million from the EU. It involves ten European cities including the German cities of Stuttgart and Hamburg. The objective is to build hydrogen filling stations and run three Mercedes-Benz Citaro fuel cell buses from 2003-5.

- Sulzer Hexis, a Swiss company, is involved with the Sulzer Hexis Residential Fuel Cell demonstration project which aims to test 400, 1kW solid oxide fuel cells (SOFC) all over Germany. The system is managed by utilities such as EnBW, EWE, EWR, E.ON, GVM, RWE, Thyssengas and VNG.

Industrial Examples of Developing Hydrogen-based Fuel Alternatives: The Auto Industry

Since auto emissions are of primary concern, we will examine some of the major auto manufacturers as examples of industrial interest in the development of hydrogen as an alternative fuel. Most of the major auto manufacturers are in varying stages of developing a hydrogen-fueled vehicle. Many are using strategic alliances and technical agreements to share information and collaborate in order to advance the technology.

General Motors

According to General Motors Public Policy statements, the company believes hydrogen is the most effective long-term response to address the global climate issue in the motor vehicle industry. A fuel cell vehicle operating on pure hydrogen is the ultimate clean vehicle. General Motors has mapped out both a short term and long-term strategy in pursuit of emission reductions as quickly as possible.

GM leads in developing next generation fuel cell systems. In the late 1960s, GM was the first manufacturer to demonstrate a vehicle powered by a fuel cell. In 1998, GM demonstrated an Opel Zafira fuel cell vehicle, featuring a methanol fuel processor. In 2000, GM introduced and demonstrated an Opel Zafira fueled with liquid hydrogen. GM is the first manufacturer to operate a fuel cell from start-up to full power in temperatures as cold as – 40C. GM is also leading the industry in the development of gasoline processor-based fuel cell systems (GM Ability, 2003a).

General Motors believes that initiatives to improve efficiencies and reduce greenhouse emissions from gasoline should be voluntary and not subject to government intervention. The sentiment is that mandatory regulations produce minimal results while driving higher costs. The company feels this diverts resources from scientific efforts, which may lead to longer-term solutions.

For the short term, General Motors is committed to gasoline as the input for generating hydrogen. As Byron McCormick, co-director of GM's Global Alternative Propulsion Center notes, gasoline has the current infrastructure that cannot be easily duplicated (GM Ability, 2003b). To try and do so would be prohibitively expensive. An alternative is to develop gasoline-powered fuel cells. The attractiveness of this approach is that it will be relatively seamless to the consumer. The basic concept is that hydrogen is extracted from the gasoline to feed the fuel cells. The gas-powered fuel cells can run the millions of vehicles currently on the road using the existing distribution infrastructure.

In parallel efforts, General Motors continues development of fuel cell technology. The company showcased their first drivable fuel cell vehicle back in 1966, but further work stalled as it was decided that the concept was not practicable. The oil crisis in the 1970's coupled with heightened environmental concerns stimulated development in the early 1980's. The next time a fuel cell powered car was demonstrated was in 1998 at the Paris Auto Show.

Today the company has about 600 people working on fuel cell technology in three US locations as well as Germany and Japan.

Adam Opel is the wholly owned European and Latin American arm of General Motors. In November 1997, General Motors and Adam Opel AG established the Fuel Cell Development Center GAPC (Global Alternative Propulsion Center). Today, under the name of "GM Fuel Cell Activities," it operates at one German location (Mainz Kastel) and three US locations (Warren MI, Torrance CA and Rochester NY). Since 1999, there has been close collaboration with Toyota in the development of fuel cells as an energy source for vehicles (Geiger, 2003).

Some recent key events for General Motors are:

- February 12, 2003 – General Motors announced a new 10,000 psi tank storage technology that extends the range of a vehicle powered by fuel cells. Previously approval had only been granted for storage systems up to 5,000 psi. This leading edge technology, which is approximately one year ahead of other automakers, puts the fuel cell powered vehicle closer to reaching a range equivalent to a traditionally powered vehicle. This is a joint venture with Federal Express who will utilize the unit on normal runs over a one-year period (GM, 2003a).

- March 10, 2003 – Japan grants General Motor's approval to drive liquid hydrogen fueled vehicle on public roads. This vehicle, GM's HydroGen3 has a range of 250 miles, which is the farthest of any fuel cell allowed on public roads in this country. The vehicle can travel up to 100 mph. The uniqueness of this prototype is that the fuel cell system has been combined into a single unit using similar mounting points as today's models (GM, 2003b).

- May 2003 – two HydroGen3's passed the District of Columbia's Department of Motor Vehicles safety and emission inspections. The vehicles can now be registered in Washington, D.C. and will be part of a two-year technology tour (GM, 2003c). The autos will provide test rides to those in government agencies.

Toyota

Toyota highlighted its environmental leadership at the World Summit on Sustainable Development 2002 in Johannesburg, South Africa, with a special exhibit featuring two hybrid vehicles – including one powered by a fuel cell. The exhibit featured Toyota's production gasoline/electric Estima Hybrid minivan and the hydrogen-powered fuel cell hybrid vehicle (FCHV-4) prototype. Accompanying display panels presented Toyota's overall approach to creating the "ultimate eco-car" and provided a look at specific Toyota achievements in this field.

Toyota has long believed that hybrid technologies hold the key to the future of the automobile, and introduced the world's first mass-produced hybrid vehicle – the Prius passenger car – back in 1997. Since then, it has broadened its hybrid lineup with the Estima Hybrid and a hybrid version of the Japanese-market luxury Crown sedan. Sales of Toyota hybrid vehicles topped the 100,000 mark in March 2003, and Toyota plans to sell 300,000 hybrids a year by around 2005. Toyota's hybrid endeavors include the application of fuel cells in what Toyota calls "fuel cell hybrid vehicles", or FCHVs. Toyota began its development of FCHVs in 1992. Units of its fourth prototype – the FCHV-4 – have covered a cumulative 110,000 kilometers on and off the test track (as of the end of June 2003), providing valuable insight toward the commercialization of FCHVs in the United States and in Japan around the end of 2003 (Toyota, 2003a).

Toyota's proprietary fuel cell development program with the University of California, Irvine and Davis campuses has put the Company at the forefront in providing resources to develop fuel cell technology. Since 1992, the company has given substantial research grants to both Centers for Advancement of Alternative Fuels. The amount of the grants is expected to double over the next three years (Toyota, 2002). The centers now have actual fuel cell vehicles to use in testing and developing.

The company works closely with the state of California and together they plan to establish fully functional, fuel cell friendly model communities in both northern and southern California. The company began real-world testing with the fuel cell vehicle on US roads at the end of July 2001 in cooperation with the California Fuel Cell Partnership. Organized in 1999, the partnership is a public-private venture dedicated to demonstrating fuel cell technology in California. The success of this initiative is dependent on the completion of six refueling stations within the first six months. The project will be a coordinated effort among the various state agencies, public utilities and chemical companies (Toyota, 2003b).

Toyota shares the same belief as General Motors that while hydrogen is the best long-term option for alternative fuel, part of the transition phase will be to develop a much cleaner fuel capable of utilizing the current distribution network. The two companies signed a technical agreement in 1999, which lays the foundation for sharing and collaborating on the outcomes of individual research for developing both the short and long term alternatives. Exxon Mobil has since joined the arrangement and together the three companies are testing technologies, sharing simulations and collaborating on findings.

Several of Toyota's vehicles received high marks from the United States EPA and are certified as either low emission vehicles or ultra low emission vehicles. The company's website claims that their in-use emission compliance leads most of the major auto manufacturers.

Recent key events:

- December 2, 2002 – Toyota delivered its first two market-ready hydrogen fuel-cell vehicles to the University of California, Irvine and the University of California, Davis. The official delivery is the first step in a plan to establish California fuel-cell "community" partnerships of government, business and higher education that will tackle product, infrastructure and consumer-acceptance challenges. The two vehicles are the first of six "Toyota FCHV" fuel-cell vehicles that will be leased to the two UC campuses. The four additional vehicles will arrive in 2003. Each vehicle will be leased for a total of 30 months (Toyota, 2002).

- May 13, 2003 – Toyota announces that it will lease six of its hybrid fuel cell vehicles to Japanese organizations using hydrogen to feed the polymer electrolyte fuel stack.

Honda

Honda much like both General Motors and Toyota is investing heavily in the development of alternative fuel sources and believes that hydrogen is the ultimate alternative over the long term.

On its corporate website Honda (2003a) states:

> "Use of alternative fuel means less reliance on dominant commodities like imported oil. Honda is developing alternative fuel vehicles not only to support our government's energy/security and clean-air goals, but to meet even more stringent voluntary standards. Our mission is to give consumers what they need, while at the same time providing for real and lasting environmental improvement. That's why our alternative-fuels program focuses on dedicated natural gas, electric and fuel-cell vehicles."

The company started its fuel cell research in 1989 and has been road testing vehicles in the United States since 1999. Honda is also a member of the California Fuel Cell Partnership.

The company acknowledges however that there are no plans to mass market the vehicles or make them available to individuals. While they have contracted with a chemical company to provide the hydrogen fuel for the test cars, the lack of wide spread refueling stations limits the ability to expand the offering. There are also other technical issues to overcome. As Honda's CEO Hiroyuki Yoshina noted in an interview (Business Week, 2002) the number of catalysts needed to produce the hydrogen must be reduced in order to have a lighter and more compact unit. Another interesting problem is how to manage the pure water byproduct. Without some type of heat, it will freeze in colder temperatures. In the same interview, Yoshina foresees that it will be a least a decade or two before the technology is ready for full commercialization.

Some key events:

- July 2002 – The Honda FCX became the first fuel cell vehicle in the world to receive government certification, paving the way for the commercial use of fuel cell vehicles. Both the U.S. Environmental Protection Agency (EPA) and the California Air Resources Board (CARB) certified the hydrogen-powered Honda FCX as meeting all applicable standards. The FCX was certified by CARB as a Zero Emission Vehicle (ZEV) and by the EPA as a Tier-2 Bin 1, National Low Emission Vehicle (NLEV), the lowest national emission rating. The FCX also meets applicable U.S. safety and occupant protection standards (Honda, 2002a).

- December 2002 – The City of Los Angles will lease five of the FCX's as part of their normal fleet cars. Honda has plans to lease up to thirty cars both in California and Japan over the next two to three years (Honda, 2002b).

- February 2003 – A recent milestone was reached in February 2003 when the hydrogen powered Honda FCX became the only fuel cell vehicle certified by the California Air Resources Board and the U.S. EPA for everyday commercial use (Honda, 2003b).

DaimlerChrysler

DaimlerChrysler is one of the leaders among car manufacturers working in the field of fuel cell technology. This German manufacturer produces over 4 million vehicles a year. Its Fuel Cell project was formally launched in 1996 even though its research with the new technology started much earlier.

Its Fuel Cell program involves passenger cars, light duty vehicles and buses. Its first fuel cell car NECAR 1 (New Electric Car) was unveiled in 1994. In the following years technically improved versions were offered and in 2002 a new cell A-class, called F-cell was presented. DaimlerChrysler plans to offer as many as 60 cars between 2003 and 2005 for passenger trials.

DaimlerChrysler’s fuel cell powered bus NEBUS made its debut in 1997. As mentioned earlier, Citaro, a more technically advanced bus would be used in the CUTE project from 2003 to 2006. 30 vehicles would be put on the road across Europe (Geiger, 2003).

DaimlerChrysler believes that by 2010 about 500,000 fuel cell powered vehicles will be on the road across the world.

Milestones for DaimlerChrysler include:

- November 2001 – In close cooperation with Hermes Versand Service, a Hamburg-based delivery service, the Mercedes-Benz Van Unit, the DaimlerChrysler Fuel Cell Project House and Messrs. Ballard Power Systems based in Vancouver, Canada, the world's first vehicle with fuel cell drive was put into operation by a service provider in 2001. The customer was deliberately integrated in the project - regular customer inquiries and presentations of the new propulsion technology in operation generate acceptance and trust on the part of customers at an early stage. The Fuel Cell Sprinter is powered by electrical energy which is released during the reaction of hydrogen and oxygen. The enormous advantage of this technology lies in the fact that the chemical reaction produces nothing but water vapor. As a result, the zero-emission and low-noise van, running on gaseous hydrogen, is optimally suited to operation in cities and conurbations with high traffic loads (DaimlerChrysler, 2002).

- March 2003 – The first Japanese testing facility for fuel cell vehicles was opened. DaimlerChrysler is co-initiator of this project, in which five automotive manufactures and companies from the energy supply sector have joined forces to test fuel cell vehicles along with the necessary fuel infrastructure under everyday operating conditions. Japan Hydrogen & Fuel Cell Demonstration Project (JHFC), which is subsidized by the Japanese government, sets out to bring fuel cell automobiles towards market maturity by fostering close cooperation between the spheres of industry and science and the authorities. DaimlerChrysler will be involved in this test program with its Mercedes-Benz "F-Cell" A-Class, which was first presented in October 2002. The necessary road operation approval for this car has already been granted by the Japanese Ministry for Land Infrastructure and Transport (DaimlerChrysler, 2003a).

- May 2003 – In continuation of DaimlerChrysler's leadership in the development of viable fuel cell vehicles, the company will collaborate with the U.S. Environmental Protection Agency (EPA) and UPS with the goal of creating the first fuel cell delivery vehicle demonstration program in North America (DaimlerChrysler, 2003b).

- May 2003 – The first Mercedes-Benz Citaro city bus with fuel cell drive was handed over by DaimlerChrysler to the Lord Mayor of Madrid at the 2003 UITP World Congress in Madrid. It is the first of three buses with this zero-emission technology to be operated by the local public transport authorities of Madrid. By the end of this year, a total of 30 Mercedes-Benz buses will have been supplied to ten European cities. The European Commissions supports the test program - the most comprehensive for fuel cell vehicles on a global scale to date - with funds amounting to € 21 million within the framework of the CUTE (Clean Urban Transport for Europe) and ECTOS (Ecological City Transport System) projects. The goal is to test both the vehicles' engineering and the necessary infrastructure, as well as to gain new findings with respect to the technology's acceptance by the public. The forthcoming fleet test will be staged in the European cities of Amsterdam, Barcelona, Hamburg, London, Luxembourg, Madrid, Porto, Reykjavik, Stockholm and Stuttgart (DaimlerChrysler, 2003c).

Organizational Development of Hydrogen-based Fuel Alternatives: A Canadian Example

Ballard Power System Inc.

Ballard Power Systems is the driving force behind many fuel cell and hydrogen initiatives of the automobile manufacturers worldwide. The discussion about the future of fuel cells or adoption of hydrogen technology cannot be complete without profiling this Canadian firm.

Ballard Power Systems Inc. (2003) was founded in 1979 under the name Ballard Research Inc. to conduct research and development in high-energy lithium batteries. In 1983, Ballard began developing proton exchange membrane (PEM) fuel cells. Proof-of-concept fuel cells followed beginning in 1989 and from 1992 to 1994, sub-scale and full-scale prototype systems were developed to demonstrate the technology. Ballard launched its first commercial fuel cell product, the Nexa power module, in 2001.

Ballard Power Systems has established itself as the world leader in developing, manufacturing, and marketing zero-emission proton exchange membrane fuel cells. It has been commercializing fuel cell engines for the transportation market, electric drives for both fuel cell and battery-powered electric vehicles, power conversion products for fuel cell generators, micro-turbines and other distributed generation technologies, and fuel cell systems for markets ranging from portable power products to larger stationary generation products.

Ballard's proprietary technology enables automobile, bus, electrical equipment, portable power and stationary product manufacturers to develop environmentally clean products. Ballard partners with strong, world-leading companies, such as DaimlerChrysler, Ford Motor Company, FirstEnergy, ALSTOM and EBARA, to commercialize Ballard fuel cells. Ballard has supplied fuel cells to Honda, Nissan, Volkswagen, Yamaha, Cinergy, Coleman Powermate and Matsushita Electric Works, among others.

Ballard's research and development headquarters is located in Burnaby, British Columbia.. This facility is used for fuel cell and fuel cell systems development, assembly and testing, and for heavy-duty fuel cell engine activities. Ballard's facility in Nabern, Germany, near Stuttgart is used for fuel cell engine development, assembly and testing, and for PEM fuel cell module development. Ballard Material Products, which manufactures high quality carbon fiber products for the aerospace, automotive, electrical, fuel cell and sports equipment industries, is located in Lowell, Massachusetts.

Ballard's core competence lies in the development of fuel cells for transportation and power generation (portable and stationary) applications.

Vehicular Alliance

Ballard's first major collaboration was a four-year agreement, signed in March 1993 with DaimlerChrysler (formerly Daimler-Benz AG). In December 1997, Ballard and DaimlerChrysler announced that they would expand their alliance to include Ford Motor Company.

DaimlerChrysler, Ford and Honda are now introducing fleet demonstration vehicles and have already delivered some to customers. A number of the world's major automakers have stated that they expect fuel cell vehicles to be commercially available between 2010 and 2012.

Stationary Power Alliance

Ballard's stationary power alliance was created in 1996 when Ballard and FirstEnergy (formerly GPU) created Ballard Generation Systems (BGS). Soon after, ALSTOM SA and EBARA Corporation also joined the alliance.

Until 2001, BGS was focused on the development and advancement of PEM fuel cells for stationary applications with the assistance of the alliance partners. In 2001, Ballard began a process to streamline its alliance relationships and today BGS is a wholly-owned subsidiary of Ballard Power Systems.

The alliance relationships with Ballard continue in new ways to improve our ability to bring stationary fuel cells to market. FirstEnergy is now a non-exclusive distributor of Ballard's stationary generators in the Northeast and North Central United States. The jointly-owned company EBARA BALLARD (51 per cent EBARA, 49 per cent Ballard), now has exclusive rights to manufacture and distribute Ballard's stationary generators in Japan. The jointly-owned company ALSTOM BALLARD GmbH has exclusive rights to manufacture and distribute Ballard's stationary generators in Europe. And finally, ALSTOM is now a worldwide (except Japan) non-exclusive distributor for Ballard's PEM fuel cell stationary power generation products.

A Roadmap for Sustainability

Progress is usually defined in terms of improvement, yet many of the benefits of exploiting fossil fuels for consumer and industrial applications have come at a high cost to both society and the environment. We now define progress in terms of sustainability which integrates social and environmental factors with economic considerations.

Changing from non-renewable fuels to Hydrogen appears to be the best long-term solution to the social (e.g., health related costs and benefits) and environmental (e.g., climate and ecological costs and benefits) problems facing most of the world's nations.

While change is pervasive, there is a natural tendency to avoid it or slow its inevitability. How change occurs is worth investigating. Change is accomplished in one of two ways:

- *Reactive*, in which an event or situation requires a response to one or more undesirable outcomes. Examples of reactive change abound – the world's reaction to the recent SARS outbreak, Canada's response to finding a case of BSE in its cattle system and the ongoing investigation of the Space Shuttle disaster.

- *Proactive* change occurs when there are incentives to change that are perceived to be more attractive than the status quo. Many proactive efforts occur after a reactive situation. Examples include security upgrades in airports following the 9/11 tragedy, reformulation of the policies governing cattle feed production in Canada and improved procedures for screening blood at blood collection services. Examples of proactive change without an undesirable antecedent are harder to find but consider the following:

  Leaders of the G-8 industrial countries June 2003 issued a statement in support of the development of cleaner, sustainable and more efficient technologies to improve public health and reduce pollution worldwide. In the statement, the leaders of Canada, France, Germany, Italy, Japan, Russia, the United Kingdom and the United States pledged to accelerate research in renewable energies and to work toward the development of fuel cell and hydrogen technologies. They also pledged to develop an action plan to improve the worldwide reporting and archiving of scientific research data by spring of 2004 (Bak, 2003b).

  "The G8 leaders will:

  - Accelerate the development of fuel cell and hydrogen technologies (power generation, transportation, hydrogen production, storage, distribution, end-use and safety);
  - Increase international co-operation and exchange of information in pre-competitive research based on the principle of full reciprocity through the IEA and other existing organizations;
  - Work with industry to remove obstacles to making fuel cell vehicles price competitive, striving to achieve this goal within two decades;
  - Accelerate developing internationally agreed codes and standards in appropriate existing organizations;
  - Work together to facilitate the use of hydrogen technologies in our and other markets, including through development of infrastructures."

This is a welcome change in the quest for adopting an alternative energy source. Governments must take an even more active role in providing guidance and resources for developing the technology. If left to Industry to bear the significant costs, progress will be slow.

Clearly the depletion of non-renewable fuel resources serves as an incentive to change, but the perceived costs still exceed the perceived benefits. In the short to medium term the oil producers and refiners have more of an incentive to use and develop non-renewable resources than make a shift to renewable resources. The primary organizational cost is a reduction in shareholder wealth if funds are diverted from net profits to accelerate the research and development of alternative fuels. From a public policy perspective, governments do not want to be seen as excessively taxing organizations that provide a necessity and employ thousands of workers.

In the case of developing Hydrogen as an alternative to non-renewable fuels, we now know that it is able to provide clean, reliable and renewable energy through the fuel cell technology discussed earlier. While not problem free, there is optimism that there are a growing number of incentives for organizations to divert funding to the accelerated development of Hydrogen, and for governments to use policy to support market based initiatives for the development of alternative fuels. These incentives have been created by:

1. Increasing prices for oil and natural gas are eroding disposable income needed to sustain consumption based economies.

2. Health problems traced to pollutants are increasing both health care costs and costs due to lost hours of work.

3. Increasing credible evidence of the linkages between climate change and GHG with the resulting imbalances in nature which, although hard to predict, are potentially catastrophic in effect.

4. Increasing pressure on organizations to be good corporate citizens including controlling the pollution they produce. Positive links between corporate responsibility and financial performance are now emerging.

5. The growing influence of the Kyoto Protocol and other international environmental policies (e.g., the Montreal Protocol, the U.S. Acid Rain Program) are forcing governments, as well as industries, to be good nation-state citizens.

6. Important business opportunities are emerging from the social and economic pressures for conformance to tougher environmental standards.

Given that the incentives to change proactively exist, what actions should be taken to address the five problems that are slowing the adoption of Hydrogen?

1. **Production**: Of the four primary production methods (SMR, coal, gasoline / methanol and natural gas), it appears that natural gas has the highest probability of providing a sustainable production method. Tax incentives to develop the natural gas method should be extended to auto manufactures

who move away from the gasoline / methanol method. No tax breaks for those manufacturers ignoring the natural gas method. At the same time, an alternative fuel tax should be levied on the sale of gasoline at the retail level. The tax will have two potentially beneficial outcomes: reduced consumption of gasoline and a market shift away from "gas guzzlers." The worst case is that vehicles and driving habits remain constant, but the tax revenue will be provided to support further research and development of Hydrogen.

2. **Storage**: Short term, storage is probably going to consist of using an extraction process as fuel cells are phased in. While not ideal, research will be required to invent a better storage system. This research is being conducted, but again, tax incentives for the industrial development of non-extraction based storage and preferential funding for University based research are two ways to keep the required resources flowing to the problem.

3. **Distribution**: It is likely that hydrogen will not be produced on the site for ultimate consumption (e.g., a gas station or a home); rather, hydrogen will probably be distributed via pipelines. This system will follow the ultimate production method. Further incentives at this time are not required.

4. **Safety**: Hydrogen has been produced and used safely for over 40 years. The Department of Transportation in the U.S. and its counterparts in other countries will continue to provide safety guidelines and regulations to minimize danger in production, storage, distribution and use.

5. **Public Perception**: This may not be as much of a problem as currently perceived. As with gasoline and propane, consumers realize the potential for fires and explosion and take appropriate action. Safety concerns have not altered consumer behavior in terms of gasoline, so communication programs apprizing consumers of the benefits and requirements of using hydrogen safely, should be relatively easy to design and execute.

In summary, there are three basic approaches for addressing three of the five problems seen as inhibitors to the development of hydrogen as an alternative fuel. No recommendation has been made for government to increase funding in some undefined, unaccountable way. Rather, taxes (breaks, levies) or redirection of current University funding schemes are recommended to create the behaviors sought. Strategic partnerships and alliances are, of course, good ideas, but they are neither novel nor in need of government intervention. Government serves society better by using fiscal policy to support and facilitate desired activity rather than engineering industries. The desired activities now include the social and environmental consequences as well as the economic. Government can serve as an umpire, informed by the latest scientific thinking to insure that there is a social and economic balance between competing forces.

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Section IV: Organizational Perspectives

IV Organizational Perspectives

Jim Dunn

In the introduction to Part I of the book, Professor Mayo commented on the current definition of sustainability, summarized a general approach to defining sustainability and related environmental sustainability to the interaction of economic activity with nature and the outcomes of the interaction. This section continues with another element of the "Triple Bottom Line" approach to environmental sustainability. That is the interaction of the people leading the organization's efforts with the related outcomes that impact the journey towards sustainability.

In this section the researchers address environmental sustainability from an organizational perspective by examining the performance of three large corporations. Bev-Fenerty-McKibbon and Anshuman Khare (Canada Post Delivers Energy Conservation) examine the environmental journey undertaken by Canada Post to reduce energy consumption and related greenhouse gas emission of its buildings. The authors demonstrate how Canada Post, a very large crown corporation with a single shareholder (Government of Canada) has achieved a position of leadership in energy savings activities in building management and how Canada Post was the first large Crown Corporation to respond to the Federal Government's leadership challenge.

The energy management activity of Canada Post is reviewed over three time periods beginning with 1992 – 2001 to the present day. A significant element of the Canada Post success story is that the corporation has been able to focus on long term energy management rather than simply pursuing short term solutions to achieve quick but short term gains.

The authors assert that the commitment of Canada Post to the leadership challenge, the establishment of regional energy committees and the implementation of Sustainable Design and Energy Guide have fostered an environment for continuous innovation in conservation and a climate for continued change and improvement. The pursuit of sustainability through the reduction of energy consumption and lowering of greenhouse gas emissions remains a corporate priority.

A key element in the Canada Post strategy is that the strategy is applicable to all levels of Canada Post and that every function within the corporation will share in the mandate to reduce greenhouse gas emissions and to conserve energy. The corporation will seek and implement initiatives for energy conservation even if these initiatives require substantial change in the workplace environment.

Fenerty-McKibbon and Khare conclude that companies like Canada Post are key players for Canada in its pursuit of its Kyoto Commitment and Canada Post has demonstrated a corporate will to contribute to the long term environmental sustainability.

The second paper by S. Venugopal (Towards Effective Management of Methane Emissions from Natural Gas Pipelines) examines the approach taken by a large energy transmission company. The paper documents the emissions management strategy of TransCanada. The paper begins by introducing the Methane Emissions Management Model as part of TransCanada's overall strategy towards climate change. The model demonstrates the key role played by senior management, the accountability required and the alignment between the outcomes of the program and the business needs of Transcanada.

Methane gas emissions from pipeline transmission fall in two broad categories (fugitive and vented methane). The two types of emission require different elements of the organization to participate in the reduction of the related emissions. TransCanada has developed a multi stakeholder team to manage fugitive losses and a blow-down emissions team to manage vented methane losses. The paper describes the two sources of emissions and the need to deploy different organizational strategies to manage each emission type.

The paper concludes with a discussion of the achievement in emission reduction. The results are reported from 1990, the baseline year for the Kyoto protocol. The leadership undertaken by TransCanada has resulted in a substantial reduction in methane emissions from pipeline operations over the period 1990 – 2002. In fact, the methane emissions over the period 1997 – 2002 would have doubled without the implementation of the reduction and management program.

In the final paper of this Section, Jerome Hoog and Anshuman Khare (General Motors Corporation: An Environmental Performance review), review the global environmental performance of General Motors Corporation (GM) as publicly reported.

The paper takes significant elements of the GM global footprint and examines them along the lines of public accountability, manufacturing performance, product performance and stakeholder relationships. The paper describes the steps taken and results achieved in each of these areas. The public records cited by the authors do not provide specific performance targets or performance measurements for GM.

In the area of fuel efficiency, it is interesting to note that GM was seen as being ahead of the curve in terms of alternative fuel technologies but appears to be behind the curve in terms of small car hybrid products, and the average fuel economy of GM's products has not improved since 1994.

The paper concludes that performance of General Motors can be summarized as having met or exceeded expectations in the areas of public accountability, plant performance and stakeholder relationships while having fallen below expectations in the average fuel economy performance of its products in North America. It appears that there are areas for improvement that reduce the environmental impact of the global GM footprint.

The message from these articles is that environmental concerns are actionable and substantial outcomes can be achieved if the people and their organization demonstrate commitment to the goal of continuing to march towards improved levels of environmental sustainability. This is a goal that must involve every level and every person within each organization. As stated by David Suzuki, Canada Post Performance Magazine ([15], pp. 18, 19), small steps in the movement towards sustainability by each sector of an organization when added together can have a substantial impact. This can be extrapolated to suggest that when added together, small steps taken by each organization can make a significant contribution towards achieving higher and higher levels of environmental sustainability.

12 Canada Post Delivers Energy Conservation[1]

Bev Fenerty-McKibbon
Anshuman Khare

Abstract

Buildings account for more than 30% of Green House Gas (GHG) emissions generated in Canada [1]. Canada Post Corporation (CPC) occupies 3,223 buildings and as a result has the opportunity to make a significant positive impact on the environment through energy conservation.

In accordance with the corporation's environmental policy and with a proactive strategy, Canada Post has several long-term programs dating back to 1992 that have resulted in reduced energy consumption and therefore reduced GHG's. Recently the corporation has introduced several new energy management initiatives. In order to support the commitment, energy conservation strategies have been developed. It is anticipated that CPC will be achieving 33% reduction in GHG emissions by 2010 [2].

Energy conservation has financial benefits related to energy cost savings. However, CPC believes that cost savings are an important benefit but not the reason behind the decision to pursue a strong energy conservation policy.

Companies like Canada Post are important to Canada's future in its ability to achieve its Kyoto commitment but more importantly there is an opportunity to exercise environmental responsibility. Canada Post has adopted a leadership position and in doing so has demonstrated a corporate will to contribute to the environmental well being of the world.

Keywords: sustainable development, energy conservation, Kyoto Protocol, environmental policy on buildings.

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[1] **Canada Post Delivers Energy Conservation** (Bev Fenerty-McKibbon & Anshuman Khare): Published in ENERGY & BUILDINGS, the international journal presenting the science of buildings from Elsevier Science - Vol. 37 No. 3 (March 2005) / pp. 221-234 (ENB 1816).

Preamble

In the preface of his book The Ecology of Commerce, Paul Hawken ([3]; pp. xiv) writes: “If every company on the planet were to adopt the best environmental practices of the “leading” companies [….] the world would still be moving toward sure degradation and collapse.” This is a very dark prophecy. However, Hawken goes on to provide solutions. The first of the solutions that he proposes is “Reduce absolute consumption of energy and natural resources in the North by 80 percent within the next half century.” This means that 80% reduction would be necessary by the year 2043.

If you accept this revelation it is a very sobering thought. It seems like an impossible task. However, if you are aware of companies that are embarking upon programs to address the issue including reducing consumption of energy and natural resources you may be filled with hope for the future.

The preface to the Climate Change Plan for Canada 2002 begins “There are few things more fundamental to Canadians than the rich natural legacy we have inherited. Canadians understand the importance of the environment, both to the quality of life we enjoy and to our future economic progress” ([4], 2002; pp. III). This statement is indicative of a change that has begun to sweep the world. Governments and businesses are making changes to the way in which they conduct their operations. The document goes on to say “It is a vision of a responsible, innovative, energy-efficient society with long experience as a leading producer of energy” ([4]; pp. III). Energy-efficiency and energy reduction in buildings is an important part of this plan.

The Federal House in Order website states: “To assist in meeting Canada's Kyoto target the federal government created the Federal House in Order (FHIO) initiative through which it has committed to reducing GHG emissions from its operations by 31% from 1990 levels by 2010”. It goes on to say: “The Leadership Challenge is the Federal House in Order vehicle for encouraging all federal departments, agencies and Crown corporations to undertake a GHG reduction program of their own design and voluntarily report on results” [5].

In September of 2003, Canada Post joined the Leadership Challenge and is now committed to the same reduction levels. Reductions are possible in two areas of its operations – the buildings it occupies and the corporate fleet of vehicles.

This paper examines the environmental journey of Canada Post Corporation (CPC), one of Canada’s largest corporations, with specific focus on energy consumption reduction and related greenhouse gas emission (GHG) of its buildings. Canada’s commitment to the Kyoto Protocol brings a particular relevance to this topic. CPC is a major real estate holder, owning or leasing in excess of 3,000 buildings throughout Canada [6]. As a result, the corporation has the opportunity to significantly and positively affect GHG’s in Canada and contribute to Canada’s target of a 6% reduction in emissions.

The paper also examines the past and present objectives and performance of Canada Post as it pertains to energy management. It will then look to the future to discuss CPC plans for energy conservation and potential opportunities for further gains in GHG emission reductions.

Prior to discussing Canada Post's action relating to energy conservation in its buildings, it is first necessary to understand the environmental impact of building energy usage and the magnitude of CPC's building portfolio.

Canadian Buildings and the Environment

Paul Hawken ([3]; pp. 21) makes an overwhelming statement: "One statistic makes clear the demand placed on the earth by our economic system: every day the worldwide economy burns an amount of energy the planet required 10,000 days to create." This is not limited to buildings but does provide a startling reason to examine how we use energy in our everyday lives and most particularly in the buildings that we live and work in.

Canada has nothing to be proud of when it comes to energy consumption. Boyd ([7]; pp. 2) states "Canada's record on energy issues is abysmal. In terms of energy use per capita, Canadians rank 27th out of 29 OECD nations, ahead of only Iceland and Luxembourg. In terms of total energy use, Canada stands 26th out of 29." Much of this energy use is related to building operations.

The official launch of Canada Green Building Council was announced in Vancouver on July 31, 2003 [1]. In the article, The Honorable Stephen Owen was quoted as saying "In Canada, 80 per cent of our population lives in cities. Buildings account for more than 30 per cent of greenhouse gas emissions. A third of the energy consumed in Canada is used in buildings. Two thirds of the electricity is consumed in buildings". Further information concerning the impact of buildings can be found in the Sustainable Design Fundamentals for Buildings, a manual edited by Peter Busby ([8]; Chapter 5, pp. 1) – "Approximately 40% of worldwide energy use is for the cooling, heating and supply of power to buildings."

The environmental impact is not limited to direct energy consumption. Mendler and Odell ([9]; pp. 2) state: "Buildings and construction contribute directly and indirectly to most of our environmental problems. Buildings are tremendous consumers of resources and generators of waste, and the industrial processes used to manufacture building materials and equipment contribute to waste and pollution as well."

Acknowledgement of the magnitude of building energy consumption presents great opportunity for corporations occupying vast amounts of building space to reduce consumption and at the same time significantly contribute to all three pillars of sustainability – economic, social and environment.

In his book Good News for a Change, David Suzuki ([10]; pp. 283) provides us with an example of improved energy efficiency in a building: "… First Canadian Place, Canada's largest office tower and the headquarters of the Bank of Montreal, Olympia and York commissioned the retrofit, investing $6.5 million in order to save 19.4 million kilowatt hours of electricity and reduce their CO_2 emissions by 27,000 tons annually. The investment will pay for itself in reduced energy costs in only about three years, and over the next ten will save First Canadian Place over $20 million." This story provides evidence of the possibilities for GHG emission reduction, energy conservation in buildings while at the same time benefiting from energy cost savings. This is but one example among several provided by Dr. Suzuki.

Energy conservation, like any other management focus, needs to be rooted in the company vision and policies if it is to be effective and considered a priority within the company. While reducing energy consumption is the right thing to do for social and environmental reasons it also makes good business sense providing economic benefit. Energy represents a significant cost to building operations but there is a direct relationship between consumption and cost making the costs somewhat controllable.

Costs and Benefits of Energy Conservation

While it seems simple and obvious to conserve energy, it requires a change in the way companies and individuals view the manner in which they operate. In other words it is necessary to adopt a philosophy of conservation. Doing so consumes time and money and therefore both advantages and disadvantages must be considered. For example,

Benefits:

- All energy conservation contributes directly to environmental preservation.
- All energy conservation contributes directly to energy cost savings and thus the bottom line.
- Many conservation efforts are at no cost or low cost.
- There is often an improvement to indoor environment for employees when energy conservation projects are implemented.
- Some energy conservation is achieved through proper maintenance and calibration of equipment. This effort not only saves energy but increases efficiency of equipment and has potential to save repair costs and extend the life of the equipment.
- Energy conservation contributes to the image of the company.
- Employees, interested in the environment, will have increased pride in the company and therefore increased employee satisfaction.
- Conservation efforts may provide a market advantage.

Costs:

- Some energy conservation initiatives require substantial initial investment making payback longer.
- Energy conservation requires human resources to identify, implement, monitor and measure opportunities.
- Measurement of potential savings is essential. Determining a standardized measurement system is time consuming and difficult.
- Changing attitudes of individuals within the company is sometimes difficult. Education and leadership is required to convince employees to change behavior.

- Technology is changing so quickly that making choices between the various technological solutions can be difficult. Proven technology is often already out of date.

Canada Post has made the strategic decision to conserve energy. To understand the potential impact of Canada Post's energy management it is necessary to provide an overview of the CPC portfolio of buildings.

Canada Post Corporation

Canada Post Corporation is a Crown Corporation with a single shareholder – the Government of Canada. CPC has an economic responsibility to operate in a financially responsible manner and to pay dividends to the shareholder.

The core business of Canada Post is the delivery of letter mail and packages to all Canadians. The Canada Post Annual Report for the fiscal year 2002 reported that the corporation delivered nearly 10 billion messages and parcels to over 13 million addresses. The Corporation serves 31 million Canadians and over one million business and public institutions. The delivery of mail requires a variety of facilities to accommodate mail processing, letter carrier depots, post offices, retail outlets and administrative space.

The Annual Report [11] states that in the year 2002, $224 million was spent on accommodation costs for operating and maintenance of its buildings. In excess of 30% of this cost can be attributed to energy.

Over the years Canada Post has concentrated on energy consumption reduction in an effort to reduce building operating costs to fulfill its economic responsibility and to conform to its environmental policy. The environmental policy is evidence of the corporation's intent to carry out its operations in an environmentally responsible manner and will be explained in more detail later.

In recent times a global urgency to find ways in which to reduce GHG emissions has evolved. This urgency is evidenced in the United Nations Framework Convention on Climate Change and the Kyoto Protocol. Canada Post has a successful history in reducing energy consumption in its buildings and has expertise upon which to build and to create further efficiencies and achieve higher rates of energy conservation. The call for GHG emission reduction provides a new motivation and an additional assessment tool for making management decisions regarding capital investments for energy saving projects.

The most recent event heralding a new focus at Canada Post is its commitment to the Federal House In Order Leadership Challenge. The Government of Canada introduced the Leadership Challenge to encourage all federal departments, agencies and Crown Corporations to voluntarily implement a GHG reduction program within their own departments and to report on their progress annually. The Challenge target is a 31% reduction of GHG emissions by the year 2010 [5]. This is an example of government providing incentive to act in an environmentally responsible manner without using the traditional method of imposing regulations.

The CPC Real Estate Facility Portfolio by Division database [6] reveals that the corporation occupies 3,223 (owned and leased) buildings representing 1,957,575 square meters of space. This provides Canada Post with a unique opportunity for a substantial reduction of energy consumption and a significant contribution to the environmental pillar of sustainability.

Concern for the environment is not new to the corporation. In fact there is an entire environmental policy committing Canada Post to environmental stewardship. The policy supports the Corporate Vision "Canada Post will be a world leader in providing innovative physical and electronic delivery solutions, creating value for our customers, employees and all Canadians." Supporting the creation of value to all Canadians the environmental policy, CPC Corporate Policy 15 [12], provides a framework that encourages environmental initiatives and in fact makes it the responsibility of all employees and functions within the corporation to care for the environment in the course of performing their day-to-day activities. The policy states: "It is the policy of Canada Post Corporation (CPC) to manage its operations and serve its customers with diligence and care for the natural environment. Canada Post believes that environmental protection and conservation are essential to the well-being of its employees, its customers and the communities in which it serves." It goes on to say: "The Corporation is committed to conducting its operations in a manner that meets applicable standards and which reflects a proper balance between ecological, technical and economic considerations."

In recent months a number of things have occurred that bring energy conservation to a much higher importance. They include the Leadership Challenge commitment and a recent power outage in Southern and Eastern Ontario that was declared to be a state of emergency and an energy crisis by the Ontario Provincial Government. The state of emergency lasted for a full week after power was restored. The power outage and subsequent energy crisis required the corporation to take several actions to reduce energy consumption during the energy crisis. All businesses, agencies, institutions and government departments were asked to reduce their consumption by 30%. Canada Post accomplished this and more [13]. Doing so revealed many opportunities that had not previously been obvious or if known had not been deemed necessary.

The Canada Post Real Estate function has taken a proactive approach to this corporate focus. In 2002, prior to the Leadership Challenge commitment and prior to the Ontario energy crisis, the Canada Post Real Estate Sustainable Design and Construction Guide [14] was developed and issued to companies providing Project Management and Facility Management services to Canada Post.

Canada Post Buildings

At a presentation to Canada Post employees during Environment Week (June 3, 2003) Dr. David Suzuki made the statement reported in the Canada Post Performance Magazine ([15]; pp.18-19): "The thing about an organization like Canada Post is you're so immense that a tiny change, spread throughout the organization, becomes huge. …. with the size of the building portfolio at CPC, even a small change in the way in which CPC uses energy can have an immense effect."

The Canada Post portfolio of 3,223 buildings contains a variety of sizes and operational requirements. For instance there are mail-sorting plants that operate 24 hours seven days a week. These buildings range in size from approximately 40,000 square meters to 97,000 square meters. Letter Carrier Depots are much smaller and operate during daytime hours only. Retail Outlets and Post Offices vary in size but are small and generally operate during regular business hours. Administrative buildings also vary in size across the country, however the Head Office buildings alone account for 92,000 square meters. In total Canada Post leases or owns 1.9 million square meters of building space. The financial budget for 2003 real estate utility costs was $36 million for all facilities excluding smaller postmaster managed buildings [6]. This supports the earlier claim that in excess of 30% of accommodation costs are attributable to utilities. The budget actually represents 32% of the total operating costs for the same buildings. A simple 10% reduction in consumption would result in $3.6 million savings.

Canada Post Real Estate Area Managers (1 for each of the 7 areas) and the Canada Post employee responsible for the operations within the building oversee the performance of the Facility Management Companies.

The Facility Management Companies identify the investment requirements for planned repairs that are necessary to ensure the integrity of the buildings. They also make recommendations for improvements. It is the responsibility of the Real Estate Managers to validate the recommendations and prioritization of the projects. It is also the responsibility of the Facility Management Companies to identify opportunities for energy conservation projects and to operate the buildings in accordance with the standards developed by the corporation.

Energy Management

Period: 1992 - 2001

CPC's Environmental Policy [12] sets the stage for environmental responsibility and provides insight to the framework from which the corporation has historically viewed the environment. It forms the basis from which environmental initiatives, including energy consumption reduction, has evolved and is evolving. The policy statement is as follows: "It is the policy of Canada Post Corporation (CPC) to manage its operations and serve its customers with diligence and care for the natural environment. Canada Post believes that environmental protection and conservation are essential to the well being of its employees, its customers and the communities in which it serves. The Corporation is committed to conducting its operations in a manner which meets applicable standards and which reflects a proper balance between ecological, technical and economic considerations." The policy statement contains reference to the three pillars of sustainability: social (customers, employees, community), ecological (diligence and care for the natural environment) and economic (economic considerations).

While not prescriptive, the policy iterates the corporate expectation that each of its employees carries out their operational activities in an environmentally responsible manner. The Canada Post Real Estate function has oversight of the Corporation's facilities and is specifically named in the policy as having environmental responsibility for the buildings. Included in the Guiding Principles (3.1 of the Environmental Policy) is the commitment to "develop, design and operate facilities and conduct activities taking into consideration the efficient use of energy and materials, the sustainable use of renewable resources, the minimization of adverse environmental impact and waste generation, and the safe and responsible disposal of residual waste;". The Guiding Principles emphasize the requirement of the Real Estate function to consider energy conservation as a priority.

In accordance with the policy, and with a proactive strategy, Canada Post Real Estate has documented several long-term initiatives dating back to 1992 that have resulted in reduced energy consumption and therefore reduced Greenhouse Gas (GHG) emission reduction. There are two methods to reduce energy use:

1. Choosing low impact energy sources such as those from renewable resources or clean energy sources.
2. Implementing energy efficient solutions either in new construction, retrofits or life-cycle replacement.

The following initiatives have achieved energy efficiency but have not taken advantage of low impact energy sources.

<u>Centrifugal Chiller Replacement</u>: Between 1992 and 2001 nine chillers were replaced with more environmentally friendly and energy efficient chillers in four of the major mail sorting plants. This replacement accomplished a reduction in electrical demand of approximately 2.0 MW (mega watts) per year. The calculation was performed by CPC Real Estate's mechanical engineering department and was based on an assumption made using demand information supplied by the manufacturer [16].

<u>Boiler Replacement</u>: During the same timeline CPC has replaced many of its older boilers with new and higher efficiency ones thus consuming less gas and/or oil.

<u>Re-lamping Projects</u>: Several small re-lamping projects were completed between the years 1992 and 2001. The projects replaced less efficient T12 magnetic ballast lamps by the more efficient T8 electronic ballast lamps. These replacements resulted in lower demand and energy consumption.

Supported by its Environmental Policy, faced with the need to replace equipment that had surpassed the life expectancy and fueled with a view that energy efficiency will in the long term bring financial benefits, the corporation supported these initiatives. While, small in number it is indicative of a will to take a direction that combines good business sense with environmental responsibility. Less energy efficient equipment could have been purchased at a lower price and still have met the regulatory requirements of the day.

The Canada Post Place facility houses the head office functions of the corporation. The building was constructed in 1993 with the latest technologies of its time. Over the years systems have been modified as a result of an energy audit performed in 1997. At the annual convention held in Chicago, Canada Post Place was awarded the prestigious 2002 Building Owners and Managers Association (BOMA) International Earth Award. The award recognizes excellence in resource preservation and environmentally sounds commercial building management. The Canada Post Place submission included information regarding numerous efforts to reduce energy and water consumption, recycling, composting, employee commuting challenge, car pooling, organic landscaping, reuse of construction material and much more.

Period: 2002 - 2003

During this period Canada Post Corporation took some giant steps to achieve energy conservation and towards addressing the issue of green buildings. The first step was the launch of Canada Post Sustainable Design and Construction Guide. The second step was Canada Post Corporation's commitment to the Kyoto Protocol. These initiatives were introduced while a large scale project for re-lamping was on. During August 2003 Canada Post voluntarily participated to overcome an energy crisis due to the power outage in parts of Ontario and the United States. Not only did Canada Post participate, it took forward some valuable lessons from the power outage.

<u>Canada Post Real Estate Sustainable Design and Construction Guide</u>: Mendler and Odell ([9]; pp. 5) provide ten simple things that can be done when designing and constructing buildings, among which are three that are directly related to energy are (a) improve energy efficiency, (b) reduce environmental impacts related to energy use and (c) use environmentally preferable building materials. The <u>Climate Change Plan for Canada</u> ([4]; pp. 25), states in the year 2000 Canadian buildings were responsible for 77 mega tones (MT) of direct emissions and an additional "57 MT of emissions from the generation of electricity from coal, oil or natural gas." It goes on to say: "Emissions from energy consumption in buildings can be significantly reduced through improved energy efficiency, both in the construction of new buildings and the retrofit of existing ones. In the shorter term, the greatest energy efficiency gains will come from retrofitting existing buildings …".

Canada Post buildings contributing to the history of energy conservation, of course fall into the category of existing buildings. However, it will be seen in the discussion on future plans that there are opportunities to avoid consumption in the design and construction of new buildings.

The <u>Canada Post Real Estate Sustainable Design and Construction Guide</u> [14], referred to as the Guide, was developed and introduced in 2003 to both CPC Real Estate and the service providers of project management and facility management services. The Guide was introduced at a workshop held in Ottawa and hosted by Canada Post in June of 2002. The purpose of the workshop was to provide, not only an introduction to the Guide, but also case studies of successful sustainable design and construction projects. The idea of sustainable design and construction was still relatively new and was met with some skepticism with regard to the attainable cost savings and the achievability of financial justification for such projects.

In June of 2003 a second workshop was held to assess the progress of the implementation of the guide and to discuss potential improvements to it. The case studies presented at this second workshop were those projects, implemented by the service providers, since the introduction of the Guide the previous year.

The purpose of the Guide is to provide a process whereby sustainable design and construction principles and practices are integrated into project delivery for all new construction, renovation and property management. The goal is to encourage the service providers to examine sustainable alternatives at every opportunity to enable informed decisions. In order to understand the cost implications of sustainable alternatives the budget holder must also understand all benefits of the alternative.

While this paper is focused on direct energy consumption reduction, it is worthwhile noting here that sustainable design and construction has the additional potential to reduce indirect consumption through 'cradle to cradle' analysis of materials and equipment being used. Cradle to cradle analysis considers the production, transportation and disposal of the products being used in either new construction or retrofit. Embodied energy consumption reduction is not included in CPC's calculations of direct energy conservation, however, while not measured presently, it is worthy of note.

One focus of the Guide is integrated design. It is essential that all professionals involved in the design and construction of either new buildings or retrofits be involved from the conceptual stage through to and including commissioning. The traditional design process usually designated the architect as the lead consultant. This often resulted in the building orientation and other design features being finalized prior to receiving input from the engineers and building operators. The result was that mechanical and electrical systems often had to be designed to fit within the architectural structure thus limiting potential performance efficiencies. Integrated Design ensures that mechanical engineers and electrical engineers can work with the architects to maximize all possible energy efficiencies. By working together as an integrated team,adjustments can be made in the early stages of design resulting in savings for both design and long term operating costs.

The Guide goes on to stress the importance of applying an Environmental Management System to the project. Among the benefits of implementing this system are:

- Development of commitment by all parties involved in the project to environmental protection.
- Encourages environmental planning.
- Establishes a management system to meet specified performance targets.
- Identifies environmental aspects and legal requirements.
- Develops a review process to assess performance target achievements at all stages of the project.

Another very important focus in the Guide that ensures highest possible energy efficiency coming from design and construction is the commissioning process. This process verifies that the heating, ventilation, air conditioning, lighting and building automation systems are constructed, and calibrated to function according to the objectives and the design. This type of verification is extremely important in the achievement of desired energy efficiencies.

The commissioning process also includes transfer of information to building operators and provides training where necessary. Without this step in the process, designed and constructed efficiencies may be lost entirely. It is essential that operators are well informed to ensure the equipment and systems operate in an optimal fashion.

At the 2003 workshop, feedback from service providers indicated that since the introduction of the Guide they were able to initiate few sustainable projects. They believed that the corporation needed to invest capital dollars required for truly 'green' projects.

In addition, the service providers are becoming more educated in the area of sustainable design and construction. Awareness of potential efficiencies and ultimate energy savings is key to identification and implementation of sustainable design and construction alternatives. As awareness grows more opportunities will be identified.

The Sustainable Design and Construction Guide information, provided here, is in no way exhaustive and does not include the many other important elements of the Guide that address such things as water efficiency, waste management, product selection and many other opportunities that contribute to conservation in embodied energy. The Guide also highlights the importance of 'cradle to cradle' analysis that considers inputs and outputs of products and product disposal when choosing building materials. This way of looking at design and construction is much like a portion of Hawken's ([3]; pp. 21) proposal for change required to avoid the ultimate and complete environmental destruction. He says: "To change this state of affairs, business will have to deal directly with the three issues of what it takes, what it makes, and what it wastes."

To ensure continuation of learning and to keep the Guide in the forefront of the consciousness of both Canada Post Real Estate employees and the service providers for both facility management and project management a news bulletin has been developed. The bulletin is entitled "Sustainable Design and Construction News Bulletin". The Bulletin is issued as new information or related news concerning environmental issues for buildings and/or achievements, becomes available. The Bulletin is particularly important in the ongoing effort to communicate and encourage attitude change of both CPC Real Estate professionals and the service providers.

Kyoto Commitment – a Voluntary Initiative: In a communication to all employees on October 24th, 2003, the President and CEO of Canada Post, announced the corporation's commitment to the Government of Canada Leadership Challenge (Challenge) to support Kyoto Protocol.

Canada Post is the first large Crown Corporation to agree to participate in the Challenge that is expected to assist in Canada's target to reduce GHG emissions by 6% between 2008 and 2012. This is not a mandated initiative but a voluntary one. It is an indication of the corporation's intent to carry out its business through integration of economic, environmental and social responsibility.

The Climate Change Plan for Canada ([4]; pp.5) clarifies greenhouse gases as "Naturally occurring greenhouse gases include water vapor, carbon dioxide, methane, nitrous oxide and ozone." Carbon dioxide is emitted by the burning of fossil fuels for the heating and cooling of buildings. The plan goes on to say that by making existing buildings more energy efficient 1.2 mega tons of emissions can be avoided ([4]; pp. 25).

CPC is not considered a large emitter of GHG's, however, as noted in the introduction, the corporation has an opportunity to make a significant contribution through energy consumption reduction in its buildings. Large industrial emitters are able to accumulate or trade emission credits under the existing federal definition. Presently, companies such, as CPC that do not fit into this category are able to collect domestic offsets that large industrial emitters such as petroleum companies can invest in.

CPC's commitment provides incentive to investigate and implement energy conservation programs. It introduces another element in the analysis of the value of projects. The key to the success of CPC programs will be the development of acceptable and reliable measurement tools that will provide information regarding the conservation achievement of energy projects.

Environment Canada has developed computer-based tools for calculating GHG emissions. While helpful, this is not enough. The corporation must develop its own measurement system relating to consumption. This is particularly important when trying to define what equipment needs to be fitted with sensors etc. Presently consumption records are kept and reported upon by the Facility Management Companies. However the consumption records are for the entire building and do not specifically identify the separate elements of buildings and their related consumption. In many cases this can be determined through using calculations based on manufacturers' information for each specific piece of equipment. This is a tedious exercise. Energy audits will provide this information.

<u>Large scale re-lamping</u>: The first large-scale re-lamping project was completed in 2002 at the Vancouver Mail Processing Plant, a building of 63,941 square meters. Phase 1 of the project was a retrofit that replaced T12 lamps with T8's. This project accomplished both energy conservation and the removal of ballasts containing PCB's. Removal and proper disposal of PCB's is consistent with the corporation's environmental policy and plan.

Phase 2 of the project was the installation of controls. The investment required for both phases of this project was $650,000 that was reduced by an energy conservation incentive of $296,000. The annual energy savings have been calculated as $196,000 achieving a 1.8-year payback.

The result of this effort was 25% reduction in demand and a 28% reduction in electrical consumption. In addition to reducing the annual hydro cost by $196,000, the project improved the working conditions of its employees. Canada Post Corporation was presented with the 2003 BC Power Smart Award for this project.

Other smaller projects were completed at 12 sites in the Vancouver area resulting in an annual savings of $35,000 with a net investment cost of $206,000 achieving a 5.8-year payback

At the South Central Mail Processing Plant in Toronto a similar project was completed. South Central is a 51,791 square meter building. The conversion to T8 florescent lamps and control modifications resulted in anticipated annual energy savings of $344,000 for an initial investment of $975,000. This result is a 2.8-year straight payback.

The energy savings numbers for these projects are based on engineering calculations performed by consultants and using manufacturer's energy demand information for the particular products and equipment used. The information and reports are held by Canada Post Real Estate and/or the Facility Management Companies [6].

<u>Power Outage</u>: In August of 2003 the lights went out in Southern and Eastern Ontario and many parts of the U.S. The power outage lasted a little more than 24hours for some areas and longer for others. However, when the power went back on the province of

Ontario announced a state of emergency and urged all individuals and companies to conserve as much energy as possible. Companies were, in fact, asked to reduce their demand by 30% for the duration of the crisis in order to reduce the pressure on the power source and grid during the extensive repair process.

The state of emergency ended, however the fragility of the energy sources has not changed. Provincial governments in Ontario and Quebec continue to appeal to the public to conserve energy wherever possible. The high-energy demands resulting from the extreme cold winter temperatures in January 2004 placed great stress on the energy grids. This can be considered as a reminder of the necessity to be ever vigilant and to develop long-term conservation strategies.

During the energy crisis CPC implemented some very effective short-term initiatives to reduce the energy demand in excess of 30%. Through the introduction of these drastic short-term solutions, longer-term possibilities came to light. The longer-term solutions are presented in the next section. It is however, worthwhile to present some of the initiatives taken by Canada Post during the Ontario energy crisis and the remaining efforts considered a mid-term response to the need to reduce energy consumption.

Short-term efforts taken once the power was restored but the province was still in a state of emergency, included reduced lighting, shutting down of cooling systems, implementation of daytime cleaning, use of generators during peak hours to provide some relief to the demand on the grid, communication to employees to keep all unnecessary equipment turned off and to avoid using elevators whenever possible. Other communications were issued providing information to employees concerning simple energy conservation opportunities both at work and at home.

The mid-term changes that were made included a de-lamping program that consisted of removing approximately one half of the fluorescent tubes from overhead lighting in areas around the perimeter of the building where natural light is available. Of course respect for the lighting standards of the corporation was maintained, providing an average of 500 lux for work areas. In addition each employee affected by the removal of lights was consulted. Some employees require more lighting than others and it was not the intent to reduce lighting at the expense of the quality of the working conditions. In fact, when employees working on the interior of the building observed the de-lamping several requested lamps to be removed in their area. Some employees found lower level of lighting to be more comfortable.

This approach, while providing immediate benefits should not be looked at as a long-term solution. Removing lamps in an *adhoc* manner produces an aesthetically unpleasing effect with the appearance that lights are burnt out rather than purposely turned off. It is also dependent upon the employee affected. From an operational perspective this approach could cause problems in the future with the movement of employees from one office to another making it necessary to re-install lamps to accommodate specific lighting requirements of employees.

De-lamping was also performed in all lobbies where high levels of lighting are neither required nor pleasing. The lobbies will most likely remain this way for the long-term. The aesthetic result is pleasing and the corporate lighting standards for lobby lighting were maintained.

At the Head Office buildings alone 1,731 fluorescent lamps of 32 watts each were removed [6]. The fixtures are two lamp fixtures. A decision was made to remove both lamps from selected fixtures rather than to remove 1 lamp from a larger number of fixtures. Assuming that lights are on for 12 hours each day, 250 days per year, the lamp removal results in a consumption reduction of 166,176 Kw per year. Using an average cost of $0.08 per Kw the cost savings are $13,294 per year. The only cost to the corporation for implementation of this effort was the cost of time spent by facility management to remove the lamps.

The cost savings and energy conservation may at first glance appear small, however it should be remembered that this information applies to only one building of 650,000 square feet and only the areas around the perimeter of the building where day-lighting is available. A longer term program for lighting reduction in all areas of the building using an engineered design that would both reduce lighting loads and maintain lighting quality has potential to accomplish much more. It should also be remembered that the building mentioned here represents only 3% of the total CPC portfolio of buildings in terms of square footage.

Daytime cleaning was introduced reducing lighting requirements by four hours each day. That means twenty hours of lighting is avoided each week and 1,040 hours per year. The lights are currently on 25% fewer hours than they were prior to the power outage. This translates to a 25% reduction in energy costs and consumption related to lighting for those buildings that do not require 24/7 lighting for operational reasons - a very simple way to reduce costs and consumption. Why it was not thought of earlier? It took a crisis to make it apparent that the minor inconvenience of day cleaning could have such a large positive impact.

Other measures such as increasing summer indoor temperature and reducing winter indoor temperature have been implemented. These changes were implemented only where existing temperature settings exceeded the corporate standards for temperature. The standards are 22^{o} C +/- 1^{o} C for the heating season and 24^{o} C +/- 1^{O} C for the cooling season [6]. No calculations are available to determine energy conservation related specifically to this measure. However, as annual consumption is tracked results will be included in overall reductions.

Period: 2003 - Future

The list of commitments expressed in the October 24th, 2003 communication to CPC employees from the President and CEO, included the following related to buildings:

- Develop GHG emissions measurement, analysis and verification processes and to monitor progress;
- Develop a long-term corporate GHG emission reduction plan;
- Participate in activities aimed at promoting best practices related to energy efficiency programs/initiatives; and
- Provide an update on plans and report on GHG emissions reduction activities annually.
- Day –to-day improvements such as monitoring and managing use of lighting and office equipment;

- Energy efficiency projects;
- Life Cycle Replacement Improvements;
- New Facilities that minimize long-term unit cost of energy.

The corporate commitment to measurement, analysis and verification is essential to the success of the strategies. If measurement tools are not in place, it is impossible to verify successful implementation of energy conservation initiatives. If verification is not possible, sustainability of such initiatives is also not possible. Measurement of energy conservation success involves theoretical measurement of demand and consumption before and after implementation and includes circuit verification reports. . Year over year tracking is not considered accurate because of variables that cannot be accounted for such as changes in operational requirements and upgrades to equipment.

Day-to-day Improvements: Canada Post has outsourced the operations management of its buildings to two facility management companies. The companies are contractually obligated to manage the buildings in the most energy efficient manner possible. They are mandated to identify opportunities for improvement to Canada Post. Further, it is incumbent upon CPC managers to also look for ways to reduce our energy consumption.

A pilot project is underway to assess the effectiveness of a sensor for office equipment. The sensor automatically turns off all office equipment connected to it when the office is empty. When the employee returns the equipment immediately powers up. Examples of office equipment for which this type of sensor is useful include: computer monitors, task lighting, calculators, printers etc. The pilot includes a meter that is attached to the sensor and records the information required to calculate the energy conservation. An analysis of the effectiveness of this equipment will be performed at the end of the pilot project forecasted to be June of 2004. The outcome will determine the extent to which office equipment sensors will be installed.

Lighting sensors for boardrooms are being installed. Education of employees who have closed offices is necessary to ensure lights are turned off when the office is not occupied.

Improvements in facility management and in particular scheduled equipment preventative maintenance and control calibration can keep equipment operating at optimal levels thus ensuring highest possible efficiency. Maximizing use of existing building automation systems is another facility management conservation opportunity.

There are also several simple and obvious things that can be done such as keeping loading dock doors closed during the heating season, replacing old appliances with energy efficient units and turning lights off in unoccupied areas.

Energy Efficiency Projects: Consideration of energy efficient equipment such as LCD monitors, task lighting and shared printers is presently underway. Performance analysis, based on manufacturers' information, will determine the extent of implementation.

Re-lamping projects have been proven viable in the corporation and will be implemented in buildings across the country based on site-specific analysis. In fact, re-lamping projects for two major mail-processing plants and some smaller buildings have been planned for the near future.

The facility management companies will be included in the development of a strategic plan for energy efficient project identification and implementation in the long-term.

Life Cycle Replacement Improvements: A five-year sustainable Real Estate strategy based on a review by facility category and energy use will be developed and will be used to recommend conservation measures. The normal life cycle replacement plan for equipment will include energy conservation as part of the criteria for equipment procurement.

New Facilities Minimizing Long-term Unit Cost of Energy: New facilities provide an opportunity for energy cost avoidance. In an integrated design process, Canada Post Real Estate gathered together a team of professionals to develop a concept and design for the new Standard Post Office building that would meet the Canada Post Sustainable Design goals and objectives. Included in the concept and in ongoing development of the design, is an emphasis on energy conservation. To make the concept applicable to any site and to achieve the desired sustainability goals, a New Post Office Kit of Parts [17] was developed from which teams for site-specific designs can pick the applicable and possible elements for implementation at the location of the new post office.

The Site Plan Goals include minimization of solar gain, maximizing daylight and permitting winter solar gain if convenient. This would achieve energy consumption avoidance for heating, cooling and lighting.

The building envelope is to be designed to maximize energy. Such things as R2000 insulation and airtight drywall systems are included in the Kit of Parts. Electrical and mechanical systems are to be selected to achieve the highest possible efficiency.

Selection of equipment is to be guided by the GHG emission rate of the specific equipment. The Kit dictates that the equipment selected is to have the lowest emission rate.

It is also suggested that Solar walls and shading techniques such as vines and trees may be appropriate in certain locations to reduce energy requirements.

Assessment of the site for potential renewable energy use such as solar, wind, geothermal or low-impact Green hydro is included in the requirements. It may not be possible, however, it must be considered.

The Kit of Parts only applies to new post offices being built as a result of business decisions to relocate an existing post office. Generally, post offices are small buildings with low energy consumption in relation to the much larger buildings housing the corporation's mail sorting operations. However, this heralds the beginning of exploration of the effectiveness in terms of 'green' design. Success of Sustainable Design and Construction in smaller buildings will provide necessary information concerning verifiable energy conservation and cost savings for larger projects. Presently the corporation has verifiable information based on past projects relating to mechanical and electrical equipment contribution to energy conservation. Financial information related to architectural contribution to energy conservation, while accepted, remains theoretical.

CPC Energy Management Strategy for Facilities: Early in 2003, Canada Post appointed a Senior Advisor, Environment - GHG Programs responsible to develop a strategy to reduce GHG emissions resulting from the operations of Canada Post. The mandate was not limited to buildings but includes all facets of the operations.

In September of 2003 the Energy Management Strategy [2] was presented to CPC Real Estate employees. The objectives of the strategy are to:

- Achieve operational objectives at minimum energy consumption and cost, while maintaining an acceptable level of comfort and effectiveness.
- Develop and communicate a process to do so with appropriate management in the Regions.
- Position CPC to achieve its commitment to the Federal Government Leadership Challenge (Kyoto).

The objectives encompass a concern for sustainability and the economic, environmental, and social aspects of it.

The key principles identified in the strategy are:

- Purchase energy at lowest price.
- Manage the business Operations energy consumption at peak efficiency.
- Harness the most appropriate technology.
- Develop energy information platform for measurement of continuous improvement.

The overall strategy introduces changes that have some affect on employees, especially in terms of lighting and temperature. Canada Post has employees belonging to management as well as unions. There are four unions representing various positions within the corporation. Consultation and communication with unions will ensure continued partnership of the Corporation and unions to work together to achieve their common goal of environmental stewardship. Consultation with all four unions is a priority and is part of all change management at the corporation. Energy conservation is no different, and the unions will be involved in the strategy implementation.

Finally a communication plan will be developed using all communication tools available – the Employee Performance magazine; intranet and email communications – to keep employees informed of corporate energy conservation progress as well as provide tips for individual and corporate conservation opportunities.

National and Regional Energy Committees have been established and will facilitate continued development and implementation of the strategy. The energy conservation strategies will be incorporated in the Corporate Planning, Investment Planning and Operating Planning processes.

In December of 2003, the Senior Advisor, Environment-GHG Programs made a presentation to the Canada Post Operations Committee [2]. The presentation presented opportunities for further emission reductions. In addition to already achieved reductions and assuming continuation of the same level of investment as is currently in place, it is anticipated that with further energy conservation initiatives, energy efficiency projects and life cycle replacements the corporation could achieve a 33% reduction in GHG emissions. This number relates to those areas that are controlled by Canada Post only, and is 2% over the Leadership Challenge target.

Other areas in which the corporation does not have control but is able to influence have an assumed potential of an 11% emission reduction. This includes such things as - employee transportation (addressed through different commuting options such as public transit, tele-work), contracted transportation services, business travel (addressed through increased use of teleconferencing and videoconferencing).

Energy Conservation Strategies and Solutions Website: In February of 2004 the "Energy Conservation Strategies and Solutions" website was launched on the Canada Post Intranet as a tool to provide employees with information concerning the corporation's progress relating to energy conservation. It provides detailed information of the Kyoto Protocol and Canada Post's actions and initiatives. In addition it includes tips and suggestions for employees who wish to make changes in their daily activities at home and at work that would have a positive impact on the environment.

This tool is another example of a proactive approach to promote ongoing efforts to conserve energy. The Sustainable Design and Construction Guide is aimed at service providers while the intranet website is directed at employees. It communicates to employees, the importance that Canada Post has placed on energy conservation. By doing so employees are not only encouraged to take positive action at work but this is an effective method of changing attitudes. It enables concerned employees to explore and suggest ways to conserve energy in the workplace. It also has a far-reaching educational potential. Canada Post has in excess of 60,000 employees across the country. These employees live in communities and have influence on their friends and families. The potential for spreading the idea that energy conservation is important is unlimited.

A four-page article was included in the January/February edition of the CPC employee magazine – Performance. In the article Payne ([18]; pp. 12) tells employees: "It's easy to blame someone else for the greenhouse gases (GHG's) that are causing climate change, but individual Canadians are responsible for about a quarter of the country's GHG emissions – nearly five tons a person a year. Over the next five years, the federal government will invest a significant amount to help Canadians reduce their energy consumption through the One-Tonne Challenge." The article encourages employees to view the intranet website for more information on the Challenge.

Changing Approach to Financial Assessment & Investment**:** The economic responsibility of the corporation is to maximize profits and to return dividends to the Government of Canada. Canada Post has done well in this area by keeping a focus on increased sales and decreased costs.

Most energy efficiency projects, particularly retrofits, require an initial capital investment. Often this investment is substantial and the pay back is long term. This has historically been a hurdle for CPC. However, the increase in activity relating to energy conservation projects at the corporation in recent years is indicative of a change in the way in which the financial analysis is performed.

In his book The Green Economy, Michael Jacobs ([19]; pp. 198) explores sustainable development within the framework of economics. He says of Cost Benefit Analysis: "For anyone concerned about sustainability – about the interests of future people – this limitation of CBA immediately invalidates its claims to legitimacy as a decision-making procedure."

Jacobs ([19]; pp. 202) goes on to explain that Cost Benefit Analysis attempts to convert "all values into monetary units…". In the case of energy conservation this is possible for at least the obvious and low investment projects because energy conservation reaps savings in energy costs. However, as companies complete the high savings and obvious projects and move on to try to achieve even more savings through higher investment this method of financial analysis will not work since the short-term payback will not be there.

Until 1995 Canada Post used Net Present Value (NPV), Internal Rate of Return and straight payback to perform analysis of potential projects. While the environmental policy was in place and the corporation had the will to act as a responsible corporate citizen with regard to the environment, energy conservation projects were cost prohibitive and therefore, unless regulated, were not implemented.

In 1995 CPC began changing the method of financial analysis and used only the NPV method, however this was before tax. While an improvement, the hurdle to making capital investment in energy saving initiatives remained. By 1998 the NPV was changed to include after tax information. Further improvements to the analysis were made when the corporation began using after tax IRR analysis and included in the analysis was a five-year benefit calculation of the individual projects. In addition, reliable measurement tools for energy demand were implemented. Thus by improving energy analysis through reliable measurement and after tax IRR financial analysis, it appeared that energy savings projects were feasible.

However, most companies have limited amount of capital dollars to invest in any given year. This is no different for Canada Post Corporation. While analysis made energy projects attractive, there were two very large financial pressures on the corporation's capital that took priority during the last 5 years.

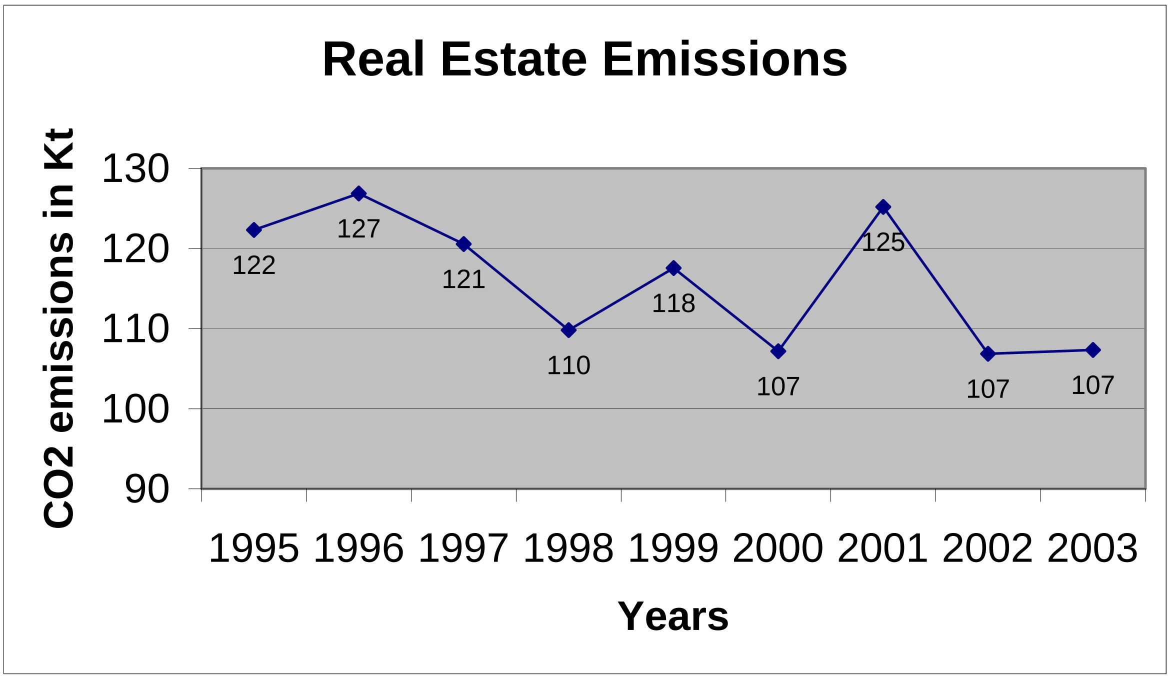
The first pressure was felt in the years 1998 to 1999. Preparation for Y2K was considered a priority around the world for almost every company and government. There was no escaping the costs to ensure continuity of business. During this time very little capital was left to sustain existing facilities making energy enhancement projects out of the question.

The second financial pressure at Canada Post began in 2001. This pressure was the capital requirement for implementation of SAP in support of the corporation's Business Transformation project. This project received priority. The Business Transformation was necessary in order to move the corporation forward and to ensure its financial, operational and competitive future.

Now, in 2004, some of the financial pressure has been alleviated and combined with improved and more reliable analysis, energy conservation projects are more possible than ever before.

To summarize the effects of direct energy conservation efforts of Canada Post Corporation from the beginning of this story (1992) to 2003 calculations have been performed using a database tool developed by Environment Canada. The tool assists in converting energy consumption related to electricity, natural gas and oil to GHG emissions. **Figure 1** is a graph, prepared by CPC that indicates emission reduction achieved in CPC buildings between 1995 and 2003. During this period direct energy conservation at CPC has resulted in a reduction of GHG emissions totaling 15 Kt of C02.

Figure 1: Real Estate Emissions

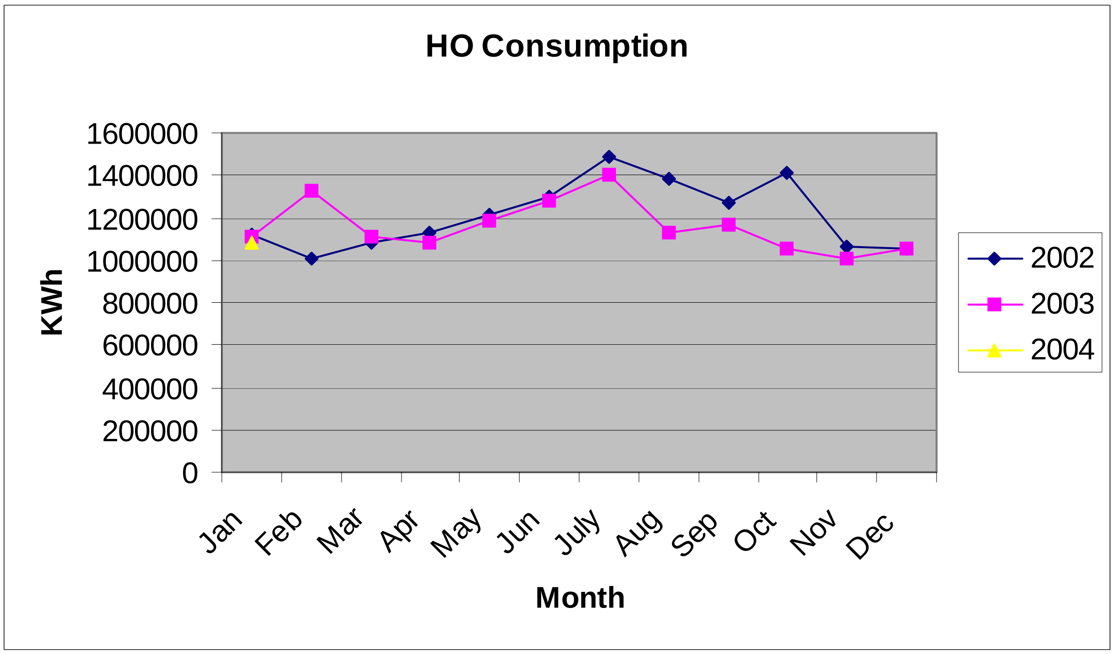


Data related to electricity, natural gas and oil consumption from 2001 to present was collected from the facility management companies for buildings managed by them. Financial data was available for facilities managed by CPC. Prior to 2001 estimation has been based on financial data alone. Actual consumption information is available from the year 2001 and will be the basis for accurate reporting from that year through to 2012.

Canada's Kyoto target for 2012 is a 6% reduction in building related emissions This translates to 110Kt for CPC buildings. The actual GHG emission reduction achieved from buildings as of 2003 is 12%. Double the 6% Canadian target for 2012. Ongoing efforts will result in a much greater environmental contribution by the corporation. In fact there is a focused corporate intent to reduce GHG emissions wherever possible. The corporation has already identified opportunities for additional reductions to reach the potential 33%. These opportunities have been previously presented in this paper. With the commitment to establish long term strategies for emission reduction more opportunities will be identified.

As an example of the progress being made using simple conservation initiatives **Figure 2** shows the reduction of 621,145 KWh in consumption at the Head Office facilities of CPC between 2002 and 2003. Much of the reduction in consumption has resulted from the efforts implemented as a result of the 2003 energy crisis in Ontario. Early information regarding the January 2004 consumption records indicates that 2004 will show further reductions.

Figure 2: Canada Post (Head Office) Consumption



Measurement of consumption is relatively new to the Corporation; however, these early results are promising and are definitely an indication of the direction being taken by the corporation in order to achieve its commitment to the environment and the Leadership Challenge through energy conservation.

With this information it is clear that CPC has achieved significant reductions. The reductions can be attributed to the practical initiatives described in this paper.

<u>Sustainable Buildings – A Growing Philosophy</u>

Individual professionals, around the world involved in building design, construction and maintenance have been coming together in the form of associations and organizations to promote sustainable design and construction. Sustainability in design and construction and resulting energy conservation is not new to the building community. The growth in membership of green building organizations is an indicator that the idea of sustainable construction and design is moving towards becoming a core building philosophy. North America has numerous such associations, a few of which are described below.

USGBC: In 1993 the U.S. Green Building Council (USGBC), a national nonprofit organization, was founded and now has 23 chapters with 3,400 member organizations across the US. Their mission statement is "The U.S. Green Building Council is the nation's foremost coalition of leaders from across the building industry working to promote buildings that are environmentally responsible, profitable, and healthy places to live and work" [20].

The founder recognized the need to have a system to define and measure various aspects of design and construction for both new and existing buildings in order to assess the degree to which a particular project would qualify as being 'green'. The council reviewed the possibility of using existing rating systems from other countries but in the end decided to create a system specific to the U.S. The rating system created is called the Leadership in Energy and Environmental Design (LEED ™) and was launched as a pilot in 1998.

CaGBC: A similar organization was launched in Canada in July of 2003. The Canada Green Building Council (CaGBC) also promotes the use of LEED ™ as a rating and measurement system. By January of 2004, just a little over one year after its launch, the CaGBC announced in a notice to its members that they had reached a total of 232 member organizations. The CaGBC website states that the organization is growing at 15% per month [1].

Sustainable Buildings Canada (SBC): The Sustainable Buildings Canada Business Case (October, 2002) [21] found on the SBC website contains information regarding the mission and vision that indicates SBC is very similar to USGBC and CaGBC. However, SBC has formed a close relationship with the Canadian Energy Efficiency Alliance (CEEA). While differences between the three organizations do exist, perhaps the main difference is the adoption of the measurement and rating tools. SBC has chosen Green Globes as its preferred tool.

These are but a few of the organizations that have been founded during the last few years but serve as an indicator of a change in attitude in North America. More and more people involved in building design and construction are becoming aware of the environmental responsibility to conserve energy and resources. The establishment of the organizations mentioned above also indicates that their members are interested in promoting the philosophy of sustainable buildings to others and to be educators in the industry. The potential of growth in this area is immense.

While the USGBC is by far the largest of the three organizations, Canada's participation is growing at a very rapid pace. The Canadian organizations are young and still trying to work out details but this has not stopped them from holding educational events and promoting sustainable buildings.

Conclusion

The uniqueness of Canada Post is evidenced in the corporate commitment to the Leadership Challenge, the establishment of National and Regional Energy Committees and in the implementation of the Sustainable Design and Construction Guide. All three are open ended allowing for innovation and providing potential for unlimited conservation. All three are directed at change and improvement. All have a part to play in changing attitudes and thought processes. Attitude is the core element in accomplishing change. Changing attitude towards the environment is the purpose of almost all writings on the environment and is thought to be the key to global sustainability. The attitude of Canada Post as a corporation has changed in that it has evolved. It has moved from corporate responsibility to one of proactive leadership. Perhaps the greatest contributor to the present attitude is the Kyoto Protocol and Canada's support of it. If there were any decision makers in the corporation who were uncertain as to the importance of environmental initiatives, the federal government decision to support Kyoto provided them with reason to accept the importance.

The commitment to the Leadership Challenge makes the reduction of GHG emissions a corporate priority. This is not only an indicator of the corporate attitude but is also an agent for changing individual attitudes.

The corporate strategy is applicable to all CPC functions. This means that every function within the corporation will share in the mandate to reduce GHG emissions and to conserve energy. The result will be encouragement of innovation in the way in which all employees carry out their daily operations. The potential for new and creative employee suggestions for energy conservation is increased. These innovative suggestions will increase in importance as the more obvious energy conservation projects are implemented and the conservation achieved because it will become more and more difficult to find additional efficiencies.

Initiatives for energy conservation that require change in the workplace will be supported by the mandate. This is important because change of any kind, is often met by resistance. Resistance can be lessened if the purpose for change is accepted as reasonable or important. An example of a workplace change is daytime cleaning already implemented in administrative offices. While employees may find it somewhat inconvenient they are able to accept it because they realize the importance of conserving energy.

Communication to CPC employees regarding corporate progress in its commitment will form a catalyst for attitude change among individuals. Canada Post has in excess of 60,000 employees throughout Canada. The employees will be involved in reduction initiatives and will be made aware of simple ways to reduce negative impact to the environment. The audience for the message is extensive, reaching the homes and communities of the employees.

Establishment of National and Regional Energy Committees further emphasize corporate commitment and priority. The Regional Energy Committees are in the best position to recommend changes and to implement them. They are on the front lines and know the operations and use of the buildings. They also are in direct contact with the Facility Management Companies. This puts the committee members in the position to effect attitude change in the way in which buildings are managed. The emphasis on efficiency and effectiveness in support of the environmental mandate will not be limited to CPC buildings. As the Facility Management Companies learn and change their processes to accommodate the CPC mandate, other companies for which the FMC provides services to will also benefit.

The benefit of increased building efficiency has potential to increase the quality of the workplace environment contributing to increased employee satisfaction. Building efficiency will certainly achieve cost savings as well.

The Sustainable Design and Construction Guide, while not prescriptive in nature places emphasis on the corporate attitude towards the value of the environment and the need to make choices that protect the environment. The Guide makes the project management service providers responsible to implement energy efficient alternatives. The strength of the guide is that by not being prescriptive it allows the newest of technologies and products to be considered. It goes beyond energy conservation and touches every aspect of building construction and maintenance. In doing so, there is opportunity to reduce energy consumption through choosing products with the least amount of embodied energy.

The potential environmental benefits of the Guide are enormous through fostering a change in attitude of project management service providers who have historically sought the fastest and least expensive alternatives to design and construction. The implementation of elements of the guide is becoming part of the key performance indicators for project management. The environmental benefit is not limited to Canada Post projects. The knowledge and experience gained by the project managers by using the Guide for CPC projects will benefit other companies and individuals for whom the project manager provides services. The benefits are far reaching. At the moment the construction industry is limited in its knowledge pertaining to sustainable alternatives. The application of the Guide will serve as a teaching tool for contractors supplying services and products. The more the Guide is applied the more knowledgeable the industry will become and the environmental benefits will increase. These far reaching benefits will not be limited to Canada Post but will be enjoyed by companies and individuals across Canada.

Canada Post came out of the Kyoto starting gate very quickly. This can, in part, be attributed to the corporation's long history of environmental concern both corporately and within its employee population. While not presented previously in this paper it is necessary to mention here that the corporation has been helped in its environmental journey by grass roots efforts. There have been many initiatives implemented by employees that have helped to form the corporate attitude of sensitivity to the environment. The environment committee at CPC is comprised of volunteers from several functions. The committee put together a business case and obtained corporate approval to engage Dr. Suzuki to make a presentation to CPC employees during Environment Week. At the presentation Dr. Suzuki said that if a grass roots entity is combined with an executive champion, great things could happen in a corporation. There are both at Canada Post and there is evidence that the corporation is on its way to achieving enormous environmental benefits. One example of a grass roots organization is the CPC Commuting Challenge that promotes self-propelled means of commuting to and from work. The organization has been in existence for several years and has won numerous awards related to emission avoidance including the 1997 Environment Canada Citizenship Award and the 1999 City of Ottawa Environmental Achievement Award.

Hawken ([3]; pp. 10) proposes: "If business is prepared to reexamine its underlying assumptions and listen to ecologists, botanists, toxicologists, zoologists, wildlife management experts, endocrinologists, indigenous cultures, and victims of industrial processes, without the selective filter of its internal rationale and biases, it will not only fulfill its own agenda of contributing to society by providing products, jobs, and prosperity, but also initiate a new era of ecological commerce, more promising and ultimately more fulfilling than the industrial age that preceded it." Energy Conservation and the resulting reduction in GHG emissions is one way in which companies can take a step in this direction. Canada Post has reexamined financial assumptions that at one time made it economically unjustifiable to implement energy saving programs. This change is extremely important to the future potential of energy conservation.

Canada Post has evolved in its journey towards sustainable development. It has moved beyond fixing problems and compliance to environmental regulations and management. It is presently working towards a proactive and innovative approach to the environment. It is no longer concerned with its environmental obligation alone but has shown a sincere commitment to environmental responsibility.

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13 Towards Effective Management of Methane Emissions from Natural Gas Pipelines

S. Venugopal

Abstract

Methane emissions from TransCanada's pipeline operations can be categorized into fugitive losses and vented emissions. There are a number of facets to TransCanada's methane emissions management program: source identification, quantification, tracking system, mitigative actions, pilot program, full scale implementation, monitoring progress, and continuous improvement through research and development. In 2002, TransCanada's methane emissions management program avoided 1.1 millions tonnes of carbon dioxide equivalent from being emitted to the atmosphere. This paper documents TransCanada's methane emissions management strategy, its implementation and results obtained from source identification to research and development.

Keywords: TransCanada Pipelines Ltd., methane, emissions management, fugitive losses, vented emissions

Introduction

TransCanada PipeLines Ltd. (TransCanada) is Canada's largest natural gas pipeline company combined with a growing power generation business. TransCanada owns and operates a 37000 kilometer pipeline system that contains more than 110 gas compression facilities, 1200 gas metering facilities and over 5000 valve sites. The gas compression facilities have a combined capacity of nearly 4000 megawatts. TransCanada's Canadian facilities emit nearly nine million tonnes of carbon dioxide equivalent. Based on 2002 data, approximately nine per cent of TransCanada's greenhouse gas (GHG) emissions originate from methane losses along its pipeline network. Without the methane emissions management program in place TransCanada's GHG emissions would be 11 per cent higher (equal to 20 per cent of total GHG emissions). Carbon dioxide (89 per cent) and nitrous oxide (two per cent), result from combustion processes that take place at the compression facilities contribute to the remaining of 91 per cent of GHG emissions.

A Methane Emissions Management Model

The management of methane emissions at TransCanada is part of TransCanada's overall strategy towards Climate Change. The Climate Change strategy is guided by several principles developed by TransCanada, of which one principle is dedicated towards the development and implementation of a GHG emissions reduction program. The methane emissions management model (Figure 1) at TransCanada can be broken down into three tiers: i) Tier 1 - Senior Leadership Support, ii) Tier 2 - Program Management, and iii) Tier 3 - Execution and Monitoring. This model is based on TransCanada's experience in the development and implementation of a methane emissions management program. It was developed in order to maintain future methane emissions reduction efforts on natural gas pipeline system.

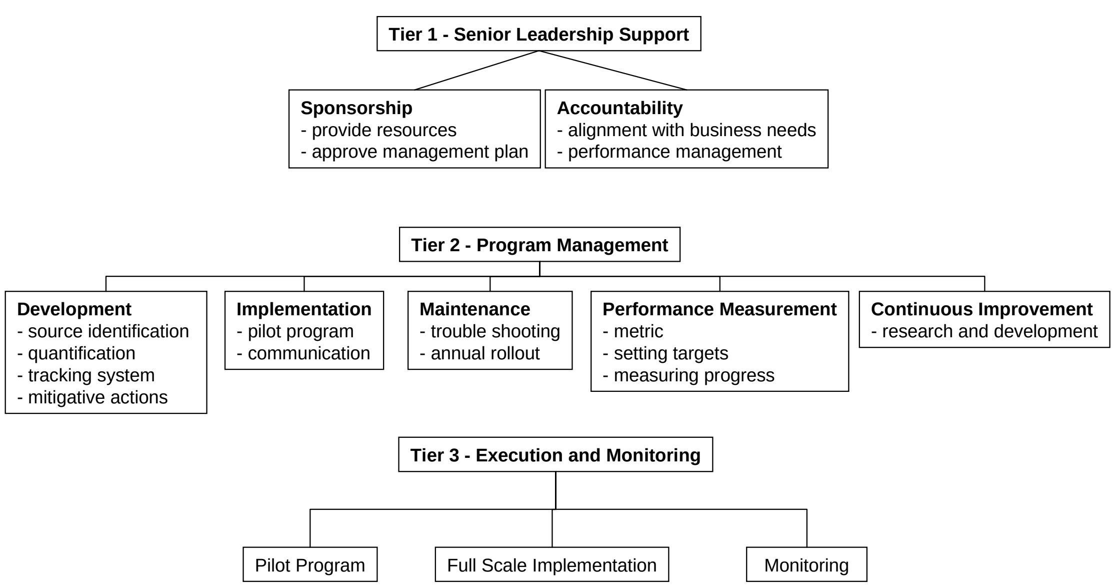


Figure 1: A Three-Tier model for methane emissions management from natural gas pipeline.

Tier 1 provides the necessary leadership and resources needed to carry out the management program. There are two key elements to Tier 1, sponsorship and accountability. One senior level leader within the firm is assigned the role of championing the program. This champion's role is to obtain support from leaders of the various departments that influence decision making with respect to methane emissions and control strategies. The other key role for this champion is to provide accountability for the program. That is, making sure that the program is aligned with business needs and that it becomes a measure of business performance. This alignment demonstrates to all parties that management of methane emissions is an important part of the business cycle.

Tier 2 and Tier 3 are carried out by a multi stakeholder team from the various interested departments across the firm. There are several components within Tier 2; development of an emissions management program is the first step and it involves identification of emissions sources, quantification of emissions, development of a system to track emissions and take mitigative actions. The identification emission sources leads to the development of techniques for emissions quantification. In some cases, quantification means the use of standard engineering calculations to quantify emissions. While in other cases, it may involve research and development work to develop procedures and protocols to quantify emissions. In order to control and effectively manage methane emissions mitigative actions need to be investigated and implemented. The next step in the management plan is it's "Implementation." There are two components to this stage, development of a pilot program and a communication plan. The pilot program should be a focused effort that attempts to address possible issues that will arise in the full scale implementation of the management program. Some considerations for the pilot program are, geographical area, audience, sites for field testing the quantification and tracking systems, and evaluating mitigation options. This communication needs to be focused on all levels of management and employees involved with the program.

The management program will require ongoing "Maintenance." This maintenance needs to be carried out with a mechanism for trouble shooting during the annual roll out of the program. The annual roll out is an opportunity for communicating messages and addressing issues that arise in the previous year. Performance measurement is an important component in the overall management plan. The first step is to determine a metric for the performance, the next is establishing both short term and long term targets and then establishing a periodical system of measuring progress. Continuous improvement is a business value as well as an environmental ideal. Research and development is an important tool for achieving this ideal. Special effort needs to be put forth so that new and innovative ideas for emissions quantification, mitigation and management are continually sought after.

The final stage of the model, Tier 3, is Execution and Monitoring. There are three components to be considered at this point: implementing a pilot program, full scale implementation and ongoing monitoring. The pilot program phase is really the opportunity to assess the program and its effectiveness on a small scale. A comprehensive pilot program is needed before full-scale system implementation. Another important element is monitoring, where a process is put in place to asses the program on continuous basis.

The TransCanada Experience

Methane is emitted to atmosphere during the construction and operation of gas metering stations, gas compressor stations, valve sites and from the pipeline itself. There are two categories of methane emissions arising from TransCanada's operations; fugitive losses and vented emissions. Fugitive losses are either engineered emissions of methane or leakages that occur on equipment such as valves and flanges. Vented emissions of methane arise from the evacuation of natural gas (which is mainly composed of methane) from pipelines, losses from compressor starts to purging of pipelines. The methane emissions management program is facilitated by the Department of Community, Safety and Environment. However, it is not a completely integrated system of methane emissions management. This is shown in Figure 2. Fugitive losses from TransCanada's pipeline network are managed by a multi stakeholder team, known as the Fugitive Emissions Management team (FEMT) and the vented emissions are managed by the Blowdown Emissions Team.

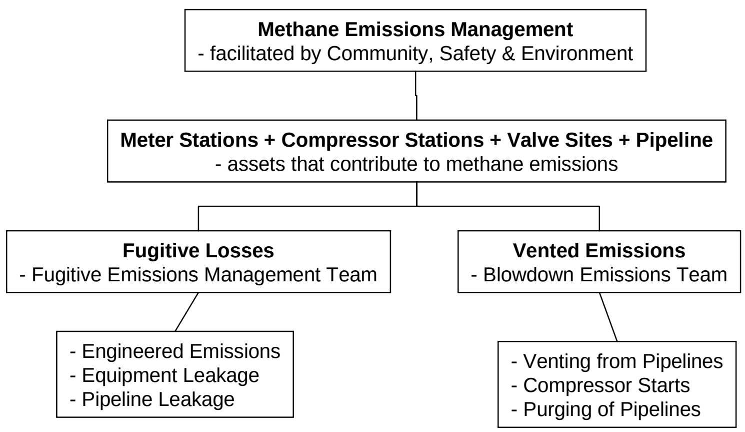
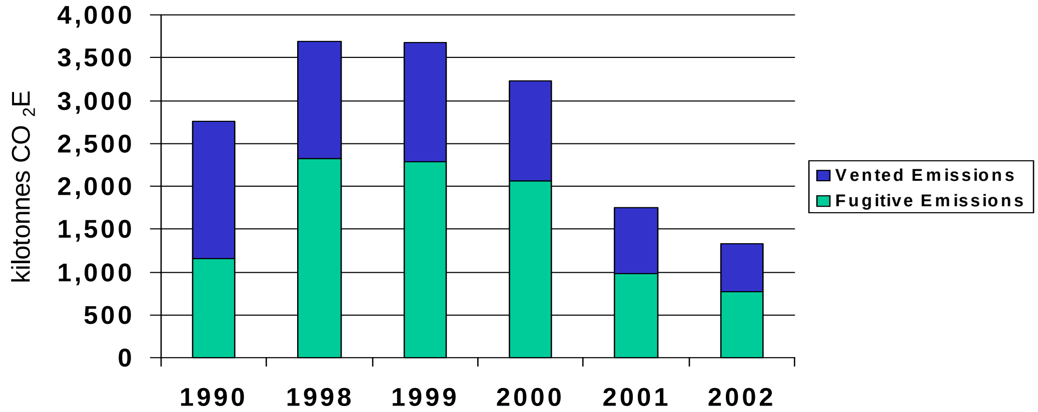


Figure 2: The methane emissions management structure at TransCanada is divided into managing fugitive losses and vented emissions.

The system to manage methane emissions is not fully integrated because both fugitive emissions and vented emissions require a different approach to management. In the case of fugitive losses, they are small sources of emissions from thousands of continuous leaking components. These need to be identified, prioritized and repaired in order to manage them effectively. Vented emissions are large single events of methane releases to atmosphere. In many instances, vented emissions are avoided or greatly minimized by applying a mitigation options. In 1990, fugitive losses accounted for 42 per cent of methane emissions and in 2002 fugitive losses accounted for 74 per cent of methane emissions. Over all methane emission declined significantly, 72 per cent, between 1990 and 2002 (Graph 1).



Graph 1: The contribution of vented and fugitive emissions to total methane losses from TransCanada's pipeline operations.

3.1 Management of Fugitive Losses

The FEMT is comprised of management and personnel from engineering, representatives maintenance regions across TransCanada and the environment department. The team is sponsored by a senior management representative. There are three major areas of program development and management for the FEMT. This is shown in Figure 3.

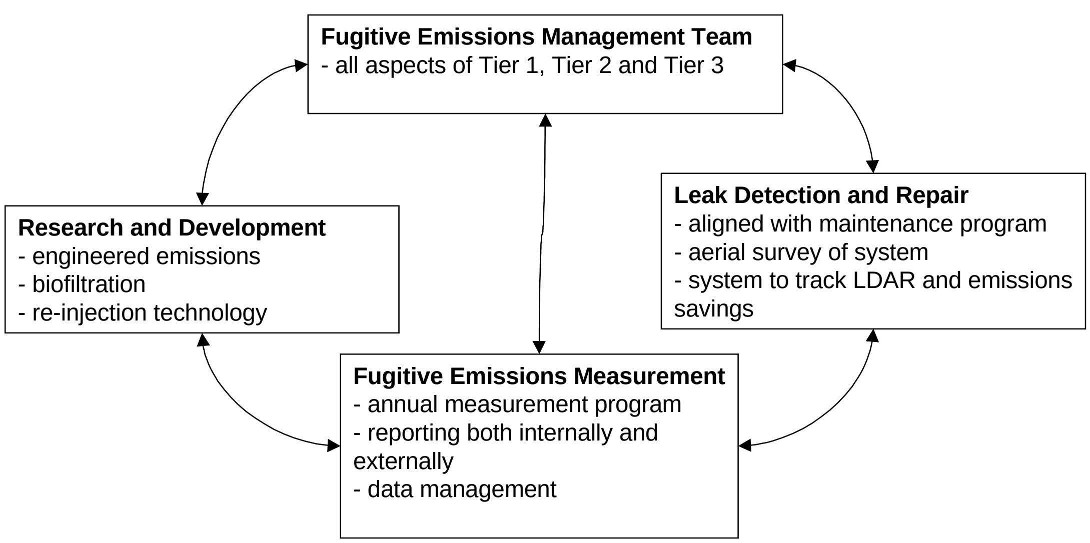


Figure 3: The fugitive emissions management team has three major areas of management responsibilities, research and development, fugitive emissions measurement and implementing a leak detection and repair program.

The key element behind the measurement program is the device High Flow Sampler, which was developed through collaborative research with government and industry groups. This technology has allowed TransCanada to accurately measure fugitive losses. Approximately 20 per cent of the facilities are subjected to High Flow Sampler measurements annually. The data collected from these measurements are used to develop emission factors for TransCanada facilities and are used to report emissions internally within TransCanada and externally. It also provides the basis for setting annual targets for fugitive emissions reductions.

In parallel with the measurement program, is the Leak Detection and Repair (LDAR) program. This program is closely aligned with TransCanada's preventive maintenance program and is administered through this process. The LDAR program is an annual activity for selected facilities across Canada. A system has been implemented using the FEMT to track the LDAR progress and resultant savings in emissions from mitigation activity.

There are two research initiatives underway to address engineered emissions. One is a biofiltration project, where methane is oxidized in a biofilter cell into carbon dioxide. This reduces global warming impacts by 85 per cent. The other major initiative is research into the re-injection of engineered emissions into the pipeline system. In 2002, approximately 191,000 kilotonnes of carbon dioxide equivalent of fugitive losses were avoided from being emitted to the atmosphere.

3.2 Management of Vented Methane

The management of vented methane is a shared responsibility between the engineering and operations department. The Blowdown Emissions Team monitors and facilitates the management of the vented emissions. A senior management representative sponsors this team and a variety of stakeholders are represented on this committee.

A tool called the Outage Decision Model (ODM) is a tool that has been developed by TransCanada's operations planning group to facilitate how pipeline and system outages are addressed. Construction and maintenance activity along the pipeline facilities often require the system to come off line. In the past, this has been synonymous with the venting of methane. Outages along the system also have a financial impact to TransCanada in the form of the value of natural gas that is vented and lost revenue during the outage time.

Tracking of methane fall into two categories, actual emissions emitted to atmosphere and the emissions saved by implementing mitigative measures. The volume of methane emissions saved is captured by the emissions tracking system that is managed by the operations planning group. The methane vented is captured in TransCanada gas accounting system. When an outage is required, a request in put forth to the operations planning group. The ODM is used to determine the best course of action for the outage, which includes mitigation techniques (Table 1). During the outage itself, field personnel are required to fill out forms that provide detailed operations information that allow the gas accounting system and the emissions tracking system to determine the volume of methane vented and saved.

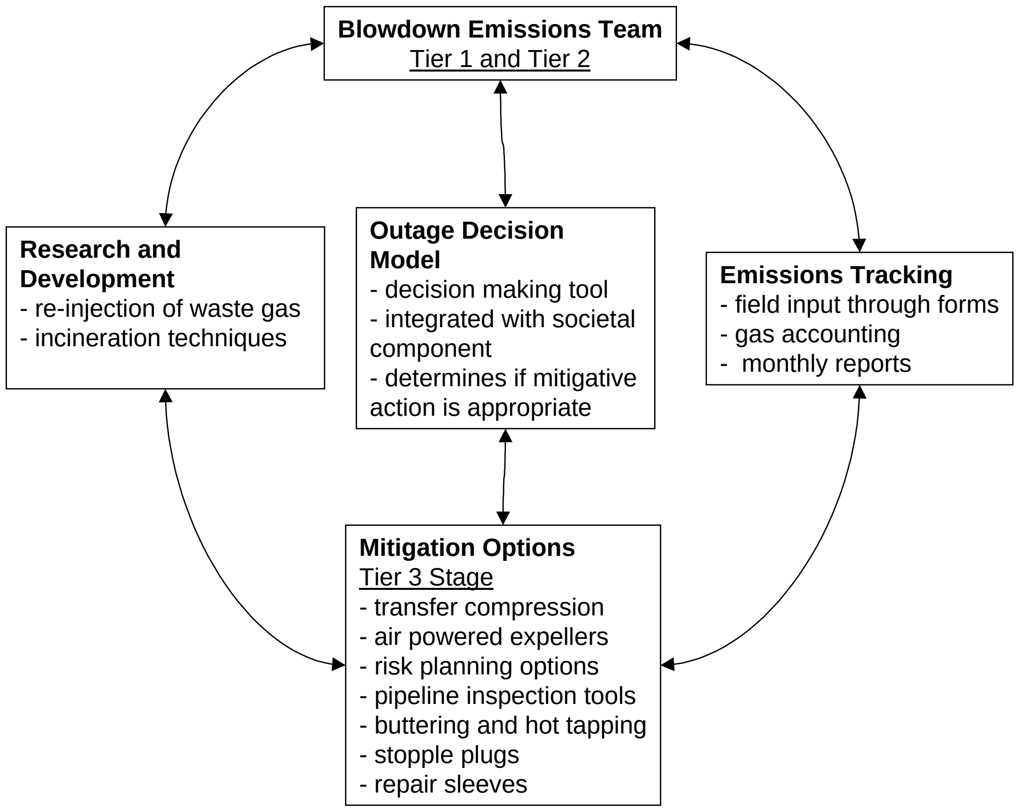


Figure 4: Venting of methane emissions to atmosphere, the application of the appropriate methane mitigation options and savings from emissions reduction activities are monitored and managed by the Blowdown Emissions Team.

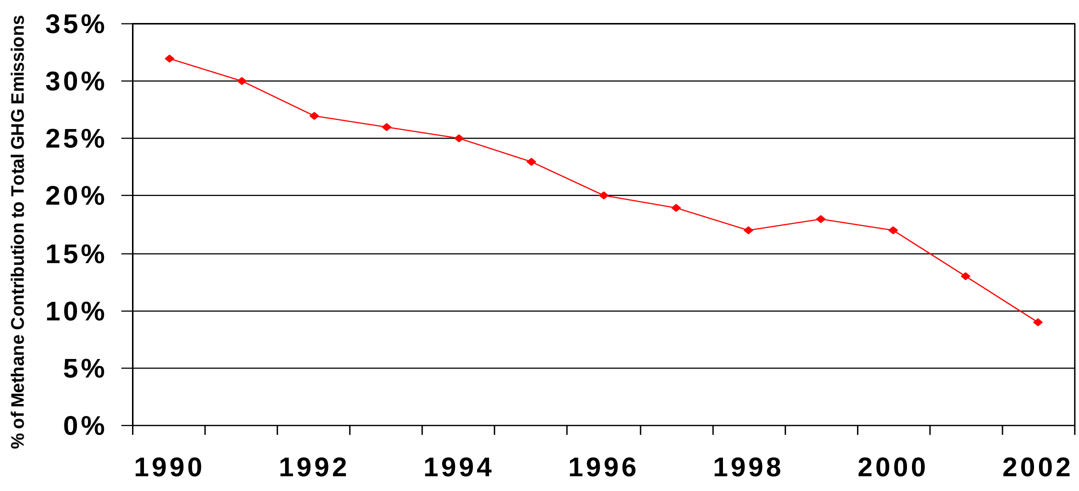
Table 1: Summary of Mitigation Options and Savings for Vented Emissions

Mitigation Option	Description	2002 Savings (tonnes CO_2E)
Transfer Compressors	When a section of pipeline is taken out or service for construction or maintenance, one or more transfer compressor is used to pump gas from the isolated section to a pipeline that is still in service.	362,000
Air-Powered Expellers	After transfer compression has been completed, small amounts of residual methane remain in the affected pipeline section. The methane is removed using a fan-type expeller that draws off the residual gas from the pipeline section being repaired. Air is used to drive the expeller, instead of methane.	5,730
Incineration	Some methane left in pipelines after the use of transfer compressors. The remaining gas is usually vented to atmosphere. Incineration allows for the remaining methane to be oxidized and lower the GHG emissions emitted to atmosphere. A pilot test was conducted in 2002.	1,100

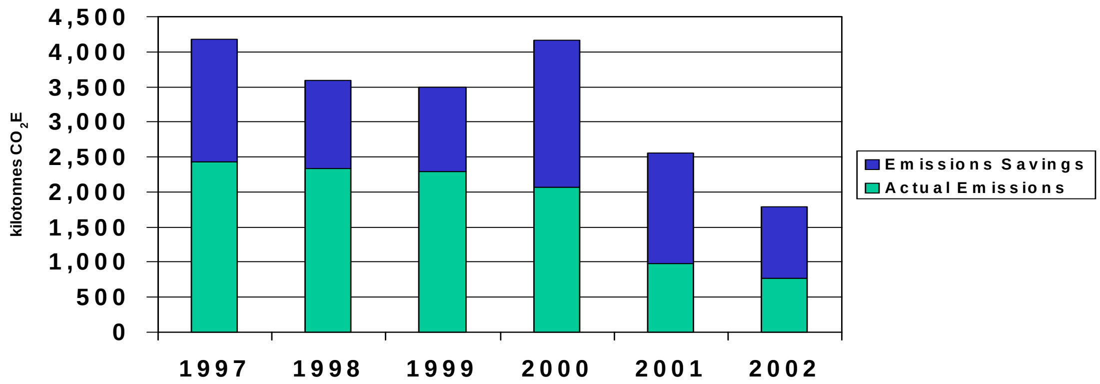
Mitigation Option	**Description**	**2002 Savings (tonnes CO_2E)**
In-Line Inspection Tools	These are tools, called "pigs," that are commonly used to inspect the internal condition of pipelines. TransCanada has enhanced this tool so that it can detect stress corrosion and cracking. Thereby, reducing the need to vent gas to atmosphere and reducing methane emissions.	Not Quantifiable
Valve Sealing	This is a TransCanada derived procedure that allows the application of a special sealant and avoids the need to vent gas from a pipeline.	12,540
Buttering and Hot Tapping	These are procedures that allow for a section of pipe to be added on a existing section without the need to vent gas to atmosphere.	374,000
Repair Sleeves	These are fibre or steel enforced sleeves that are used to repair corrosion on a pipeline system and avoid the need to vent methane to atmosphere.	220,000

<u>Results</u>

The baseline year for GHG emissions has been established at 1990 in accord with the Kyoto protocol. In 1990, methane emissions contributed to 32 per cent GHG emissions from pipeline operations (Graph 1). Since then, due the implementation of a methane emissions management program, the total methane emissions have declined, contributing to only nine percent of total GHG emissions in 2002. Methane emissions, in some past years, would have been double or more without the implementation of the existing management plan for vented and fugitive losses (Graph 2).



Graph 1: The contribution of methane emissions to total GHG emissions has declined steadily since the baseline year of 1990



Graph 2: Methane emissions would have doubled without the implementation of reduction and management program.

Conclusions

There are a number of facets to TransCanada's methane emissions management program: source identification, quantification, tracking system, mitigative actions, pilot program, full scale implementation, monitoring progress, and continuous improvement through research and development. The management of methane emissions is coordinated through a multi stakeholder team that consists of personnel from engineering, field operations, environment and system operations.

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14 General Motors Corporation: An Environmental Performance Review[1]

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Anshuman Khare

Abstract

This paper reviews the global environmental performance of General Motors Corporation (GM), as publicly reported. GM has a global presence in automotive manufacturing and other non-automotive business interests. GM's products and facilities play a contributing role in the ecological footprint due to its global market presence.

GM's environmental reporting is based on the CERES (Coalition for Environmentally Responsible Economies) principles. CERES is a coalition of environmental, investor and advocacy groups, which have a mutual interest in a sustainable future. Environmental performance elements reviewed are public accountability, plant performance, product performance and stakeholder relationships.

GM's global performance can be summarized as being above expectations in the areas of public accountability, plant performance, and stakeholder relationships. Alternatively, GM is considered to be below expectations with its product's average fuel economy performance in North America. While the model-by-model performance has improved, the overall fleet has not improved since 1994 due to a market shift from passenger cars to less fuel-efficient SUV's and personal use trucks. Unlike competitors Toyota and Honda, GM does not have a small fuel-efficient hybrid passenger car. These hybrid products provide the ability to improve the average fuel economy rating for a manufacturer.

Keywords: sustainable development, automotive industry, General Motors environmental reporting, CERES, GM sustainability.

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[1] **General Motors Corporation (Canada) – An Environmental Performance Review** (Anshuman Khare & Jerome Hoog): Published in *Perspektiven und Facetten der Produktionswirtschaft* (Eds.: Udo Mildenberger, Jochen Wittmann , Karsten Junge), Gabler Verlag, Wiesbaden (Germany), July 2003 / pp 55-71.

Introduction

General Motors Corporation (GM) publicizes its commitment to the environment and to sustainable development. GM's core business is the design, manufacture, sales, marketing, distribution, and financing of automotive vehicles and related products. GM has strategic partnerships and Joint Ventures (JV's) with other automotive manufacturers such as Fiat Auto, Subaru parent Fuji Heavy Industries, Isuzu, SAAB, Suzuki and Toyota (vehicle assembly). GM's other interests include Allison Transmission Division, GM Locomotive Group, GM Defense, GM Service and Parts Operations and OnStar.

GM has a global reach, with assembly operations in 30 countries, and a marketing presence in more than 90 countries. In the year 2001, GM employed approximately 365,000 employees and purchased from 30,000 suppliers. GM's 2001 market share was 26.9% in North America and 15.1% worldwide. Total worldwide vehicle sales in 2001 were 8,073,000 vehicles. (GM 2001 Annual Report, p.42). As a result of this significant presence in the marketplace, GM's manufacturing facilities as well as it products have a significant impact upon the global environmental footprint.

Key performance indicators, which affect the ecological footprint, are shown in **Table 1** (GM Corporate Responsibly and Sustainability Report, 2001-2). For example, favourable performance was realized for Carbon Dioxide emissions and water consumption, while unfavourable performance was realized for solid landfill wastes.

With a global market share of 15.1% and an annual vehicle production rate of 8 million units, any improvements in key performance indicators will improve the global ecological footprint. For example, a 10% reduction in landfill waste would improve the ecological footprint from by 120,000 tons annually.

This report is to review GM's published information relative to its environmental performance. GM formed a relationship with CERES (Coalition for Environmentally Responsible Economies) in 1994, and as a result has endorsed the CERES Principles. An endorsement of the CERES principles represents a commitment by GM to continually improve its environmental performance, and accountability.

GM's accountability extends to a web based reporting system, using GRI or Global Reporting Initiative format (www.globalreporting.org). GM has continually expanded its geographic scope of reporting to include its other international operations.

Performance Review

GM's public accountability has a 'triple bottom line' scope of environmental, social and economic performance. This sustainable development review is focused on GM's environmental performance. This review is segregated along the lines of Public Accountability, Manufacturing Performance, Product Performance, and Stakeholders Relationships (CERES, 2002).

Table 1: Key Performance Indicators of GM's Ecological Footprint

Indicator	1999	2000	2001
Economic indicators			
Sales (US$ in millions)	$176,558	$184,632	$177,260
Earnings/(loss) (US$ in millions)	$5,686	$4,972	$1,475
Vehicle Production (millions)	8.651	8.597	8.560
Global vehicle market share (%)	15.6	15.0	15.1
Dividend (US$/Common Share)	$2	$2	$2
Employees	391,000	389,000	365,000
Environmental indicators			
Carbon dioxide emissions (tons)	15,560	13,590	13,200
Waste disposed to landfill (tons)	1,138	920	741
Water consumption (m^3)	72,750	73,168	66,193
Product: Average grams CO_2 per mile	369	368	367 (Est)
Process: Sites certified to ISO 14001	NA	81%	96%
Suppliers: Number certified to ISO 14001	NA	NA	600

Public Accountability

GM's public accountability is communicated through the GM Annual Report, CERES Annual Environmental Report (www.ceres.org/), and thorough its corporate website (www.gm.com). GM's reporting has progressed from a North American based report, to a report on its global operations. "The GM reports are viewed as comprehensive and informative by a broad range of stakeholders. Moreover, GM is widely regarded as a leader in promoting the Global Reporting Initiate (GRI), a multi-stakeholder project aimed at creating a global framework for sustainability reporting" (CERES, 2002; p.2).

In 1994, GM endorsed the CERES Principles. "An endorsement of the CERES Principles represents a company's commitment to continual environmental improvement and to public accountability for it environmental impact" (CERES, 2002; p. 4). The endorsement involved expectations on GM's performance, in the areas of Public Accountability, Plant Performance, Product Performance, and Stakeholder Relationships. In contrast, Ford Motor Company endorsed the CERES principles in 1999 (Ford website, 2002). Therefore, GM has been ahead of its main competition in utilizing CERES as part of its public accountability.

The CERES review of GM notes that performance is above expectations in the three areas of public accountability, plant performance, and stakeholder relationships. But GM has not met CERES overall expectations with respect to fleet fuel economy since model-by-model gains in fuel economy have been offset by a market shift to less fuel-efficient larger sized vehicles such as SUV's, minivans and trucks. (CERES, 2002; p. 8).

"An environmental report offers the public a window of corporate performance at one particular moment in time. It can also explain future goals and how policies work to achieve them, and in the end, assist targeted stakeholders in better understanding the challenges and strengths of the disclosing organization" (Piasecki et. al., 1999; p. 273). The global society is becoming more keenly aware of environmental concerns and the environmental performance of organizations. As a result there is a potential for an increase of 'green consumerism'. Prudent 'green capitalist' firms can capitalize on this market potential (Piasecki et. al., 1999). GM is in a leadership position to cater to a potential increase in the market for green products. GM is improving is public accountability, and with its vast financial resources, is in a strong position to be a leader in new green products and green facilities.

Manufacturing Performance

GM has set internal goals to reduce the amount of waste materials, which are not incorporated into the final products. Essentially, manufacturing performance can be divided into two elements, facility performance and supplier performance. The environmental performance of suppliers is an important element of overall non-product output (NPO), due to the ever-increasing levels of outsourcing of manufacturing operations. Therefore it would be easy to transfer an NPO environmental issue to a supplier and/or a different region such as a developing economy.

Facility Performance

GM measures it's plant performance in terms of consumption in an environmental profile and eco-efficiency profile in terms of vehicles produced and sales dollars. This performance is noted in **Table 2** (GM Sustainability, 2000).

Table 2: Global Environmental Profile

Environmental Profile	Measure	1999	2000	2001	Performance
Energy Consumed	Gigawatt Hours	38,550	37,578	33,856	12.2%
Water Consumed	Cubic Meters	72,750,694	73,168,350	66,193,467	9.0%
CO_2 GHG emissions	Metric Tons	15,560,000	13,590,000	13,200,000	15.2%
Recycled Non Product Output	Metric Tons	2,903,000	2,891,000	3,022,000	(4.1%)
Non-recycled Non Product Output	Metric Tons	1,138,000	920,000	741,000	34.9%

GM's key environmental profile performance indicators show improvement over the previous reporting period in all areas. Energy efficiency gains are being achieved though plant level process improvements such as more efficient painting, metal casting, powerhouse energy conversion systems and energy management systems. The energy management system for example controls plant lighting, heating, ventilation, and air conditioning to achieve optimum performance. (GM Sustainability, 2000, p.3.9-10).

Water consumption has been reduced through the implementation of more efficient water management systems. For example, the Oshawa Ontario Truck plant achieved a 50% reduction in water consumption by utilizing a humidification water recirculation system in the paint facility. Other examples include installing instrumentation to control water usage through the cooling tower systems.

Non product solid waste output has been reduced though the use of returnable packaging, recycling small plastic protective caps, reclaiming aluminum splashes, reselling fly ash as a potting soil additive, regrinding glass for use in reflective paints and reclaiming cafeteria grease as a pet food additive (GM Sustainability, 2000, p.3.14-15).

The eco-efficiency profile, as it relates to environmental performance on a per-unit and per sales dollar basis, is shown in **Table 3** (GM Sustainability, 1999; GM Sustainability, 2000).

Table 3: **Eco-efficiency Profile**

	Eco efficiency Profile	**Measure**	**1999**	**2000**	**2001**	**Improvement**
	Vehicles produced per:					
1	Gigajoule energy consumed	GJ	224.41	228.78	252.84	12.7%
2	Cubic meter water consumed	M3	0.12	0.12	0.13	8.8%
3	CO2 equivalent emitted	Metric ton	0.56	0.63	0.65	16.6%
4	Non-recycled Output	Metric ton	7.60	9.34	11.55	52.0%
	$Sales per:					
5	Gigajoule energy consumed	GJ	$4,580	$4,913	$5,236	14.3%
6	Cubic meter water consumed	M3	$2.43	$2.52	$2.68	10.3%
7	CO2 equivalent emitted	Metric ton	$11.35	$13.59	$13.43	18.3%
8	Non-recycled Output	Metric ton	$155	$201	$239	54.2%

The eco-efficiency profile shows improvements over the previous reporting period, with energy consumed per sales dollar showing a marginal decline, due to negative product pricing occurring in the marketplace.

GM also tracks it's waste reduction activities as to specific initiatives. Savings realized for some example initiatives in the past reporting period include reduced printing costs of catalogues (US$996,000), remanufacture of used transmissions for spare parts (US$788,000) and recycling of foundry sand and reuse for asphalt manufacturing (US$210,000). The total amount of recycled waste in 2000 in North America is

2,073,398,210 kilograms, for a total savings of US$205,916,300 (GM Sustainability, 2001).

This performance is in line with GM's vision to "continue initiatives to improve resource efficiency and clean production" (CERES, 2002; p.10).

Supplier Performance

ISO 14001 is an environmental management system standard, which requires an organization to have a written program, provide employee training, and that the organization is aware of pertinent environmental regulations (GM Sustainability, 2000, p.10).

"By the end of 2001, all GM manufacturing sites are expected to bring their environmental management programs into conformance with either the ISO 14001 standard or the European Union, Eco – Management and Audit Scheme (EMAS). GM's suppliers play a critical role in determining environmental performance, quality reliability and durability. GM is requiring all of its direct product suppliers to have an environmental management system in place that is compliant with ISO 14000 by the end of 2002" (GM Sustainability, 2000; p.4).

Although GM will require ISO 14001 compliance from their suppliers by 2002, there are several outstanding questions. Due to GM's global sourcing strategy, which includes purchasing parts from suppliers located in developing economies, it is unclear as how quickly GM will enforce this requirement. For example a supplier in Mexico could potentially resist compliance with the ISO 14001 certification requirement, but GM will favor retaining business with this supplier country due to favorable commodity costs. The other concern is that the ISO 14001 standard may be less stringent than GM's internal continuous improvement target. As a result, GM could potentially outsource manufacturing operations to a supplier, which has an environmental performance, which is less than that which GM would have had. As a result, GM could show a performance improvement for its internal operation, while the ecological footprint may be unchanged, or deteriorate due to performance by a supplier.

Product Performance

GM's product performance reporting covers the areas of Product Life Cycle, The Global Design Process, Recycled Content, End of Life Vehicles and New Vehicle Fuel Efficiency.

Product Life Cycle

GM is committed to "reducing waste and pollutants, conserving resources and using recycled materials at every stage of the product life cycle" (GM Sustainability, 2001; p 5.6). The intent is to integrate life cycle thinking into the design, manufacture, use and disposal of GM vehicles.

GM manages the Product Life Cycle through the Design and Manufacture for the Environment (DME) Committee, which was established in 1991. The committee is charged with establishing environmental targets, which the design is required to meet at the end of the design process. In addition, the DME committee is to document the environmental performance of the vehicle at design freeze, and then present these attributes as a product design feature for marketing purposes (GM Sustainability, 2001; p 5.6).

Currently, there are no specific performance targets or performance measurements provided in GM's publications. Piasecki et. al. (1999; p. 121) state, "… often companies inject environmental considerations at the end of the product line." It appears that GM is publicly stating that product life cycle targets and measurement are important but no factual reporting is present to substantiate this position.

The "Design for the Environment (DFE) is the systematic approach for evaluating the environmental consequences of products and processes and their impact on human health and the environment" (Piasecki et. al., 1999; p.146). Additionally the Life Cycle Assessment (LCA) "…is a systematic tool used to analyze and evaluate the resource requirements and environmental burdens associated with a product, it's related processes, distribution requirements and applications. The analysis undertaken to identify quantity, and evaluate the materials and energy used to produce and use a single corporate product over its entire life cycle" (Piasecki, et. al., 1999; p.147).

The advantage of LCA is that it is a powerful tool to understanding the environmental issues related to product design and production. The disadvantage of the LCA process is that resources are required to perform the assessment in addition to accommodating possible product redesign activities.

Convergence of DFE and LCA in new product development offers "a comprehensive framework for developing sustainable new products or improving existing products by minimizing their negative aspects" (Piasecki et. al., 1999; p.150). A full life cycle assessment can uncover potential issues pertaining to environmental regulation and review by environmentalists. The benefits of Potential Product Alternatives are noted in **Table 4** (Piasecki et. al., 1999; p.148). It also identifies the potential benefits of compliance to laws or the scrutiny of environmentalists.

Table 4: Uncovering Potential Product Alternatives

	Inventory Assessment	Impact Assessment	Improvement Assessment
Elements	Objective qualification of environmental burdens	Subjective evaluation of burden effects	Systematic evaluation of opportunities to improve the burdens
Key Aspects	Identify elements and quantify in terms of inputs and outputs	Resource depletion, health risks, safety, environmental degradation	Changes needed to bring about the desired improvements
Goals	Identify inputs and outputs, evaluate classification of levels and loading	Understanding potential implications on sustainability of products and processes	Opportunities to reduce the environmental burdens leading to sustainability

Currently, GM's reporting does not measure Product Life Cycle data. Reported data are for the internal manufacturing environmental impact. Excluded is data for supplier performance, and end of life recyclability.

The Global Design Process

GM's global design process is "environmental and recycling requirements are put into technical specifications for all future vehicles. A common global template is used to establish these requirements regardless of where we develop the vehicle. The requirements are then tracked as a vehicle is designed to make sure they are achieved. The requirements include specifying vehicle recyclability and recoverability, use of recycled materials, compliance with restricted and reportable materials requirements and end of life vehicle treatment" (GM Sustainability, 2001; p.5.6). The DME committee administers the global design process. To meet this initiative, the design engineers adhere to the specifications on recycling and restricted materials.

A review of the sustainability as well as the CERES report does not provide measurable performance or targets for the global design process.

Recycled Content

To maximize quality and minimize the environmental impact, product designers seek materials which are non toxic, are renewable where possible, increase the recyclable content percentage and give preference to recycled goods over virgin materials. The example provided is that in 2000 "…more than 30,000 tons of recycled materials were incorporated in new Vauxhall and Opel vehicles, six times more than in 1991" (GM Sustainability, 2001; p.5.6).

GM tracks current and pending product regulatory requirements on a global basis in a Global Legal Database system. The Legal trading database operates in conjunction with the engineering product design database to provide regulatory input into the design process.

Before materials can be approved for use in new products, they undergo an assessment for potential health and environmental impacts. Two complementary processes are utilized. "The first, the Productive Materials Review Process (PMRV), supports the release and material engineering community and is part of the Design for Environment process. If a material is approved through this process, the information is then sent to the plant Hazardous Materials Control Committee (HMCC), the second process, for local review and implementation" (GM Sustainability, 2001; p.5.6).

Therefore GM has a system and a process in place to promote the use of recycled products in its new product development process.

In terms of renewable, natural material resources, GM states "Opel and Vauxhall are increasingly using flax, hemp, jute, coconut, sisal and wood fiber molding material or rubberized hair – mostly in door and roof linings, boots, rear window shelves and seat backrests. In the Zafira (an Opel van) alone, about 1,300 metric tons of renewable natural resources are used annually. Renewable natural resources constitute a compelling alternative to synthetic materials for both ecological and functional reasons" (GM Sustainability, 2001; p.5.7).

GM sites an example of renewable resource use for ease of recyclability in their products. The concern is that GM uses an example of favorable performance at their European division, but there is no reference to natural resource use in their high volume North American operation.

The sustainability report comments on the achievements of the GM European division but provides no performance metrics for other global operations. The only recycled material metrics provided are pertaining to facility performance and for non-product output (NPO).

The CERES report makes no further comment on product recycled materials other than it's statement that "GM has increased the recycled content of many materials used in vehicles and has increased the recyclability of vehicles at end-of-life" (CERES, 2002; p.2).

There does not appear to be solid performance metrics in place for recycled and renewable materials usage in new products. To be effective, we need to "ensure the metrics are driving the right or intended behaviour" (Piasecki et. al., 1999; p.49).

End of Life Vehicles

"To meet regional requirements on end-of-life vehicles, we have organized a global End-of-Life Vehicle Team. The team ensures that we provide the necessary data to various regions in a common manner. In North America, a centralized effort was initiated to provide material and disassembly information to the dismantling industry. A system is in place to generate this information for all vehicles that are marketed into regions that have special ELV requirements. Opel and Vauxhall are committed to working with industries involved in taking back, treating and scrapping ELV's to reduce the amount of automotive waste going to landfill to 5% of a cars weight as compared to 25% in 2000, over the next 15 years" (GM Sustainability, 2001; p.5.19).

"The European Directive of End-of-Line (ELV's) requires final vehicle owners to return ELV's to authorized collection networks to obtain 'certificates of destruction' required to deregister vehicles" (GM Sustainability, 2001, p.5.19).

In North America, "ELV manuals provide automotive dismantlers with information on which parts of a vehicle can be recycled. Currently 75% of a car is recycled because the majority of it is metal. But few plastics on vehicles are recycled due in part to lack of information available to dismantlers. With ELV manuals now easily accessible, there is potential to significantly increase the percentage of the vehicle that is recycled" (GM Sustainability, 2001; p.5.19).

The European Union directive on ELV's target values (GM Sustainability, 2001; p.5.20) are as following:

1. By 2006 – 85% by weight reuse/recovery and 80% by weight reuse/recycling.
2. By 2015 - 95% by weight reuse/recovery and 85% by weight reuse/recycling.

The CERES report (2002) reports that as part of the ELV initiative, GM has phased out the use of mercury switches and PVC materials in it's products.

It is apparent that there is limited governmental or industry direction as to target performance metrics for End-of-Life recycling in North America.

GM's elimination of mercury and PVC is consistent with removing 'stock wastes' from the environment. Stock wastes are defined as being wastes such as heavy metals, which remain unchanged in the environment after disposal (Jacobs, 1993).

New Vehicle Fuel Efficiency

"Greenhouse gas emissions from our vehicles are closely related to the fuel efficiency of those vehicles. Carbon dioxide (CO2), a greenhouse gas, is emitted by the clean combustion of gasoline or diesel fuel in an engine. Greater fuel efficiency therefore means fewer CO2 emissions" (GM Sustainability, p.5.9). Since there is an increase in concern as to global warming, recent increases in fuel pricing and enhanced concerns over overall fuel economy, GM proposes that technology, innovation and partnerships are required to address this concern.

Technology and innovation initiatives are based on short term and long term plans. The short-term plans include the following:

- "Introducing new and more efficient engines using technologies such as direct injection displacement on demand and innovative weight savings;
- Designing and adapting engines to use alternative fuels such as ethanol, LPG, CNG and bio-fuels;
- Introducing hybrids that combine an extremely efficient internal combustion engine with electric motors." (GM Sustainability, 2001; p.5.9)

The long-term strategy is to make the internal combustion engine more efficient and to develop fuel cell technology. Fuel cells dramatically reduce CO2 emissions with fossil fuels and have zero emissions with hydrogen fuel.

To achieve fuel efficiency goals, GM proposes to enter into partnerships with industry energy companies, government and society (GM Sustainability, 2001).

GM leads the major auto manufacturers in the US in terms of "model to model truck fuel economy comparisons based on US EPA data. In addition, we lead all other domestic manufacturers in model to model passenger car fuel economy performance" (GM Sustainability, 2001; p. 5.10).

In 2001, GM has met the CAFÉ passenger car standard and was 0.2 mpg under the CAFÉ standard for the light truck market. In Europe, Opel's average fuel economy is 7.0 liters per 100 kilometers in year 2000. This represents a 30% improvement over 1978. The long-term goal in Europe is 5.7 liters per 100 kilometers per average passenger car in 2008 (GM Sustainability, 2001).

GM has in the past been a leader in new environmental product technologies. For example, GM has a number of products on the market such as an ethanol E85 pickup truck, CNG pickup truck and an all-electric EVI. GM has a hydrogen fuel cell powered Zafira prototype van in operation in Germany.

In 2004, GM plans to introduce a full size pickup truck with a hybrid powertrain. This powertrain will provide a 15% improvement in fuel economy (GM Sustainability, 2001). Currently, GM appears to be ahead of the curve in terms of alternative fuel technologies such as ethanol, and CNG (Compressed Natural Gas) vehicles in North America. These fuels are cleaner burning and emit less CO2. The added benefit of ethanol is that it is a renewable resource, since it is manufactured from corn.

Of concern is that Toyota (Prius model) and Honda (Insight & Civic models) have small hybrid passenger cars in the market, which has the effect of improving their average fuel economy. Also, these new products put the respective manufacturers in the forefront in terms of powertrain technology, with the added benefit of providing a green image. Although GM was the first on the market with an EV1 small electric car several years ago, this program is now cancelled, with no replacement hybrid or electric product in the small car market. GM now appears to be ‘behind the curve’ in terms of North American small car hybrid products. There is no further indication from GM as to their small car hybrid strategy.

The CERES report comments that in the next 5 years, GM has agreed to pursue “breakthrough improvement in product performance, especially fuel economy and tailpipe emissions, through increased commitments to improving conventional technology, developing and marketing advanced technology vehicles and to design for environmental efforts.” (CERES, 2002; p.31) There is no further comment in CERES as to future fuel economy performance targets. The sustainability report provides little indication as to the future direction of technology or specific fuel economy targets.

There are four instruments with which economic activity can be constrained to meet environmental targets. These are voluntary mechanisms, regulation, government expenditures and financial incentives (Jacobs, 1993). The CAFÉ legislation in the US regulates and provides a target for fuel economy. The current initiative pursued by automakers in terms of technology is essentially due to voluntary mechanisms. If society wishes to fast track these technologies for improved fuel economy, then a change needs to take place in one of the three instruments regulation (CAFÉ), government expenditures (R&D), or financial incentives (tax break).

Stakeholder Relationships

Since the 1994 endorsement of the CERES Principals, GM increased it interactions with external stakeholders including government, environmental organizations, and suppliers. “In technical or strategic projects, stakeholders generally agreed that GM engaged in genuine dialogue and participated in a spirit of collaboration. On regulatory issues…stakeholders often viewed GM’s engagement as more perfunctory and guarded” (CERES, 2002; p. 20). The CERES organization is somewhat critical of GM’s inconsistent approach to stakeholder relations. A number of specific examples are provided to support this observation (CERES, 2002, p.20-21). On a comparative basis, GM is ranked as number 3 in terms of environmental reporting (CERES, 2002, p.11). This rank can be considered as being favorable.

GM should consider following the guiding principles of responsible care as that followed by the Chemical Industry. The Guiding Principles of Responsible Care are shown in **Table 5**. These principles have been modified for application in the auto industry.

Table 5: The Guiding Principles of Responsible Care

#	**The Elements of Responsible Care**
1	To recognize and respond to community concerns about products and operations
2	To develop and produce products that can be manufactured, transported, used and disposed of safely.
3	To make health, safety and environmental considerations a priority in planning for all existing and new products and processes.
4	To report information promptly to officials, employees, customers, and public on product and facility related environmental hazards.
5	To operate plants and facilities in a manner that protects the environment and the health and safety of employees and the public.
6	To extend knowledge by conducting or supporting research on the health, safety and environmental effects of our products, processes and waste materials.
7	To work with others to resolve problems created by past handling and disposal of hazardous substances.
8	To participate with government and others in creating responsible laws, regulations and standards to safeguard the community, workplace and environment.
9	To publicly promote the principles and practices of Responsible Care.

Note: Adapted from The Guiding Principles of Responsible Care from the CMA Chemical Manufacturers Association. (Piasecki et. al., 1999; p. 219).

Guiding principal number eight promotes participation with government to safeguard the community, workplace and the environment. It is recommended that GM consider placing extra effort into improving stakeholder relationships.

<u>Concluding Remarks</u>

GM has environmental reporting is based on the CERES Principles, which it endorsed in 1994. Environmental performance elements reviewed are public accountability, plant performance, product performance, and stakeholder relationships.

GM's performance can be summarized as being above expectations in the areas of public accountability, plant performance, and stakeholder relationships. The average fuel economy of GM's products has not improved since 1994.

The CERES organization has concluded that General Motors has performed favorably to the performance expectations established.

The initial questions as posted in the outline are reviewed as following:

1. *Does this organization comply with all environment regulations and internal performance targets within its global operations?* GM does not have a full global reporting system in place currently. There are a number of divisions in developing countries, which are not fully accounted for. GM China is one example.

2. *Is this organization aggressive enough in its sustainable development program?* GM is probably not aggressive enough, especially in the area of fuel economy. Competitors have more efficient products on the market.
3. *Are there further green opportunities, which the organization could capitalize on?* Further green opportunities are recycling of plant wastes, holding suppliers accountable for their environmental performance, and improvements in management of the product End-of-Life cycle.

Leadership in sustainable development will provide GM with cost improvements through waste reduction, and a strategic advantage in terms of 'green consumerism' in the marketplace.

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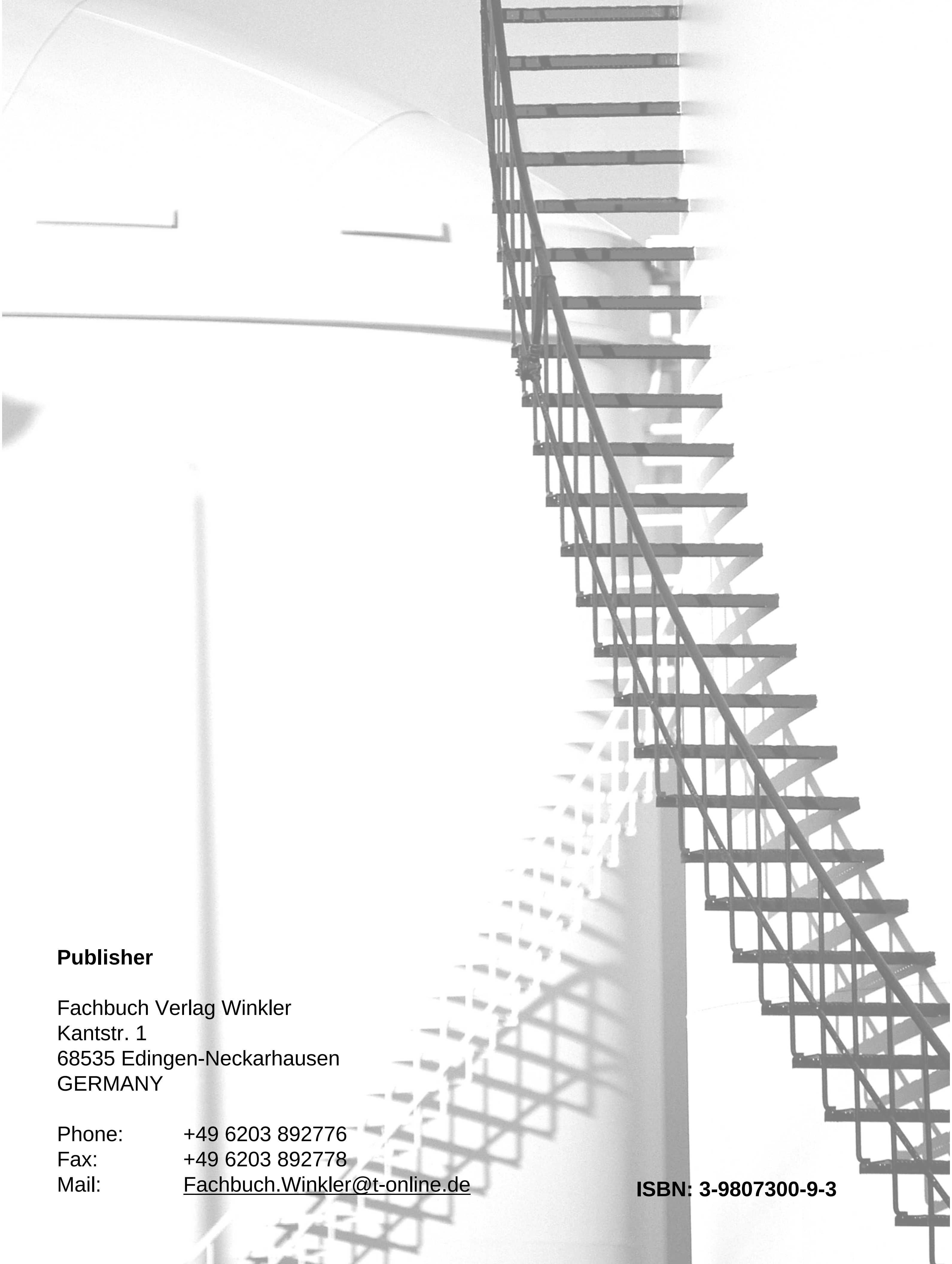

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