MAKING

GREEN

Energy Happen

carbon footprint biomass cellulosic ethanol switchgrass reduced carbon emissions solar

POLICY AND PRIORITIES WORKSHOP




APRIL 26 & 27, 2009

LAWRENCE NATIONAL CENTRE FOR POLICY AND MANAGEMENT

Richard Ivey School of Business The University of Western Ontario

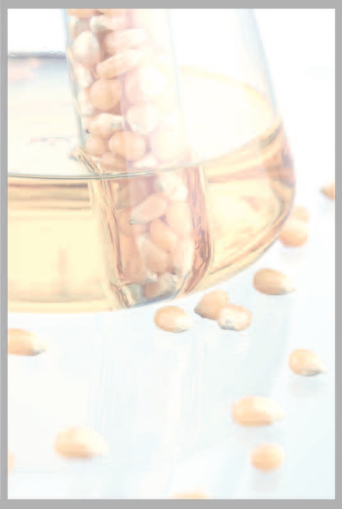
MAKING

GREEN Energy Happen

carbon footprint biomass cellulosic ethanol switchgrass reduced carbon emissions solar

POLICY AND PRIORITIES WORKSHOP



APRIL 26 & 27, 2009

LAWRENCE NATIONAL CENTRE FOR POLICY AND MANAGEMENT

Richard Ivey School of Business The University of Western Ontario

THE LAWRENCE NATIONAL CENTRE FOR POLICY AND MANAGEMENT

The Lawrence National Centre for Policy and Management bridges business strategy and government policy by: providing a uniquely informed forum for business and government to discuss policy formulation and implementation; educating future business leaders in public policy and government leaders in business strategy; and conducting leading-edge research on major issues that involve business-government coordination.

> *"If we could really achieve more cooperation between government and business, we would see a quantum leap in economic performance and productivity."*
>
> **Jack Lawrence**
> **FOUNDER**, LAWRENCE NATIONAL CENTRE FOR POLICY AND MANAGEMENT

At the Lawrence National Centre we provide opportunities for our students to be involved in the study, development, implementation, and monitoring of public policy. The understanding and application of legislation, regulations, and government policy is imperative in the world of business. Many are interested in careers within government, as professional public servants, where they can serve their country within Canada and around the world.

An increasing number of students are attracted to cross-enterprise programs at the Lawrence National Centre. This workshop is a great opportunity for them to participate in this national forum of business leaders, government officials and academics, as they contribute to building a more competitive Canada, through lending their expertise and commitment to the development of timely and innovative public policy.

These are times of renewal, not just for Making Green Energy Happen, but in the way we interact in partnership with each other, with our governments, and with our future leaders, our students. We now have the opportunity to influence bold decisions!

LAWRENCE NATIONAL CENTRE STUDENT ADVISORY COUNCIL

Adeniran, Adebola, *HBA 2011, The University of Western Ontario*
Cobena, Sandra, *The University of Western Ontario*
Gautier, Jennifer, *HBA 2011, The University of Western Ontario*
Gosselin, Sydney, *The University of Western Ontario*
Hayles, Scott, *The University of Western Ontario*
Judge, Hayley, *The University of Western Ontario*
Lindquist, Jeffrey, *HBA 2011, Richard Ivey School of Business, The University of Western Ontario*
Ross, William, *HBA 2010, Richard Ivey School of Business, The University of Western Ontario*
Scott, Chris, *The University of Western Ontario*
Markvoort, Peter, *HBA 2008, Richard Ivey School of Business, MA, Political Science 2009, The University of Western Ontario*
Tanveer, Muhammad, *HBA 2009, Richard Ivey School of Business, The University of Western Ontario*
Tran, Monica, *HBA 2011, Richard Ivey School of Business, The University of Western Ontario*

The Lawrence National Centre for Policy and Management is grateful for the generosity of its sponsors. However, the views, statements, opinions or recommendations made or expressed at this workshop or in this report are not necessarily shared by these sponsors. Accordingly, the sponsors do not represent or endorse the reliability or accuracy of any such views, statements, opinions or recommendations.

DIRECTOR'S MESSAGE

Dianne Cunningham

Director

LAWRENCE NATIONAL CENTRE
FOR POLICY AND MANAGEMENT

Carol Stephenson

Dean

RICHARD IVEY
SCHOOL OF BUSINESS

On behalf of Dean Carol Stephenson, Richard Ivey School of Business, and the Lawrence National Centre for Policy and Management, I extend our sincere thanks to everyone who contributed to the organization and success of our Making Green Energy Happen: Policy and Priorities workshop. In planning this workshop, the Lawrence Centre endeavored to create a neutral forum where a wide range of experts could share their knowledge and vision. To ensure that this initiative would lead to relevant and practical recommendations, the Steering Committee undertook extensive consultations to identify the most pressing issues and then carefully developed the workshop's discussion topics.

Our report builds on the Lawrence National Centre's Ontario-Quebec Continental Gateway: Developing Competitive Transportation Policy workshop report (2008) and the Developing Sustainable Energy Policy: Building Paths to a Low Carbon Society workshop report (2006). It has become apparent over the course of our workshops that the effects of climate change is a key driver of innovation and that there is no alternative to sustainable development.

This report outlines six strategies to position agriculture and natural resources as net producers of energy by 2020 without adversely affecting their role as producers of food and protectors of our environment. It then proposes recommendations that link energy policy to economic activity, describe biomass types and sources, best practices in land management, research in green technologies, and development of infrastructure including pelletizing plants and rail.

Recommendations also address regulatory barriers, including definitional issues surrounding waste and biomass and transmission challenges to reach energy markets. Finally experts addressed how we can reach our objectives in dealing with green energy issues and solutions, and next steps in moving forward. Government incentives and progress in renewable energy initiatives in Ontario, Canada and the world are described in order to provide examples of global trends and energy policy networks for the 21st century.

More than one hundred committed representatives of business, government, non-governmental agencies, academia and students came together to share their knowledge and perspectives on climate policy challenges facing our federal, provincial and municipal governments as they investigate ideas and solutions to reduce rising carbon emissions. They believe that Ontario agriculture and natural resources have the capacity to become net producers of energy and are committed to moving Ontario and Canada forward as a world leader in alternative energy production, efficiency and conservation. Workshop findings and recommendations will be presented to political leaders and government policy advisors.

The economic system is placing significant pressure on our planet, as it meets the needs of about one quarter of the people on it. Over the next decade, twice that number will be consumers and producers. Immediate action is required to combat climate change. Wasteful energy practices continue to increase greenhouse gas emissions (GHG's), pollute our air and increase smog, contributing to the deaths of 21, 000 Canadians each year. The success of this new reality, agriculture and natural resources providing the food and energy to power the economy, depends on those entrepreneurs and communities who seek partnerships and who are willing to share information and big ideas.

We recognize that this report is one link in a larger chain. It is up to governments to refine and implement policies, to set the pace of action and support ongoing research and policy advancement in facing the challenges presented by climate change. The time is NOW to be out front and to take the lead. We will require vision and strong leadership to Make Green Energy Happen!

We extend our thanks to our sponsors:

Agriculture and Agrifood Canada, the Ontario Ministry of Agriculture, Food and Rural Affairs,
the Ontario Ministry of Energy and Infrastructure, the Ontario Centres of Excellence, the AgEnergy Co-operative,
the Ontario Ministry of Natural Resources, the Ontario Federation of Agriculture,
the Ontario Greenhouse Alliance and General Electric,
who supported this workshop in the sharing of knowledge and collaboration, and provide ongoing opportunities
to our professors and students in their research, teaching and training for future jobs.

ACKNOWLEDGEMENTS

We extend our thanks to everyone involved in organizing our workshop and in assisting in the writing of this report. It was a privilege to be involved with so many participants and presenters who took significant time to help guide future policy development in Ontario and Canada. I would like to extend our appreciation to Dean Carol Stephenson who provided ongoing advice and participated in our deliberations. To Katharina Wolff, I extend my sincere personal thanks for her incredible ability to keep us all focused, for the endless hours spent in the supervision of our project and students, from the beginning of the research phase, to the publishing of this professionally prepared workshop report.

We thank Mike Bouk, Executive Director of AgEnergy Co-Operative for presenting us with the Energy and Agri-food renewed vision. This farmer owned energy co-operative is committed to developing an agriculture-based solution as part of an all industry solution to deal with Ontario's decision to close its coal-fired electrical generating stations, especially at Nanticoke. Mike and his colleague Ted Cowan, Researcher, Ontario Federation of Agriculture, were the sparks that generated the enthusiasm and commitment to the planning of this workshop.

We are particularly indebted to our Steering Committee members for their commitment of time and expertise in the choice of issues to be addressed, selection of panelists and participants, and the editing of the workshop report. As a diverse group comprised of dedicated and professional government officials, academics, business leaders, and members representing non-governmental agencies, our Steering Committee exemplified our mission at the Lawrence Centre of working together, across different sectors, sharing ideas and creating opportunities to make a difference in how public policy is developed and implemented. We hope that for our panelists, participants and students, that the approach we have taken will make a difference!

We extend our sincere appreciation to Minister Chris Bentley and Controller Gord Hume for their warm greetings at our opening reception. At the City of London we thank Grant Hopcroft and Jill Tansley for their ongoing support, and Rob Panzer for his participatory statement.

To our colleagues at Ivey who supported our efforts to ensure the success of our workshop, we extend our thanks: Maura Pare, Director, Public Affairs; Mary Weil, Manager, Media and Public Relations; Ashleigh Nimigan, Communications Specialist, Public Affairs; Dawn Milne, Media Specialist; and Kristen Rajnovich, Assistant to the Chief Financial Officer. To Melissa Harris, Jeff Lindquist and Peter Markvoort, our student research assistants, thank you for your energy, enthusiasm and good fun in seeing this project through to completion! Kate Hewitt has provided her creativity and expertise in the publication of all three of our workshop reports and we thank her and the team at Carter's Printing Inc. sincerely.

II. Government Presentations

Participants welcomed the attendance and opening message of Deputy Minister Saäd Rafi who described significant opportunities within the Green Energy Act to make bold moves towards a cleaner, greener Ontario. The Act will enable the creation of a Feed-In-Tariff model, establish a right to connect, and will streamline the approvals process – something that investors are certainly looking for in today's economy and market. The Renewable Energy Facilitation Office will help renewable energy proponents complete their environmental permit submissions, within a guaranteed six month period. The Smart Electricity Grid is one of the major and critical infrastructure investments Ontario will make on the energy side. First Nations, Métis Communities, and municipalities who host renewable energy projects will also be assisted by the act. We look forward to working with Deputy Minister Rafi as we present the recommendations put forward in the workshop proceedings report.

In his closing remarks, Ezio Di Emanuele, Regional Director, on behalf of Agriculture and Agri-food Canada and Minister Ritz, described the AAFC government-wide Biofuels Initiative, working with Natural Resources Canada and Environment Canada, which is intended to stimulate demand for renewable fuels. The participants appreciated Mr. Di Emanuel's encouraging comments on the useful content of the workshop sessions and dialogue, and the challenge of bringing forward our policy priorities and recommendations. We look forward to presenting our workshop findings to the Minister and senior policy advisors in the Government of Canada.

Phil Malcolmson, Director, Strategic Policy, Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) extended greetings on behalf of Deputy Minister George Zegarac and Assistant Deputy Minister Deb Stark, Food Safety and Environment Division, OMAFRA. Mr. Malcolmson described our open dialogue as a "new approach to policy development" and as a significant opportunity to inform government policy, legislation and regulation. He stressed the importance of good data and a stable environment in support of government policy initiatives. We look forward to working with Mr. Malcolmson in the presentation of our workshop proceedings report.

"This is certainly an exciting time to be involved in the energy sector in Ontario and I believe the Province of Ontario is on a particular and deliberate path to position itself as a renewable energy leader in North America and beyond."

Saäd Rafi, *DEPUTY MINISTER, Energy and Infrastructure,* April 2009

III. Research Support and Presentations

The Ontario Centres of Excellence provided us with sound advice in the organization of our workshop, and funding for research and analysis in the development of our workshop report. A special thank you is extended to David McFadden, Chair of the Board of Directors, Mark Romoff, President and CEO, and Dan McGillivray, Managing Director, Centre of Excellence for Energy.

Donna Cansfield, Ontario Minister of Natural Resources, addressed the opening reception with her usual expertise, appreciation and encouraging advice to participants and we extend our sincere thanks. The Minister underlined the importance of the proceedings to her ministry and government, as they investigate how advantage can be gained in Ontario and Canada relevant to the use of forest resources for bioenergy. She described demonstration projects, supported by the Ontario Centres of Excellence (OCE), in the management, development and commercialization of research programs at the Atikokan Bioenergy Research Centre and the Enabling Tomorrow's Electricity System report of the Ontario Smart Grid Forum. The Ontario Centres of Excellence has 14 projects under way or in the pipeline that relate to Smart Grids. Investment in these projects is currently close to $12 million, with almost half of this amount coming from the OCE.

On April 8th, 2009, Canada's Minister of Agriculture and Agri-Food and Minister for the Canadian Wheat Board, Gerry Ritz, announced a federal contribution of $2 million to support a Richard Ivey School of Business Chair, a five-year Agriculture and Agri-Food Project (AAFP), that will evaluate the impact of government regulation on the agriculture sector. Funding is provided through the industry-led Agriculture Adaptation Council. Ivey Professor David Sparling, Chair of Agri-food Innovation and Regulation, participated as a member of our Steering Committee and contributed to the proceedings, writing and editing of this report. We welcome and thank David sincerely for his expertise and advice as a new colleague and advisor to the Lawrence National Centre.

Dr. Franco Berruti, the Agricultural Biorefinary Innovation Network (ABIN) lead and Director of the Institute for Chemicals and Fuels from Alternative Resources (ICFAR), presented the project work of ICFAR, including the vision and mission of ABIN. Dr. Berruti invited his colleagues at The University of Western Ontario's Faculty of Engineering, to present on topics related to green energy development. Participants extended their thanks to the following professors. Their presentations added significantly to our knowledge and appreciation of how involved academia and industry are in working together in research, commercialization and the economic success of Ontario and Canada.

Professor Amarjeet Bassi, Associate Dean and Professor, Department of Chemical and Biochemical Eng., Faculty of Engineering, UWO
PROJECT TITLE *Biodiesel from Microalgal Oil using Algae grown on from Anaerobic Effluent of Biogas Plant at Stanton Farm, Ilderton Ontario*

Professor Anand Prakash, Department of Chemical and Biochemical Engineering, UWO
PROJECT TITLE *Green Energy and Fuels for and from Farm – An Integrated Approach*

Professor Xueliang A. Sun, Department of Mechanical and Materials Engineering, UWO
PROJECT TITLE *Nanotechnology for Clean Energy*

Professor Rajiv Varma, Department of Electrical and Computer Engineering, UWO
PROJECT TITLE *Grid Integration of Large Scale Wind and Photovoltaic Solar Power systems in Transmission and Distribution Networks*

Professor Tarlachon Sidhu, Department of Electrical and Computer Engineering, UWO
PROJECT TITLE *Grid Integration Issues with Distributed Generation*

Professor Horia Hangan, Department of Civil and Environmental Engineering, UWO
PROJECT TITLE *WINDEEE, Wind Engineering, Energy and Environment - Canadian Foundation of Innovation (CFI) Project*

On March 19th, 2009, the Government of Canada announced $ 8.7 million in funding for the Agricultural Biorefinary Innovation Network for Green Energy, Fuels and Chemicals (ABIN), provided through the Bioproducts Innovation Program (ABIP). The ABIN project involves top Canadian university researchers, government experts and the private sector working collaboratively to design and optimize processes that will convert renewable biomass into valuable added bio-based products.

On July 3rd, 2008, the Government of Ontario announced $5 million in funding for the Institute for Chemicals and Fuels from Alternative Resources (ICFAR), headed by Dr. Franco Berruti and Dr. Cedric Briens. ICFAR conducts fundamental and applied research and development activities in the fields of renewable energy, valorization of wastes for the production of renewable fuels and chemicals, environmental protection and sustainability. ICFAR is the coordinating centre of ABIN.

STEERING COMMITTEE

Lawrence National Centre for Policy and Management

Dianne Cunningham, *DIRECTOR, Lawrence National Centre for Policy and Management, Richard Ivey School of Business*
Carol Stephenson, *DEAN, Richard Ivey School of Business*
Katharina Wolff, *RESEARCH AND PROJECT MANAGER, Lawrence National Centre for Policy and Management, Richard Ivey School of Business*

Faculty Advisors

Franco Berruti, *DIRECTOR, Institute for Chemicals and Fuels from Alternative Resources; PROFESSOR, Department of Chemical and Biochemical Engineering, The University of Western Ontario*
John Maxwell, *PROFESSOR, Richard Ivey School of Business*
David Sparling, *CHAIR, Agri-food, Innovation and Regulation, PROFESSOR, Richard Ivey School of Business*

Research Assistants

Melissa Harris, *RESEARCH AND PROJECT ASSISTANT, Lawrence National Centre for Policy and Management*
Pamela Laughland, *RESEARCH ASSISTANT, Richard Ivey School of Business*
Jeff Lindquist, *RESEARCH AND PROJECT ASSISTANT, Lawrence National Centre for Policy and Management*
Peter Markvoort, *PROJECT ASSISTANT, Lawrence National Centre for Policy and Management*

Business Advisors

Bas van Berkel, *PRESIDENT, StormFisher Biogas*
Ryan Little, *VICE PRESIDENT, Business Development, StormFisher Biogas*

AgEnergy Co-Operative

Mike Bouk, *EXECUTIVE DIRECTOR*
Chris Hanlon, *DIRECTOR, Energy Services*

Ontario Federation of Agriculture

Ted Cowan, *RESEARCHER*

Government of Ontario

Phil Dick, *BUSINESS RESOURCE SPECIALIST, STRATEGIC INTELLIGENCE AND MARKETING UNIT, ECONOMIC DEVELOPMENT DIVISION, Ontario Ministry of Agriculture, Food and Rural Affairs*
Robert Tmej, *SENIOR POLICY ADVISOR, Ministry of Energy and Infrastructure, Ontario*

Ontario Power Authority

Victoria Gagnon, *SEGMENT MANAGER*

FULL REPORT TABLE OF CONTENTS

Report can be found online at http://www.ivey.uwo.ca/Lawrencecentre/green/report.htm

I SETTING THE CONTEXT

for Workshop Recommendations

Action is needed now to avoid more devastating consequences of climate change in the future. Wasteful energy practices and an escalating reliance on carbon based fossil fuels have contributed to a dramatic increase in carbon emissions. Once emitted, carbon emissions stay in the atmosphere for many years. Consequently, stabilizing carbon levels is a long-term process. Despite a commitment to reduce carbon emissions, Canadian emissions continue to rise, reinforcing our record as one of the world's worst per capita emitters[1]. We must mitigate and adapt to harmful emissions in the future and position ourselves as a world leader in green energy production to create a greener, safer and more competitive Canada.

In the face of rising carbon emissions, we must employ both conventional and innovative ideas. Energy efficiency and conservation are essential first steps. It is estimated that at farms in Ontario alone, the energy savings could be $80 million per year through conservation efforts.

For many European nations[2], such as the Netherlands, energy efficiency was made a major priority in the 1980s. Despite doubling their acreage between 1980 and today, the Dutch greenhouse industry focused on efficiency and was able to double output per acre while reducing overall energy consumption by 12.5%. The Netherlands then committed to procure 20% of the nation's renewable energy supply from the greenhouse sector's cogeneration capacity, which links carbon neutral economic activity to peak energy supplies.

Optimum energy efficiency and conservation can be achieved through process integration. The Dutch became pioneers of this concept in their greenhouse industry by using all of the heat, hydro and carbon dioxide outputs of greenhouse cogeneration to meet the energy needs of nearby communities and the greenhouse itself. A complete system approach is vital to success.

For all energy-intensive users, conservation and efficiency should be the first focus, before significant capital investments in green energy generation are made. Canada's own Molson brewery has become a model for energy efficiency by implementing process integration, by using energy management and monitoring equipment to help track utility efficiency, and by striving to be carbon-neutral.[3]

In Ontario, the Green Energy Act (GEA)[4], which received Royal Assent on May 14th 2009, defines a comprehensive approach to reducing carbon emissions, creating green jobs and stimulating investment in alternative sources of energy. It is a commendable step forward, yet challenges remain.

There are solutions! Agriculture and Natural Resources have the potential to become net producers of energy to help power a competitive Canadian economy. Whether it is biogas derived from corncobs and wood pellets, wind harnessed to power a family farm, Combined Heat and Power (CHP) generation, or Photo-Voltaic Solar systems, green energy potential exists in the farms, fields and forests of our vast nation. Engaging environmentally friendly energy sources and practices is essential to building a sustainable economy in Canada.

Creative strategies to move to alternative energy must include the entire energy system, identifying the best inputs, like biomass, sun and wind, developing conversion technologies and facilities, and improving and expanding the distribution systems to deliver green energy to markets. Building and ensuring the success of this emerging and exciting green energy industry depends on a policy environment that supports investment and collaboration to overcome challenges in energy affordability, security, and the reduction of carbon emissions.

1 Canada is the second-worst per capita emitter of 17 OECD countries worldwide. http://www.conferenceboard.ca/hcp/details/environment/greenhouse-gas-emissions.aspx.
2 Germany, for example, has been a leading nation with respect to energy efficiency. Germany has actually decreased its production of primary energy resources in absolute terms since 1990, despite its increasing national product. www.german-renewable-energy.com.
3 Carbon-neutral is defined as the process of offsetting carbon-producing activities with those that either reduce or capture carbon, thus credibly neutralizing the net amount of carbon released in the atmosphere from a particular activity. www.sustainabilitydictionary.com
4 More information about the Green Energy Act, also referred to as the Green Energy and Green Economy Act, can be found at http://www.mei.gov.on.ca

II SIX STRATEGIES

to Position Agriculture and Natural Resources as Net Producers of Energy by 2020

1 SETTING THE TONE FOR THE FUTURE:
ENERGY MARKETS

- Assign a value to carbon by assessing the true costs of greenhouse gases
- Link energy policy to economic activity and move forward with opportunities for co-generation and tri-generation

2 DEVELOPING THE SOURCES OF GREEN ENERGY:
ENERGY INPUTS

- Determine the green energy potential. Identify and utilize purpose grown crops for energy and sustainability
- Recognize that climate change is altering agricultural conditions and adapt production, including the sources for green energy

3 TAKING THE NECESSARY STEPS TO ENGAGE GREEN ENERGY:
DEVELOPMENT AND INFRASTRUCTURE

- Invest in Research and Development (R&D), Demonstration and Deployment
- Invest in Infrastructure for pelletizing plants and rail systems to move biomass

4 PROMOTING AN INVESTMENT-FRIENDLY ENVIRONMENT:
ADDRESSING BARRIERS

- Address regulatory barriers to investment and green energy development
- Resolve the definitional issues surrounding waste and biomass
- Provide incentives for renewable energy developments
- Support the development of new infrastructure funds that allow farmers to invest in and borrow, to build green projects

5 REACHING ENERGY MARKETS:
DISTRIBUTION

- Accelerate the transition to a Smart Grid System
- Provide fast track grid connection agreements to producers of green base load power

6 BUILDING THE FOUNDATION FOR THE SHIFT TO GREEN ENERGY:
CREATING A SUPPORTIVE ENVIRONMENT

- Invest in research and commercialization of green energy technologies
- Support energy efficiency and conservation plans as integral first steps to achieve energy savings, increase outputs and reduce overall consumption
- Invest in and develop educational programs and develop human resources for renewable energy jobs

III SUMMARY OF RECOMMENDATIONS

1 SETTING THE TONE FOR THE FUTURE

ENERGY MARKETS

1 | Assign a value to carbon by assessing the true costs of greenhouse gases:
- Capture the accurate social cost of carbon through comprehensive analysis to create a framework that is clear, stable and that makes a difference
- Create a carbon tax and carbon tax fund in which carbon tax revenue is available for businesses to develop green energy projects
- Develop protocols for carbon credit creation and verification in Ontario and consistently across Canada
- Reward those who are taking action to sequester carbon and reduce their emissions, as well as taxing negative carbon-intensive practices
- Act within an international framework that is focused on mitigation and adaptation for Canada to be a strong leader in combating climate change

2 | Link energy policy to economic activity. For example, link a national sustainable energy policy to natural synergies with existing economic activity such as converting greenhouse and industrial heating systems to CHP (combined heat and power) and tri-generation (electricity, heat and CO_2 for plant growth).

3 | Support the shift to sustainable production through industry led public-private partnerships.

2 DEVELOPING THE SOURCES OF GREEN ENERGY

ENERGY INPUTS

1 | Determine the green energy potential. In order to identify and utilize purpose grown crops for energy and sustainability:
- Define and classify biomass types and sources
- Define expected energy content for each biomass type
- Develop best management practices for crop residue removal
- Develop a system to measure soil erosion and organic matter levels for land used for biomass energy production
- Determine and implement best practices in land management that consider potential demands on the land
- Create an inventory of the availability of biomass, including accounting for available renewable resources in remote and First Nations communities

2 | Focus on developing energy crops, such as miscanthus and switch grass, to take advantage of their strong energy balance, low inputs, and drying and storage costs.

3 | Recognize that climate change is altering agricultural conditions and adapt production, including the sources for green energy:
- Incorporate different crop species and genetically modified crops that are more resilient to the effects of climate change in order to optimize growth
- Adopt no-till agricultural practices and other environmentally friendly and sustainable agricultural methods
- Invest in carbon neutral or carbon negative crops that act as a “carbon sink”

4 | Determine, through further research, the role that genetics and genomics can play in expanding traditional crop growth regions and increasing yields.

3 TAKING THE NECESSARY STEPS TO ENGAGE GREEN ENERGY

DEVELOPMENT AND INFRASTRUCTURE

1 | Invest in Research and Development (R&D), Demonstration and Deployment:
- Support green technologies during the initial phases of research and development, the implementation of pilot demonstration plants and finally, commercial demonstration sites
- Support pro-innovation policies, business and personal tax policies, and matching funds for R&D
- Support the capital-intensive initiatives of biomass planting and harvesting, and the development of biogas installations and equipment
- Provide funding assistance for industry to research and determine the environmental value of biomethane
- Educate the Canadian public on the facts behind the food versus fuel debate, in that we can produce enough food as well as green energy

...CONTINUED

- Support research to identify the best size, shape and hydrophobic nature of biomass pellets that are dust free so that they can be transported, stored and handled safely
- Investigate the supply chain and consider the economic implications to reduce the cost of biomass supply to all fossil fuel plants in Ontario, possibly starting with the Atikokan plant
- Conduct more detailed studies to better understand the economics of using the marginal lands in northern Ontario for bioenergy crops

2 | Invest in Infrastructure: Pelletizing Plants and Rail

- Take into account projected changes to the climate when planning and building new infrastructure in order to achieve longevity
- Construct agricultural pelletizing plants, facilities that process biomass to produce pellets for eventual anaerobic digestion and biogas production, near the source of raw materials
- Consider and invest in methods of delivering pellets to generation facilities, such as ship and rail
- Consider locating pelletizing plants on non-class 1 rail lines to avoid potential conflicts between existing transnational rail schedules and local plant switching needs
- Reestablish and rebuild second and third rail connections to Nanticoke. Tracks have been removed but the rail bridges remain intact
- Determine best practices for logistics to store biomass and to ship it to the generation facilities

3 | Focus on reducing vulnerability and enhancing resiliency of resource-dependent communities in Canada, identify alternative resource opportunities and providing financial protection, possibly through engaging the insurance industry to insure at-risk communities.

4 PROMOTING AN INVESTMENT-FRIENDLY ENVIRONMENT

ADDRESSING BARRIERS

1 | Address regulatory barriers to investment and green energy development:

- Expedite the approvals process by creating a single point of contact for entrepreneurs and energy developers to help navigate the regulatory process
- Establish an interdisciplinary action team with representation from the three levels of government, and a Chair from industry. This team should identify regulatory needs and remove redundant and conflicting regulations, preferably within a time frame of three months
- Provide the regulatory consistency and stability necessary for a climate of investment
- Fast track or remove approval processes within industries for green energy and pollution prevention projects and replace them with a performance reporting mechanism. Integrate utility monitoring and tracking systems with benchmarking protocols that will also help government verify sectoral environmental impacts

2 | Resolve the definitional issues surrounding waste and biomass:

- Develop a common understanding of these definitions with all three levels of government, ministries and government agencies
- Treat waste as a potential new product to allow for both proper management to protect the public and the ability to turn waste into a useable product

3 | Provide incentives for renewable energy developments

- Provide capital assistance, in the form of grants and tax-exempt bonds, for renewable energy projects
- Government investment agencies must act like investment companies to aggressively encourage entrepreneurial investment in green energy development
- Streamline government financial support programs
- Provide access to government land, especially brownfield sites, which can be developed as renewable energy sites
- Consider a natural gas feed-in-tariff to reflect the full cycle environmental value of biomethane
- Extend elevated new pricing in the 2009 Ontario Green Energy Act's feed-in-tariff to a small number of biogas plants previously signed on to the Renewable Energy Standard Offer Program
- Support the development of agricultural based investment funds for renewable energy and environment projects. An example is the Agri-fund created by AgEnergy Co-operative which could be expanded into a national fund
- Reduce the regulatory impediments and disparities related to green energy projects. One example is the issue of exempting centralized biogas plants from requiring Certificates of Approval according to the EPA Part V Reg. 347 so that they can achieve parity with on-farm biomass plants

5 REACHING ENERGY MARKETS

DISTRIBUTION

1 | Transition to a Smart Grid system, making targeted investments where transmission capability is available to:
- Expand distribution networks where high demand exists
- Provide telecom protection and control infrastructure
- Enable increased use of existing transformer capacity
- Provide voltage support across wide areas of the grid
- Properly manage power quality
- Provide easier access to energy producers

2 | Provide fast track grid connection agreements to producers of green base load power.

3 | Accelerate the transition to Smart Grid for our transmission system to accept distributed technologies such as renewable Combined Heat and Power generation.

4 | Consider and analyze outstanding policy and regulatory questions regarding transmission and infrastructure projects:
- Who should pay for the transmission and development upgrades?
- Should certain types of projects or proponents be given priority? (E.g. biodigesters, First Nations)
- Should certain locations be given priority?
- How do we ensure that projects which are not moving are not blocking viable projects behind them?
- How do we streamline the approval process?

6 BUILDING THE FOUNDATION FOR THE SHIFT TO GREEN ENERGY

CREATING A SUPPORTIVE ENVIRONMENT

1 | Invest in Research and Commercialization of Green Energy Technologies:
- Support investment in leading edge research in universities and private companies providing the science foundation for green energy
- Develop commercialization capabilities to facilitate the transition from science to green energy solutions
- Support the adoption of new technologies from around the world and optimize them for local conditions

2 | Support end-use contracts, which provide a stable base for building green energy markets.

3 | Support open dialogue and workshops where business, government and academia work together to develop sound public policy.

4 | Pursue short-term green energy investments to ensure that government stimulus programs in both the United States and Canada achieve the greatest possible impact in restoring strong economic growth.

5 | Develop Human Resources for Renewable Energy:
- Increase the number of Masters and PhD students, as well as postdoctoral fellows, who should take innovative research to the next level by seeking out commercial applications and patents, to bridge the gap between university research and societal need
- Establish dedicated energy efficiency teams at the industry level that cross departments, train staff, reward employees for project efficiency ideas, use performance indicators for production, have the ability to audit and identify waste, and monitor and track utility efficiency
- Invest in and develop educational programs to transition skilled labourers to meet the needs of a green economy
- Invest in the training of transport truck drivers to meet the current deficit, as truck transportation remains an important step in the green energy development process
- Train greater numbers of highly qualified technicians, managers, public service personnel and apprentices for green jobs

AN ECONOMIC OPPORTUNITY WITH A POSITIVE ENVIRONMENTAL IMPACT

Chair ■ CHRIS HANLON, DIRECTOR OF ENERGY SERVICES, AgENERGY CO-OPERATIVE

Objective

The purpose of this session is to examine the present and future sources of biomass and its economic potential.

Topic #1 ONTARIO'S PRESENT AND FUTURE SOURCES, VOLUMES AND DISTRIBUTION OF BIOMASS

Presenter ■ IAN McDONALD
Applied Research Coordinator, Field Crop Unit, Ontario Ministry of Agriculture, Food and Rural Affairs

PRESENTATION OVERVIEW

The volumes of biomass that are available for energy generation from present crop residue sources, based on the distribution of landscapes in Ontario, are open topics for discussion. Crop yields, harvest techniques and sustainable removal levels are subjects of considerable debate at present. There is a need to explore the potential for dedicated biomass crops and crop residue to meet the rising demand for bioenergy from agriculture. A move from crop residue to dedicated energy crops provides potential solutions to some of the concerns regarding crop residue removal. These concerns include increased erosion of soil and decreased soil health and organic matter, all of which impact the long-term productivity of the landscape.

ISSUES AND SOLUTIONS

Issue #1 ■ How much biomass is truly out there?

Biomass[1] for energy production will come from crop residue, dedicated (purpose-grown) crops, food processing residue and the forestry sector. Ontario has approximately 7 to 8 million acres of arable land spread predominantly across the southern part of the province from Leamington to Ottawa, with southwestern Ontario being a prime location for biomass production due to land quality, quantity and climate. The gross available biomass in crop residue alone is estimated at around 15 million metric tonnes (MMT), with an energy value over 271 million gigajoules (GJ) or 75 billion kilowatt-hours (kWh). The anticipated volume of dedicated crops and other sources add to the potential of the emerging Ontario bioeconomy.

The challenge is to define the volumes of all biomass sources to ensure long-term, continuous supply from a range of sources using sustainable practices for production and removal. The information presented in Figure 1 describes the vast scale of available biomass in Ontario.

ONTARIO CROP RESIDUE (MMT)

Based on 2008 Harvest Numbers	Corn	Soybean	Wheat	Forages
Total Residue (million mt)	5.37	2.12	2.24	5.16
btu / lb	8100	7520	7200	7950
Total Energy Volume (btu)	9.5×10^{13}	3.520×10^{13}	3.56×10^{13}	9.04×10^{13}
Total Energy Volume (GJ)	101,171,819	37,098,706	37,512,911	95,343,441

Ian McDonald, OMAFRA

FIGURE 1

1 Biomass is defined as any plant matter used directly as fuel or converted into other forms before combustion. Included are wood, vegetal (relating to plant life), animal materials/waste, sulphite lyes, and other solid biomass. Biogas is the gas produced from biomass. Biomethane is the biofuels equivalent of compressed natural gas. *Energy Statistics of OECD Countries: 1999-2000.* Paris: International Energy Agency, 2002. (http://stats.oecd.org/glossary/detail.asp?ID=4603)

During the past four decades, energy activities have accounted for 6% to 10% of Canada's GDP on an annual basis. The energy industry directly employed 345,000 workers in 2006, and when supporting activities are included, that number climbs to approximately 500,000 workers. Energy companies also invest more money in Canada than do any other type of business—typically more than $30 billion per year.

"Improving Energy Policy in Canada", Fraser Institute, December 2008

■

Biomass power in China comes mostly from sugarcane wastes and rice husks, and has not grown in recent years. New policies will likely mean more biomass power from other sources, such as agricultural and forestry wastes. In addition, industrial-scale biogas, such as from animal wastes, is starting to make a contribution to power generation.

Powering China's Development: The Role of Renewable Energy, Nov. 2007, Summary, www.worldwatch.org

■

Ontario consumes approximately 170 billion kWh annually. The potential energy available from crops residue is almost 45% of the total electricity needs for Ontario.

Chris Hanlon, AgEnergy Cooperative 2009

Solution #1

An overall system to identify, classify and provide oversight for the effective management of biomass sources would be helpful to ensure longevity of the supply and the appropriate balance between best-practices land management and the extraction of biomass for energy production.

NEXT STEPS:

- Define and classify biomass types and sources.
- Define expected energy content for each biomass type.
- Develop best management practices for crop residue removal.

"We need to understand the difference between what is practically available and sustainably available."

Ian McDonald

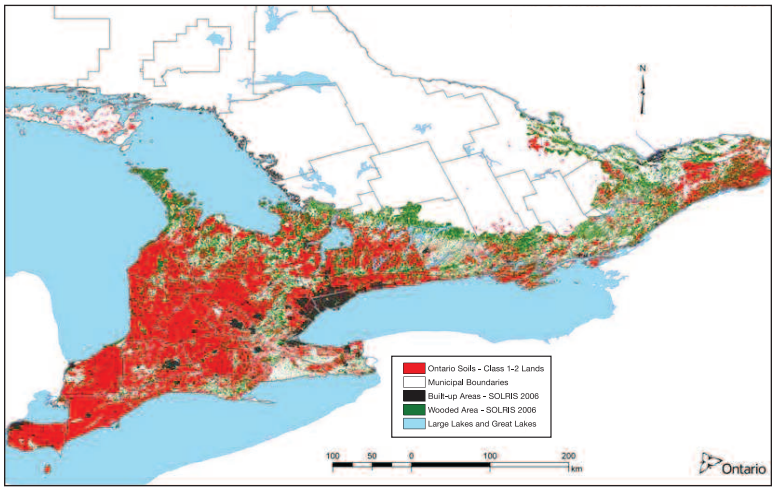
Issue #2 ■ Where is the biomass?

Biomass from crop residue and dedicated (purpose-grown) crops in Ontario is expected to come primarily from southern Ontario. Current land classification assists with understanding the suitable areas for biomass production.

"We do not want solar farms on Class One, Two or Three lands. There's 823 000 square feet of corporate rooftop in the GTA, that's just under 19,000 acres of no opportunity for food. 1% of the roof area in Toronto would produce 32 MW of solar power. There's 300 acres of land being proposed for a solar farm at Mount Louistone in Simcoe area... beautiful farmland. I'd rather those panels be on 1% of the rooftops in Toronto."

Don McCabe

CANADA LAND INVENTORY CAPABILITY CLASSES FOR AGRICULTURE • CLASS 1 AND 2 LANDS



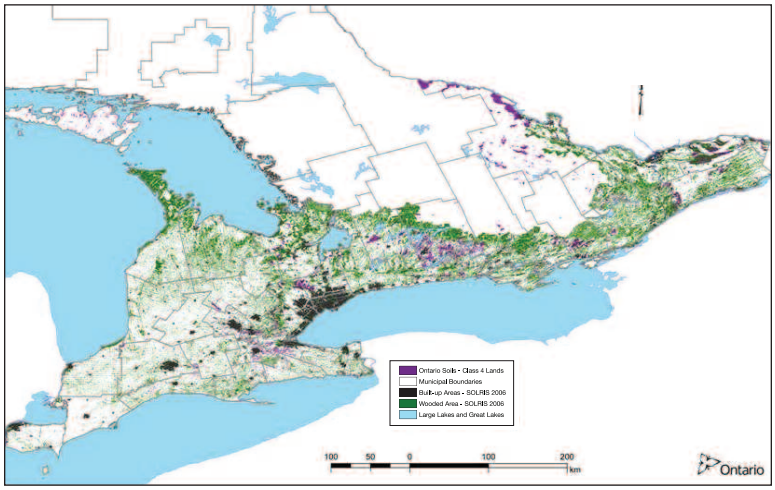
Ian McDonald, OMAFRA

FIGURE 2.A

"We've got about 101 million gigajoules of energy sitting in corn residue resources out there, 37 million in soybeans, 37 in wheat, and 95 million in forages. There's a lot of energy out there but how much of it is actually removable from the landscape?"

Ian McDonald

CANADA LAND INVENTORY CAPABILITY CLASSES FOR AGRICULTURE • CLASS 4 LANDS



Ian McDonald, OMAFRA

FIGURE 2.B

Figures 2.A and 2.B indicate landscapes within Ontario where biomass may potentially be sourced. A great deal of discussion on this topic has focused on less productive lands (Class 4 and poorer lands). The issue with this argument is that land of this type is less productive, sparsely distributed and more difficult to manage. Class 1 to 3 lands are more productive, broadly distributed and easily managed. Practical availability relates to the ability to physically get onto the landscape and harvest biomass with respect to equipment, labour, time and other logistical components of extraction, as well as the economic viability of bioenergy crop production and crop residue removal on each of the Canada Land Inventory (CLI) classes of agricultural land. The real challenge is to determine how much of the available biomass can be sustainably harvested. This takes into account soil erosion, land nutrient management and organic matter levels in the soil. Crop residue and food crops can simultaneously be harvested from the landscape if managed sustainably (Figure 3).

ESTIMATES OF ACCESSIBLE RESIDUE VOLUMES

Based on 2008 Harvest Numbers	Corn	Soybean	Wheat	Forages
Residue Yield (0% mt/ac)	3.10	1.01	1.86	1.98
Total Residue (million mt)	5.37	2.12	2.24	5.16
Practically Available (%)	50	40	66	5-10
Sustainably Available (mt)	?	?	?	?

Ian McDonald, OMAFRA

FIGURE 3

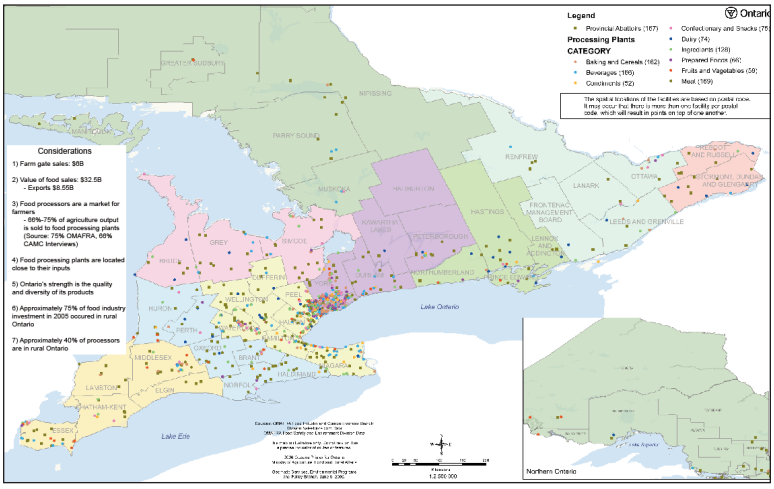
Solution #2

In line with Solution #1, an integrated system with best management practices for land management and biomass extraction levels should be developed.

NEXT STEPS:

- Develop a system to measure soil erosion and organic matter levels for land used for biomass for energy production (BFEP).
- Research, develop and consult on land management best practices that take into account the demands on the land under various scenarios, including food and feed crops, bioenergy crops, crop residue removal for bioenergy production, and others.

FOOD PROCESSING INDUSTRY IN ONTARIO



Ian McDonald, OMAFRA

FIGURE 4

Significant volumes of agricultural processing residues are available from the food industry (Figure 4). This biomass is broadly available across the province and can be combined with crop residue or dedicated biocrops as feedstock to meet energy and bioproduct needs in the future.

Did YOU Know

The Ontario Biogas Systems Financial Assistance Program is a $9 million initiative designed to encourage the implementation of biogas systems and to foster agricultural and agri-food innovation in Ontario. Application instructions have been developed for both Phase 1 and Phase 2 and provide up to $35, 000 and $400, 000 in funding respectively.

http://www.omafra.gov.on.ca/english/engineer/biogas/proj_list.htm, 2009

Topic #2 HOW DO WE TAKE ADVANTAGE OF ONTARIO'S FOOD-RELATED BIOMASS CAPACITY, AND WHAT DOES IT MEAN TO OUR ECONOMY?

Presenter ■ GORD SURGEONER
President, Ontario Agri-food Technologies

"It takes multiple agencies to collaborate in traditional government systems, which tends to be an oxymoron."

Gord Surgeoner

"No one organization has all of the resources to make this happen alone so there is a real need to collaborate and think about how Ontario can best pool its resources."

Carole Champion

"When you fail to meet your standard operating procedures, what's the punishment?"

Gord Surgeoner

"We have timelines, guaranteed timelines. We've seen governments where, at the last minute, they ask another question and set the clock again. Government needs to look for the weakest link. It all comes down to the weakest link."

Gord Surgeoner

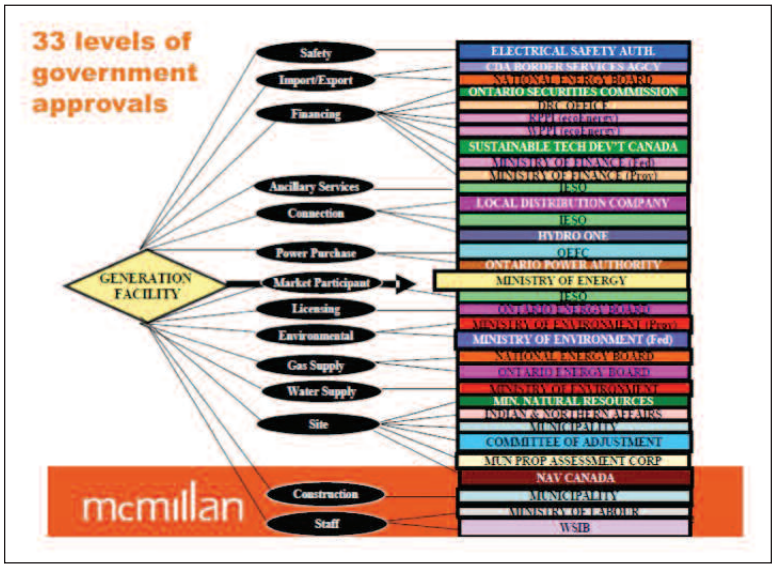
PRESENTATION OVERVIEW

Toronto is the second largest food manufacturing jurisdiction in North America, after Chicago, Illinois. Ontario essentially has no fossil fuels, but a large manufacturing sector that consumes energy. The Green Energy Act and public policy related to coal fired plants has provided policy incentives for renewable energy from forestry and agriculture. The food industry produces "waste" streams. There is no such thing as waste, but rather "opportunities looking for solutions." How do we implement the policies to make this happen?

ISSUES AND SOLUTIONS

Issue #1 ■ Working together

We have identified over $300 million in bioprojects over three weeks – projects where companies want to invest in Ontario. The current regulatory regime requires projects to go through 3 levels of government and up to 33 levels of approvals (Figure 1). The time and dollar demands to get through approvals are so enormous that they frustrate companies to the point that they look to other jurisdictions to invest their money. The result is loss of business opportunity for Ontario and Canada, loss of jobs, a reduced tax base and flight of money and labour from our borders.



Mike Richmond, McMillan Binch

FIGURE 1

Solution #1

1.1 Collaboration is Key

The interdisciplinary nature of bioenergy and bioproducts requires multiple ministries and agencies to collaborate in traditional government systems, such as Agriculture, Energy, Environment, Natural Resources, Transport, and Finance, among others. Government agencies must have the determination to work together, to change and to move beyond traditional boundaries.

NEXT STEPS:

- Establish an interdisciplinary action team with representation from the three levels of government. This should be immediately convened with a Chair representing business. The team should identify pressing regulatory needs, remove redundant and conflicting regulations and prepare an action plan to change or remove regulations that stand in the way of progress.
- Create a new process for regulatory approvals with an emphasis on expediting the approvals process.
- This interdisciplinary action team should complete its work, including recommendations to government, within three months.

1.2 Single Point of Contact

A number of jurisdictions around the world provide a single point of contact to assist business as they navigate the regulatory and approvals process. Benefits in supporting business with a timely and professional response include adherence to regulatory requirements and time frames for project completion, reduced customer and industry frustration, employment growth, retention of talent and sustainable growth of the economy.

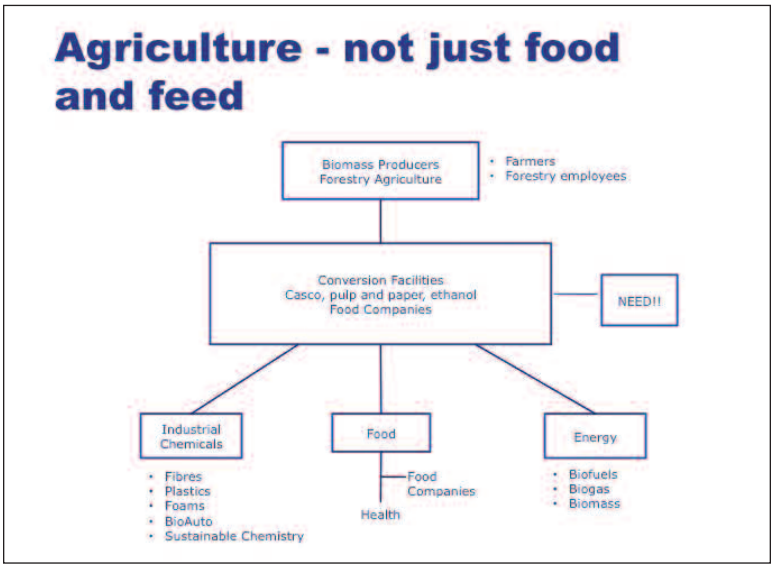
NEXT STEPS:

- Support single point of contact positions to assist in the coordination and expedition of regulatory and approvals systems of federal, provincial and local governments.
- Create standard operating procedures to ensure that projects are completed in a timely fashion and that overall process improvement occurs.
- Assign responsibility and authority to work across intergovernmental and interministerial boundaries.

Issue #2 ■ Biomass - Current and Future Uses

Biomass is much more than food versus fuel (Figures 2 and 3). We are still exploring the potential for biomass which has many current and future uses. Food riots in Mexico occurred when the high price of corn was attributed to its perceived scarcity, due to corn being used for fuel as opposed to corn for food. In reality, the type of corn used for making tortillas (white corn) is different than the type used for energy (yellow corn). There is a need for education and a clear understanding of this issue.

BIOMASS - CURRENT AND FUTURE USES



Ontario Agri-food Technologies

FIGURE 2

The United States and Germany have fallen behind China in terms of renewable power capacity as of end-2008, despite the U.S.'s leading role in wind, geothermal and biomass power production and Germany's leading solar PV (grid-connected) capacity.

Renewable Energy Policy Network for the 21st Century - Global Status Report, 2009 Update, pg.9, http://www.ren21.net/pdf RE_GSR_2009_Update.pdf

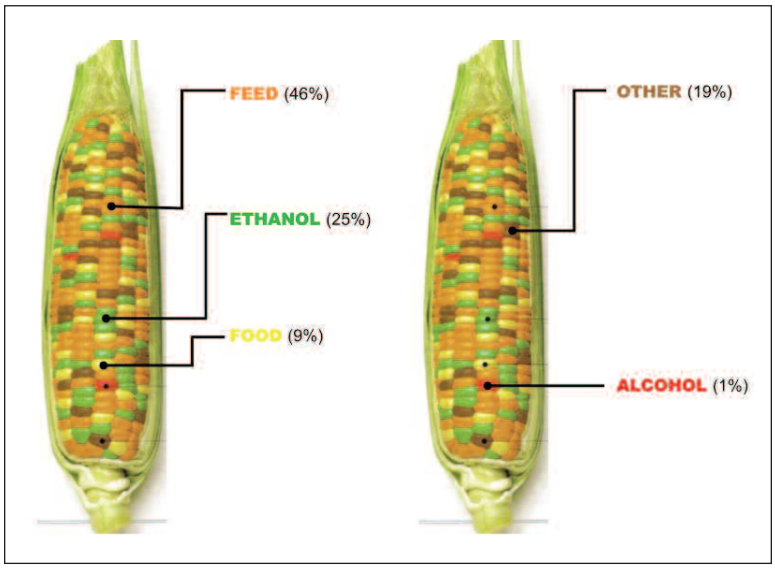
■

Over the past two years, as much as 20 million hectares of farmland, worth $20 billion-30 billion, has been quietly handed over from some of the world's poorest countries, including Sudan, Ethiopia and Pakistan, to capital-exporting countries such as Saudi Arabia, Kuwait and China. After buying or leasing millions of acres of farmland, these countries grow staple crops and biofuels on it and ship them home.

Leaders: Cornering foreign fields; Land deals in Africa and Asia. (2009, May). The Economist, 391(8632), 16.

The unused portion of corn and other crops is treated as waste and must be managed. The perspective from the food companies is "there is no such thing as waste... it is an opportunity looking for a solution" (Figure 3).

THE MANY USES OF CORN



Ontario Agri-food Technologies

FIGURE 3

"Has anybody here had a nightmare with the approvals branch of government? Under the Green Energy Act, renewable energy approvals are going to be much more difficult for the Ministry of the Environment than anything the Approvals Branch does now. And they've never been able to get their huge backlogs under control for long."

Dianne Saxe

"On the agricultural side, it seems that there are numerous perception issues, particularly in urban areas, about what is good sustainable agricultural practice. I believe that the assistance of all the participants in this sector in communicating these issues is very important."

Robert Lyng

"It sounds like there is a consensus that more coordination is needed to move this cause forward. What jurisdiction is appropriate to try to manage that level of coordination?

Mark Healy

Solution #2

2.1 Education is a key enabler to ensure that the debate on food versus fuel is based on facts rather than emotion. Business, academia and government must work to ensure a consistent message and that the public is educated on the facts.

2.2 All three levels of government must work to clarify and develop solutions for what is defined as "waste."

NEXT STEPS:

- A joint marketing campaign should be developed to educate the public on the facts of the food versus fuel debate. The campaign should focus on the apparent competing uses of food sources and provide information on food production levels as compared to world food demand.
- Academia should teach the facts in or as an adjunct to their courses. Business should provide the facts on use of crops and product streams. Government should support these efforts to educate the public.
- Academia should provide research in conjunction with business to identify waste from crop or food processes and determine the potential uses of waste.
- Business should build and develop new products from waste streams, identify and develop markets for product use, and build waste storage sites where a current market does not yet exist.
- Government should enable business to develop new product streams, provide partial research funding, and work with business to develop and manage waste storage sites.

Topic #3 WHAT IS THE RENEWABLE EQUATION FOR AGRICULTURE BIOMASS AND WHAT NEEDS TO BE BALANCED?

Presenter ■ DON McCABE
Vice President, Ontario Federation of Agriculture

PRESENTATION OVERVIEW

Three components need to be assessed when addressing the renewable equation for agricultural biomass: the economy, environment and society. Each of these components has an established equation. However, an integration of these equations will illustrate that it is possible to have improved air, water and soil quality for society's benefit while being economically viable, so long as we have public policy and regulation that are coordinated and make sense. The need to advance policy will be required in order to achieve a growing and renewable agricultural biomass equation. With 10% of crops not harvested by April of 2009, Ontario still had the highest yielding corn crop on record. Public and private research dollars have contributed significantly to the success of these improvements.

KEY MESSAGES

- Farmers manage carbon and nitrogen cycles.
- Biomass in the field has a far greater volume than that of grain harvested for some crops.
- We need to follow the European example and assemble agriculture's biomass resources for biogas and biomass pellet production.
- Changing to a bioeconomy requires some equipment changes on the farm for harvesting and processing. This is an opportunity to attract or develop equipment manufacturers and entrepreneurs.

There are three pillars to be considered when addressing the potential for agricultural biomass: Economics, Environmental Values and Social Policy.

Economic:

- There is an economic need to balance the books and to create positive economic activity. Europe is a decade or two ahead of Canada and is the Canadian farmer's real competitor in bioenergy. The incentives initiated in the United States Food, Conservation and Energy Act (2008) are real and happening. Bioproducts and bioenergy are moving ahead. In Bonn, Germany,[2] the United States negotiating team reported that 10% to 25% of their mitigation effort is estimated to come from biofuels. That is not ethanol, but rather biomass and other opportunities.
- There is a need for long-term aggregating contracts. The agricultural sector in southwestern Ontario has many absentee landlords. Production is in the hands of fewer producers who only tend the fields. The sale and handling of a harvested product is a transactional role that needs critical mass to meet the needs of large biomass users.
- Farmers manage the nitrogen and carbon cycle (soil fertility and photosynthesis respectively) to produce starch and oil for a global market to local market standards. This product differentiation has an economic value.
  - Food-grade soybeans or "white hilum" beans have a market premium over oil-grade soybeans, not only because they take more intensive management on the part of the farmer, but because food-grade soybeans can be made into higher value food products than oil-grade beans. Food-grade soybeans are produced for different markets. Consumers in China look for different properties in soybeans than consumers in Japan. For example, natto beans are different from tofu beans.
  - White maize, yellow full dent corn, blue corn and high oil corn have different genetic traits and different economic uses.

2 In June 2009, preliminary climate change negotiations took place in Bonn Germany, bringing together 182 countries. At this important meeting, key texts were discussed which will provide the basis for the climate change agreement to follow the Kyoto Protocol when it expires in 2012. A series of meetings will occur before thousands of participants come together for the Conference of the Parties in Copenhagen in December 2009 to negotiate the post-Kyoto agreement. (http://unfccc.int/meetings/sb30/items/4842.php)

In 2007/2008, the United States had more than 850,000 green power consumers purchasing an estimated 18 TWh, up from 12 TWh in 2006.

Renewable Energy Policy Network for the 21st Century - Global Status Report, 2009 Update, pg. 20, http://www.ren21.net/pdf/RE_GSR_2009_Update.pdf

■

The Ministry of Agriculture, Food and Rural Affairs offers the ecoEnergy Biofuels program, which will invest up to $1.5 billion over nine years to boost Canada's production of renewable fuels such as ethanol and biodiesel.

http://www.omafra.gov.on.ca/english/food/industry/funding-prog-index.htm, 2009

Environmental Value:

"I'm a no-tiller and corn cobs are very available out there. We've got lots of wheat straw. Bottom-line: show me the money and you'll get more than what you need."

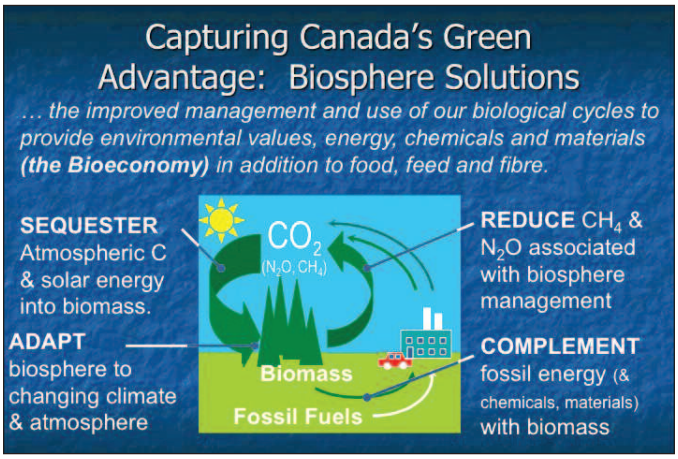
Don McCabe

"Europe is ahead of us by 12 years, but I'm going to take a very close look at the folks to the south of here or to the west of here because, bottom line, that's my closest competitor... harmonization is of the utmost importance because Obama gets it and he and Congress are moving."

Don McCabe

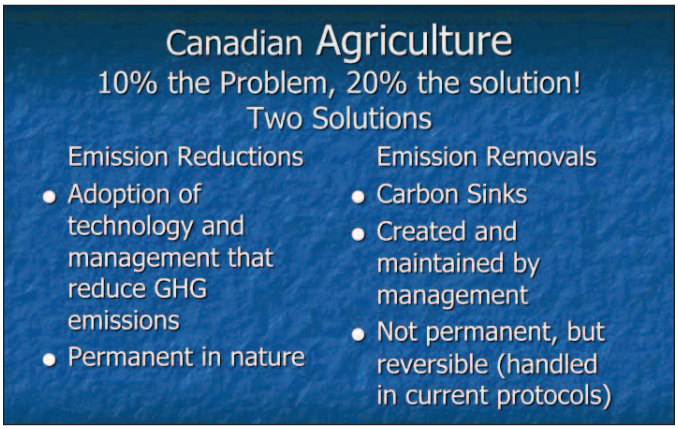
"Market signals are needed now to initiate investment. We need to get this stuff done. The Green Energy Act is the next step in this direction."

Don McCabe



BIOCAP Canada **FIGURE 1**

- Carbon sequestration[3] is a tremendous opportunity in Canada and a tremendous opportunity worldwide. The Intergovernmental Panel on Climate Change (IPCC)[4] estimates that the economic potential of carbon sequestration could be between 10% and 55% of the total mitigation effort until year 2020.[5] Carbon sequestration can be treated as a commodity. We know that we can put carbon back in the ground through "no-till,"[6] a conservation practice. Alberta has protocols in place that could be considered nationally.
- One of the byproducts of biodigestion and biomass combustion are nutrients. The process of nutrient management[7] is key to agricultural management and farmers cannot afford to waste money on nutrients that pollute and do not produce yield.
- Agriculture is approximately 8.3% of the climate change problem in Canada. With the right policy it could be 20% of the solution (Figure 2).
- Farms and forests can create and maintain carbon sinks, for example, through the use of soil to store plant-based carbon, as is done with zero-tillage or long-term forage production. Managing and maintaining carbon sinks is a form of GHG emission removal that should be encouraged by government through incentives.



Don McCabe, OFA **FIGURE 2**

3 Carbon sequestration is defined as the removal and storage of carbon from the atmosphere in carbon sinks such as oceans, forests and soils, through physical or biological processes. In this instance, carbon sequestration refers specifically to the process of increasing the carbon content of a reservoir, other than the atmosphere, for use in green energy. (http://greenfacts.org)

4 The Intergovernmental Panel on Climate Change (IPCC) was created in 1988 by the World Meteorological Organization and the United Nations Environmental Program to assess the scientific, technical and socio-economic information relevant for understanding the risk of human-induced climate change. The main activity of the IPCC is to provide, in regular intervals, Assessment Reports of the state of knowledge on climate change. (www.ipcc.ch)

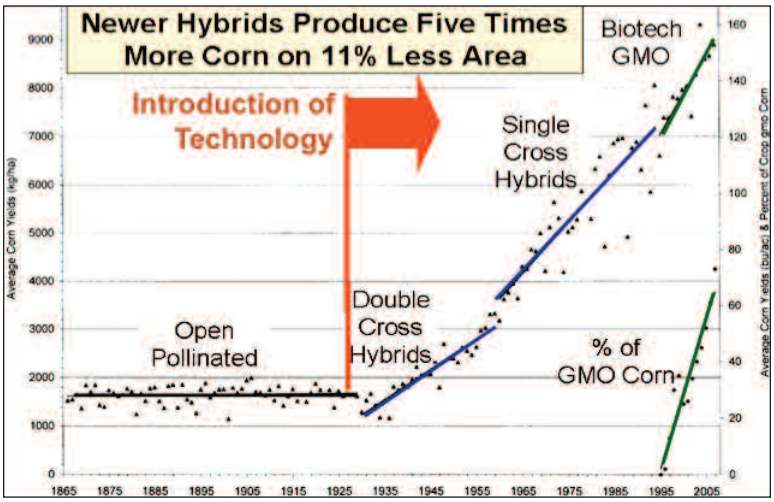
5 Bert Mentz, ed. *IPCC Special Report on Carbon Dioxide Capture and Storage.* 2005. (http://www.ipcc.ch/publications_and_data/publications_and_data_reports_carbon_dioxide.htm)

6 Tilling is defined as the process of turning and stirring the land by plowing, harrowing or hoeing in order to raise crops. Doing so releases CO_2 into the atmosphere. Thus, no-till farming is considered an environmentally friendly conservation practice.

7 Nutrient management is defined by the United States Environmental Protection Agency as managing the amount, form, placement, and timing of the application of nutrients such as manure and fertilizer, to plants. (http://www.epa.gov/oecaagct/tfer.html)

Social Policy:

- There are two major products in the cash crop marketplace: the starch from corn, wheat and other grains, and oil from soybeans and canola. It can take many years to get approvals for new or different uses of existing products (for example, taking a soybean or oil fraction and putting it through the chain with biotech). Industry cannot afford these approval delays. Competing countries are creating centres of production and excellence while Canadian industry is delayed.
- On the issue of food versus fuel, in 1865 corn yields were 40 bushels per acre. In 2008, Ontario corn yields were 161 bushels per acre. It is estimated that by 2030 farmers will grow 300 bushels per acre of corn. In Canada, farmers provide for many different markets.
- Ontario's farmers are already committed to environmental farm plans for future sustainability.



Performance Plants, Kingston, Ontario
GMO: Genetically Modified

FIGURE 3

ISSUES AND SOLUTIONS

Issue #1 ■ Farmers provide environmental goods and services at great cost when they sequester carbon or change production practices to improve the environment beyond what they need for sustainable production.

Solution #1

1.1 Biogas installations, biomass planting and harvesting equipment and the planting of perennials are capital-intensive initiatives that require support.

1.2 Protocols for carbon credit[8] creation and verification need to be developed in Ontario and consistently across Canada.

Issue #2 ■ The regulatory process is restricting the rapid development of bioenergy products. In Ontario, this is largely based on restrictions found in the Environmental Protection Act (EPA) that contradict the principles of "Reduce, Reuse and Recycle."[9]

Solution #2

Empower carbon footprint reduction as a tracked process and carbon neutrality as exempt from the EPA. Best-in-class manufacturers like the Molson Toronto plant already use energy management and monitoring equipment to help track utility use.

8 Carbon credits are measured as the equivalent of one tonne of carbon. In accordance with the Kyoto Protocol (1997) some countries limit the amount of greenhouse gases that industry can emit. Businesses that emit less than the limit can sell their additional carbon credits to businesses that emit more. Carbon credits are traded in an emissions trading system to attempt to mitigate the overall growth of concentrations of greenhouse gases in the atmosphere. (http://carbon-clear.com)

9 Distiller's grains from production of ethanol using corn are labeled as a toxic substance by the Ontario Ministry of the Environment. Therefore, Lambton Generating ran into excessive paperwork to test the grain in pilot projects for bioenergy. Similarly, some materials that could be used for biogas are stopped by a similar red tape barrier, due to labels from government.

Did YOU Know

Korea launched the world's first "green new deal" stimulus package in January 2009, planning over $38 million in spending on various green projects. China is also currently completing a $440 billion package to support wind and solar energy.

The Green Growth Race 2009, www.oecdobserver.org

Issue #3 ■ Agriculture, food processing and forestry are primary industries that support the service industry and require substantial support to develop a green economy.

Solution #3

3.1 Focus on the stimulation of the primary sector by supporting green energy crop production and the development of renewable fuels.

3.2 Encourage sustainable or carbon-reduced development through green energy generation (to replace the use of fossil-fuels).

3.3 On-farm food-fuel-fiber balance of production is possible. Current sustainable agriculture practices, like no-till planting, will support production of corn based and cellulosic ethanol, biodiesel and biomass energy. Proper management by farmers will not only improve the land's ability to produce more food, but provide diversified markets for farmers.

"If we do not take care of our primary resources (forestry and agriculture), our renewable resources, we are not going to have service industries to service anything when the primary sectors are dead."

Don McCabe

Topic #4 HOW CAN ONTARIO AND CANADA GAIN ADVANTAGE FROM ITS RENEWABLE FOREST RESOURCES?

Presenter ■ CAROLE CHAMPION
Director, Business Development, Ontario Centres of Excellence

"When the Ontario government made the announcement that they were going to close all of the coal-fired plants, it was somewhat devastating to Atikokan because OPG is one of the major employers."

Carole Champion

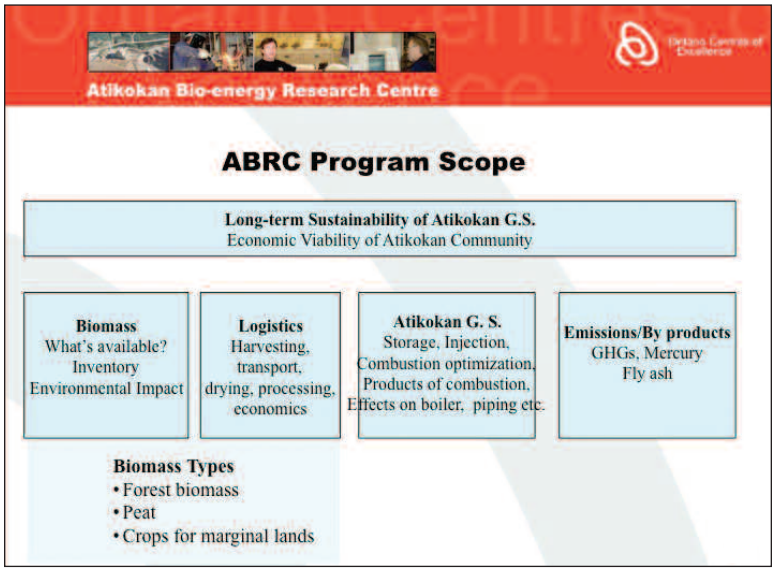
"$120 per ton is the starting price for biomass obtained from Western Canada. Through the ABRC research, we are considering the economics of harvesting and transportation in Ontario and this work is still ongoing."

Carole Champion

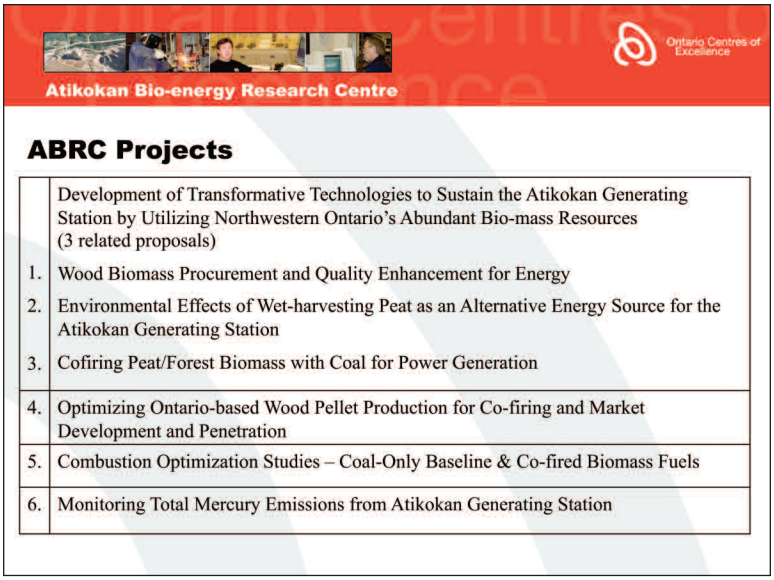
PRESENTATION OVERVIEW

Following the decision to close Ontario's coal-fired power plants, the Ministry of Energy and Infrastructure invested $4 million in a program of research, development, and demonstration relating to co-firing feedstock with coal, to promote the development of cleaner electricity generation for the province. The Ontario 2006 Budget provided the funding to establish a Bioenergy Research Centre associated with the Ontario Power Generation's Atikokan Coal-fired Generating Station (AGS). The Ontario Centres of Excellence, Centre for Energy, was asked by the Ministry to establish demonstration projects and to manage the research and development (R&D), funding, as well as commercialization projects for the Atikokan Bioenergy Research Centre (ABRC).

The ABRC program involves six universities and a college. It also involves 29 university and college professors supervising a total of 87 students. The program is supported by 29 partner organizations contributing $4.6 million through cash and in-kind support in addition to the funding of $4 million from the Ontario Ministry of Energy and Infrastructure. The partner organizations have 23 individuals contributing directly to the advance of the research program. Preliminary outcomes from the program, relevant to the use of forest resources for bioenergy, are addressed together with some of the opportunities arising from the program (Figure 1).



Carole Champion, OCE **FIGURE 1**



Carole Champion, OCE **FIGURE 2**

Issue #1 ■ How can Ontario gain advantage from its renewable forest resources?

The Atikokan Bioenergy Research Centre (ABRC) was established in 2007, and currently has six projects up and running. Three types of fuel are being considered under the program. Forest biomass and short rotational crops that could be grown on marginal lands represent renewable sources of fuel. Although peat is not considered a renewable resource, it is being investigated as a potential for fuel because of its abundance in the Atikokan area. In addition to determining the availability of biomass for energy generation, the effect on the plant of changing from coal to biomass is considered, including an investigation of emissions and by-products (Figure 2).

Renewable Forest Resources:

- ***Forest Biomass:*** This includes slash piles by the edge of the road, burn areas and parts of the tree that are not normally used in the forest products industry. Lakehead University and Confederation College are investigating the procurement of wood biomass and quality enhancement for energy. Both institutions have very close links with First Nations communities. Educational opportunities related to the effects of removal of forestry products for the use of bioenergy will be provided to these communities. It is hoped that First Nations communities will benefit from OPG's decision to consider the use of biomass for these coal plants.
- ***Use of Marginal Lands to Grow Biomass:*** This work is being done at Queen's University under the guidance of Paul Treitz. He is using geographic information systems including LIDAR (light detection and ranging) to identify whether there are any prospects of growing short rotation crops, such as willow and poplar, for bioenergy purposes in northern Ontario.
- ***Peat:*** There are many environmental considerations surrounding the use of peat as fuel. The environmental effects of harvesting peat, using a new technique called wet harvesting, is being investigated by Peter Lee of Lakehead University and Mike Waddington of McMaster University. Although it is unlikely that peat will be used in Ontario's coal-fired plants, an interesting outcome of this research is that reclaimed peat lands can be used successfully for growth of high value-added crops such as cranberries, blueberries and wild rice.

In Canada, public research expenditures in agriculture are funded predominately by the federal government (74% of total public research expenditures over the past 10 years). However, public sector investment in agri-food R&D has fallen over time when measured as a share of value of agricultural production.

Government and the Agriculture and Agri-Food Sector: Government Expenditures in Canada, 2009, http://www4.agr.gc.ca/AAFC-AAC/display-afficher.do?id=1205853623962&lang=eng

■

Global renewable energy investment has increased fourfold to reach $120 billion in 2008—solar PV capacity to 16 GW, wind power capacity to 121 GW, and a capacity of 280 GW from new renewables including small hydro, geothermal and biomass generation.

Renewable Energy Policy Network for the 21st Century - Global Status Report, 2009 Update, pg. 8, http://www.ren21.net/pdf/RE_GSR_2009_Update.pdf

Solutions

The ABRC is attempting to answer some key questions surrounding the viability of biomass, while trying to provide long term sustainability to the Atikokan Generation Station, which in turn provides economic stability for the Atikokan community. The objectives of the ABRC program are to:

1. Create an inventory on the availability of biomass, what it is and where it is available.
2. Determine best practices for logistics in terms of how to store biomass and how to get it into the plant. Wood poses different challenges than coal. Determine the implications of using biomass rather than coal. Traditionally it has been much more expensive to fire biomass than to fire lignite coal, which is currently used at the station. Wood pellets are at least three times more expensive for the same weight as coal. Consequently, the entire R&D program has been looking at the supply chain and considering the economic implications of reducing the cost of the supply to the plant.
3. Reduce emissions and increase efficiency. Burning biomass is a more environmentally friendly alternative to burning coal because it releases CO_2 that already exists in the biosphere instead of introducing more CO_2 into the carbon cycle that has been stored in the ground for millions of years. Biomass contains less mercury than coal. By installing a state-of-the-art sensor system, increased efficiency can be measured when the plant is co-firing biomass along with coal. Burning both will slow the rate at which additional CO_2 is added to the biosphere.

"One of the largest opportunities is the need to be able to go into communities and assess what is available in terms of renewable resources for each specific community. This could be particularly useful for remote communities in northern Ontario and First Nations communities."

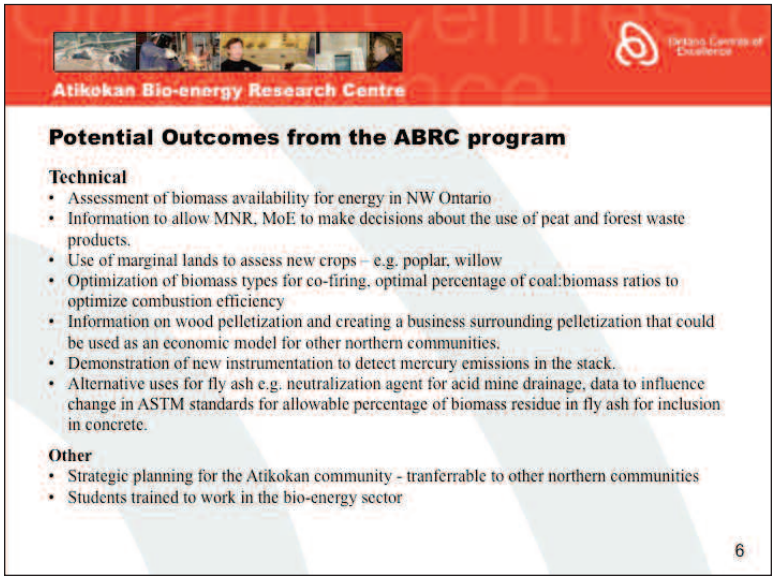
Carole Champion

"At the ABRC, you mentioned that the cost of coal was $40 per ton and the cost of biomass was $120 per ton, or three times the cost of coal. You talked about a government subsidy, the feed-in tariff, which is an incentive to get change, which will be added to the cost of energy that we use. This may be a reflection of the cost of the environmental impact that we have to include in our cost of energy."

Vinay Sharma, London Hydro

"There is no question that biomass is going to be substantially more expensive than coal, even if you consider a significant carbon cost on the coal. As a society we need to understand that tradeoff."

Chris Young, OPG



Carole Champion, OCE **FIGURE 3**

NEXT STEPS:

- More detailed studies should be done to get a better understanding of the economics of using marginal lands in northern Ontario for bioenergy crops.
- An integrated strategy for the creation of improved forest products, sustainable soil management, bioenergy and aggressive greenhouse gas mitigation should be carried out.
- Another possibility could include taking CO_2 emitted from the burning process and capturing it for use in algae growth. The algae could then be dried, processed and used as feed-stock for the plant.

- Going forward, cost-effective transportation and the safe storage and handling of biomass are extremely important. The ability to produce dust-free, dense, hydrophobic pellets that can be easily transported will be critical for safe, long-term use of biomass pellets. Currently, there are no standards for pellets. The ongoing work at Queen's University will lead to the establishment of standards for pellets of large-scale use.
- From the perspective of the Ontario Centres of Excellence, one of the largest opportunities is the need to be able to go into small, remote or off-grid communities and assess what is available in terms of renewable resources for each specific community. It could be a combination of wind and run-of-river[10] with biomass or perhaps solar and biomass. This ability could be particularly useful for remote communities in northern Ontario and First Nations communities. To help displace the use of diesel, turnkey renewable Combined Heat and Power (CHP) systems for small, remote or First Nations communities could provide clean energy solutions for the North.
- Finally, no single organization has all the resources required to do all that is needed. Now, more than ever, there is a need to pool resources and collaborate in leading Ontario towards a clean, affordable and available energy future!

Topic #5 MAKING CANADIAN FORESTRY MORE COMPETITIVE

Presenter ■ FRANK DOTTORI
Founder, former President and CEO, Tembec Inc.

PRESENTATION OVERVIEW

Forestry was the driver of the Canadian economy for over 100 years until recently when the oil patch became a dominant energy source. Our forestry sector plays a key role in the move to biomass production as an important energy supplier. Canada is rich in harvestable forest lands for biomass supply. Intelligent forest management will ensure a supply stream for years to come. Secondary streams for forest residue and production waste provide a unique opportunity to fuel a greener economy. Effective carbon management can incent the right behaviour and finance the technology required to deliver this change. Other jurisdictions have it figured out, what about Canada?

KEY MESSAGES

- The Canadian forestry industry is one of the industries helping to significantly reverse the Canadian trade deficit. On an annual basis, from the 1990s to early 2000s, the forestry industry contributed approximately $30 to $40 billion of net positive balance of trade.
- Forestry is one of the biggest industrial and financial sectors in Canada, providing high-paying jobs in over 350 communities and sustaining the high-tech industry as its largest single buyer.
- The Canadian forestry industry could generate enough power from the sector to displace anything generated in solar power in Canada over the next 50 years. This could be achieved within three years and for 10 cents per kilowatt hour (kWh), it can be cheaper than the price of solar.

ISSUES AND SOLUTIONS

Issue #1 ■ Competitiveness Issues, the Canadian Dollar, and Tariffs

The forestry industry in Canada was not competitive towards the end of 2008. When the dollar dropped to 80 cents six months later, our competitive advantage returned. China and India maximized their tariffs to promote their own industry and set the climate for investment.

2008 was the first year that new power generation investment in renewables was greater than investment in fossil-fueled technologies.

Global Trends in Sustainable Energy Investment, pg. 11, 2009, www.unep.org

■

The economic stimulus package of the Obama administration in the United States includes an estimated $180 billion of support for sustainable energy, and suggests that the political will to secure sustainable energy supplies and reduce energy-related carbon emissions has never been greater.

Global Trends in Sustainable Energy Investment, pg. 10, 2009, www.unep.org

10 Run-of-the-river hydroelectricity relies on the natural flow and elevation drop of a river to generate electricity. See B. Freedman, *Environmental Science: a Canadian Perspective* 4th ed., Toronto: Pearson Education Canada, 2007, pp. 226, 394 for more information

Solution #1

To improve our competitiveness, Canada should aggressively pursue short-term measures to ensure that government stimulus programs in both the United States and Canada achieve the greatest possible impact in restoring strong economic growth. It is clear that a broad and reciprocal procurement agreement will be the most effective way to secure mutually beneficial market access over the long term. We need to explore every possible means of encouraging the free flow of goods and services among our communities.

"We used to deal in China and in China they can build a paper mill in 13 months from the decision to go to when it's up and running. It took me 4 years to get approval permits. By that time they were up and running, had eaten up the market, were doubling their mills and somebody had said 'geez, Canadians are not competitive."

Frank Dottori

Issue #2 ■ Technology and Modernization

The Canadian forestry industry boasts some of the best technology. The industry has been challenged as new technology shrinks the demand for products such as white paper.

Solution #2

The forestry industry needs to adapt to these changes as well as to the demand to provide cost competitive products. The industry does not have the capital to modernize. Financial support from government is required to revitalize the efficient parts of the industry, to inspire industrial conversion and change, and to retrain the workforce. The recent announcement of the Government of Canada's $1 billion pulp and paper Green Transformation Program to support Canada's forestry communities is an excellent step.[11]

Issue #3 ■ Rationalizing the Forestry Industry

If there is only enough wood for a forestry company to run two of three of its mills, government will not allow it to shut down the third mill, as this would result in a reduction of jobs. For example, in Quebec, it took Tembec seven years to gain approval to shut down one mill, despite the fact that the company and government knew it no longer had the wood to run at capacity. This illogical intervention by government resulted in a reduction in profits and jobs.

"In the forestry sector there is clear provincial policy that is consistent with renewable energy initiatives within the province... they have a very robust system in place which provides good assurance to the public that forests are being managed in a sustainable manner."

Robert Lyng

Solution #3

If the government would allow companies to rationalize, businesses would be profitable and could reinvest. A reduction in jobs in the short-term could realize investment in new jobs in the long-term.

Issue #4 ■ Regulatory Issues

It used to require thirteen certificates and four months time for a forestry company to put a shovel in the ground to repair a road. By that time the season would be over. Companies would have to plan a year in advance to get a truckload of sand to repair a road, wasting time and shrinking productivity.

Tembec used to deal in China, where it took thirteen months from the point of decision to build a paper mill to the completion of the construction. In Canada, it took Tembec four years to get approval permits for one mill. By that time, the mill in China was up and running, took over the market, doubled the mill size and Canadians could not compete.

"If you think that greenhouse gas is an issue, you better start looking at nuclear power."

Frank Dottori

Solution #4

Get rid of the overlap, duplication and red tape: One regulation is layered on top of another, and eventually the regulations become so confusing that it is impossible to understand or navigate the system.

Issue #5 ■ Policy Development

Too often, government with a significant number of advisors gets involved in all of the peripheral details with no conclusive clarity of policy. The government needs to ask the question: should we be allowing companies from within Canada and abroad to enter the market, make wood pellets, and ship anywhere? This threatens the survival of Canada's forestry industry and high tech jobs. When it comes to policy, government must decide what they want to achieve and what their objective is.

"Some of these things we just don't like to speak about, but if we're going to meet the challenge, these are issues we've got to face. I commend the panelists for their forthrightness, honesty and perspective."

Chris Hanlon

11 The Government of Canada announced $1 billion to support environmental improvements for the pulp and paper industry. (http://news.gc.ca/web/article-eng.do?m=/index&nid=459769)

Solution #5

Governments should work with the forest products industry and agriculture to determine where advice could be most helpful in the development of meaningful public policy, legislation and regulations. The Canadian forest products industry should be producing the pellets because they have the infrastructure. The high cost of wood pellet fuel must be absorbed at some point.

Issue #6 ■ Equitable Financial Support for the Forestry Industry

Equitable support for the forestry industry is needed. Biogas companies have been offered a subsidy of up to 14 cents per kWh. If the government was to give a 10 cent subsidy to the forest products industry they could add more green power to the grid than that contributed by all other renewables combined.

Governments often favour small and medium sized enterprises (SMEs), as they have the reputation as large job creators. Tembec did a regional study and discovered that only 1 in 10 SMEs remained in business for more than three years.

The price of wood is skyrocketing. Nobody wants to lend money to Canadian companies in the industry.

Solution #6

The forestry business is a global business, and we are in a global competition. The United States subsidizes the forest products industry in many jurisdictions. The Government of Canada must also protect market access and allow consolidation.

- Governments should consider support for the forest industry for both small and large enterprises that have a successful and sustainable job creation record.
- The government must look at the 80/20 rule. The government should focus 80% of its efforts on the resources it currently has and 20% on new development, compared to what is happening now with more focus on new and renewable industries and less on supporting current industries. The forestry industry helps create Canada's wealth and the government should focus on support.

Issue #7 ■ Financial Support and the Softwood Lumber Accord (SLA)

The forestry industry must be supported and given free access to U.S. markets. The SLA limits the amount of softwood lumber that can be exported to the United States, due to quotas. Energy is given free access, why not forestry?

Solution #7

The SLA must be eliminated. In terms of financial support, this industry needs the same type of support as the government is giving the car industry, such as bridge loans to help the industry survive the recession.[12]

Issue #8 ■ Support of Nuclear Power

Agriculture and forest products could provide 15% to 20% of the solution in supporting a green economy. Energy demand is going to continue to grow at an estimated 3% to 4% globally. Nuclear is the only energy source that does not produce GHG emissions and can provide a solution to the increase in energy demand.

Solution #8

Governments must consider nuclear power, as GHG emissions and climate change are such pressing issues. This is a reality Canadian politicians must face. Government must start talking about and supporting nuclear energy options. It should not take 10 years to get an environmental permit to build a nuclear plant. In China it takes 1 to 2 years. There are more than enough safety regulations in nuclear energy production.

Canada's forestry industry is recognized as being very environmentally friendly. It is the leading country with the largest certified forest in the world, and Canada is recognized with the highest certification of the Forestry Stewardship Council – the only recognized certification in the forestry industry by environmentalists worldwide.

Frank Dottori

■

A study by the C.D. Howe Institute indicates that nuclear power is cost-competitive with fossil fuels once the social costs of all energy are accounted for. Nuclear power, they say, already internalizes far more of its social costs and potential liabilities than fossil fuels, and the introduction of a carbon price will place the two on a level playing field.

C.D. Howe Institute: "Canada's Nuclear Crossroads: Steps to a Viable Nuclear Energy Industry," pg. 2, No. 290, June 2009.

12 The $1 billion that the Government of Canada announced for the pulp and paper industry is designed to offset the effects of billions of dollars in subsidies that have been provided for the rival US forest industry. To prevent retaliatory trade action, the Canadian plan will focus on support for green power projects in the pulp and paper industry. (Steven Chase and Patrick Brethour, "Ottawa Plans $1 billion for pulp producers." *Globe and Mail, Report on Business*, Thursday June 11th 2009).

CLEARING THE PATH

Chair ■ ROBERT TMEJ, SENIOR POLICY ADVISOR, MINISTRY OF ENERGY AND INFRASTRUCTURE

Objective

The purpose of this session is to examine the critical infrastructure and regulatory matters necessary to make green energy happen.

"You can have all of the process and all of the rules, but it comes down to the people and whether or not they have a mandate to make decisions. We need about 20 to 30 people with small files of companies helping them navigate through the regulatory landscape."

Gord Surgeoner

"According to production figures supplied by the Canadian Fertilizer Institute, about 7 percent of Ontario's natural gas use is attributed to the production of nitrogen fertilizers."

Don McCabe

Topic #1 THE DEFINITION OF BIOMASS, ELIMINATING REGULATORY BARRIERS AND HARMONIZING REGULATION[1]

Presenter ■ RYAN LITTLE
Vice President, Business Development, StormFisher Biogas

PRESENTATION OVERVIEW

In February 2008, Ontario-based StormFisher Biogas closed a U.S. $350 million funding partnership to develop biogas plants across North America. As an emerging market, Ontario is now home to the world's most highly funded biogas company. Ryan Little discusses the opportunities and challenges facing renewable energy developers in Ontario, what the Green Energy Act could mean for renewable energy development, and what the provincial and federal governments must do to push green energy forward.

BACKGROUND INFORMATION

StormFisher Biogas utilizes agricultural and food processing by-products in order to create baseload renewable energy and organic fertilizer.[2] Backed by U.S. $350 million from a Boston-based private equity firm, StormFisher currently has 5 projects in active development and 36 projects in the development pipeline which will account for 120 megawatts (MW) of renewable energy. A key to StormFisher's success in penetrating this relatively new industry has been their strategic relationships with government agencies and academic organizations in Canada and several U.S. states, and their partnership with Krieg & Fischer, a German biogas plant construction and planning firm.

One of StormFisher's shovel-ready projects, the London Ontario Cogeneration Facility, will begin construction in October 2009, and is expected to begin commercial operation in 2010. This facility will utilize 140,000 tonnes of manure and food processing by-products and produce an electrical output of 2.85 MW. StormFisher's Listowel Natural Gas Facility, in conjunction with Union Gas, is set to be operational by 2010, and is expected to generate 205,000 MMBtu[3] per year of natural gas.

The alternative energy industry is a relatively new entrepreneurial space in Canada. In 2006, the StormFisher team was introduced to this new emerging industry by Jan Buijk from GE Jenbacher. Bas van Berkel, President, and Ryan Little and Chris Guillon, Vice Presidents, began their market research phase shortly thereafter. In 2006, the province of Ontario introduced the first comprehensive feed-in tariff (FIT) in North America, in the form of the Renewable Energy Standard Offer Program (RESOP).[4] Entrepreneurs responded quickly to this improved environment for investment in Ontario.

1 Biomass is defined as any plant matter used directly as fuel or converted into other forms before combustion. Included are wood, vegetal (relating to plant life), animal materials/waste, sulphite lyes, and other solid biomass. Biogas is the gas from biomass. Biomethane is the biofuels equivalent of compressed natural gas. *Energy Statistics of OECD Countries: 1999-2000*. Paris: International Energy Agency, 2002. (http://stats.oecd.org/glossary/detail.asp?ID=4603)
2 The Ontario Ministry of the Environment defines organic fertilizer as fertilizer that is made of organic matter including horse, cattle or poultry manure, fish emulsion or cottonseed meal. (http://www.ene.gov.on.ca/en/myenvironment/outside/fertilizer.php)
3 205,000 MMBtu per year of natural gas is equivalent to approximately 60.06 megawatt hours of electrical (or electricity) output.
4 The United States was the first country to introduce a feed-in-tariff in 1978, albeit limited in scope. In Canada, the province of Ontario introduced the first comprehensive feed-in-tariff (FIT) in North America in 2006. (*Renewable Global Status Report 2009*. Renewable Energy Policy Network for the 21st Century. Paris: REN21 Secretariat, 2009, p. 26)

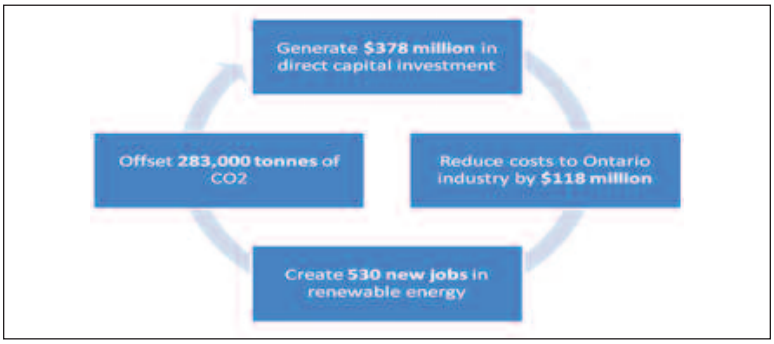
The alternative energy industry presents enormous opportunities for Ontario and Canada. In the biogas industry alone, $378 million in direct capital investment could be generated and costs to Ontario industry could be reduced by $118 million, largely in the food-processing sector. Companies could reduce costs and gain safer disposal of organic by-products. The biogas industry is not just about electricity. The biogas industry could offset 283,000 tonnes of carbon dioxide (CO_2) emissions, create 530 new green jobs, solve nutrient management problems for dairy farmers, increase the supply of non-chemical fertilizer and create major opportunities in academia, laboratory services and biotechnology.

ISSUES AND SOLUTIONS

Issue #1 ■ Expediting the Approvals Process – Renewable Energy Facilitation Office (REFO)

The Green Energy Act poses some questions for consideration. Upon proclamation of the Act, and at the completion of the regulation development process (often a few months in time), the question remains: are investors still willing to put up capital? Investment friendly regulation remains a serious concern. In addition, the streamlined permitting process may expedite the process, but may also create a bottleneck at the Ministry of the Environment or other ministries and agencies. The challenge is not to hide behind the process. It is too easy for some groups to blame others for delay. While the Green Energy Act is an important step in facilitating renewable energy development, it is important to note that we are in an increasingly competitive landscape and are not alone in our desire to build a green economy.

WHAT THE BIOGAS INDUSTRY COULD MEAN FOR ONTARIO



Ryan Little, StormFisher

FIGURE 1

Solution #1

The role of a Renewable Energy Facilitation Officer in the Ontario government is to coordinate and expedite the approvals process, and enhance opportunities for increased investment and success for entrepreneurs in this new industry. The office should be more than just a process or facilitator, and should include a team of highly qualified and experienced personnel who are required to support a streamlined process that includes monitoring and timelines.

Issue #2 ■ Competitiveness: A German Case Example

Consider the case of ARISE Technologies: ARISE Technologies, a Waterloo, Ontario-based company that develops solar PV cells, received a grant from Sustainable Development Technology Canada[5] at the beginning of their development period. This highly respected solar company was subsequently courted by *Invest in Germany* to join the 55 other solar companies operating in Germany. Their offer included a €25 million grant, including €9.5 million for the construction of a new plant. With their streamlined regulatory process and aggressive approach, Germany was able to approve funding within seven months and pull the manufacturing plant out of Ontario.[6] This is a well-known story in the renewable energy world and gave major profile to *Invest in Germany*. Big moves like this make international headlines and indicate to investors and businesses which countries are aggressively seeking investment. What can we take away from the ARISE story?[7]

5 Sustainable Development Technology Canada (SDTC) is a not-for-profit foundation that operates two funds to support the development and demonstration of clean technologies to address issues of climate change, clean air, water quality and soil. See http://www.sdtc.ca/ for more information.

6 Arise Technologies is still an active company in Ontario, however, the province lost an opportunity to support their plan to manufacture and help finance the growth of products in Ontario, rather than in Germany.

7 The United States ranked number 1 in 2008 for new capacity investment in renewable energy with $24 billion invested, 20% of global total investment. It was followed by Spain, China, Germany and Brazil. (*Renewable Global Status Report 2009*. Renewable Energy Policy Network for the 21st Century. Paris: REN21 Secretariat, 2009, p. 9)

Did YOU Know

According to the United States Department of Agriculture, 29% of agriculture's energy use is related to the manufacture and use of fertilizers. One of the byproducts of biogas production is a fossil fuel-reduced organic fertilizer.

www.usda.org

■

The United States became the world investment leader in renewable energy development in 2008, with nearly $24 billion in new investment, amounting to 20% of total global investment. Spain, China and Germany were not far behind (in that order), all in the range of $15-19 billion.

Renewable Energy Policy Network for the 21st Century - Global Status Report, 2009 Update, pg. 14, http://www.ren21.net/pdf/RE_GSR_2009_Update.pdf

Solution #2

In Canada, and Ontario, government investment agencies must act like investment companies. Companies are too busy to be looking at changing and improved government incentives. Foreign Affairs-International Trade Canada (DFAIT) and the Ontario Ministry of Economic Development and Trade must package the incentives in a way that meets each company's specific needs.

In order to move Canada and Ontario forward as a world leader in the biogas industry, investment and regulatory environments must be more conducive and manageable for entrepreneurs to take on risk and penetrate this new industry. Germany sent a major signal worldwide by being aggressive, and Canada should do the same before we are left further behind.

"Right now, if we remove manure from one farm and bring it onto another farm it's considered waste, if we process it on the same farm it's nutrients. That has got to change."

Ryan Little

Issue #3 ■ The Definition of Waste[8]

Regulations are in place for biogas as a form of manure management, but not for industrial-scale renewable energy production. Not every farm is a viable site for a biogas plant: the average sized Ontario dairy farm (with 63 cows) could never support industrial-scale renewable energy production on their own. In the current regulatory environment, if a biogas company were to remove manure from one farm and deliver it to another, it is considered waste. However, if the company were to process it on the same farm, it is considered a nutrient. Ontario's Nutrient Management Act does not contemplate multi-client biogas plants, and nutrients become waste under these regulations. The difficulty with nutrient/waste management lies in the definition of waste,[9] as we are currently in a regulatory regime that treats nutrients as waste. The successful Danish model uses a multi-farm system, with "waste" from many farms being digested at a central location. This system makes digestion more affordable and allows smaller farms to contribute to the green economy.

"It is no surprise that the American Clean Energy and Security Act definition of "biomass" goes on for multiple pages. The cheery innocence of existing Ontario definitions, such as 'In this Regulation, biomass means biological materials, including gases generated from the decomposition of biological material', certainly will not last."

Dianne Saxe

Solution #3

The province of Ontario must quickly resolve the definitional issues surrounding waste and nutrients. It was underlined during discussions that the present definitions of waste are a significant deterrent to investment.[10]

Issue #4 ■ Policy Stability – Fair and Equitable Pricing

According to RESOP, the province pays generators of biogas and biomass energy $0.11 per kilowatt hour (kWh) with an on-peak premium of $0.0352 to providers who can produce energy at peak hours at least 80% of the time. Solar photovoltaic (PV) is the sole exception to the base rate, as developers are paid $0.42 per kWh for energy produced from this source. Compared to the biogas industry, the environment for wind and solar is much more stable. In the biogas industry, however, feedstock will move, providing a more volatile environment and creating the need for a higher price per kWh incentive.

"The Ministry of the Environment has to deal with the definition of waste... If you are doing a good green project you should be able to cut some of that red tape and get the paper work done... that will make a difference to speed things along."

Doug Dittburner

Solution #4

To provide a level playing ground and to not place early movers at risk, the new feed-in tariff must extend elevated new pricing to the small number of biogas plants signed on to RESOP. In the Green Energy Act (2009), the price paid by the province of Ontario for biogas and biomass has been increased to $0.147 per kWh. This new feed-in-tariff (FIT)[11] inadvertently punishes the first movers in the biogas and biomass industry, who receive a blended rate of $0.119 per kWh under the FIT's precursor, the Renewable Energy Standard Offer Program (RESOP). Biogas and biomass developments are distinct from other forms of renewable energy in this respect in that the source of energy, such as organic by-products, wood waste and others, are subject to market pricing. Wind will blow, sun will shine and rivers will flow regardless of changes in energy contract pricing. However, groups that control organic by-products, wood waste and other sources of biogas and biomass feedstock will gravitate towards the best economics for their sources of feedstock that can be offered by renewable energy producers, who receive a higher price per kWh.

8 See Dianne Saxe, Participatory Statement for further discussion on the issues surrounding waste definitions.
9 There were many discussions by industry and OMAFRA representatives that this is a major roadblock to investment. OMAFRA should be charged with finding a solution for a definition of waste, and should work with other ministries and governments at all levels.
10 It has been stated that the province of Ontario is considering a toxic definition strategy. Presently, a circular definition of waste and toxics are used. A scientific definition is required to clarify what is considered toxic and resolve the problematic aspects of current definitions. Multiple legislated definitions of waste are of concern. They must be harmonized across jurisdictions. Currently, the United States Government and the Canadian Government definitions are highly scientifically based.
11 Complementary to the GEA, the proposed feed-in-tariff program (FIT) would guarantee specific prices for energy generated from renewable energy sources and drive investment in Ontario.

Issue #5 ■ Grid access to base load power

The rationale for the implementation of the RESOP and now the feed-in tariff is in large part to encourage small-scale, distributed energy to buttress an electrical grid under strain.

Solution #5

In recognition of the benefits to the electrical system provided by base load power, it is necessary to provide 'fast track' grid connection agreements to producers of base load power. Intermittent power such as that provided by wind and solar requires that far more grid capacity is allocated than is actually used during the normal course of operation.

Issue #6 ■ Competitiveness

Ontario has made strides in attracting and maintaining a cleantech[12] and renewable energy workforce through programs like the *Next Generation of Jobs*.[13] However, the reality is that, in the absence of major government-backed capital and tax support, Ontario is not competitive with the United States given programs such as the Investment Tax Credit[14] and the Production Tax Credit.[15]

Solution #6

Provide incentives for Ontario renewable energy developments. Possibilities include:

- Providing capital assistance, in the form of grants and tax-exempt bonds,[16] for renewable energy projects that provide positive benefits to the province beyond just clean energy.
- Providing access to government land, especially brownfield sites,[17] that can be developed as renewable energy sites.

Issue #7 ■ Discrimination against centralized biogas plants in feedstock exemptions

Under Part V, Regulation 347 of the *Environmental Protection Act (EPA)*, organic by-products used as a feedstock for ethanol and biodiesel are exempt from a Certificate of Approval for waste requirement. Moreover, exemptions from a Certificate of Approval for waste have been provided to farm-based biogas plants that receive up to 5,000 cubic metres per year of off-farm material, consisting of 25% or less of total volume of material digested. This exemption puts developers of centralized biogas plants (which may serve the nutrient management needs of several farms) that are not located on a farm, and surpass this volumetric limit, at a significant disadvantage. This is not in line with the economic reality that very few Ontario farms can economically support a biogas plant on-site.

Solution #7

In order to achieve parity with other forms of bioenergy and on-farm biogas plants, extend the exemption from EPA Part V Reg. 347 to biogas feedstock, regardless of the size or zoning of the plant.[18]

The Department of Foreign Affairs and International Trade Canada offers the "Going Global Innovation" program to promote and enhance Canada's international innovation efforts by supporting Canadian companies and/or researchers in pursuing international R&D collaborative opportunities through the development of partnerships with key players in other countries/economies. This program contributes up to 75% of the eligible expenses.

http://www.tradecommissioner.gc.ca/eng/science/going_global.jsp, 2009

■

Germany implemented an aggressive feed-in tariff program in 2000, and now boasts 280,000 employees in the renewable energy industry. Germany's feed-in tariff rates will gradually be reduced, incenting companies to develop more efficient technology. This program has helped the country reduce its GHG emissions by 5.2% between 2000 and 2007.

Canadian Business: "FIT to be Tried", Joe Castaldo, July 20, 2009

12 Clean technology is a term used to refer to a wide spectrum of environmentally-friendly technologies and industries from alternative power generation, photovoltaic solar panels, and advanced biomaterials to environmental consulting, pollution abatement equipment, and remediation services. (The 2009 OCETA SDTC Cleantech Growth & Go-to-Market Report. Toronto: The Clean Technology Report Partnership, 2009, p. 23. (http://cleantechnologyreport.ca/report/2009-oceta-sdtc-cleantech-growth-and-go-to-market-report)

13 "The Next Generation of Jobs Fund" is a five-year, $1.15 billion strategy to help innovative companies grow and create well-paying sustainable jobs for today's workforce and for the next generation of Ontario's highly skilled workforce. (http://www.ontario-canada.com/ontcan/ en/nextgen_main_en.jsp)

14 Investment Tax Credit refers, in this case, to credits earned when qualified buildings and equipment are purchased for use in farming businesses. These credits can be applied against federal income tax and federal surtax, although it cannot be applied against provincial income tax payable. (http://www.nr.gov.nl.ca/agric/fact_pubs/pdf/fbm/investment.pdf)

15 The United States introduced the Production Tax Credit in 2009, which provides companies in the renewable energy sector with a 2.1 cent per kilowatt-hour (kWh) benefit for the first ten years of a renewable energy facility's operation. (http://www.ucsusa.org/clean_energy/solutions/ big_picture_solutions/production-tax-credit-for.html)

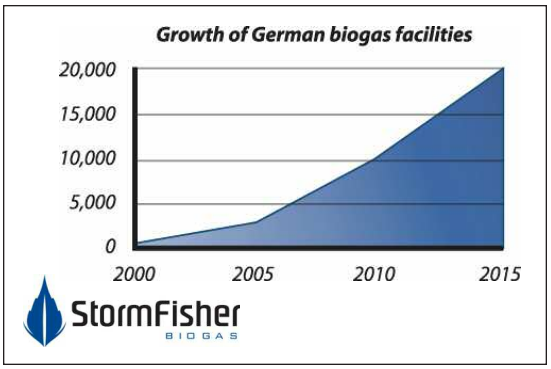
16 In the United States, tax-exempt bonds are issued by a municipal, county or state government, whose interest payments are not subject to federal income tax, and sometimes also state or local income tax. (http://www.treasurer.ca.gov/cpcfa/bondfinancing.asp). An example is the Pollution Control Tax-Exempt Bond Financing Program that "provides private, active tax-exempt bond financing to California businesses for the acquisition, construction, or installation of qualified pollution control, waste disposal, waste recovery facilities, and the acquisition and installation of new equipment." (http://www.treasurer.ca.gov/cpcfa/bondfinancing.asp)

17 "With certain legal exclusions and additions, the term brownfield site means real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant." (http://epa.gov/brownfields/glossary.htm)

18 See the "Guide for Applying for Approval of Waste Disposal Sites" for illustration of certification requirements. (http://www.ene.gov.on.ca/envision/gp/4183e.pdf)

SUCCESS FROM AROUND THE WORLD

A) ■ Europe



Ryan Little, StormFisher

FIGURE 2

"Three years ago in Germany companies like StormFisher were less developed than they already are, and today they are on the stock exchange and have 300 employees."

- Gerhard Klammer, GE Energy

"Wind and solar industry developers who are interested in the biogas industry quickly lose interest when they understand the permitting requirements and all the challenges facing biogas producers."

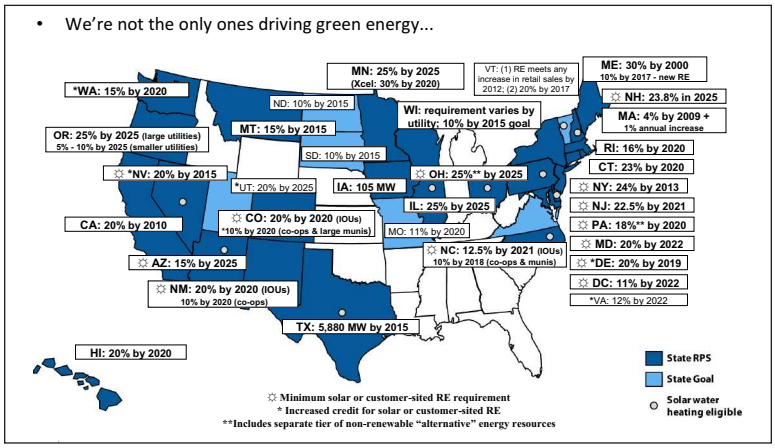
Ryan Little

Europe is undoubtedly a pioneer in the alternative energy industry. In Germany, it took nine years for the industry to develop, and the nation now boasts 4000 facilities in operation, over 300,000 green jobs, 400 biogas companies and 55 solar companies. By 2020, it is expected that biogas will account for 17% of Germany's electricity mix. Germany's success can be attributed to their well-developed renewable energy purchase programs, which are now widely used throughout Europe. These programs now include feed-in tariffs.

"How do we translate lofty goals into streamlined regulation?"

Ryan Little

B) ■ The United States



Ryan Little, StormFisher

FIGURE 3

www.dsireusa.org, July 2008

"There is a significant opportunity from a manufacturing standpoint in transitioning some of the failures in the auto industry into green energy jobs–and Michigan has swiftly taken a lead on this."

Ryan Little

How do we stack up against our neighbours? States such as Michigan and Wisconsin[19] have significant backing from governments that are ready for change and willing to make the necessary stimulus investments and regulatory changes, including a faster approvals process, to move this new industry forward. Michigan currently has the Green Jobs Initiative[20] which is a program that provides funding to educate and train a new class of green collar workers. Green business moves much faster in Michigan and Wisconsin. They have the money and a more seamless regulatory environment. We must improve the pace to be competitive and to create jobs!

19 The Government of Wisconsin is much smaller than the Government of Ontario. Government officials in Wisconsin assemble various industry stakeholders to discuss issues and find solutions. Consequently departments in the Government of Wisconsin are not silos; they work together. Silo is a term commonly used in the public service to describe a lack of communication and collaboration between administrative bodies. Departments would benefit from working together instead of working in isolation.

20 Michigan's Green Jobs Initiative is an extension of the No Worker Left Behind program, and is designed to ensure that emerging green industries have the trained workers they need to grow and prosper, offsetting the losses currently being experienced in the auto industry. The Michigan Green Jobs Report is the first effort of its kind for Michigan. The report covers private sector jobs in Michigan's green economy, and acts as a launching pad for government and business leaders in further developing Michigan's green economy and green collar workforce. See www.michigan.gov for more information.

Topic #2 UPDATING INFRASTRUCTURE – BIOGAS INITIATIVE

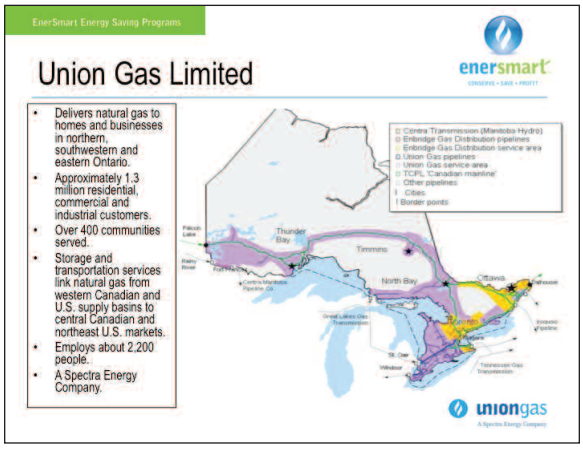
Presenter ■ BRYAN GOULDEN
Manager, Market Development, Union Gas Ltd.

PRESENTATION OVERVIEW

This presentation discusses the merits of a "second option" for biogas. This option involves generating biogas by existing technologies, then cleaning and filtering the gas to produce biomethane for injection into the natural gas distribution grid. This is an alternative to the more typical Ontario option of using the biogas produced to generate power for sale into the Ontario electricity grid. Operational and market opportunities associated with this approach will be identified, as well as the current challenges that need to be overcome.

BACKGROUND

Union Gas is one of Ontario's largest distributors of natural gas, and is responsible for the delivery of natural gas to homes and businesses in northern, southwestern, and eastern Ontario. Figure 1 illustrates their delivery coverage.



Bryan Goulden, Union Gas 2009 **FIGURE 1**

Union Gas is currently participating in research regarding the viability of biomethane, a refined version of biogas that could be used as a substitute for natural gas. Biogas has two common uses:

- ***Power Generation:*** Generate electric power by utilizing biogas produced in a combined cycle power plant. Electricity is the primary energy produced, followed with the production of energy from wasted heat.
- ***Biomethane:*** Clean and separate biogas and inject it into the natural gas distribution system (less than 95% methane). This can substitute for natural gas in end use applications.

Biogas can be produced from a number of sources including agricultural waste, crops, food industry waste, sewage treatment and landfill. The gas produced is typically 50% to 60% methane, with the remainder primarily CO_2.

Biogas can be used in power generation, which means using an anaerobic digester to process agricultural materials and convert it into biogas. The gas is then fired in a combined cycle power plant to produce electricity. This process is very efficient as long as there is use for the excess heat. The other purpose of biogas would be the production of biomethane.

Biomethane is essentially biogas that has been treated and filtered to a gas that is at least 95% methane. This can then be injected into the natural gas distribution system and ultimately used by end users for applications like a residential furnace, resulting in 70% to 90% efficiency.

Part of Premier Dalton McGuinty's plan to replace coal in Ontario relies on the province becoming more dependant on natural gas as a fuel for electricity generation. The Government has directed that natural gas generation will increase from roughly 4,350 MW (2003) to 9,400 MW by 2025 in order to replace coal.

Purchase, Bryne, "The Future of Coal in Ontario? Towards a Clean, Secure and Competitive Energy Portfolio," pg. 4, 2007, Queen's University.

■

For every six cubic meters of gas sent to Ontario from Alberta, one cubic meter is used as fuel to transport the other five here.

Chris Hanlon, AgEnergy Cooperative

Significant opportunity exists in the area of biomethane:

- It replaces non-renewable conventional natural gas
- Burns as cleanly as natural gas
- Full environmental value of biomethane is high, although currently uncertain
- Delivery infrastructure may already be in place
- Can be produced effectively with existing technologies

Issue #1 ■ Capacity

Similarly to biogas used in electricity production, biomethane has distribution capacity issues. The issue with natural gas infrastructure is that biomethane is typically produced and injected into the local natural gas distribution system, which may have limited seasonal market demand, such as in the summer when customer space heating requirements are low. Like electricity, tie-in opportunities to the natural gas system can also be challenging due to the lack of transmission and distribution infrastructure.

"Many of the biogas opportunities are not where people are located and not where demand is located."

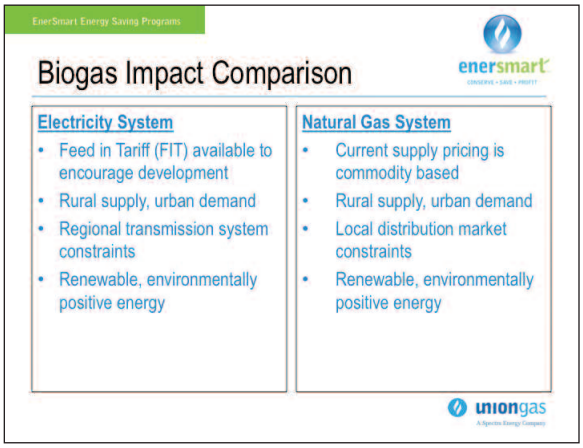
Bryan Goulden

Issue #2 ■ Pricing

An issue that is unique to biomethane, and the natural gas industry, is the current market pricing model, which creates significant uncertainty for potential investors. Because there is no feed-in tariff for biomethane, and because the price of natural gas can fluctuate anywhere from $4 to $15 per GJ, it makes it very difficult for developers to predict a rate of return on their investment. The lack of purchase price stability leaves this market unattractive due to the significant capital costs involved with building a facility that could create biomethane from biogas.

"In terms of a break-even price for biogas vs. conventional natural gas, the challenge we have is with the current pricing model... we pay market price. Market price is not going to get development going, so we need to figure out the full environmental value calculation, and recover that in our rates."

Bryan Goulden



Bryan Goulden, Union Gas 2009 **FIGURE 2**

"Ultimately all energy ends up as heat. One of the fundamental difficulties with central generation is that you only use 30%, if you're lucky, of the energy that's available in the fuel that's being combusted."

Jan Buijk

Solutions

Four Energy Policy Considerations:

1. Provide funding assistance for industry to determine the environmental value of biomethane.
   - Although there is a high level of agreement that biogas production through anaerobic digestion is environmentally beneficial, quantification of this value is not well established. For example, the offset credits generated by specific biogas applications require some research and analysis to be determined. Provision of funding assistance to quantify the environmental value of these potential projects would provide more information for all stakeholders and more certainty for project developers.
2. Provide funding assistance for first pilot and demonstration sites.
   - Pilot or demonstration biogas project funding would allow the first small number of projects to be built with less risk for project developers. This would also improve the knowledge and familiarity with these technology applications that are new to Ontario.

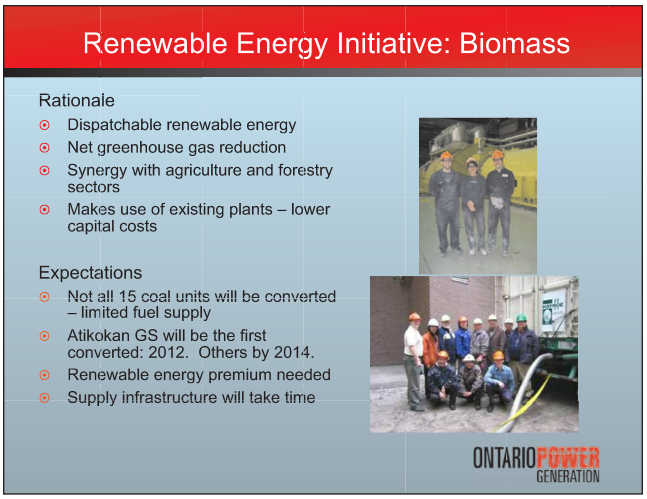
3. Provision of incremental utility infrastructure.
    - Utility infrastructure to tie-in potential biomethane projects to the natural gas distribution system can be expensive since potential biogas sites can be located a significant distance from existing natural gas distribution infrastructure. Developers are required to pay these costs since they are typically the only party benefitting from this connection. Funding assistance would lower the overall cost of these projects.
4. Consider a natural gas feed-in-tariff to reflect the full cycle environmental value.
    - A natural gas feed-in tariff could be created to encourage the development of renewable natural gas energy, consistent with the recent electricity feed-in tariffs introduced by the OPA. This would help provide another viable supply option and revenue stream for biogas developers. Their production of renewable energy significantly reduces greenhouse gases (GHG) and agricultural waste while generating a valuable digestate[21] for use on farmland.

Topic #3 BIOMASS INITIATIVE

Presenters ■ ROBERT LYNG - Senior Advisor, Ontario Power Generation
CHRIS YOUNG - Vice President, Business Development Fossil Fuels, Ontario Power Generation

PRESENTATION OVERVIEW

Ontario Power Generation (OPG) is moving on a fairly aggressive biomass initiative. They intend to convert some of Ontario's 15 coal burning power units to either wood pellet fuel (WPF) burning, or agriculture pellet fuel (APF) burning by 2014. The first of these conversions will take place at the Atikokan Generating Station and will be completed by 2012. In the tests at the northern Ontario plant, the OPG was able to achieve 100% load output when burning wood pellets. The southern Ontario plants have also started the conversion process and are already well underway with the tests at the Nanticoke Generating Station, producing 4 gigawatts (GW) of electricity in 2008. Here they are producing energy through the firing of both wheat shorts and WPF.



Robert Lyng, OPG **FIGURE 1**

ISSUES AND SOLUTIONS

Issues

Cost aside, there are two major challenges to overcome if biomass is to be widely accepted as a fuel for electricity production. First, the greenhouse gas (GHG) benefit must be demonstrable. And second, the competition for resources must be satisfactorily addressed.

Did YOU Know

Ontario Power Generation (OPG) is currently testing the use of biomass as a new renewable energy source for Ontario. Biomass used in OPG's program consists primarily of wood pellets and agricultural by-products such as grain screenings and milling spoils that can be burned to generate electricity. OPG does not use food crops in its biomass program.

www.opg.com

21 Digestate is the solid material remaining after the anaerobic digestion of feedstock.

"What is the concept that would have broad public policy support from the communities, to regulators, suppliers and stakeholders? Nobody wants to get into this business with something that is unsustainable and nobody wants to go into it to lose money."

Robert Lyng

Robert Lyng, OPG **FIGURE 2**

"We're making use of the existing plants, the transmission, infrastructure, staff and personnel, everything that is in place there. These are plants that we know how to operate and can use when the phase out of coal is complete. Biomass looks like a great opportunity for these plants."

Robert Lyng

Robert Lyng, OPG **FIGURE 3**

"There needs to be a net greenhouse gas reduction, and we need to land on some kind of consensus on what competition for resources really means. And from the electricity perspective, we need to have an agriculturally based fuel supply."

Robert Lyng

Solutions

1. Establish a communication strategy, supported by sound science, regarding the sustainability of the forestry and agriculture sectors, and the renewable nature of biomass fuels they produce.
2. Establish a transportation infrastructure capable of meeting the delivery demand to the pelletization and electricity generating facilities.
3. Come to a consensus surrounding what types of biomass are widely accepted in Ontario for electricity production.

Topic #4 UPDATING INFRASTRUCTURE – RELATING TO POWER GENERATION

Presenter ■ MARK GRAHAM
Director, Investment Policy and Agreement, Hydro One

PRESENTATION OVERVIEW

Ontario's transmission and distribution (T&D) systems were developed mainly to take power from large centralized power plants and deliver it to consumers. As Ontario moves to a more distributed electricity generation mix, driven in many ways by the desire to move supply to cleaner, renewable sources, the T&D systems need to be updated to allow the connection of these new generators and to enable their output to reach consumers.

This presentation discusses the problems that exist in the current T&D systems, and how they will be affected by the expected passage of the Green Energy Act. It also discusses the implications of the impending feed-In tariff program, and what Hydro One is doing to prepare and manage these regulatory changes.

ISSUES AND SOLUTIONS

Issue #1 ■ Power Distribution Constraints

Most of the province's population lives in areas where the local use of electricity far exceeds the local power output. This means that power needs to be created outside of the local community and brought in. This especially occurs in the Greater Toronto Area (GTA) where there is a need for substantial transmission and distribution. Other than landfill gas and rooftop solar power, most renewable energy is created in areas remote from where the power is needed. New renewable generation will thus likely require a major investment in wires systems,[22] which is a solution as well as an issue – who pays?

Issue #2 ■ Wire infrastructure implications

The Green Energy and Green Economy Act (GEGEA)[23] is a Province of Ontario initiative, which received Royal Assent on May 14, 2009. The objectives of the act are to transition Ontario to a greener economy, stimulate economic development, and create new jobs. In particular the GEGEA is aimed at:

- Fostering the growth of renewable energy projects; and
- Promoting and expanding energy conservation in Ontario

The GEGEA also sees the implementation of a Smart Grid as critical to meeting these objectives and encourages local community power generation.

Most renewables, except some solar and landfill gas, are distant from the major load. New renewable generation will require major increases in enabling wires systems. The province's ability to generate green power is located primarily in rural Ontario where there are significant transfer capability constraints. The Orange and Yellow zones in Figure 1 illustrate the challenge of where renewable generation exists and where the transmission system is constrained right now.

22 Dr. Tarchlochan Sidhu presented his research on wire systems at this workshop. For more information on his leading-edge research, see http://www.eng.uwo.ca/people/tsidhu/.
23 Also referred to as the Green Energy Act (GEA).

As part of the American Recovery and Reinvestment Act, the Vice President outlined plans to distribute more than $3.3 billion in smart grid technology development grants and an additional $615 million for smart grid storage, monitoring and technology viability.

www.energy.gov/newsroom2009

■

"The last time we did a major new 500 kV transmission line in the province, it took 14 years to get approvals and build it."

Geoff Olgram, Hydro One Lawrence Centre, 2006, Energy Report p. 24 www.lawrencentre.ca

■

"Sustainability can lead to interesting next practice platforms. Called the Smart Grid, it uses digital technology to manage power generation, transmission and distribution from all types of sources along with consumer demand. The concept has been around for years, but the huge investments going into it today, will soon make it a reality."

Harvard Business Review, p. 64, September 2009, www.hbr.com

"A number of people have talked about the Green Energy Act and renewable energy approvals. One thing is clear: that Act is focused on generation, not transmission. Whether by wire, train, ship or pipeline, it's not there. It's great to have renewable energy generation but it's no use if you don't have transmission."

Dianne Saxe

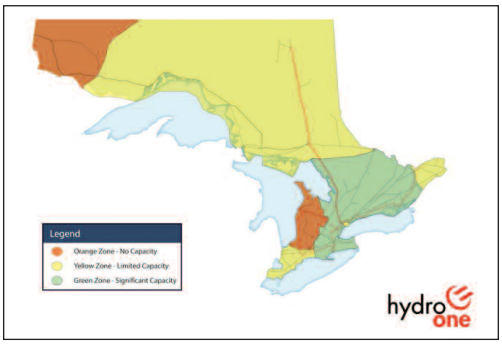
"When I say transmission constrained I don't mean we've got room to move 1000 megawatts before we hit the constraint, I mean we've got 50 or 100 megawatts or less."

Mark Graham

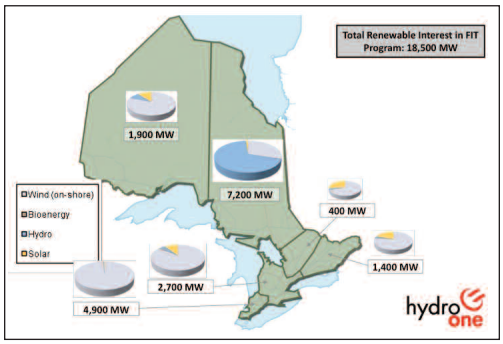
"We need to make investments and we need to expand the distribution networks where high demand exists. For on-farm biogas power generation, those farms are served by a very skinny distribution system to begin with and they cannot take new generation, so we have pretty expensive additions to the distribution system to incorporate on-farm."

Mark Graham

CONTEXT – TRANSFER CAPABILITY CONSTRAINTS



CURRENTLY IDENTIFIED RENEWABLE INTEREST



Mark Graham, Hydro One

FIGURE 1

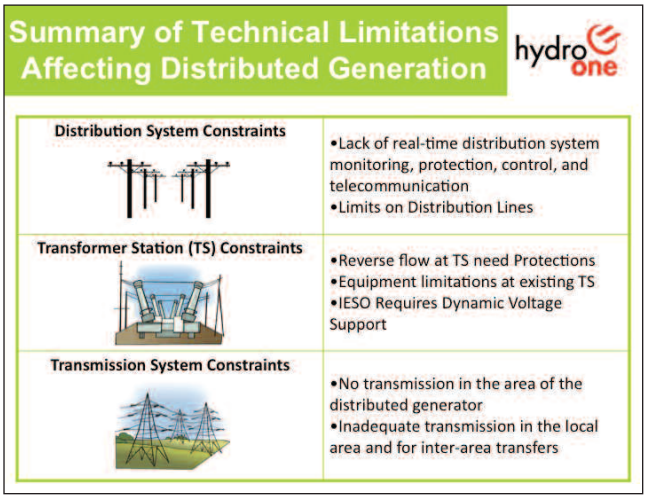
The distribution system in rural Ontario is referred to as a "skinny system" and was built to deliver power to those loads. Historically, these loads have not been high enough to justify large investments beyond those required for basic service, so we have a "dumb system." That is, the system currently does not provide information on shortages and outages. We really have no idea what is happening in real time. People have to phone in to tell us where outages are. As we put smart meters in place, we begin to receive information as the smart meters are linked by communication systems.

If we are going to operate a system with significant amounts of generation, we need to change the nature of that distribution system and make it more intelligent. What we need is a system, commonly referred to as the "Smart Grid," which would provide intelligence for better monitoring and control of electricity generation. A Smart Grid would enable a "two-way flow of electricity and information, using sensors, monitoring, communication, automation and computers to improve the flexibility, security, reliability, efficiency and safety of the electricity system."[24]

Beyond the need for increased intelligence in the distribution system, there are also basic capacity constraints. These constraints can occur in the distribution wires, in the transformer stations that link the distribution and transmission systems, and in the transmission system between areas that have high generation and areas that have high loads. Many of these constraints will need to be alleviated by new infrastructure to realize the goals of the GEGEA.

Issue #3 ■ Technical limitations affecting distributed generation

Technical limitations on the wires system are summarized in Figure 2.



Mark Graham, Hydro One

FIGURE 2

24 "Enabling Tomorrow's Electricity System." *Report of the Ontario Smart Grid Forum.* Convened by Ontario's IESO, Burlington Hydro, Hydro One, Hydro Ottawa, and Toronto Hydro, 2008.
The Ontario Centres of Excellence has 14 projects under way or in the pipeline that relate to smart grids. Investment in these projects are currently close to $12 million, with almost half of this amount coming from OCE.

The GEGEA incorporates a feed-in tariff program. Under this initiative there is a standard offer, where prices are differentiated by size, technology, and in some cases, type of proponent. The standard offer is applicable to both transmission and distribution. The "right to connect" to the grid will be subject to economics. Constraints will be respected, but transmitters and distributors are obligated to respond where economically viable.

The maps in Figure 1 show the power transfer capability constraints in Ontario and the areas of interest for proposed renewable generation through the feed-in tariff program. It is easy to see that when Ontario moves forward with the program, the province is going to run into serious challenges in the delivery of distributed generated electricity.

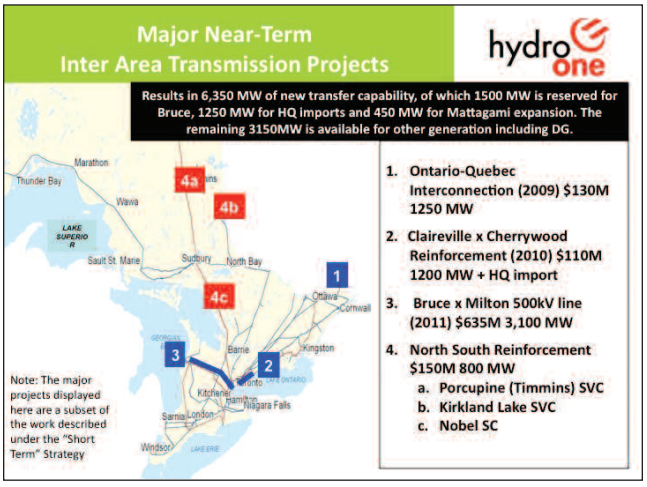
Solutions

Actions Required to Enable Distributed Generation:

1. Make targeted investments in distribution, where transmission capability is available, to:
   - Expand distribution networks where high demand exists
   - Provide telecom, protection and control infrastructure
   - Enable increased use of existing transformer capacity
   - Provide voltage support across wide areas of the grid
   - Properly manage power quality
2. Expand transmission capability.
3. Address policy and regulatory questions. However, with all of this progress there are still several substantial system constraints that need to be addressed. Also, many policy and regulatory questions still exist surrounding the transmission and infrastructure projects:
   - Who should pay for the Transmission and Development upgrades?
   - Should certain types of projects or proponents be given priority? (Biodigesters, First Nations)
   - Should certain locations be given priority?
   - How do we ensure that projects that are not moving are not blocking viable projects behind them?
   - How do we streamline the approval process?

More and faster progress is required for future projects as indicated by the Minister's directive to the OPA to review the Integrated Power System Plan. Hydro One is working with OPA on additional transmission.

There are currently several projects underway that address some of the above issues. The map below highlights projects that are near completion and that will help alleviate a portion of the stress placed on the transmission system.



Mark Graham, Hydro One

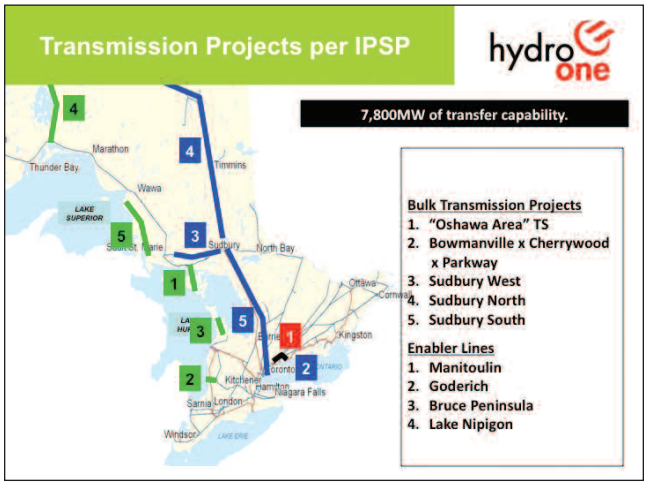
FIGURE 3

Did YOU Know

Provincial initiatives on conservation, renewable generation and smart meters begin the move towards a new electricity system, but their full promise will not be realized without the advanced technologies that make the smart grid possible. The challenges that Ontario faces in simultaneously incorporating distributed generation, addressing growth, and replacing aging infrastructure while maintaining reliability and quality of service are daunting. While new grid infrastructure will be necessary to connect generation resources, replace aging assets and address growth, simply adding wires and equipment without intelligence is not a viable option.

Report on The Ontario Smart Grid Forum, pg. 2, 2008.

There are also major transmission projects identified by the IPSP that are under consideration. If implemented, these projects would add 7,800 MW of transfer capability. Figure 4 outlines these projects.



Mark Graham, Hydro One

FIGURE 4

"It's important for people to remember that much of this new power generation will require new wires to move it to the places that use large amounts of electricity."

Mark Graham

"Wood and agriculture biomass numbers are a mathematical calculation based on the amount of coal that is being used at Lambton and in Nanticoke right now, plus 20%, which would be the volume needed for biomass, and dividing it in half."

Phil Dick

"Establish a transportation infrastructure capable of meeting the delivery demand to the pelletization and electricity generating facilities."

Robert Lyng

Topic #5 LOGISTICS AND TRANSPORTATION OF RAW MATERIALS AND PELLETS

Presenter ■ TOM SAGASKIE
General Manager, Guelph Junction Railway

PRESENTATION OVERVIEW

The utilization of biomass as a green fuel source for electrical power generation is a near reality as demonstrated by successful tests. The challenges of implementation include the movement of vast volumes of pelletized biomass fuel pellets to electrical power generation facilities. Both Nanticoke and Lambton generation facilities can be accessed by water and rail, which could facilitate wood pellet movements from northern Ontario and agriculture pellet movements from southern Ontario.

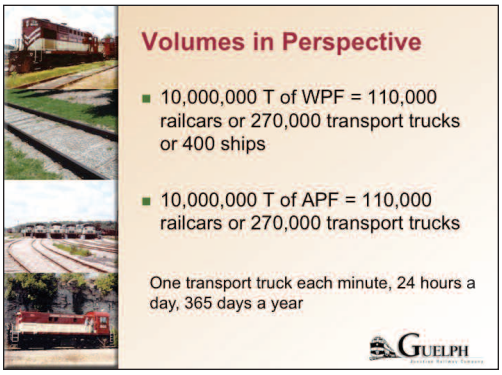
ISSUES AND SOLUTIONS

Issue #1 ■ Logistics and Transportation

Ontario has made a commitment to abolish coal-burning power generation facilities and convert them to wood pellet fuel (WPF) and/or agriculture pellet fuel (APF) burning facilities. In order to meet this commitment, Ontario must face the impending supply-chain bottleneck surrounding the delivery of the wood and agriculture pellets to the power generation facilities. There are currently four coal-burning power generation facilities in Ontario; Lambton, Nanticoke, Thunder Bay, and Atikokan, which account for 6077 MW of power. The majority of this power is being generated at the Nanticoke and Lambton sites (5560 MW). In order to convert both of these sites to entirely pellet burning, they would need to be supplied with 10,000,000 tonnes (T) of wood pellet fuel and 10,000,000 T of agriculture pellet fuel. The figures of 10mT of wood and 10mT of agricultural biomass reflect an estimation of volumes that would be required to undertake a complete conversion from coal. It is most probable that any conversion would take place in incremental steps over a number of years.

Solutions

1.1 Transporting 10,000,000 T of WPF and 10,000,000 T of APF converts into one truck each minute, 24 hours a day, 365 days a year entering a power plant. Logistically this is impossible. Ontario Power Generation needs to look at other methods of delivering the pellets, such as ship and rail (Figure 1 and 2). These alternative methods of delivery will avoid creating congestion on highways and are significantly more environmentally friendly.



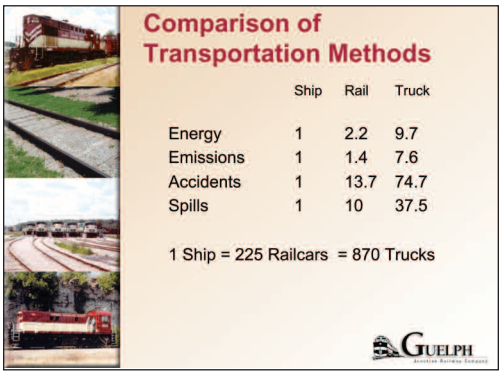
Tom Sagaskie **FIGURE 1**

Ships could move wood pellets from northern Ontario to the Lambton and Nanticoke power generation facilities. This would involve trucks taking the pellets from pulp areas in northern Ontario to various ports, then ships delivering the pellets to the final destination. Due to the seasonality of the shipping industry, these large ships could be used to store the pellets during winter months. Rail could also be used to transport wood pellets from the more remote northern locations. Agriculture pellets would be delivered entirely by rail, sourced primarily from southern Ontario croplands.

1.2 Construct Agricultural Pelletizing Plants Near the Raw Material Source

Southern Ontario needs to be split into a minimum of nine pelletizing geographic areas.

Each green dot represents a proposed pelletizing plant area that would be located on a non-class 1 rail line. These are short or secondary rail lines which generally have flexibility of schedule, spare transportation capacity and can be used to collect and aggregate railcars of fuel pellets. Locating pelletizing plants on class 1 rail lines is not advisable due to potential conflicts between existing transnational rail schedules and local plant switching needs.



Tom Sagaskie **FIGURE 2**

More railway investment and infrastructure capacity improvements are taking place in the U.S. than in Canada. For the same dollar spent-part of it is opportunity, land cost, depreciation rates, taxation and U.S. Federal and State infrastructure funding investments – you can make up to 3.5 times more return from the same expenditure from rail infrastructure investment in the U.S. than you do in Canada.

Tom Sagaskie, Developing Transportation Policy workshop report. www.lawrencecentre.ca, 2008.

In Figure 3, the red dots represent Lambton and Nanticoke, to where the pellets need to be transported. This is relatively simple to do using existing rail interconnectivity. The dashed red and blue lines represent the transnational CN and CP class 1 rail lines. The class 1 lines will need to be used to some extent, but by using this model the capacity utilized will be minimized.

The use of agricultural products does create a local problem with the number of farm trucks moving in and out of the pelletizing plants. It takes a lot of agricultural product to create 33 rail cars of agriculture pellets. Neighbours and people living in the proximity of these plants may be bothered by the increase in noise and traffic on rural roads.

"Why wouldn't we just set up the palletization plants at Nanticoke and Lambton rather than trucking the goods to a point, then have them transferred by rail... it seems that you'd have a fair amount of redundancy with bringing goods to a central point and then moving them around by rail."

Peter White

"You physically can't get that many trucks in the gate, unload, and get them back out before they start backing up."

Tom Sagaskie

"I ran one of the biggest pulp mill operations in Ontario, and all we could handle was 400,000 tonnes... the reason we couldn't go any bigger was because of the cost of transportation"

Frank Dottori

"It will take 2-3 years lead time to establish pelletizing plants and the supporting infrastructure... It does take you quite a while so we need to get started soon. We need a clear process for the necessary approvals to construct the plants and the infrastructure."

Tom Sagaskie

1.3 Additional Rail Connection to Nanticoke

An important and challenging part of this process will be reestablishing and rebuilding a second and third rail connection to Nanticoke. This is necessary in order to avoid system redundancy and guarantee of access. Although an investment of approximately $70 million is required, it is crucial to make this plan work. Interestingly, these additional rail connections did exist at one time. While the tracks have been removed, the rail bridges remain intact.

It is of significant importance to understand the need for the concept of geographic regions. In order to minimize the number of rail cars being cycled, the travel time between pelletizing facilities and the power generation plants needs to be kept relatively small. However, from an economic standpoint, the distance between farms and pelletizing plants also needs to be minimal. The pelletizing process itself condenses the materials, which means for transportation efficiency purposes, Ontario is better off building its pelletizing facilities closer to the source of the raw materials rather than near the generation facilities.

NEXT STEPS:

- Establish a clear process for necessary approvals to construct pelletizing plants and necessary infrastructure improvements.
- Construct pelletizing plants and the needed storage and handling facilities. These should be constructed in different geographic regions, with access to secondary rail lines. This needs to be acted on now because it takes 2 to 3 years lead-time to get a facility up and running.
- Upgrade the rail infrastructure on the secondary lines. This will amount to approximately $1 million per region.
- Reestablish a second and third rail line access to Nanticoke. This will cost approximately $70 million.

Issue #2 ■ Railway Infrastructure Investment

Railway movements in the central and southwestern Ontario regions noted above are currently running at approximately 50% of past record usage. This is in large part due to the current recession.[25] At present in Canada and the United States about 40,000 surplus rail cars have been placed in temporary storage.

Solution #2

Now is the time to move forward with railway infrastructure investments. The current recession has created a situation whereby the purchase of rolling stock (rail cars), could be made today at a deep discount.

The current excess capacity on rail lines allows for more flexibility when setting up these new fuel pellet transportation networks. The proposed rail transportation of agricultural fuel pellets itself will require the purchase or dedication of 870 rail cars, a value of about $131 million.

NEXT STEPS:

- Make an immediate commitment to purchase fuel pellets. Private sector investment in pelletizing facilities will only occur when the market establishes a benchmark price for fuel pellets.
- Negotiate to acquire or have dedicated 870 rail cars.

25 As of August 15, 2009, the western part of the 300 km freight line between Sault Ste. Marie and Sudbury will close due to economic constraints caused by the recession. Up to 45 jobs may be lost and transport trucks will replace the 16 000 railcars currently operating, causing environmental issues and additional strain on road conditions. (http://www.saultstar.com/ArticleDisplay.aspx?e=1616548)

Issue #3 ■ Shortage of Qualified Truck Drivers

One year ago there was a shortage of 13,000 truck drivers, which was a critical transportation issue for all industry in Ontario. Now, due to the economic recession and stricter Canada-U.S. border polices, there is decreased demand for truck drivers. Ontario is currently able to meet its transport truck driver demand. As the economy improves and border crossings become more efficient the demand for drivers will increase again.

Solution #3

This current lull in driver demand creates a window of opportunity for investment in the education and development of transport truck drivers. Doing so now would ensure that in the future Ontario has the necessary trained labour force needed to attract new business development.

Establish training programs that will increase the number of qualified transport trucks drivers.

AGRICULTURAL PELLET FUEL MOVEMENT TO POWER PLANTS

Tom Sagaskie

FIGURE 3

Did YOU Know

Vehicle Emission Standards to Accelerate Reductions in the Transportation Sector:

Regulations could involve the national adoption of California's GHG emissions intensity policy out to 2020, gradually increasing the stringency to a zero GHG intensity policy by 2040. These regulations imply either complete electrification of the transport fleet or switching to an alternative liquid or gas motive fuel ; biofuels and hydrogen are two candidates. The policy delivers 11 Mt CO_2e in 2015m, gradually increasing to 68 Mt CO_2e by 2050.

Achieving 2050: A Carbon Pricing Policy for Canada. www.nrtee-trnee.ca . 2009

FROM SCIENCE TO SOLUTIONS

Chair ■ DAVID SPARLING, CHAIR, AGRI-FOOD, INNOVATION AND REGULATION, PROFESSOR, RICHARD IVEY SCHOOL OF BUSINESS, THE UNIVERSITY OF WESTERN ONTARIO

Objective

The purpose of this session is to examine the science behind green energy and how it can be commercialized.

"The amount of CO_2 in the atmosphere that was thought to go up by 1-2% is going up at over 3.5% per year since the beginning of this century and... Canada is doing its part in making it go up."

Gordon McBean

"Give industry a set of rules, set them in place so that they're clear and understandable, and actually stick to them so industry can make decisions with some clear stability."

Gordon McBean

Topic #1 CLIMATE CHANGE – THE CHALLENGES AND OPPORTUNITIES FOR GREEN ENERGY

Presenter ■ GORDON McBEAN [1]
Research Chair, Institute for Catastrophic Loss Reduction; Professor, Department of Geography, The University of Western Ontario

PRESENTATION OVERVIEW

Dr. McBean addresses how the climate is changing and will change in the future, presenting challenges in adapting our agricultural production. The uncertainty of the evolving climate must be considered when discussing the sources of green energy. Governments are now developing strategies to reduce the human impact on the climate and these policies may or may not be supportive of green energy. At all levels of government and industry, a comprehensive analysis is required to avoid making the "wrong" choices on green energy.

KEY MESSAGES

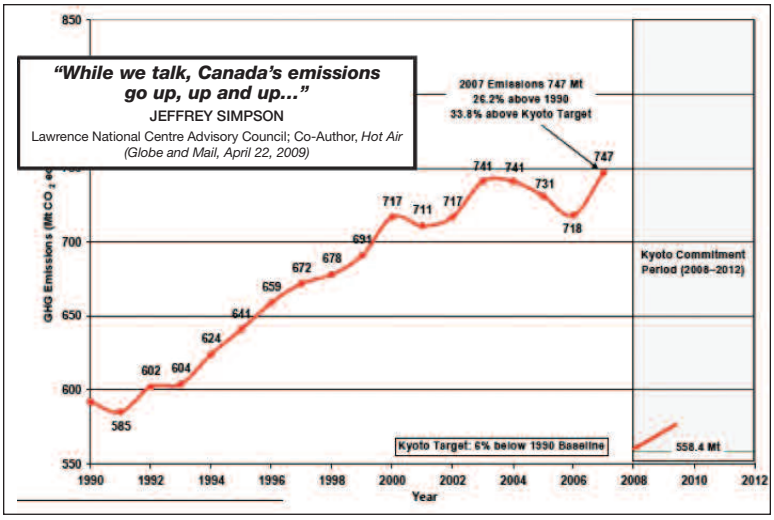
- The climate is already warming, it will continue to warm and humans are the cause. Many government leaders, including British Prime Minister Gordon Brown, have taken the position that "climate change is potentially the greatest challenge to global stability and security... tackling its causes, mitigating its risks and preparing for and dealing with its consequences are critical to our future security."
- The choices we make now in terms of re-tooling our energy system will make huge differences in a global sense, in the mid-century and beyond. It will be crucial that Canada implement both mitigation and adaptation strategies. We have options, but the past is not one of them.
- Climate change will create both opportunities and challenges for agriculture and green energy.
- With the recent changes in international and U.S. greenhouse gas (GHG) emission reduction strategies, Canada should move quickly to implement an effective 'made-in Canada' approach, recognizing the economic, environmental and social benefits.

1 Dr. McBean is currently involved in numerous government-supported projects, including the *Knowledge Synthesis on Climate Change as a Security Issue* (Social Sciences and Humanities Research Council), *Arctic Net* (Networks of Centres of Excellence), *Storm Studies of the Arctic* (Canadian Foundation for Climate and Atmospheric Sciences), *Canadian Regional Network on Earthquakes* (Networks of Centres of Excellence), and *Multilevel Governance* (SSHRC and Major Collaborative Research Initiatives).

Issue #1 ■ "Warming of the climate is unequivocal" (The IPCC, 2007)[2]

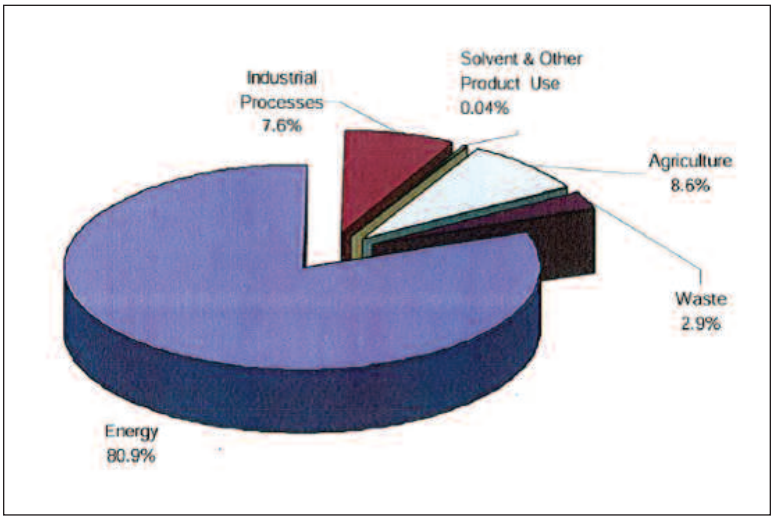
The effects of climate change are now becoming evident. An increase in global average air and ocean temperatures, widespread melting of snow and ice, rising sea levels, more frequent extreme weather events, changing precipitation patterns and other climate-induced impacts will pose significant challenges. It is projected that the temperature could continue to increase globally anywhere between 1.5°C to 6°C by the end of the century. The extent of warming is dependent on many factors including the rate of GHG emissions, which will increase based on population growth, GDP per population, and energy intensity per population.[3]

CANADA'S GHG EMISSIONS 1990-2007



Gordon McBean, The University of Western Ontario **FIGURE 1**

SECTOR BREAKDOWN GHG EMISSIONS



Gordon McBean, The University of Western Ontario **FIGURE 2** *Source: Environment Canada*

Germany has unveiled its plans to cut carbon dioxide emissions by 40 percent within 13 years and become the most energy-efficient country in the world.

www.energy-daily.com, April 26, 2007

From 2005 to 2007, the European Union allowed each country to set its own cap on carbon emissions. The reluctance of countries to hobble domestic industries led to an overly generous allocation of allowances. This contributed to a sharp decline in the price of carbon allowances, from about €35 per ton in April 2006 to €10 per ton in May 2006, which threatened to render the entire undertaking meaningless. Consequently, the volume of allowances was reduced by about 8% for the second phase of trading, which commenced in 2008.

"State and Trends of the Carbon Market" (2008). World Bank.

2 The Intergovernmental Panel on Climate Change (IPCC) was created in 1988 by the World Meteorological Organization and the United Nations Environmental Program to assess the scientific, technical and socio-economic information relevant for understanding the risk of human-induced climate change. The main activity of the IPCC is to provide, in regular intervals, Assessment Reports of the state of knowledge on climate change. (www.ipcc.ch)

3 Energy intensity is defined as the ration of energy consumption and economic or physical output. At the national level, energy intensity is the ratio of total domestic primary energy consumption or final energy consumption to gross domestic product or physical output. (www.climatechange.ca.gov)

The amount of carbon dioxide (CO_2) in the atmosphere that was thought to be increasing by 1% or 2% is actually going up at a rate of more than 3.5% per year since the beginning of this century. This major issue is not being adequately addressed at the global level. Canadians have one of the most dubious records in terms of per capita emissions and have been very unsuccessful in meeting our Kyoto Protocol emissions reduction target. Canada agreed to reduce emissions by 6% below 1990 levels between 2008 and 2012. Instead of decreasing by 6%, Canadian emissions have increased by more than 27% putting us 33.8% above our Kyoto target (Figure 1). Agriculture is responsible for about 8.5% of Canadian emissions, and energy is responsible for 81% (Figure 2).

"Canada agreed to reduce emissions by 6% below 1990 levels between 2008 and 2012. Instead of decreasing by 6%, Canadian emissions have increased by more than 27% putting us 33.8% above our Kyoto target."

Gordon McBean

According to the European Union, any increase beyond 1.5°C will have dangerous implications for water, ecosystems, food, coasts and health. Canada does not currently have a position on what we consider to be a dangerous level of warming. However, Canada will experience greater warming than other regions. If the global temperature change is about 3°C then the average temperature in Canada is expected to change by 5°C to 7°C. We will experience much warmer winters, much hotter summers, with more hot days over 30°C, and more smog. According to a recent report from the Canadian Medical Association,[4] 21,000 Canadians die of smog every year and that number will be four times higher in the next 30 years. Consequently, in discussions about clean energy, it is important to focus not only on CO_2 emissions, but also on smog.

Solutions

"If you want to take on GHG's efficiently you have to do it four or five different ways. So, put a price on it, put a tax on it, and put some regulations on it."

Ted Cowan

"Canada will warm significantly faster than the global temperature. We will experience much warmer winters and much hotter summers."

Gordon McBean

"The choices we make now in terms of re-tooling our energy system will make huge differences in a global sense."

Gordon McBean

1.1 Strong Canadian action within an international framework that is focused on both mitigation and adaptation will be integral to combating climate change. There have been many international agreements to address climate change. The United Nations Framework Convention on Climate Change was negotiated in 1992 and has resulted in important international initiatives including the Kyoto Protocol (1997), and the upcoming Copenhagen meeting in December 2009. Canada must be well-prepared to negotiate an effective post-Kyoto agreement. This will be an on-going process through numerous Conferences of the Parties, but the continued dialogue is important because it indicates that the public is serious about addressing climate change.

1.2 The Federal government needs to make a decision about the price of carbon. Whether it is $50 per tonne or $10 per tonne, it will make a significant difference to how business is done. It is an important initiative to capture the accurate social cost of carbon. The price will not be determined by Ontario, but rather by Canada, the United States and global communities. We need to make the right choices through comprehensive analysis, and we need a framework that is clear, stable and that actually makes a difference. It is important not only to tax the negative, carbon-intensive practices, but also to reward those who are taking action to sequester carbon and reduce their emissions.

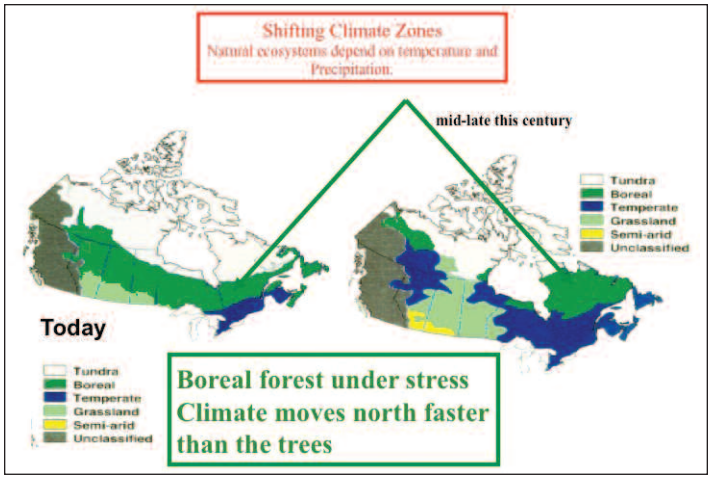
1.3 In addition to reducing emissions, adaptive measures are essential. Regardless of how much mitigation occurs today, CO_2 stays in the atmosphere for many years, so some of the effects of climate change are inevitable and irreversible. Consequently, adaptation strategies need to be mainstreamed into strategic planning across all climate-sensitive sectors. In recognition of the importance of adaptation, the Ontario Ministry of Environment has created the Expert Panel on Climate Change Adaptation[5] to establish an effective strategy for Ontario. Some key ideas include better designs for structures and cities, more green space in cities, heat alerts and raising awareness about climate-induced health implications.

Issue #2 ■ How can agriculture and green energy be more resilient to climate change?

Agriculture is an important industry in Canada. It is also the economic sector that is most sensitive to climate change because crop development is directly dependent on climate. Climate change will affect temperature, weather events, moisture, soil and other key factors involved in farming. Changing precipitation patterns will lead to more winter rain, causing soil erosion and more extreme rain events, causing floods. Many areas will experience water shortages causing problems for agricultural production. Droughts are expected to increase in the Prairie regions. As the temperature increases, shifting climate zones will be highly problematic.

4 Jennifer Geduld. *No Breathing Room: National Illness Costs of Air Pollution, Summary Report.* Canadian Medical Association, 2008. (http://www.cma.ca/index.cfm/ci_id/86830/la_id/1.htm)

5 It is the mission of the Expert Panel on Climate Change Adaptation to provide the province with adaptation strategies to address the impacts of climate change in the province's communities and ecosystems. (www.ene.gov.on.ca)



Gordon McBean, The University of Western Ontario **FIGURE 3**

Climate is a defining factor for where certain plant species will grow and flourish. Consequently as the climate changes, ecosystems will eventually change their location. A climate under a typical doubling of CO_2 conditions, which will likely occur within the next fifty years, will significantly reduce the areas suitable for boreal forests in Canada, while increasing the areas suitable for grasslands and temperate forests. Since forests migrate very slowly, the transition of these ecosystems to new climatic zones will be out of step with changes in climate. Current ecosystems, such as the boreal forests, will be situated in climatic regimes that they are not used to (Figure 3). This is likely to cause dieback and forest loss due to insects, diseases and fire in those ecosystem regions where climate change imposes greatest stress. Changes in ecosystems can, in turn, significantly affect regional climates, agriculture, forests and resource-based communities. This will affect where and how people live and may have disastrous effects if it is not taken into consideration in future development.

Solution #2

2.1 Adapt agricultural production, including the sources for green energy, to an evolving climate with increased uncertainty. Initiatives like incorporating more varied crop species, and genetically modified crops that are more resilient to the effects of climate change will optimize growth. More efficient agricultural methods, such as no-till[6] practices, will also be important. Current over-tillage practices are problematic because they over-oxygenate the soil and release CO_2. Other measures may include on-farm water storage systems to collect water to facilitate irrigation during drought periods. Adaptation should be seen as an opportunity, because regardless of climate change, many adaptation initiatives will improve sustainability.

2.2 Focus on reducing vulnerability and enhancing resiliency. The number of resource-dependent communities in Canada, particularly in Ontario, is a big issue. Crop insurance, and the insurance industry in general, can play a role in providing financial protection thereby increasing resiliency. Statistics Canada reports a dramatic increase in the use of insurance since 2003.[7] Crop insurance provides an element of security for farmers in instances of extensive loss due to hazards.

2.3 Aging infrastructure is also a critical area where adaptive capacity can be improved. Many rural roads are deteriorating and railway lines are disappearing. These are important for agricultural transportation needs. With the projected increase in floods and heavy precipitation events, roads will continue to wash away. Plans for new infrastructure should take into account projected changes to the climate and be built, not based on historical data, but on updated climate-conscious information in order to achieve longevity.

2.4 Government action is important to support agriculture, forestry and green energy. Initiatives like the Green Energy Act, AgEnergy Co-operative's Agri-fund,[8] and research and development programs are essential in creating a comprehensive framework for adaptation and ensuring the success of green energy in a changing climate.

6 Tilling is defined as the process of turning and stirring the land by plowing, harrowing or hoeing in order to raise crops. Doing so releases CO_2 into the atmosphere. Thus, no-till farming is considered an environmentally friendly conservation practice.
7 Ellen Wall, Barry Smit and Johanna Wandel eds., Farming in a Changing Climate: Agricultural Adaptation in Canada. Vancouver: UBC Press, 2007, p. 39.
8 See Session Four, Topic #4 (C. Hanlon) for more information, p. 61.

A recent study by the C.D. Howe Institute analyzed the cost-effectiveness of GHG emissions reduction programs. The study indicates that the most cost-effective use of taxpayers' money for subsidies and incentives to mitigate GHGs are for renewable heat and power technologies such as wind power, solar, air and hot water heating, and biomass pellet heating. For these programs, mitigation could be realized at $10 to $60 of government subsidy per tonne of carbon dioxide equivalent offset.

"Going Green for Less: Cost-Effective Alternative Energy Sources", C.D. Howe Institute, No. 282, February 2009.

The transaction value in the global carbon market grew 87% during 2008, reaching a total of $120 billion.

Global Trends in Sustainable Energy Investment, pg. 12, 2009, www.unep.org

Topic #2 INTEGRATING RESEARCH, TECHNOLOGY AND COMMERCIALIZATION

Presenter ■ FRANCO BERRUTI
Director, Institute for Chemicals and Fuels from Alternative Resources (ICFAR);
Professor, Department of Chemical and Biochemical Engineering, The University of Western Ontario

"I'm concerned about the increased focus on commercialization at universities. We're not doing the basic research we need to compete in the future. A lot of what we're talking about and dealing with doesn't make business sense yet, and we're already trying to commercialize it. We need to build our basic research capacity in this country."

Greg Penner

PRESENTATION OVERVIEW

Fundamental and applied research has been a key component of the scholarly activities in engineering schools for many years. Recently, Canadian universities have made technology transfer and commercialization one of their highest priorities. This trend follows the Government of Canada's Innovation Strategy, which promotes the development of projects and activities leading to tangible contributions to society, such as new technology and more jobs and wealth. As a result, universities throughout the country are helping to diversify Canada's economy and are creating a reputation for excellence and an impact that extends well beyond our borders. Dr. Franco Berruti discusses The University of Western Ontario Faculty of Engineering's recent experience in the integration of basic and applied research, technology development and commercialization. He describes the example of Agri-Therm, a spin-off green energy company dedicated to developing, manufacturing and marketing portable and stationary equipment for producing bio-oils[9] and co-products from biomass, and specifically, from agricultural residue, wastes and transition crops.

ISSUES AND SOLUTIONS

"I'm certainly promoting both. Most of the programs that exist where there are funds from the government that match private investments are really directed towards maintaining the fundamental research in parallel with the development of solutions that have an opportunity to be applied. We are still training and educating highly qualified individuals, including Masters and PhD students. Don't forget the ultimate application: the opportunity for academia to work with industry, because one feeds the other... many people take advantage of that synergy."

Franco Berruti

Issue #1 ■ Canada's overall level of innovation capacity in 2000 was "near the bottom among the G7."

The Conference Board of Canada's report *Performance and Potential 2001–02* rates Canada as a "relatively poor performer in innovation" across a range of indicators, including research and development (R&D) spending as a percent of GDP, number of external patent applications, and number of researchers relative to the size of our labour force.

Solution #1

Innovation is the key to improving productivity. In February 2002, the Federal government launched its *Innovation Strategy*[10] to move Canada to the front ranks of the world's most innovative countries. R&D investments are intended to help develop knowledge and skill creation. Pro-innovation policies, business and personal tax policies and matching funds for R&D are important initiatives.

Issue #2 ■ There is a disparity between the amount of R&D in Canada and the amount of licensing income. Universities and industry do not work as closely together as they should.

American universities perform about 14 times as much research as their Canadian counterparts, but receive 49 times as much licensing income. Universities in Canada perform approximately 30% of Canada's R&D. Until recently, it was not widely recognized that Canadian universities need to work closer with industry. Good technologies were developed but remained on the shelves and in papers and publications instead of in the marketplace.[11]

"Universities need to focus on the areas of excellence... train a higher number of highly qualified people in the skills required by society, and more aggressively seek out commercial applications for publically funded research."

Franco Berruti

9 Bio-oil is a fuel produced from biological waste material.
10 In February 2002, Canada's Ministers of Industry and Human Resources Development released Canada's Innovation Strategy in two papers: *Achieving Excellence: Investing in People, Knowledge and Opportunity* and *Knowledge Matters: Skills and Learning for Canadians.* (http://dsp-psd.pwgsc.gc.ca)
11 Ibid.

Solution #2

2.1 Focus on areas of excellence, train greater numbers of highly qualified people, such as Masters and PhD students, as well as postdoctoral fellows, to take innovative research to the next level by seeking out commercial applications for publicly funded research. In 1999 Canadian universities and research hospitals:

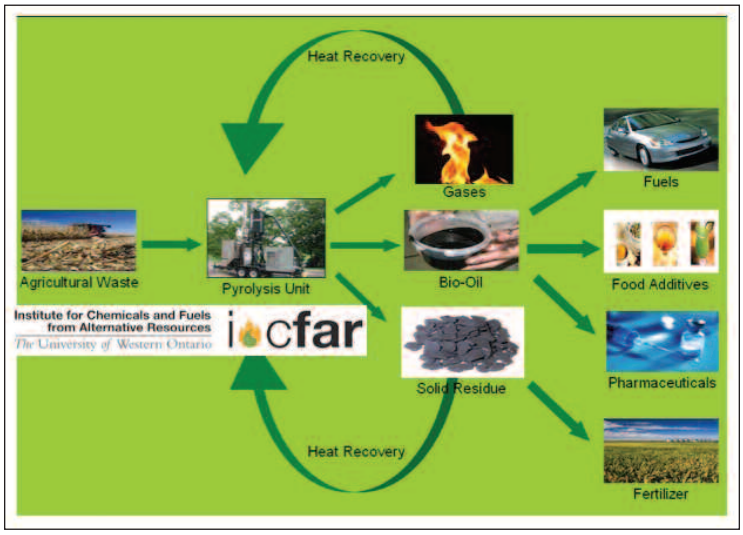
- earned $21 million in royalties
- held $55 million in equity
- generated 893 invention disclosures
- were issued 349 new patents
- executed 232 new licences
- commercialization of academic research in Canada resulted in more than $1.6 billion in sales and supported more than 7300 jobs

2.2 Triple key commercialization performance outcomes over the next decade. Universities are currently collaborating with Canadian firms to develop new technologies and new spin-off companies. It is important that this collaboration increases in the future. At The University of Western Ontario, the Board of Governors has made it a mission to focus on technology transfer and commercialization. The University created the Western Innovation Fund and developed a strategic action plan with specific targets for commercialization to:

- encourage faculty engagement in collaborative research with industry
- double the value of contract research work with the private sector over the next five years
- establish clear and transparent policies and procedures for faculty and institutional interactions with industry
- support the growth of faculty-based start-up companies based at Western
- double the value of licensing and royalty income from Western-based inventions over the next five years[12]

SUCCESS AT HOME

Agri-Therm is an example of a spin-off bioenergy company that partners with the Institute for Chemicals and Fuels from Alternative Resources (ICFAR)[13] at The University of Western Ontario (Figure 1). Agri-Therm specializes in developing, manufacturing and marketing portable and stationary equipment for producing bio-oils and products from biomass, specifically agricultural residues and transition crops.



Franco Berruti, The University of Western Ontario **FIGURE 1**

12 "Engaging the Future." Western's Strategic Plan. 2008.
13 In 2008, the Government of Ontario announced $5 million in funding for ICFAR, headed by Dr. Franco Berruti and Dr. Cedric Briens. ICFAR conducts fundamental and applied research and development activities in the fields of renewable energy, valorization of wastes for the production of renewable fuels and chemicals, environmental protection and sustainability. ICFAR is the coordinating centre of a major national research network, the Agricultural Bioproducts Innovation Network (ABIN) (http://www.eng.uwo.ca/icfar)

Did YOU Know

The Conference Board of Canada has rated Canada a "D" in terms of innovation on a 17-country scale (13th place).

www.conferenceboard.ca, 2008

Canada's strongest innovation initiatives create a supply of scientific discovery rather than foster demand for innovative products. The result: good science faculties and lots of small companies without much prospect of success on a globally efficient scale.

http://www.conferenceboard.ca/topics/inn/default.aspx, 2009

Bio-oil development is an important initiative. In 40 years, oil is going to cost significantly more than $50 per barrel; in fact, oil may not be there at all. Consequently, we have to find a substitute. ICFAR researchers have developed a technology to create a synthetic crude oil out of renewable resources that looks like the conventional petroleum crude. Taking agricultural residues that, depending on the value that exists at the farm and may or may not be competitive, ICFAR tries to convert this material into oil at the farm-level. During this process they create bio-char, which serves the dual purpose of carbon sequestration,[14] while harvesting the nutrients that can then be put back into the ground. The farmer can produce a wide range of goods that are typically available during traditional oil production. There will be many important bi-products for personal use at the farm-level and the additional crude oil can be pumped, sold and transported in tankers. This is an important exercise in maximizing the utility of a product and ensuring that nothing is considered waste. The key to success in green energy and technology development is academia working with industry, government and especially motivated people.

"From an industry standpoint, I don't want to see more policy. I just want to see a monetization of GHG's and let us go after them and get them. Just put some money on it and go get it. Keep it as simple as possible."

Greg Penner

Topic #3 IMPLEMENTING NEW TECHNOLOGIES AT EVERY SCALE: PUTTING TOGETHER MAJOR PROJECTS

Presenter ■ FRANK DOTTORI
Director, Cellulosic Ethanol Division, GreenField Ethanol

"One thing that has been coming out loud and clear is the need for an overall vision and also the need for really assessing the true costs of greenhouse gases, the true value of going to green energy."

David Sparling

PRESENTATION OVERVIEW

GreenField Ethanol has been taking cellulosic feedstock and turning it into commercial products for over twenty years; whether from corn to ethanol for fuels, industrial and beverage alcohols, and distiller's grains as a secondary stream. The process of converting cellulosic supplies into ethanol produces more energy than it consumes. The positive energy balance together with carbon reduction, and sound water management strategies, are important steps toward a greener world. GreenField continues to push research in cellulosic production to turn one company's waste into another company's fuel.

"We have a unique approach... to be sustainable and viable economically – not theoretically... we lead the development of economically viable processes."

Frank Dottori

KEY MESSAGES

- GreenField, the largest private ethanol company in Canada, produces 550,000 litres of ethanol per year, which amounts to about 60% to 70% of Canadian production.
- Although ethanol is sold in 1,300 gas stations, industrial and beverage products using ethanol, such as disinfectants with ethanol, produce the highest revenue.
- GreenField's corporate strategy is to maximize cash flow from existing corn-based ethanol and to grow the business via innovation and generation of biofuels and chemicals. The company is pursuing two parallel processes: *biochemical* (pretreatment, hydrolysis, and fermentation of biomass feedstock into biofuels and biochemicals) and *thermochemical* (gasification of biomass and refuse derived fuel from municipal waste and conversion to biofuels and biochemicals).
- GreenField runs a Green Centre of Excellence, spending $3 million per year in biochemical research and development (R&D). The company operates a biochemical lignocellulosic[15] pilot plant in Chatham and is involved in about fifteen projects (Figure 1).

14 Dr. Michael Hitch and Sheila Ballantyne from the Norman B. Keevil Institute of Mining Engineering, University of British Colombia, are currently researching the feasibility of mineral carbon sequestration. A mineral carbon sequestration system would deliver carbon dioxide from an industrial source to a mineral carbonation plant. The plant would use mine waste materials, which contain appropriate types of silicate minerals, to permanently store carbon dioxide in mineral form. Because this technology is safe, permanent, and uses material that currently have no value, the use of mineral carbonation to sequester carbon dioxide has numerous benefits.
15 Lignocellulosic biomass refers to plant biomass that is composed of cellulose, hemicellulose, and lignin.

A) Biochemical Process:

Objective: Convert cellulosic biomass from agricultural, forestry and municipal waste into biofuels via biochemical technology.

- BIOMASS
  - Corn cobs, corn residue
  - Grasses
  - Woodchips and wood residues
  - Pulp and paper liquors[16]
- PROCESS
  - Preparation of feedstock
  - Thermochemical pretreatment
  - Hydrolysis
  - Fermentation
  - Distillation
- NEXT STEPS
  - Optimize process
  - Evaluate new feedstock
  - Build a demonstration plant 2009 to 2010
  - Build commercial and sell technology in 2012

Franco Dottori, GreenField Ethanol

FIGURE 1

B) Thermochemical Process:

Objective: Use a wide variety of biomass feedstock to convert solid urban waste, which cannot be recycled or reused, into biofuels instead of sending them to a landfill (85% reduction in volume).

- PROCESS
  - Preparation of residues – sorting, recycling, drying and shredding
  - Gasification – convert carbon rich residues into syngas
  - Scrubs clean syngas
  - Convert syngas to biofuels via reforming and catalytic conversion
  - One tonne (T) of material produces 350 litres of ethanol
  - Pilot plant in Sherbrooke – started in 2003
- NEXT STEP
  - Demonstration plant in Westbury 10 T/day – started in January 2009

16 Black liquor is a liquid by-product of the chemical pulping process used to generate renewable heat and power.

A recent C.D. Howe Institute study into the cost-effectiveness of GHG emissions reduction policies found that the most expensive government incentives to mitigate GHGs are for liquid biofuels, which ranged from $295 to $430 for ethanol and $122 to $175 for biodiesel (in terms of dollar value per tonne of carbon dioxide equivalent offset). The Government of Canada's $4.5 billion ecoENERGY program has dedicated over half of the total budget towards liquid biofuels.

"Going Green for Less: Cost-Effective Alternative Energy Sources", C.D. Howe Institute, No. 282, February 2009

Since end-2005, Canada has more than quadrupled its ethanol production from 0.2 billion litres to 0.9 billion litres.

Renewable Energy Policy Network for the 21st Century – Global Status Report 2008

R&D at GreenField has focused on learning how to break down cellulose[17] and removing the inhibitors, and today they have taken the costs of enzymes down by 90%. When the company began, the cost of enzymes was twice the value of ethanol. There have been some significant breakthroughs.

ISSUES AND SOLUTIONS

Issue #1 ■ These technologies are highly technical, capital intensive and high risk.

When looking at financing, if there is something that could go wrong in a new process it will likely go wrong. Companies such as Tembec and GreenField have spent over $2 billion building new projects that were considered leading edge technology, and many ended up as "bleeding" technology. New technologies involve a great deal of more work than what is tested in laboratories at universities, including the preparation of the material, cost evaluation and commercialization.

"We have a lot of public private partnerships in the Netherlands... there is an open process, and the strengths of this open process is that every next application is better than the former one. You need public private partnerships in order to get the bottlenecks out of the way and to go forward."

Nico van Ruiten

These processes are very capital intensive. As a nation, we rely on small companies and entrepreneurs who do not have a great deal of capital. Foreign ownership of Canadian companies results in research being done elsewhere.

Solution #1

New technologies need significant government support during the initial phases of R&D, the implementation of pilot demonstration plants and finally, commercialization. These projects are important. They reduce greenhouse gas (GHG) emissions, use waste and non-food feedstock, create local jobs and train highly skilled engineers and scientists. In addition, they improve and diversify energy and feedstock supplies, create value-added products and develop and support forestry and agriculture.

Issue #2 ■ There is a lack of hardware and facilities in Canada for companies to run their tests.

"If there are no end-use contracts, there is no market and there is no industry."

Dean Tiessen

Because of a lack of demonstration plants in Canada, GreenField is working to optimize the process and evaluate feedstock economics. GreenField will be building a demonstration plant. They may tie in with a proposed demonstration plant in Thunder Bay. Greenfield is going to push actively to make Thunder Bay's demonstration plant a model for everyone in the industry so they can properly test their technologies.

Solution #2

Canada needs significant government support in R&D including more demonstration plants. This will facilitate the eventual commercialization of new technologies. In the German system, the government constructs pilot plants and entrepreneurs can use them to test their technologies. In Canada, demonstration plants need government support at 75% or more.

Issue #3 ■ Pilot Plants: Significant Delays in Approvals Process

There have been significant delays in establishing pilot plants at the University of Sherbrooke, which has been running since 2003, and a $20 million demonstration plant at Westbury that was supposed to take six weeks to start up in January but took six months instead.

Solution #3

Expedite the approvals process.

Issue #4 ■ Greenhouse gases and their effect on the climate.

There must be a clear integrated policy to reduce GHG emissions. As Canadians, we expect our politicians to be creative and take a leadership role. Escalating GHG emissions and climate change are serious problems and the government needs to take initiative. Define the objective as the first step – then determine the sources and the solutions.

17 Cellulose is an organic compound that is the structural component of the primary cell wall of green plants, many forms of algae and the oomycetes. (www.pslc.ws/macrog/cell)

Solution #4

Create a carbon tax and carbon tax fund. In this model all of the carbon tax revenue could be allocated to a fund from which businesses can borrow money for ten years interest-free to develop green energy projects.

If a company is a big polluter, it will resist spending money and paying a large tax. If a company receives half of its money interest-free to build green projects, it will do it. This will create a substantial number of new jobs.

Government should put an incentive in place because that is how business operates. Tembec had three pulp mills in France, and spent $100 million to clean up those mills because the French government put incentives in place. Now there are no mills in North America that compare in terms of energy efficiency. In France, the government took the money from pollution taxes and put it into a special fund where companies could apply for grants to make their production green.

RECOMMENDATIONS

Governments need to:

- Expedite the approval process for pilot and demonstration facilities
- Understand and support projects and technologies providing lowest cost solutions
- Streamline government support programs
- Create a carbon tax and a carbon tax fund
- Determine if GHG emissions are a problem, and if so, act now.

LOOKING FORWARD

Like all new technologies, the work at GreenField is high risk and expensive. However, economics will evolve and improve with time. GreenField is pleased with government support for their R&D and demonstration projects, and will be a major player moving forward in this evolving sector.

Topic #4 IMPLEMENTING NEW TECHNOLOGIES AT EVERY SCALE

Presenter ■ DEAN TIESSEN
Partner, Cantus Bio Power Ltd; General Manager, Pyramid Farms

PRESENTATION OVERVIEW

There are many challenges associated with building a new bio-based energy supply. Using biomass for energy is a relatively new area and Dean Tiessen outlines some of the hurdles that consumers of new biomass and bioenergy must overcome and how consumers may address them. Some of the challenges are identifying appropriate feedstock, building appropriate infrastructure, partnering with researchers to improve genetics, and developing efficient production and cropping systems.

ISSUES AND SOLUTIONS

Issue #1 ■ Feedstock for fuel – a new role for farmers

In a newly emerging market like the bioenergy industry, there are many challenges for family farm producers with no guarantee of a reward. In a family farm every decision affects both the business and the well being of the family. Pyramid Farms is addressing the bioenergy opportunity by expanding its focus from producing greenhouse tomatoes to producing feedstock and improving the genetics behind it. Pyramid Farms consumes about 40,000 tonnes of biomass each year in heating their greenhouses. After noticing a change in the quality and price of biomass over the last four years, they began feedstock production and are experimenting with different feedstock crops. The risks are high, especially if there are no end-use contracts. Without contracts for feedstock, there can be no industry.

As part of the ongoing effort to increase the use of domestic renewable fuels, U.S. Secretary of Energy Steven Chu announced plans to provide $786.5 million from the American Recovery and Reinvestment Act to accelerate advanced biofuels research and development and to provide additional funding for commercial-scale biorefinery demonstration projects.

www.energy.gov/news2009/7375.htm

■

The 2008 Farm Bill in the United States (The Food, Conservation, and Energy Act of 2008), provides new programs and a stronger federal commitment to farm-based energy. These programs include the Biomass Crop Assistance Program (BCAP) with an estimated cost of approximately $70 million over five years to encourage farmers to grow sustainable energy crops.

"Summary of the 2008 Farm Bill's Energy Title," http://www.rurdev.usda.gov/ia/rbcs_2008_Farm_Bill_Energy_Title_Summary.pdf

Solution #1

1.1 Support end-use contracts.

While infrastructure development and feedstock research are important, end-use contracts are paramount to the success of this market. The province, Ontario Power Generation and others are supporting industry progress in this direction. Contracts are critical for providing economic stability for family farms and motivation for development, not just for wood pelletization, but for all of the bio-based economy products.

"A lot of us here are excited about what miscanthus offers. Have you considered the economics of growing miscanthus and how that contributes to the bottom line, as it relates to cost of production and what the net Return on Investment would be?"

John Kelly

1.2 Increase research and development (R&D) for potential feedstock crops and support R&D partnerships.

Most of the research related to feedstock crops at Pyramid Farms has been done at the farm-level with the support of a few Federal tax credit programs. In the last year, Pyramid Farms has engaged with academia and various levels of government on different research trials, as well as working on various types of genetics with other companies, including companies in Germany and the United Kingdom. Further R&D and more diverse proposals for feedstock crop R&D at universities should be supported.

1.3 Develop a value chain strategy and build relationships through the chain.

Building relationships with different parts of the value chain is essential for growth and development of the bioenergy industry. Primary agriculture producers and associations, transportation sectors, equipment dealers, genetics, researchers, academics, energy suppliers, end users and all levels of government should communicate to prevent silos[18] and to facilitate the exchange of ideas and the adoption of best practices.

"It depends on what the end use is. I would say that on a cost per ton basis, the price is about $45 per dry ton in baled form. Through small gains and agronomy we'll see yields increase, which will reduce costs in the future."

Dean Tiessen

1.4 Focus on Sustainability.

Pyramid Farms wants to have products that are stable and that will have a future. In order for this to happen, feedstock needs to be grown, managed and used in a sustainable manner. Sustainable development is something that large companies like BASF,[19] Canadian National Railway, Canadian Pacific Railway, Dow, El DuPont, Honeywell, Shell Chemicals, and others are actively working to improve. These companies and many others are members of Responsible Care®, a voluntary initiative for industry to commit to practices that support sustainable development.[20]

Issue #2 ■ In order to make a profit, costs associated with biomass must be reduced.

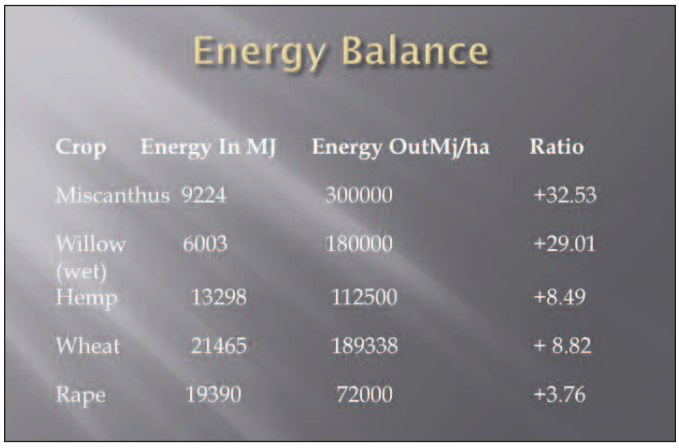
The Ontario greenhouse industry covers around 1,700 or 1,800 acres in vegetables and over 2,000 acres including flowers. This industry is currently consuming 18 to 20 million gigajoules of energy at prices that range between $8 to $12 per gigajoule. For bioenergy, the cost of dry wood was $22 per tonne four years ago, and today the cost is more than $80 per tonne.

"If you put in place a $3/gigajoule thermal incentive, you would find industries like the greenhouse industry changing over night."

Dean Tiessen

"One of the reasons why some of these purpose grown crops haven't hit the market is that I was paying $22 per dry tonne of wood four years ago, and today I am paying $80 per tonne."

Dean Tiessen



Dean Tiessen, Pyramid Farms **FIGURE 1**

18 Silo is a term commonly used in the public service to describe isolation and a lack of communication and collaboration between departments, administrative bodies, or other groups who would benefit by sharing information and working together.
19 BASF is a world-leading chemical company. For more information visit www.basf.com.
20 Responsible Care® was commended by the United Nations Environmental Program at the World Summit on Sustainable Development in 2002 for their significant contributions to sustainable practices. See http://www.ccpa.ca/ResponsibleCare/ for a list of verified companies and more information on this initiative in Canadian industry.

Solution #2

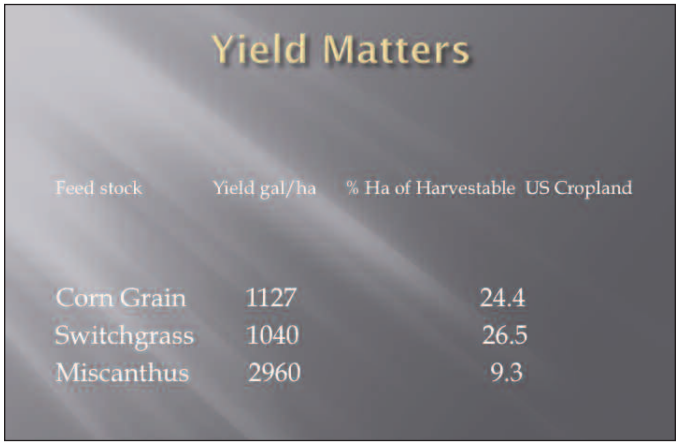
2.1 Focus on purpose grown crops.

Purpose grown crops can be useful for their strong energy balance, low inputs, drying costs and storage costs. At Pyramid Farms the emphasis has been on perennial grasses which have a very strong energy balance. Crops that have too many inputs are avoided. If the price of nitrogen changes it would no longer be feasible to produce that crop. Miscanthus is an example of a highly effective feedstock. It requires little or no input, has a high energy output and high yields. Furthermore, this type of purpose grown crop provides sustainability and allows for future planning and the stabilization of energy costs. A land-use policy for purpose grown crops could be helpful for the agricultural community.

2.2 Increase yields.

Crop yield is important for bioenergy. For example, for the United States to produce the amount of ethanol required to meet their energy needs in 2030, 24% of the total arable land in the United States would be required to grow corn grain feedstock, 26% of the total arable land would be required if switchgrass was used, but only 9.3% of the land would be required if miscanthus was used.

Genetics is the key to increasing yields. Genetically modified plants are already exhibiting double the yields, however it will take a long time before they complete the regulatory process. Other modifications will increase the plant growth range, for example new varieties of feedstock that can be grown north of Edmonton.



Dean Tiessen, Pyramid Farms **FIGURE 2**

2.3 Thermal Incentives could help the industry reduce energy use.

The greenhouse industry uses an enormous amount of energy. While the sudden introduction of a carbon tax would be difficult to manage, a thermal incentive would be beneficial in encouraging reduced energy use. If a $3 per gigajoule thermal incentive was introduced, the greenhouse industry could change overnight.

The Ontario Ministry of Energy and Infrastructure offers the "Ontario Solar Thermal Heating Incentive," to encourage entities in the industrial, commercial and institutional sectors in Ontario to install qualifying solar thermal heating equipment. The Government has allocated $14.4 million, available until March 31, 2011.

http://www.mei.gov.on.ca.wsd6.korax.net/english/energy/conservation/?page=OSTHI

Some of Ontario's greenhouse growers practice tri-generation. They produce electricity for the grid, steam heat for their greenhouses and capture the CO_2 from combustion to help their plants grow.

Nico van Ruiten

Topic #5 COGENERATION IN GREENHOUSES: THE DUTCH EXPERIENCE

Presenter ■ DICK KRAMP
Marketing Program Manager, GE Energy Jenbacher, Netherlands

PRESENTATION OVERVIEW

There are a number of reasons why, in recent years, cogeneration has become such an overwhelming success in the Dutch greenhouse industry. First, the industry can use all three outputs from cogeneration[2] activities: the heat recovered from the engine, the carbon dioxide (CO_2) in the engine exhaust, and the power created by the process can be used in the greenhouse or exported to the electrical grid. Second, the wide scale utilization of large thermal storage facilities allows Combined Heat and Power (CHP) systems to run when CO_2 is required by the plants and power prices are high, while heat recovered from the engine is stored for utilization at a later time of day. The end result is that greenhouses are able to provide flexible, dispatchable power at system efficiencies that often exceed 90%. Third, by becoming food and energy producers, the Dutch greenhouse industry has been able to fend off foreign competition, and maximize vegetable and flower production at the lowest possible costs, while continuing to be a leading jurisdiction for new greenhouse and related energy technologies.

Given that Ontario is home to the largest North American greenhouse industry, it requires flexible, dispatchable power in order to facilitate the maximum implementation of renewables. Furthermore, Ontario and Canada are under tremendous competitive pressure from the southern United States and South America. Investing in cogeneration systems can help growers remain competitive and ensure that Ontario continues to be home to North America's leading greenhouse industry. Facilitating cogeneration development in the greenhouse industry will ensure that sustainable energy, environment and employment all come together in a multi-billion dollar industry.

"I see a big threat for the Ontario greenhouse sector from Mexico. Mexico is already transferring to highly sophisticated greenhouses and now a project in Mexico City is underway which includes 18 MW of cogeneration. They are already moving on this, and the biggest mistake that Ontario can make is not to move."

Dick Kramp

"I bet there are no Canadian greenhouse products in the Netherlands, yet there are Dutch products in our markets every day of the year."

Dean Tiessen

"Ontario has a potential for high efficiency CHP for approximately 500 MW. Becoming a quality food and energy supplier will allow the Ontario Greenhouse industry to fend off Mexican competition."

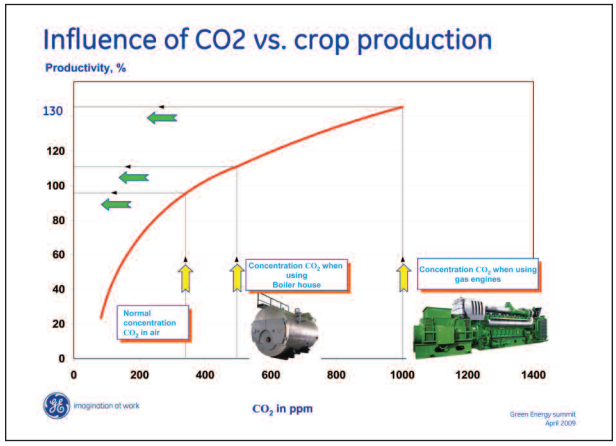
Dick Kramp

KEY MESSAGES

- *What makes the Combined Heat and Power process attractive?*
  - The attractiveness lies in the separate production and utilization of CO_2, heat and electricity, which when combined creates 50% less heat as compared to a boiler. Most importantly, CO_2 is a key factor in fertilization[21]; many crops such as vegetables, flowers and plants thrive under elevated levels of CO_2. The greener the plant, the more CO_2 is needed (Figure 1).
- *Benefits of a Cogeneration Facility:*
  - Efficiency:
    - Year round system efficiency will typically be at 90%. Implementing CHP in the greenhouse industry facilitates generation where the thermal loads are located, which maximizes energy efficiency.
    - A boiler with a thermal efficiency of 95%, with a 100 kW of energy input, will produce 95 kWt of heat and create 18 kg CO_2. Input the same amount of energy into a cogeneration plant and it will produce 44kWe (electricity) and 50 kWt (heat) and produce the same amount of CO_2, 18 kg.
- *Use of CO_2 by-product:*
  - CO_2 captured during power production can be utilized in the greenhouse where plants absorb CO_2 for production increase. Exhaust gases are cleaned using urea, an organic compound, cooled to 40°C to 50°C and can be blown into the greenhouse when the CO_2 is needed.
  - Increasing the amount of CO_2 output creates up to a 30% increase in crop production. The Netherlands can thus produce up to 80 kg of tomatoes per square metre in greenhouses compared to competitors in locations like Spain where field production averages approximately 25 kg per square metre.

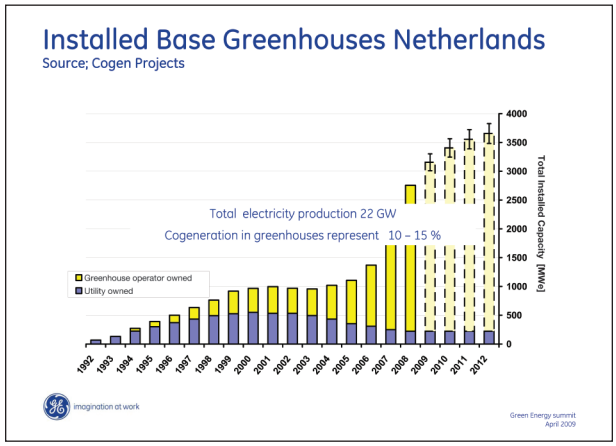
21 Cogeneration is defined as the production of electricity and useful thermal energy simultaneously from a common fuel source. The rejected heat from industrial processes can be used to power an electric generator. Surplus heat from an electric generator can be used for industrial processes, or for heating purposes. (www.power-technology.com)
22 Plants flourish with greater exposure to carbon dioxide. This is known as the carbon dioxide fertilization effect.

- *Flexibility in heat storage and use:*
  - Thermal energy produced during power production can be transferred to the greenhouse or stored in existing thermal storage tanks and be utilized at other times of the day.
- *Rapid implementation...*
  - Project construction typically takes less than twelve months from start to finish.



Dick Kramp, GE Energy **FIGURE 1**

- *What the Netherlands needed to move forward:*
  - A big step towards the cogeneration facility was the liberalization of the electricity market in 2001. The implementation of a positive trading environment provided growers with the ability to trade their electricity and thus become electricity suppliers to the grid. The money earned helped growers remain competitive with other tomato growing countries. The introduction of grow lights in the vegetable sector allowed growers to have year-round production further enhancing their competitiveness.



Dick Kramp, GE Energy **FIGURE 2**

In Kingsville Ontario, Soave Hydroponics has established a $20-million, 55 acre tri-generation greenhouse facility, Great Northern Greenhouse, which will produce enough electricity (12 megawatts) to power 15,000 homes. Burning natural gas to produce electricity to sell to the Ontario grid works for greenhouses because they are able to use both heat and carbon dioxide created during the process. Greenhouses of at least 20 acres in size could benefit from tri-generation.

Sharon Hill, "Power Plant Helps Save an Industry." The Windsor Star. July 13, 2009.

A J624 engine at Royal Pride Holland can:

- Provide primary energy output equivalent to the energy contained in over 64, 000 barrels of oil.
- Emit 14% less CO_2 than would be emitted in the separate production of heat and electricity.
- Prevent the emission of over 4, 800 metric tons of CO_2, which is about the equivalent of 2,400 cars on European roads.
- Absorb the amount of CO_2 annually compared to 1,200 hectares of UK forest (equivalent to 1,600 FIFA soccer fields).

Dick Kramp

Solutions

Learning from the Dutch Experience:

1. The Dutch cogeneration experience showed that by using all of the outputs of the process and meeting the needs of greenhouse and nearby electricity users, greenhouse growers could be competitive and contribute to the nation's energy needs. A complete system approach is vital to success.
2. Connection to the grid is critical.
3. Continued adoption of new technologies is important. Introduction of grow lights, use of CO_2, and sophisticated distribution and generation systems all contributed to the success.
4. Finding the right balance between the use of electricity and heat is essential.
    - The combination of the following factors is necessary to find the right balance:
        - CO_2 fertilizing
        - Heat storage
        - Purchasing and selling of electricity and natural gas
        - Intelligent energy management system
    - This will result in the reduction of energy costs per square metre of up to 30%.

"Of the total electricity production in the Netherlands, approximately 22 GW, the greenhouses represent 10-15% of the total production in the Netherlands, and this is huge"

Dick Kramp

Learning from the Dutch Experience:

Ontario should quickly move forward applying lessons learned from the success of the Dutch cogeneration experience of CHP. If Ontario does not move forward, it will lose business, economic activity and employment. Becoming an energy producer allowed the Dutch greenhouse industry to fend off foreign competition.

- Reducing energy costs, increasing productivity and creating new revenue streams from cogeneration will help the Ontario greenhouse industry take the lead in North America and fend off increasing competition from the southern United States and South America. Mexico is already transferring production to highly sophisticated greenhouses.

"When the government finally focuses on cogeneration development in the Ontario greenhouse industry, this will ensure that sustainable energy, the environment and employment all come together in this multi-billion dollar industry."

Dick Kramp

Improve the electricity grid to make it easier for growers to supply electricity to the grid.

- Ontario's potential for high efficiency CHP with CO_2 capture and utilization is about 500 megawatts (MW), enough to power more than 150,000 homes. Benefits are more than greenhouse industry competitiveness.

"There are 101 million gigajoules of energy sitting in corn residue resources out there. 37 million in the soybeans, 37 in the wheat, and 95 million in the forages."

Ian McDonald

"Connection to the grid is a big problem here in the region and without that, and if you don't use grow lights, it is impossible. Also, installing more power than necessary is a big problem... you need to find the right energy balance. The use of heat, together with electricity, is very important... you should reach a total efficiency of more than 90% otherwise it has no use."

Dick Kramp

IT'S THE ECONOMY AGAIN!

Chair ■ PHIL DICK, BUSINESS RESOURCE SPECIALIST, STRATEGIC INTELLIGENCE AND MARKETING UNIT, ECONOMIC DEVELOPMENT DIVISION, ONTARIO MINISTRY OF AGRICULTURE, FOOD AND RURAL AFFAIRS

Objective

The purpose of this session is to assess how green energy policy and projects will strengthen economic performance in Ontario and Canada.

Topic #1 A STUDY OF THE ONTARIO WIND POWER SECTOR: REGULATORY RISK AND PRIVATE INVESTMENT

Presenter ■ GUY HOLBURN
Professor, Richard Ivey School of Business, The University of Western Ontario

PRESENTATION OVERVIEW

Dr. Holburn presents the results of four new surveys of renewable energy developers and technology manufacturers that assess the policy environment for renewable energy investors in Ontario. During late 2008, Holburn surveyed 63 wind power firms and 12 solar power firms active in Canadian energy markets, and more than a dozen component manufacturing firms. The survey asked two questions that provide the basis for the analysis:

- What are the most important criteria that make a jurisdiction attractive for renewable energy firms?
- How does Ontario rate on these criteria?

ISSUES AND SOLUTIONS

Issue #1 ■ Ontario's Unstable Policy Environment for Renewable Energy

While Ontario fares comparatively well on operational and natural environment conditions, it is the regulatory regime that was cited as the primary disincentive for investment in, and the completion of, renewable energy projects.

Specifically, the results of the survey suggest that firms rate the stability of public policy for renewable energy among the most important features of a jurisdiction when assessing its attractiveness for potential investment. However, the firms surveyed also rated policy stability as one of the weakest aspects of the environment in Ontario. Component manufacturers were also consistent in their concern regarding instability in Ontario's regulatory environment as it affects green energy projects.

Interviews with renewable energy developers revealed that firms have responded to policy instability by investing in other jurisdictions instead of, or before, Ontario by increasing project price bids in competitive procurement auctions to account for regulatory risks and by undertaking more lobbying and government relations activities.

In 2008, the United States overtook long-time wind power leader Germany, ending the year with 25 GW compared to Germany's 24 GW. China is close behind with an annual total wind power doubling for the fifth year in a row and breaching their 10 GW target for 2010.

Renewable Energy Policy Network for the 21st Century - Global Status Report, 2009 Update, pg. 11, http://www.ren21.net/pdf/RE_GSR_2009_Update.pdf

■

Conventional wind turbines stop when the wind dies. Turbine-bearing balloons or rotors could intercept powerful, reliable winds 1, 000 to 15, 000 feet up. There is potentially enough high-altitude wind energy to power the planet 100 times over. Whether technology hurdles can be overcome and the energy can be economically exploited remain to be seen.

Harvard Business Review, p. 66, September 2009, www.hbr.com

"Guy, you mentioned that one of the discouragements for renewables developers would be the perceived instability of policy, and you pointed out the changes that have gone on since 2003. Since those changes have gone on, I think there is a perception that the policies have become more aggressive towards renewables development each time. So, are you saying that that increase in enthusiasm for renewables is not perceived as stable or that developers are waiting for even better returns at the next go around of policy changes?"

Victor Stein

"The Ontario Energy Board has a mandate and so does the Ontario Power Authority. Their mandates may not always be in sync."

Doug Speers

"Is a key concern with the uncertainty of regulatory risk a classic case of analysis paralysis – not making a decision at all because governments are forced to make the best decision?"

Joel Adams

Criteria affecting attractiveness of a jurisdiction for renewable energy investment

	Wind firms (29)	Solar firms (8)	Technology manufacturers (15)
3 Most Important Criteria	1. Natural wind conditions 2. Stability of the policy environment 3. Transmission capacity availability	1. PPA rate 2. PPA length 3. Stability of the policy environment	1. Presence of long-term gov't target 2. for renewable energy 3. Manufacturing gov't incentives 4. Stability of policy for renewable power generation
3 Least Important Criteria	13. Investment / tax subsidies 14. Availability of engineering and construction expertise 15. Proximity to equipment manufacturers / suppliers	15. Availability of engineering and construction expertise 16. Net metering 17. Proximity to equipment manufacturers / suppliers	16. Cost of electricity 17. Proximity to research centres / universities 18. Prior experience in jurisdiction

IVEY © Copyright 2009 Holburn, Lui and Morand

Dr. Guy Holburn, The Richard Ivey School of Business **FIGURE 1**

Ontario ratings

	Wind firms (29)	Solar firms (8)	Technology manufacturers (15)
3 highest rated criteria in Ontario	1. Length of PPA 2. Transparency of PPA process 3. Availability of engineering and construction expertise	1. Length of PPA 2. Ease of obtaining rights to land 3. Transparency of PPA process	1. Cost of electricity 2. Proximity to transportation infrastructure 3. Availability of skilled labour
3 lowest rated criteria in Ontario	13. Ease of obtaining municipal approvals 14. Stability of the policy environment 15. Coordination between government-related bodies	15. Availability of transmission cap 16. Stability of the policy environment 17. Presence of l-t gov't target for renewable energy	16. Presence of l-t gov't target for renewable energy 17. Stability of public policy for renewable power generation 18. Cost of skilled labour

IVEY © Copyright 2009 Holburn, Lui and Morand

Dr. Guy Holburn, The Richard Ivey School of Business **FIGURE 2**

Long-term government targets for renewable energy are seen as a positive policy position. They are, however, seen as in isolation of other policy imperatives like stability (achieving targets rather than revising targets) and regulatory barriers like zoning and environmental compliance protocols that have changed since, rather than prior to, targets being established. By reducing regulatory risk, governance reform could enable renewable energy policies to achieve their goals at reasonable cost to consumers and taxpayers.

Solutions

1. Reforms should be made to the governance of the energy sector in order to insulate policy from short-term political pressures, creating longer-term stability. This would improve investor confidence in the province and lead to greater investment in renewable energy capacity and technologies.
2. Long-term carbon dioxide emissions or renewable megawatt (MW) targets should be established through legislation rather than ministerial directives.
3. Ontario needs to standardize the regulatory process prior to establishing targets for development.

SUCCESS FROM AROUND THE WORLD

Renewable energy investment levels in Ontario appear to have been relatively low compared to the experiences of American states that have enacted Renewable Portfolio Standards[1] (RPS): between 1999 and 2007, 23 states adopted legislation specifying for the first time long-term targets for renewable energy capacity. In the years since adopting RPS targets, these states added, on average, 40 MW per 1 million state population of new wind capacity each year. Ontario, by comparison, added approximately 13 MW per 1 million population of new wind capacity annually during the five year period until November 2008, an investment rate approximately one third of the average RPS state.

In Germany, municipal zoning regulations permit municipalities to define where green energy projects are not allowed. However, municipalities that enact exclusion bylaws (NIMBYism[2]) must also define space where green energy projects are permitted.

Each German state has a green energy target for 20% to 30% of renewable energy (heat, fuel and power) based on their natural resource capacity.

Topic #2 ENERGY AND CLIMATE CHANGE POLICY IN THE NETHERLANDS – THE GOAL OF THE HORTICULTURE SECTOR TO BE A NET ENERGY PRODUCER IN 2020

Presenter ■ NICO van RUITEN
Chairman of Horticulture, Dutch Farmers' Union, Netherlands

PRESENTATION OVERVIEW

The Dutch horticultural sector has been a trailblazer in energy efficiency programs. Reduction of production costs has been the traditional driver. In a concerted effort with the Dutch Government, the sector has already made significant investments in research and development (R&D), and in practical implementation of the results of the research in operational applications. The sense of urgency surrounding the climate change problem has underpinned the drive for sustainable production in the Dutch horticultural sector.

In a new program in which the Dutch Government and the horticultural sector cooperate entitled "The Greenhouse as a Source of Energy," the sector has formulated challenging and ambitious goals for the year 2020. By then, only climate-neutral[3] greenhouses will be built, the horticultural sector will lower its carbon dioxide (CO_2) emissions by 48% to 63% compared to 1990 levels, be a producer of sustainable warmth and energy, and significantly reduce the use of fossil fuels. There are seven tracks on which substantial effort will be put forth to realize these goals (Figure 1): the use of energy from the sun, the use of warmth from inside the earth, a more efficient use of light, new strategies for the growth of produce, plants and flowers, the development of varieties which can be grown efficiently with less energy-use and more use of renewable energy sources; intensification of the production of electricity (present capacity of Dutch greenhouses is already 3,000 megawatts) and intensification of the use of CO_2 from third parties (Figure 1). In the program "The Greenhouse as a Source of Energy," the greenhouse sector, the Dutch Government and relevant research institutes work together to reach these goals through basic and applied research, and the application and testing of innovation in day-to-day practice.

The Ontario Power Authority offers the "Technology Development Fund" for projects that promote the development and commercialization of technologies or applications that have the potential to improve electricity supply, conservation and demand management. The Fund's annual budget is $1.5 million with a maximum $250, 000 contribution to any one project.

http://www.powerauthority.on.ca/tdfund/Storage/103/15039_July09TFundGuidev2.pdf, 2009

■

A thermal coal, gas or nuclear generating plant dumps about 60% of the energy it generates into the air or in adjacent lakes, whereas a co-generation facility uses the wasted heat of a centralized generation station for economic applications like heating greenhouses or heating/cooling processes in a factory or community.

Nico van Ruiten

1 An RPS is a policy ensuring that a minimum amount of renewable energy is included in the portfolio of electricity resources serving a state, province or country, and, by increasing the required amount over time, the RPS can put the electricity industry on a path toward increasing sustainability. (www.awea.org/policy)
2 NIMBY is an acronym for "not in my back yard," the concept that while certain green initiatives may be beneficial, some people do not want them located in their communities. Wind farms are a common example, as many people recognize the value in wind energy but due to issues of noise and size, do not want windmills on nearby property.
3 Climate-neutral, or carbon-neutral, is defined as the process of offsetting carbon-producing activities with those that either reduce or capture carbon, thus credibly neutralizing the net amount of carbon released in the atmosphere from a particular activity. (www.sustainabilitydictionary.com)

Nico van Ruiten, Dutch Farmers' Union **FIGURE 1**

"The need for sustainability is widely accepted amongst growers nowadays – horticulture and energy have a long lasting and close relationship."

Nico van Ruiten

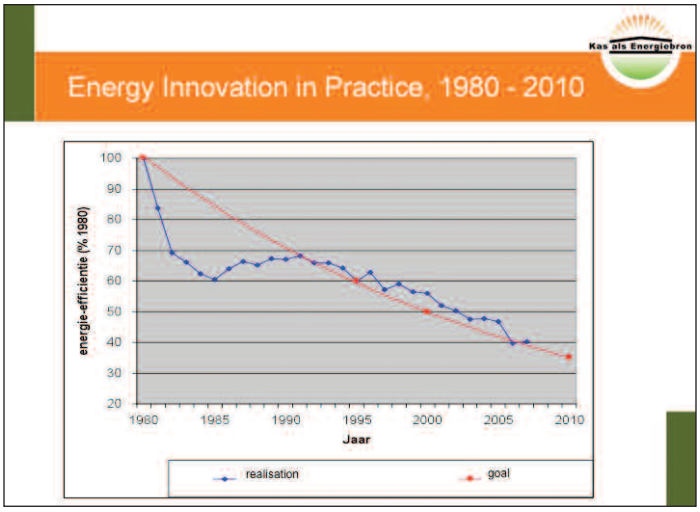
"Open innovation in an open market with permanent competing growers who look upon each other as colleagues are very important for fast implementation of techniques in growing, in building and in energy saving."

Nico van Ruiten

KEY MESSAGES

- The concept of "industrial ecology" had its beginnings in the Netherlands in the 1990's, when the Dutch Environment Ministry sought economic solutions to environmental problems caused by industry. The ministry implemented the idea of environmental stewardship – a pragmatic concept that suggests that "for every environmental issue caused by industrial waste, there is an opportunity to create or use previously wasted byproducts for economic gain."
- In 2008, the Netherlands committed to a target of 20% renewable energy in the greenhouse industry by 2020.
- The Netherlands has embedded a cogeneration[4] strategy to improve the efficient energy use of agriculture and distributed energy.
- The Netherlands greenhouse industry is committed to significantly reducing its greenhouse gas (GHG) emissions impact by 2020.

According to Harvard professor Michael Porter,[5] the Netherlands' clustered greenhouse industry is an attribute that supports the industry's vibrant growth. On 25,000 acres, with 5000 farmers and 110,000 employees, this agricultural dynamo produces €7.5 billion per year in sales.



Nico van Ruiten, Dutch Farmers' Union **FIGURE 2**

4 Cogeneration is defined as the production of electricity and use of thermal energy, simultaneously, from a common fuel source. The rejected heat from industrial processes can be used to power an electric generator. Surplus heat from an electric generator can be used for industrial processes, or for heating purposes. (www.power-technology.com)

5 See Michael Porter's *The Competitive Advantage of Nations* (1990) for a detailed analysis of the importance of clusters in increasing a nation's competitive advantage.

The Netherlands' greenhouse industry uses an enormous amount of natural gas, 3.5 billion cubic metres per year. Historically, the Netherlands greenhouse industry moved from coal to oil to natural gas for its heating supply. Overall energy use per acre of production has declined by 60% since 1980 and productivity per gigajoule of energy has doubled, while net energy use by the sector has remained the same. Much of the Netherlands electricity supply is based on natural gas. Energy security and the preservation of economic capacity are critical issues for the Dutch.

In 2008 the Dutch greenhouse industry committed to a "Clean Efficiency" policy. This climate-neutral, net zero CO_2 target for 2020 is comprised of a mix of options for growers that include: Combined Heat and Power (CHP) production (making electricity and using waste heat for greenhouses), CO_2"nutrition" (the use of CO_2 as a crop nutrient—the building block for photosynthesis), geothermal heat, biofuels, low energy production and solar and light strategies.

Nico van Ruiten, Dutch Farmers' Union **FIGURE 3**

To achieve their goal, the Dutch Growers Association has committed to a long-term covenant with the government and has organized its efforts with government through a partnership between the Horticultural Commodity Board, the Ministry of Agriculture, Food Safety and Fisheries, a variety of research institutes, energy consultants and the greenhouse supply industry. The partnership works in close relationship with six other energy transition strategy programmes of government.

The Dutch programme is a 50/50 cost share initiative that funds up to 100 projects per year. Funding includes €8 million per year for R&D and demonstration projects and €30 million per year for project cost sharing.

The greenhouse program is responsible to an overarching Steering Committee comprised of the Growers Association, the Commodity Board, the Ministries of Agriculture, Economics and Environment, NGOs and equipment suppliers that oversee six other sector-based sustainable energy Strategy Committees.

ISSUES AND SOLUTIONS

Lessons learned from the Dutch experience and solutions for strengthening green energy policy, projects and economic performance in Ontario.

Issue #1 ■ The greenhouse sector is energy intensive. The production of greenhouse crops in the fall, winter and spring require large amounts of supplemental heat.

"So why can't we think differently in terms of ways of raising capital? This comes back to the fact that it isn't always about governments, it's also about the private sector. I think BC and the UK have done a great job in terms of public-private partnerships... projects stall because we lack sufficient capital."

Carol Stephenson, Developing Sustainable Energy Policy workshop, 2006. www.lawrencecentre.ca

There is terrific response from the government. Governments are responding by implementing partnership models to deliver infrastructure projects sooner, on time, and on budget. Partnership models alone are not a panacea. Rather, they are one tool governments have at their disposal to clearly demonstrate they are competitive and ready for Foreign Direct Investment (FDI).

Saad Rafi, Developing Competitive and Sustainable Transportation Policy workshop, 2008. www.lawrencecentre.ca

Solutions #1

1.1 Energy Efficiency is Priority #1

In the Netherlands, energy efficiency was prioritized first, which allowed the industry to double output per acre and reduce overall energy consumption by 12.5% between 1980 and today.

1.2 Utilization of CHP Systems

The Netherlands are committed to produce 20% of household needs for electricity through CHP systems that have doubled the energy efficiency of centralized generation stations.

1.3 Carbon dioxide emissions reduction

The Netherlands committed to a 48% to 63% net reduction in CO_2 emissions by 2020 mainly through the use of CHP, geothermal heat, and heat producing greenhouses.

"Instead of many different initiatives, we have one innovation agenda and about 100 projects are financed and started every year. These projects can be feasibility studies, research and innovation projects and demonstration projects."

Nico van Ruiten

RECOMMENDATIONS

The Netherlands' greenhouse sector is a major employer and contributes a significant portion of GDP and export income. How can Ontario achieve similar results?

1. Clean Technologies

   Ontario should follow suit by aggressively expanding the implementation of clean technologies.

2. Link Energy Policy to Economic Activity

   Link a national sustainable energy policy to natural synergies with existing economic activity such as converting greenhouse heating systems to CHP and tri-generation.[6]

3. Public-Private-Partnerships

   Further support the shift to sustainable production through industry-lead public-private partnerships and program support that first demonstrates technology, then supports its uptake.

Few innovations, be they to comply with regulations or to create a new line of products, can be developed in today's world unless companies form alliances with other businesses, nongovernmental organizations, and governments.

Harvard Business Review, p. 62, September 2009, www.hbr.org

SUCCESS FROM AROUND THE WORLD

- The area of greenhouses in the Netherlands is 25,000 acres, which has been stable for the last ten years. The largest nurseries are now 100 hectares. The wholesale value of the greenhouse industry in Holland is about €7.5 billion.
- By comparison, Ontario's greenhouse industry is 5000 acres and 1000 growers with approximately $1.5 billion in wholesale.
- The Netherlands greenhouse industry uses about 60% of the natural gas as all of Ontario (3.5 billion cubic metres versus 6 billion cubic metres in Ontario), which is about the same volume as the Nanticoke station would need if it were converted to natural gas.

6 Tri-generation is defined as the simultaneous production of mechanical power (often converted to electricity), heat and cooling from a single heat source such as fuel or solar energy and the product of CO_2 for plant growth. (www.energ.co.uk)

Topic #3 DRIVING CONSERVATION AND EFFICIENCY AHEAD OF GREEN ENERGY INVESTMENT

A) The Molson Case Study

Presenter ■ DOUG DITTBURNER
Chief Engineer and Energy Team Leader, Molson Canada

PRESENTATION OVERVIEW

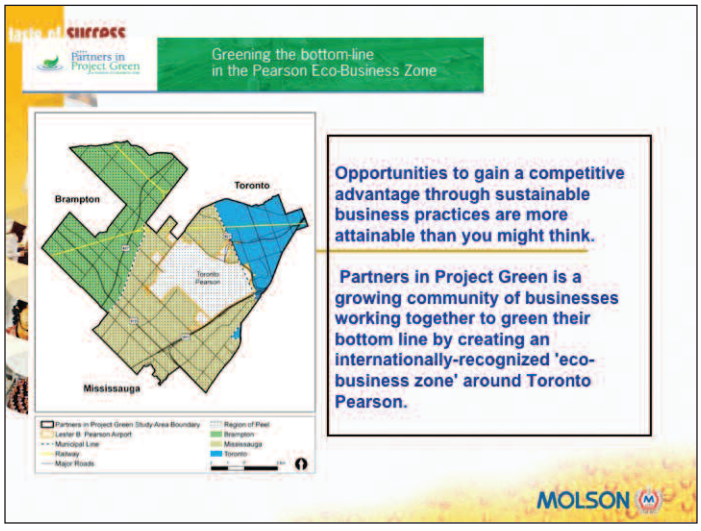
Corporate environmental responsibility can be linked to the bottom line where win-win solutions like energy and water efficiency have an impact on a company's environmental performance. At Molson's Toronto plant, Doug Dittburner, the Chief Engineer, has been tasked with water and energy efficiency targets that are second to none in Canada's brewing industry.

Mr. Dittburner discusses the dozens of large and small efficiencies that, combined with preparations for a bio-digester project, will reshape the environmental footprint of Canada's largest brewery. Achieving a greener footprint takes time, training, awareness and buy-in from the corner office to the shop floor. Mr. Dittburner talks about meeting these requirements and some of the challenges associated with getting greener in a regulatory system that resists change.

The Molson project is a highly visible participant in the *Partners in Project Green (PPG),*[7] the largest industrial ecology initiative ever begun in Canada. PPG covers 12,000 hectares of industrial and commercially zoned land around Toronto's Pearson Airport (Figure 1).

KEY MESSAGES

- It is possible to make carbon-neutral beer in Canada. To do this takes time, focus on efficiency and the ability to generate energy from waste produced in the brewery (Figure 2).
- Water efficiency and energy efficiency start with using only what is required, turning off idle equipment, operating the correct size of equipment, stopping the bleeding "leaks," and questioning how hot or cold systems are operated and adjusting to the correct temperatures. This, along with process integration[8] must happen before big capital investments in new equipment to ensure that the assessment of equipment needs is not overestimated.
- It is people who make energy efficiency happen. Energy conservation requires everyone to share in the responsibility for utility use.



Doug Dittburner, Molson Canada **FIGURE 1**

7 For more information on Partners in Project Green see http://www.partnersinprojectgreen.com.
8 Process integration involves using heating/cooling from one process in a factory to heat/cool another process in another part of the factory.

The Government of Canada offers the "ecoEnergy for Renewable Power" program to increase Canada's supply of clean electricity from renewable sources such as wind, biomass, low-impact hydro, geothermal, solar photovoltaic and ocean energy. The program will provide an incentive of one cent per kilowatt hour for up to 10 years; maximum contribution payable per Qualifying Project will be $80 million over 10 years.

http://www.ecoaction.gc.ca/ECOENERGY-ECOENERGIE/power-electricite/index-eng.cfm, 2009

■

Germany is a world leader in energy efficiency. Germany has decreased its consumption of primary energy resources in absolute terms since 1990, despite its increasing national product.

www.german-renewable-energy.com/energyefficiency

SUCCESS AT HOME AND AROUND THE WORLD

Molson's reuses and re-washes bottles 14 to 16 times. Ontario's deposit-return system requires that Molson's use water and energy to clean returned bottles. This is different from the European Union (EU) best-in-class manufacturers who only fill disposable bottles. The plants in the EU have water taking to bottling ratios of 4 to 1. Nevertheless, water use at Molson's Toronto plant is fast approaching the European Union best-in-class standard. Since 2002, the Molson Toronto plant has reduced water and natural gas use by one-third and electricity use by 27%. Subtract from Molson's carbon footprint their energy efficiency, reduced footprint of reused bottles and future green energy generation, and the Molson Toronto model could be a global environmental standard.

In Germany, new buildings must self-generate 20% of their energy requirements for building heat and cooling. In Germany and the United Kingdom, a best management practice for wastewater treatment involves a wastewater biodigester that extracts methane for combined heat and power (CHP) production.

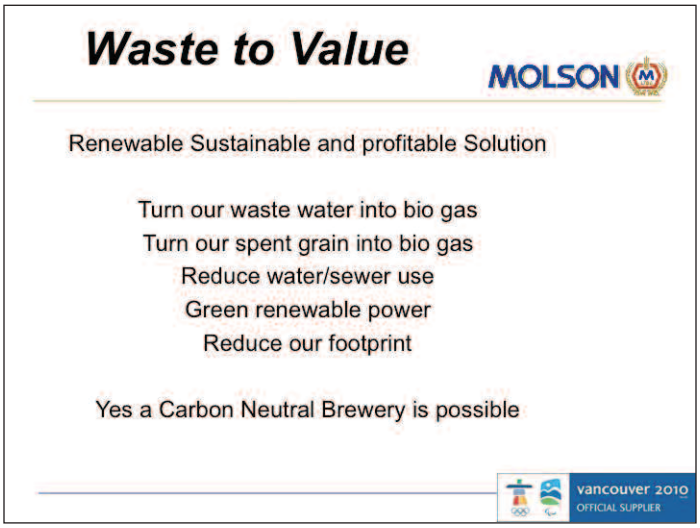
"What will we all gain from this? We will be able to save our natural resources for generations to come. We will also start to reverse the effects of global warming. We need to create a better world for our children – we have the power to do this."

Doug Dittburner

In Japan, industries compete to see how far above the minimum environmental performance standard they can reach, because pollution is waste and waste is an economic burden. In Ontario, companies that improve their environmental performance can be found out of compliance with their environmental certificate of approval.[9]

"It is people that make energy efficiency happen."

Doug Dittburner



Doug Dittburner, Molson Canada **FIGURE 2**

"The solution to water pollution is not dilution; it is concentration and digestion to create green, renewable energy."

Doug Dittburner

ISSUES AND SOLUTIONS

Issue #1 ■ Wastewater and lost energy

Anywhere from 30% to 60% of a municipality's electricity costs are directly attributable to water treatment, water distribution and wastewater treatment. Using $1 worth of municipally-treated water uses or wastes $1 worth of energy when water use and electricity generation are conducted in the same inefficient way that has continued since the 1960's.

Based on a 2003 study of 100 food plant audits in Ontario by the Ontario Centre for Environmental Technology Advancement (OCETA),[10] the 2002 Waterwise project and other food industry sources, every dollar's worth of water use triggers at least forty-cents worth of direct and indirect energy use in a food plant.[11]

9 For example, vegetable oil is a green renewable fuel—the plants grown to manufacture it take in CO_2, so when it is used as fuel it has net zero emissions. However, the approvals process for producing this fuel is very lengthy, and if the vegetable oil meets the current definition of "waste" the whole process takes even longer.
10 Ontario Centre for Environmental Technology Advancement (OCETA) is a private, non-profit corporation that accelerates the commercialization and market adoption of clean technologies and environmentally sustainable solutions through stakeholder engagement and the provision of programming, business and technical services. (http://www.oceta.on.ca)
11 This direct and indirect water use includes water heating, water softening and cooling, cooking, sanitation, refrigeration and air compression, among others. If you reduce water use, direct and indirect CO_2 reductions occur, as less water pumping, treatment and sewer treatment is necessary. If you reduce hot water use, the savings are 4 to 5 times as much.

Solution #1

Generating energy from wastewater before it is treated removes the byproducts that will otherwise cost money to be cleaned up, reduces the overall cost of treating wastewater and generates enough energy to offset one-third of the water-related energy bill. Two megawatts (MW) of electricity from a CHP system that uses sewer wastes will offset the combustion of six million cubic metres of natural gas use.

Ontario's food plants are beginning to cut their water and energy use in half through energy efficiency and process integration. This can take up to 5 years in time and money. Redpath, Unilever (in Rexdale) and the Molson Toronto plant, factories that started with utility costs of more than $5 million per year, have demonstrated that it is possible to reduce energy and water consumption by $1 million per year with a goal to reduce by 50% over time.

As water use is reduced, the wastewater becomes much more concentrated. This is a problem for Toronto's wastewater treatment system. The City of Toronto's wastewater staff is working in partnership with Molson's staff. The solution to water pollution is not dilution; it is concentration and digestion to create green, renewable energy.[12]

There is perhaps 2 MW of energy generation in Molson's wastewater stream. A solid biodigester project using spent yeast and grain may increase the renewable heat and power contribution to 90% of the plant's power requirement. Green renewable power generation means that being carbon-neutral is possible.

Issue #2 ■ Regulatory compliance is not sensitive enough to business capital constraints

Since industry has to do projects in the year the capital is available, regulatory timing can be a challenge. Corporate capital is often one-year money that requires planned time lines on spending; it is not always possible to just spend the following year. When the year-end passes, ongoing projects may be in jeopardy. Timing and approvals must be well planned to meet spending targets.

Solution #2

2.1 Fast track or remove approval processes for green energy and pollution prevention projects and replace them with a performance reporting mechanism.

Energy efficiency requires capital. Many of the projects that cost the least are not high capital but depend on the capital invested in a monitoring and tracking (M&T) system that tracks both large and small projects. Without a good monitoring system it is impossible to document performance to corporate management and government agencies such as the Toronto Water Department that supports water efficiency projects.

2.2 Integrate utility monitoring and tracking systems with benchmarking protocols that will also help government verify sectoral environmental impacts.

The Molson Toronto plant is one of the very few plants in Ontario that currently has an M&T system for its utility use. Without the ability to measure, the ability to manage is limited.

2.3 Harmonize regulatory reporting targets with benchmark information that is useful to industry (for example, CO_2 emissions per unit of production, energy use per unit of production, water use per unit of production and wastewater discharge per unit of production).

Integration is key, whether it is capturing and purifying the CO_2 produced by fermenting (brewing) to put back into the bottle, or recovering waste heat from the brew kettles to power wash down systems. Process integration in the plant is expected to save the company $1.6 million per year on water and energy costs. This constitutes a significant amount of CO_2, which would otherwise be released into the atmosphere. Molson's acknowledges NRCan's Office of Energy Efficiency (OEE)[13] and Enbridge for their financial contribution to the process integration study.

To increase energy efficiency and reduce CO_2 emissions, Germany has extended its national building-cleanup campaign, which began in 2006 and releases around €1.4 million annually in low interest loans, subsidies and tax incentives for companies and individuals to make their buildings more energy efficient.

www.german-renewable-energy.com/energyefficiency

■

The Molson project is a highly visible participant in the Partners in Project Green (PPG), the largest industrial ecology initiative ever begun in Canada. PPG covers 12,000 hectares of industrial and commercially zoned land around Toronto's Pearson Airport.

Doug Dittburner

12 Cutting down water use at the factory level means that less water goes down the drain and there is a higher concentration of waste matter in wastewater, making it easier for biodigestion and the creation of green energy.

13 Natural Resources Canada Office of Energy Efficiency (OEE) focuses on energy conservation and efficiency, provides information on alternative fuel and helps Canadians save millions of dollars in energy costs while contributing to a healthier environment. One of the OEE's main objectives is managing the Government of Canada's ecoENERGY Efficiency Initiative, with its programs to reduce energy use in buildings and houses. See http://oee.nrcan.gc.ca for more information.

Issue #3 ■ Energy and water management skilled workers are in demand.

Solution #3

3.1 Focus on human resources skills for the workplace.

The thread that ties everything together is people. Every Molson plant has an energy team to develop the culture of responsible energy management by educating, involving and motivating employees. The vision is to be recognized as a global leader for energy and water conservation results and innovations. Molson's participated in the Earth Hour and had its own energy week. Their power-house and brew-house teams were also featured in a Toronto Star Article. Molson's uses MCM world-class manufacturing practices and is a CIPEC (Canadian Industrial Program for Energy Conservation) leader. Molson's energy council's mission at every plant is to develop a culture of responsible energy management by educating, involving and motivating its employees.

"A dedicated energy team that crosses departments, trains staff, rewards employees for project efficiency ideas, uses performance indicators for production, has the ability to audit and identify waste, monitors and tracks utility use at the department level and on production lines is critical."

Doug Dittburner

3.2 Establish an energy efficient workplace culture.

This is more than the last person turning off the light when they leave. A dedicated energy team that crosses departments, trains staff, rewards employees for project efficiency ideas, uses performance indicators for production, has the ability to audit and identify waste, monitors and tracks utility use at the department level and on production lines is critical.

3.3 Appeal to the next generation.

To start to reverse the effects of global warming we need to create a better world for our children. The best and brightest students work for green companies that care. Environmentally conscious companies will attract the brightest youth and young professionals.

"Conservation is good business because it provides a quicker payback than other technology solutions and focuses on making business more viable, leading to sustainability."

Chris Hanlon

"Coordination is needed at all levels of government. The speed at which government moves versus the speed of industry are often at odds with each other, and that is what needs to be resolved. It's important that each and every one of the people here continue to discuss these issues and make sure they get to the forefront."

Chris Hanlon

Topic #4 DRIVING CONSERVATION AND EFFICIENCY AHEAD OF GREEN ENERGY INVESTMENT

B) Energy Efficiency & Environmental Stewardship – from Business Concepts to Action!

Presenter ■ CHRIS HANLON
Director of Energy Services, AgEnergy Co-operative

PRESENTATION OVERVIEW

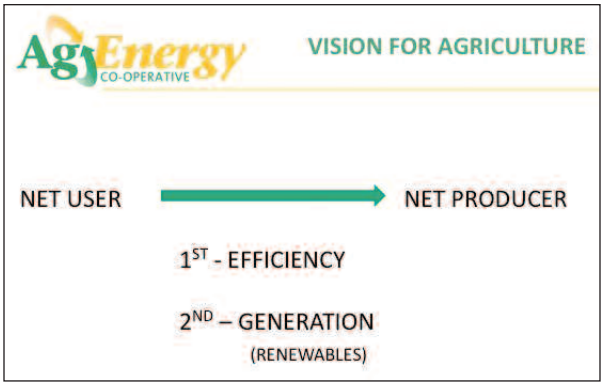
AgEnergy Co-operative is Canada's largest not-for-profit energy marketer serving agriculture and food sectors. AgEnergy's *Energy Productivity* program, in addition to targets for conservation and efficiency in agriculture, takes an economic approach to this challenging subject area. Conservation is good business as it provides a quicker payback than other technology solutions and focuses on making business more viable, leading to sustainability. When conservation is combined with new technology applications for generation and solid business management, it moves agriculture towards becoming a net producer of energy. Sustainability also demands that environmental attributes are held in high regard and carefully managed.

As an energy investment vehicle, AgEnergy's *Agri-Fund* provides a transparent process for the agricultural community to assist each other in generating revenue while ensuring improved energy security.

ISSUES AND SOLUTIONS

Issue #1 ■ How can we make agriculture a net producer of energy?

Currently, agriculture and food use represents 15% of Ontario's natural gas consumption. Greenhouses, dairy, poultry and beef production are significant consumers of energy.



Chris Hanlon, AgEnergy FIGURE 1

Solution #1

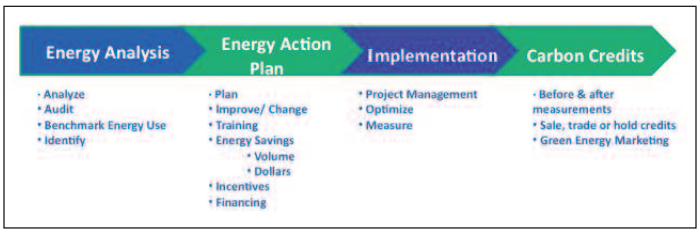
1.1 Increase energy efficiency

Increasing energy efficiency is the crucial first step to make green energy happen, before effectively building biogas plants, putting up solar reflectors, and developing wind farms. While there is no cookie-cutter approach to dealing with energy conservation and efficiency, there are a few factors that help facilitate a culture of conservation.

Driving conservation efficiency requires:

1. Vision: to go from being a net user to a net producer of energy
2. Getting your house in order: fix leaks, reduce, reuse, recycle and recover
3. Economic viability: embracing conservation is a good responsible business practice and it also saves money
4. A financial catalyst

A 20% improvement in energy efficiency can lower costs and greenhouse gas emissions by 3% to 4%. Increasing efficiency is a simple, cost-effective way to make things work better while offering the best return on every dollar invested. It is expected that there could be $80 million in savings through increasing efficiency efforts, thus saving money that could be reinvested in agriculture. As energy use is reduced and improvements are made in terms of conservation, greenhouse gas (GHG) emissions will decline making Canada and Ontario a better place to live.



Chris Hanlon, AgEnergy FIGURE 2

1.2 Generate Renewable Energy

In addition to conservation and increased energy efficiency, generating renewables will also assist agriculture to become a net producer instead of a net user of energy. Biomass and biogas can play an important role in renewable energy production.

Solid biodigesters that are manure-based and liquid biodigesters that are wastewater-based can produce four products:

- Green electricity from the combustion of methane
- Green heat from biodigestion and recoverable heat from generation
- CO_2 that can be scrubbed[14] for industrial or agricultural use
- Stable fertilizer and nutrients that can replace fossil-based fertilizer

14 A carbon dioxide scrubber is a device which absorbs or removes carbon dioxide from the atmosphere by reacting with chemicals such as sodium hydroxide and calcium oxide. Scrubbers are often used to treat exhaust gases from industrial plants and can be placed within smokestacks to limit harmful emissions.

Did YOU Know

Investments in renewable energy generation projects grew by 13 % during 2008, to $117 billion, and new private investment in companies developing scaling-up new technologies increased by 37% from 2007 to $13.5 billion.

Global Trends in Sustainable Energy Investment, pg.4,2009; www.unep.org

What appears to be needed is an integrated analysis of energy efficiency opportunities that simultaneously identifies the barriers and reviews possible solution strategies... for capturing the billions of dollars of savings potential that exists across the U.S. economy.

Unlocking Energy Efficiency in the U.S. Economy, July 2009, McKensey&Company

Issue #2 ■ A financial tool is required to attract investment and accelerate the completion of energy projects

Solution #2
AgEnergy Co-operative Agri-Fund

AgEnergy has invested $250,000 to start the Agri-fund, which will be integral in supporting energy projects. This needs to be developed into a national fund. Feedback from groups and individuals is essential to the success of the program. Greenhouse growers in the Netherlands undertook a similar initiative and invested money back into the industry to make green energy happen[15]. The vision in Canada is about building an economy that makes sense and is sustainable.

"I'm glad you are developing an Agri-fund, but how would you like to position the fund given Farm Credit Canada is providing similar services and there are other types of agricultural credit services and banks providing credit to the farming community?"

Khurshid Saharan

Chris Hanlon, AgEnergy **FIGURE 3**

"There are a number of different funds, and in terms of positioning it is a matter of providing choice to your customers. This fund is focused on the development of renewables and renewable generation, whereas some of the other funds are focused on agri-food or the production side of feedstocks. So, the positioning is about giving choice to customers, and this fund is going to be a for profit fund, so it will have a return on investment, which is different than a number of other financing structures out there."

Chris Hanlon

The Agri-Fund has been the financial catalyst for AgEnergy's four-part program for agriculture called Energy Productivity. It is designed so that customers can choose the aspects of the program that are most effective for them. The program uses analysis and benchmarking to identify viable projects and prioritize these projects for completion. There must be a return on equity for stakeholders. The program is about timely and more sustainable energy projects. Sustainability is key.

15 See Session 4, Topic #2 (Nico van Ruiten) for more information on the Netherlands' 50/50 cost-share initiative, p. 54.

PARTICIPANT PERSPECTIVE STATEMENT

Participant ■ ROB PANZER, General Manager of Planning & Development, City of London

Local governments in Ontario want to be active participants in the development of policies, programs and projects that promote sustainability in the production and consumption of energy. Progressive mayors, councillors and staff realize that green energy initiatives not only align with the interests of their constituents, but also form part of an effective, forward-working sustainable growth strategy. Many municipalities, including London, are taking leadership roles in this area and are pursuing partnership opportunities with government agencies and the private sector to advance their sustainability objectives. Municipalities like London are also pursuing opportunities for green energy projects through their economic development agencies. The London Economic Development Corporation places a high priority on the commercialization of green energy initiatives building upon the energy-related research programs at the University of Western Ontario and Fanshawe College.

Significant energy-related initiatives underway in London include:

The Mayor's Sustainable Energy Council (MSEC)

The MSEC was formed in October of 2007 and includes representatives from London's major institutions, utility companies, energy production companies, energy management consultants, economic development agencies and the agricultural sector. The mandate of the Council is to encourage energy-related research, support the development and implementation of new energy sustainability initiatives and technologies, pursue public and private investment in energy conservation programs and projects, and promote alternative forms of energy generation. Advancing public discussion and involvement in these areas is seen as a key contributor to success.

The London Energy Efficiency Partnership (LEEP)

This project is being led by staff in Environmental and Engineering Services and Planning and Development Departments in co-operation with the London Home Builders' Association. The objective of the project is to explore the feasibility and promote the implementation of alternative energy conservation technologies in residential construction and community design. One of the outcomes of the project is the ongoing development of a Green Development Strategy and the University of Western Ontario. London Development Institute has also partnered in this endeavour.

River Bend Heights Near Zero Community Energy System

Environmental Services and Planning staff are working with Sifton Properties Ltd., a prominent London development company, in the planning and design of a district energy proposal for the planned River Bend Heights project in west London. The system will utilize an aquifer-based inter-seasonal thermal storage system and roof-top solar collectors to generate the energy required to heat and cool a mixed-use community that will also incorporate advanced energy conservation and placemaking design components. The project has been supported by a $500,000 grant and a $500,000 loan through the Federation of Canadian Municipalities Program and by a $700,000 grant from the Sustainable Development Technology Corporation. The City is also sharing in study costs in addition to its "in-kind" contributions.

Official Plan and Zoning By-Law Review

Planning staff are currently reviewing Official Plan and land use policies and zoning by-law regulations that are applicable to green energy facilities and installations and will recommend any changes that are warranted to recognize new technologies and support them through policies and regulations that reflect identified best practices. The Official Plan already contains policies to promote energy conserving development through bonus zoning.

Other Sustainable Energy Initiatives

Initiatives adopted by the City include its CLEAR (City of London Environmental Awareness Reporting) Network; transportation demand management initiatives including an EcoMobility project to promote more energy-efficient forms of transportation; the planned development of a landfill gas power plant (2MW) at the City's W12A landfill site; the proposed installation of wind turbines at the regional water supply facility to be built as part of HELP Clean Water Project, which has been recently approved for federal and provincial infrastructure funding, and the "Energuide Partnership", which is a multi-stakeholder collaboration to promote energy conservation in both new and existing homes.

The City of London supports the leadership role being taken by the Province of Ontario through the Green Energy and Green Economy Act, 2009 (Bill 150). This legislation will facilitate the development of new renewable energy projects by providing economic incentives for the production of renewable energy and its distribution through the power grid, and by streamlining the approvals process for renewable energy projects. We are concerned however, that streamlining is taking the form of exemptions for such projects from municipal review and approval under the provisions of the Planning Act. There has to be a mechanism in place to ensure that municipal interests and requirements normally associated with zoning and site plan approval processes (servicing requirements, municipal easements, road widenings, assessment controls, set-backs, etc.) will continue to be achieved. Provincial policies, guidelines, best practices and mandated timelines for planning approval processes are appropriate streamlining initiatives – taking municipalities out of the process is not. Hopefully, the streamlining provisions of the Act will be subject to further consultation before any regulations are issued.

The City of London is encouraged by the Province's interest to implement a "right-to-connect" strategy and we hope that an early resolution to the current OPA-imposed transmission constraints – the so called Orange and Yellow zones – can be achieved as these constraints are a significant impediment to the creation of new renewable energy projects in our area.

I would like to thank the Lawrence Centre for the opportunity to participate in the Making Green Energy Happen Workshop and I look forward to what should be a very exciting future for green energy in Ontario

Participant ■ DIANNE SAXE, Barrister and Solicitor, Specialist in Environmental Law, Saxe Law

Biomass, Green Energy Act and Approvals

One of the key promises of the *Green Energy Act* is a "one window" approval process for renewable energy projects, coupled with a six month "service guarantee", to cut through the current dozens of approvals for a power generation project.

It won't be easy for the Ministry of Environment Approvals Branch to actually provide this service, especially for biomass projects.

MOE approvals backlogs have been a bane of Ontario's economy for more than two decades. Many attempts to simplify and speed the process have been proudly announced, but backlogs have always stubbornly returned. More ambitious plans were abandoned, such as the Transformation Agenda, which would have stopped wasting MOE approvals expertise on minor environmental risks (Alberta adopted such a system years ago). The MOE is still painfully slow in issuing air, sewage and waste approvals, even after four decades of experience. How will they cope with renewable energy approvals on top of their existing load?

Renewable energy approvals will be much more demanding for the MOE (and the Environmental Review Tribunal) than anything they do now:

The *Green Energy Act* is an ambitious attempt to transform Ontario's economy. This means disruptive changes, which may meet stronger opposition than current run-of-the-mill applications.

The new approvals must be measured against a much broader definition of "environment", requiring the MOE to evaluate and balance social, economic, archaeological, aboriginal, planning, landuse and other issues, in addition to the environmental issues that are its core mandate.

The new approvals will have an unusually broad scope. Associated roads, water crossings and transmission lines, for example, will all have be assessed, and regulated, as part of the renewable energy approval.

Projects with renewable energy approvals will be exempt from municipal and most other controls. This will focus all opposition squarely on the MOE approval process, without the current opportunity to shift some of the conflict, or solutions, to municipal and other levels.

Few MOE staff have expertise or experience in these broader areas. In addition, renewable energy technologies are developing quickly. By definition, the MOE lacks experience in regulating innovative technologies, and has always had trouble doing so. Last year, in *Lafarge*, the courts ruled that MOE regulatory inexperience is a valid ground of appeal against approvals.

Proponents have been promised a six-month "service guarantee" for decisions on renewable energy approval applications. In the past, the MOE has refused to give itself deadlines, or has avoided them by simply finding reasons to "stop the clock". This time, they won't have this out.

Despite the initial focus of GEA opposition on wind, biomass may be painfully hard to regulate.

Biomass is a key element in Canada's green future, with our large forestry and agriculture sectors and relatively small population, but it is dogged with regulatory obstacles. The *Green Energy Act* will help to lift the stigma and regulatory burden of being called "waste". The "waste" issue has a troubled history; after three decades of MOE and judicial incoherence, we still have no clear definition of what it means. (Because of painful experiences with market fluctuations, regulators reject the obvious "economic value" test.) It remains extremely hard to get approvals for any waste transfer, processing or disposal site; they are often forbidden by zoning. But the MOE continues to insist that many digestates or other residues from a biomass facility must be treated, expensively and probably unnecessarily, as waste.

Whether "waste" or not, biomass issues do have a long history of real problems, which are bound to give Approvals pause. Municipal and private biomass projects (such as composting, energy from waste, renderers, animal by-product plants, etc.) have famously triggered deluges of complaints about odour, leachate, particulates, etc. Promising sources of biomass, such as paper fibre biosolids, sewage sludge, manure, wood chips and yard waste, all show up regularly in expensive court cases and in MOE complaint logs. Public and MOE fury have shut down several multi-million dollar composting facilities over odours; even farm-based biodigesters are often unpopular. Foul odours seem to make neighbours crazier than any other impact; perhaps because odours directly affect the primitive emotional centre of the brain. I therefore expect Approvals to be extremely demanding about control of odour, leachate, dust etc. at all biomass facilities, to an extent bound to infuriate proponents.

Biomass facilities may also be hard to site well because of biomass' relatively low energy density, in comparison to coal, plus relatively high labour and transportation costs. The best sites may be not well served with infrastructure. Biomass may be better suited for smaller, dispersed plants, rather than giant nuclear or coal, but Hydro One says this will require huge changes in our electrical transmission systems. In addition, small plants may find it hard to meet Approvals demands for setbacks and expensive odour controls.

We have heard little from the MOE on how the Approvals Branch will meet all these demands. A multistakeholder committee of government ministries has been promised, but it won't necessarily offer much help. One obvious risk is that renewable approvals won't get through in a reasonable time, driving innovation and the green future to other jurisdictions. Resources needed to manage renewable energy approvals may also be shifted from existing approval processes, starving them into even more destructive backlogs.

In addition, the definition of eligible "biomass" will likely be highly controversial, as it hides an unusually complex set of tradeoffs. Is it "green energy", for example, to clear-cut and burn old growth forest from a provincial park? Or to drain peat bogs? Or to burn garbage? Or used tires? What about waste paper, if it could be recycled? Will the existing troubled composting or energy from waste facilities count? It is no surprise that the *American Clean Energy and Security Act* definition of "biomass" goes on for multiple pages. The cheery innocence of existing Ontario definitions, such as:

1. *In this Regulation*,
   "biomass" means biological materials, including gases generated from the decomposition of biological material certainly will not last.

Thursday, July 2, 2009
Dianne Saxe

Electricity Retailing — Disclosure To Consumers regulation

Participant ■ VALERIE KITCHELL, Stakeholder Engagement Consultant, Ontario Sustainable Energy Association

Sustainable energy policy is an essential driving force behind a 100% sustainable energy future for Ontario. Our commendations to Dianne Cunningham and her team on a truly ground breaking meeting of the minds at Making Green Energy Happen: Policy and Priorities.

The challenges that lie ahead are clear. Some are old friends; others have emerged in recent years. All require creative solutions, solutions which are all at once sustainable, reliable, cost effective and rapidly deployable.

With respect to replacing coal with fuel from biomass, the vigor with which cleaner alternatives are being sought is promising. Significant resources are being applied to investigate the potential of securing biomass from forestry, agriculture and possibly energy crops. Plans are being developed to determine the preferred locations for facilities that can process the biomass into pellets suitable for the coal plants. Transportation logistics are being investigated to optimize the transportation from the source, to the pelletization plants and then to the coal-fired power plants. This has the potential to be a major green power initiative: replace coal with biomass, create employment in the forestry, agriculture and transportation industries, utilize existing power generation and transmission infrastructure all in a cost effective manner.

The challenge here however, is the fact that there are more efficient means of utilizing the renewable resources available in Ontario besides simple cycle power generation. Based on combustion efficiencies, more than 65% of the energy content could be wasted before taking transportation and other steps in the process into consideration. Nutrients that normally would be returned to the land would be lost. This would encourage an ongoing focus on larger central power generation.

While we do not discount the value of this initiative, or the potential we see in the endeavour, we feel that taking into account some key considerations would significantly increase the overall benefit. Ontario's Green Energy Act is a truly landmark piece of legislation which could empower Ontarians to become generators and conservers.

Within the Act, enabling investment in combined heat and power (CHP) is a good first step. CHP, if defined to include only highly efficient generation, offers potential for vastly more efficient use of the gas resources, for dispersed development that will require less transmission and the potential to support greater penetration of intermittent renewables.

We suggest that the feed-in tariffs be utilized for "green energies" which should be defined to include high efficiency CHP with minimum system efficiency standards for biomass CHP facilities, and the capacity of these resources be taken into account when considering the allocation of biomass resources. District energy, and an emphasis on maximizing local use of biomass for heat must be prioritized along side the transformation of our coal plants.

Overcoming Barriers to Sustainable Energy

Ontario's energy system has developed and evolved over the last century. During the first half of that century, increasing economies of scale resulted in declining electricity prices. Electrification revolutionized our homes and farms, and cheap energy fueled an expanding manufacturing base. And even though this recipe for success ended when the nuclear energy industry's promise of power to "cheap to meter" failed to materialize, deep in the Ontario psyche, no doubt stimulated by the rushing roar of water falling at Niagara, there remains an expectation of cheap and reliable power.

Albert Einstein is often quoted as saying "insanity is doing the same thing over and over again and expecting different results." When higher than expected costs for Ontario's existing nuclear plants threatened low electricity prices, Ontario Hydro lengthened the amortization period for the assets. Since then, the nuclear fleet has been refurbished long before the expected end of their asset lives, again understating the true cost. Removing most of Ontario Hydro's debt from the successor companies when Ontario Hydro was restructured in the late 1990s further camouflaged the true costs of nuclear power.

Traditional power system planners consider renewable energy unreliable, intermittent and expensive – each, an anathema to their credo of "reliable, continuous and cheap." Similarly, they discount conservation as ethereal, unsustainable, and at best (or worst) enabling consumers to purchase more energy using equipment.

Unless we change the fundamentals of our energy system, unless we create a new paradigm, the existing barriers to renewable energy and conservation will make these traditional views a self-fulfilling prophecy. The benefits of sustainable energy outweigh any deficiencies, and these deficiencies can be overcome by taking a system approach: using storage, complementary systems, smart technologies and above all conserving as much energy as possible.

Some of the barriers to sustainable energy are unintended consequences of policies, legislation, regulation and practices that have little to do with an increasingly wider array of options for renewable energy and conservation. Recently, the City of Toronto passed an overarching bylaw that superceded elements in 17 different bylaws that once prevented homeowners and businesses from installing solar panels on their rooftops.

Other barriers result from the rules, regulations and practices in the energy sector itself. While no one questioned that the new transmission lines from Bruce to Milton will be included in Hydro One's rate base and recovered from all electricity customers, there was no symmetrical expectation for sustainable energy projects: anaerobic digesters on farms, solar panels on homes or wind farms before the Green Energy Act passed.

Other barriers result too from asymmetry. Huge investments in central generating plants or pipelines are recovered through regulation or power purchase agreements over the life of the asset, and financed accordingly. And while the proposed Feed-in Tariffs will go some way to creating symmetry for wind and solar projects, geo exchange systems, solar thermal, district energy, combined heat and power are constrained by the short term payback expectations of decision makers for these systems as well as their investors having no similar regulatory or contractual protection.

Ontario's sustainability pioneers have faced many barriers and persevered, but it is time to make the job easier and more cost effective.

Marion Fraser, Fraser & Company
CONTACT _Con-44779C0F1 \c \s \l Valerie Kitchell, Stakeholder Engagement Consultant, Ontario Sustainable Energy Association

WORKSHOP PARTICIPANT LIST

Business

Buijk, Jan Vice President, GE Energy, Jenbacher Gas Engines, DDACE Power Systems, Netherlands
Carneval, Frank CEO, Bridgepoint Group Limited
Dales, Joe Vice President, Farms.com Limited
Dittburner, Doug Chief Engineer and Energy Team Leader, Molson Canada
Dottori, Frank Managing Director of Cellulosic Ethanol Division, GreenField Ethanol; Founder, former President and CEO, Tembec Inc.
Goulden, Bryan Manager, Market Development, Union Gas Ltd.
Graham, Mark Director, Investment Policy and Agreements, Hydro One Networks
Healy, Mark Partner, Torque Customer Strategy
Hodgson, Bruce Director Market Development, The St. Lawrence Seaway Management Corporation
Jantzi, Jane Senior Manager, Business Development, Deloitte & Touche
Kramp, Dick Marketing Program Manager, GE Energy, Jenbacher Gas Engines, Netherlands
Lentz, Stephanie Senior Manager, Deloitte & Touche
Little, Ryan Vice President, Business Development, StormFisher Biogas
McKenzie, Anders Vice President and Director, Corporate Finance, Deloitte & Touche
Mathur, Mohan Board of Directors, London Hydro Inc, London Economic Development Corporation
McLean, Susan Manager, Stakeholder Relations, Sustainable Development Technology Canada
Penner, Greg President and CEO, NeoVentures
Sagaskie, Tom General Manager, Guelph Junction Railway
Saxe, Dianne Barrister and Solicitor, Specialist in Environmental Law, Saxe Law
Shaw, Susan Director, Ontario Business Development, EPCOR Utilities Inc.
Sharma, Vinay Chief Executive Officer, London Hydro Inc.
Stephen, Ralph President, Hybrid EcoWatts
Speers, Doug Chair, Emco Corporation, Ivey Advisory Board Member
Tiessen, Dean Partner, Cantus Bio Power Ltd; General Manager, Pyramid Farms
van Berkel, Bas President, StormFisher Biogas
vander Laan, Hank Founder and Senior Advisor, Trojan Technologies
White, Adam President and CEO, AITIA Analytics Inc.
Wood, Larry President, Norwell Group
Zhang, David President, Metro Resources Corporation, Windsor

Academia

Adams, Joel Executive Director, the Research Park (London – Sarnia – Lambton) The University of Western Ontario
Bansal, Pratima Professor, Richard Ivey School of Business, The University of Western Ontario
Bassi, Amarjeet Associate Dean, Faculty of Engineering, The University of Western Ontario
Berruti, Federico BESc, HBA Richard Ivey School of Business, The University of Western Ontario
Berruti, Franco Director, Institute for Chemicals and Fuels from Alternative Resources; Professor, Department of Chemical and Biochemical Engineering, The University of Western Ontario
Cunningham, Dianne Director, Lawrence National Centre for Policy and Management, Richard Ivey School of Business, The University of Western Ontario
Dunbar, Craig Associate Professor Finance, Richard Ivey School of Business, The University of Western Ontario
El Naggar, Hesham Professor and Research Director, Geotechnical Research Centre, The University of Western Ontario
Esselment, Rob Director, Government Relations, The University of Western Ontario

Ewart, Tom Managing Director, Research Network for Business Sustainability, Richard Ivey School of Business, The University of Western Ontario

Gloor, Chantal Director Institute for Chemicals and Fuels from Alternative Resources, The University of Western Ontario

Guo, Li Visiting Scholar, Richard Ivey School of Business, The University of Western Ontario (Northeastern University of China)

Hangan, Horia Associate Professor and Research Director, Boundary Layer Wind Tunnel Lab, The University of Western Ontario

Harris, Melissa Research and Project Assistant, Lawrence National Centre for Policy and Management, Richard Ivey School of Business, The University of Western Ontario

Higgins, Chris Professor, Richard Ivey School of Business, The University of Western Ontario

Holburn, Guy Professor, Richard Ivey School of Business, The University of Western Ontario

Laughland, Pamela Research Associate, Richard Ivey School of Business, The University of Western Ontario

Lindquist, Jeffrey Research and Project Assistant, Lawrence National Centre for Policy and Management, Richard Ivey School of Business, The University of Western Ontario

Markvoort, Peter Project Assistant, Lawrence National Centre for Policy and Management, Richard Ivey School of Business, The University of Western Ontario

Maxwell, John Professor, Academic Director, Lawrence National Centre for Policy and Management, Richard Ivey School of Business, The University of Western Ontario

McBean, Gordon Research Chair, Institute for Catastrophic Loss Reduction; Professor, Department of Geography, The University of Western Ontario

Milne, Dawn Communications Specialist, Richard Ivey School of Business, The University of Western Ontario

Mocanu, Joseph Damian PhD, MBA Candidate, Richard Ivey School of Business, The University of Western Ontario

Morand, Charles MBA 2008, Richard Ivey School of Business, The University of Western Ontario

Morse, Eric Associate Dean Programs, Richard Ivey School of Business, The University of Western Ontario

Pare, Maura Director Public Affairs, Richard Ivey School of Business, The University of Western Ontario

Prakash, Anand Associate Professor, Faculty of Engineering, The University of Western Ontario

Siddiqui, Kamran Associate Professor, Department of Mechanical and Materials Engineering, The University of Western Ontario

Sidhu, Tarlachon Professor, Faculty of Engineering, The University of Western Ontario

Sparling, David Chair, Agri-Food, Innovation and Regulation, Professor, Richard Ivey School of Business, The University of Western Ontario

Stephenson, Carol Dean, Richard Ivey School of Business, The University of Western Ontario

Sun, Xueliang A. Professor, Faculty of Engineering, The University of Western Ontario

Varma, Rajiv Professor, Faculty of Engineering, The University of Western Ontario

White, Rod Associate Professor and HBA Program Director, Richard Ivey School of Business, The University of Western Ontario

Wolff, Katharina Research and Project Manager, Lawrence National Centre for Policy and Management, Richard Ivey School of Business, The University of Western Ontario

Wood, Susan Director, Office of Research Services, Queen's University

Government

Anderson, Annette Manager Greenhouse, Agroforestry, and Specialty Crops, Ontario Ministry of Agriculture, Food and Rural Affairs

Bentley, Hon. Chris Attorney General, Province of Ontario, Member of Provincial Parliament, London West

Cansfield, Hon. Donna Minister of Natural Resources, Province of Ontario, Member of Provincial Parliament, Etobicoke Centre

Carty, Alexis Analyst, Intergovernmental Affairs, Privy Council Office, Government of Canada

Cooper, David Manager, Environmental and Land Use Policy, Ontario Ministry of Agriculture, Food and Rural Affairs

Dick, Phil Business Resource Specialist, Strategic Intelligence and Marketing Unit, Economic Development Division, Ontario Ministry of Agriculture, Food and Rural Affairs

DiEmanuele, Ezio Regional Director, Agriculture and Agri-food Canada

Hopcroft, Grant Director, Intergovernmental Affairs and Community Liaison, City of London

Hume, Gord Board of Control, City of London
Johnston, Andrea Director, Agriculture and Agri-food Canada
Malcolmson, Phil Director, Strategic Policy, Ontario Ministry of Agriculture, Food and Rural Affairs
Mathyssen, Irene Member of Parliament, London-Fanshawe
McDonald, Ian Applied Research Coordinator, Field Crop Unit, Ontario Ministry of Agriculture, Food and Rural Affairs
Panzer, Rob General Manager, Planning and Development, City of London
Pim, Linda Food Safety and Environmental Policy, Ontario Ministry of Agriculture, Food and Rural Affairs
Rafi, Saad Deputy Minister, Ontario Ministry of Energy and Infrastructure
Saharan, Khurshid Marketing and Trade Officer, Agriculture and Agri-food Canada
Tansley, Jill Municipal Policy Specialist, City of London
Tmej, Robert Senior Policy Advisor, Ontario Ministry of Energy and Infrastructure
White, Peter President, London Economic Development Corporation

Agencies

Bouk, Mike Executive Director, AgEnergy Co-operative
Bierhuizen, Robert President, Sunrise Greenhouses Ltd.
Champion, Carole Director, Business Development, Ontario Centres of Excellence
Cowan, Ted Researcher, Ontario Federation of Agriculture
Fonger, Jim Director, Ontario Sustainable Energy Association
Gagnon, Vicky Segment Manager, Agriculture, Multifamily and Low-income for Business Markets, Ontario Power Authority
Greydanus, Jack Owner, Enniskillen Pepper Co., Ontario Greenhouse Vegetable Growers
Hanlon, Chris Director of Energy Services, AgEnergy Co-operative
Kay, Gary Partner, Trio Environmental Services
Kelly, John Vice President, Erie Innovations and Commercialization, Ontario Fruit and Vegetable Growers' Association
Kellway, Matthew Staff Specialist, Policy, Society of Energy Professionals
Kitchell, Valerie Stakeholder Engagement Consultant, Ontario Sustainable Energy Association
Kuyvenhoven, Andy President, Flowers Canada
Lyng, Robert Senior Advisor, Ontario Power Generation
McCabe, Don Vice President, Ontario Federation of Agriculture
McLaughlin, Murray President and CEO, The University of Western Ontario Research Park
Newall, Paul Consultant, Ontario Power Workers' Union
Picard, Rej Chair, The Ontario Greenhouse Alliance
Plagiannakos, Takis Manager, Energy Infrastructure Policy, Ontario Energy Board
Reus, Leo President, AgEnergy Co-operative
Rich, Michael Vice President, TRIO Environmental Services
Roozen, Len Chair, Ontario Greenhouse Vegetable Growers
Sheppard, Rod President, Society of Energy Professionals
Stein, Victor Planner, Ontario Power Authority
Surgeoner, Gord President, Ontario Agri-food Technologies
Thissen, Frits Counselor for Agriculture, Nature and Food Quality, Embassy of the Netherlands, Washington
van Ruiten, Nico Chairman of Horticulture, Dutch Farmers' Union, Netherlands
Young, Chris Vice President, Business Development Fossil Fuels, Ontario Power Generation

Richard Ivey School of Business
The University of Western Ontario

IVEY

CROSS-ENTERPRISE LEADERS