**Editorial**

**Can Renewables Succeed in Retail Competition Electricity Markets?**

Canadian energy policy bodies, electricity utilities and their regulators are currently reviewing the potential for market deregulation and utility restructuring under the premise of increasing the overall economic efficiency of the electricity industry. Within a “retail competition” electricity market structure, planning opportunities will be limited and environmental sustainability objectives could be seriously hindered. The current market structure in most Canadian jurisdictions (vertically-integrated monopoly) has allowed for some inclusion of sustainability objectives through mechanisms such as “Integrated-Resource Planning”, where all cost-effective supply options must be evaluated prior to new development, including the consideration of demand-side measures.

Sustainable energy technologies (*sustainables*) are based on inexhaustible / renewable energy resources (within a human timeframe) and do not have significant impacts on society, the economy, or the natural environment. Although utility planning has largely excluded the consideration of *sustainables* for incremental capacity, there has been some utilization of these technologies through utility “set-asides”, Government R&D and demonstration programs, and some private sector initiatives. Recently, several provincial utilities (AB, SK, ON, PQ) have agreed to develop wind-farm capacity onto their grids.

There are indications that *sustainables* would not achieve significant market penetration in a retail competition electricity market due to cost and capacity limitations, and some sort of market intervention mechanism would be necessary to promote such technologies. Although the new industry structures would, “… provide end-users with much greater choice in sourcing their power needs for most customers, a primary purchase criterion will be price. While renewables are becoming more price competitive, many of their benefits are societal in nature, measured in terms of environmental considerations, diversification of our fuel source mix, etc.” (Silverman & Worthman, *The Electricity Journal*, Vol.8, No.2).

In order for *sustainables* to be successful, their societal and environmental benefits must enter into utility/NUG resource selection criteria. *Sustainables* can offer the following benefits:

- minimal environmental impacts
- increased utility system reliability due to diversity of supply options
- modular development capabilities with low lead-times and smaller capacity increments
- distributed electricity generation options
- opportunities for regional economic development through community manufacture of *sustainables* and management of distributed systems

Green electricity consumerism opportunities will be enhanced under a retail competition market structure. However, certain market intervention mechanisms may be necessary under such a system to promote a significant penetration of *sustainables* into the electricity market. These could include:

- facility for distributed electricity generation, and utility support for power backup and financing
- requirement for R&D, demonstration and commercialization programs for *Sustainables*
- utility *sustainables* “set-aside” programs
- regulation of T&D utilities with integrated resource planning requirements, and/or “environmental dispatches” or “fee-bates” on sales
- increased governmental environmental legislation
• building codes which require the inclusion of cost-effective sustainables into building designs
• consumer information programs and financing options for distributed technology development.

If any ERG-News readers are interested in discussing this issue, send an email to the editor (apape@sfu.ca) stating an interest to join our Internet discussion group (erg-info@sfu.ca) Andrew Pape

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Energy Conservation Activism through the IIEC

Cathy Strickland is the Manager of the Private Sector Program with the International Institute for Energy Conservation, and will shortly be completing her Masters thesis on the conservation potential of the commercial sector in several Canadian Provinces.

The International Institute for Energy Conservation (IIEC) is a non-profit organization established to accelerate global adoption of energy efficiency policies, technologies and practices to enable economic and environmentally sustainable development. IIEC’s activities focus on developing countries and the emerging economies of Central and Eastern Europe. The head office is located in Washington, D.C., with three regional offices in Bangkok, Thailand; Santiago, Chile; and London, England.

IIEC uses an integrated approach to facilitate its mission. Initiatives target three tiers of economic development. The Policy Program works at the country level to help create supportive national policies and build collaborative relationships among diverse stakeholders in the energy sector. The Private Sector Program works with the global energy efficiency industry to encourage the dissemination and commercialization of energy efficient products and services. The International Financing Institutions Program works with the multilateral development banks and international financing agencies to encourage and assist the banks in incorporating energy efficiency options into their standard project definitions.

As Manager of the Private Sector program, I am involved in projects in India, Indonesia, Chile, Poland, Thailand and the Czech Republic. The aim of the project work is to build the capability of the private sector within these countries to supply energy-efficient products and services. One means of achieving this is to identify in-country partners for the energy efficiency industry and then facilitate joint ventures, licensing or distribution agreements. Another is to identify and address market barriers to energy efficiency through innovative mechanisms such as equipment leasing arrangements, energy performance standards and labeling programs, life-cycle costing methodologies or alternative financing mechanisms.

IIEC’s work has succeeded in increasing the awareness of the benefits of energy efficiency to sustainable economic development. Several multilateral development banks are instituting energy policies which expressly include energy efficiency as a goal. The European Bank for Reconstruction and Development has established an Energy Efficiency Unit, solely to finance energy efficiency projects in Central and Eastern Europe. The Thai government has established a $180 million fund to finance energy efficiency. In addition, several joint ventures have been established between manufacturers of electronic ballasts and Thai lighting companies.

Sometimes progress seems glacial, and then a project will have a success and change seems to happen overnight. Its these successes, big and small, that make work in energy efficiency promotion worthwhile. Cathy Strickland.

Energy Efficiency and the Petroleum Refining Industry

The Energy Research Group (ERG) at SFU has been busy over the last few months working diligently on a study to estimate the potential for energy efficiency in Canada’s six most energy intensive industrial sectors (mining, cement, iron and steel, petroleum, chemicals, and pulp and paper).

The modeling of these industries has provided the usual array of challenges for the group. The petroleum...
refining sector, summarized here, was no exception, and for me, an neophyte ISTUMite, it provided an excellent immersion platform from which to learn the ins and outs of ISTUM and end-use modeling.

Background

The petroleum refining sector is a significant industrial sector from an energy perspective. Most evidently this sector is responsible for the supply of Canada’s petroleum fuels products. The processes and technologies required to produce these products are in themselves energy intensive, requiring significant quantities of fuel. Although much of this fuel is self generated, the industry still accounts 4% of the Canada’s total industrial energy consumption, excluding self generated fuels, or 14.3% including self generated fuels.

The Model

As with the other work done by the ERG with ISTUM, the sector was modeled to reflect the evolution of the industry’s process technologies under various scenarios over the period 1990 to 2010. This evolution is a function of the technology buying behavior of facility designers and operators which will in turn affect the energy consumption of the industry. The various modeling scenarios covered are intended to reflect a range of energy policies and prices.

The four scenarios modeled were:
- a frozen efficiency scenario in which the same process technologies are adopted as were used in the base year over the forecast period
- a natural change scenario representing a business-as-usual case (i.e.: no change in technology purchasing behavior)
- an economic scenario representing a socially and economically efficient selection of technologies, with a 7% discount rate for future cash flows
- a technical scenario in which the technologies with the lowest energy consumption capture 100% of the market

The underlying assumptions for the model included:
- the demand for petroleum products was assumed to have an annual growth rate of 1.8%
- gasoline would continue to be the petroleum fuel of choice
- there would be a moderate increase in the level of refining in the sector due to decreasing qualities of crude oil in some regions and increasing environmental standards

Results

Figure 1 shows the total energy consumed in the Canadian petroleum refining sector under each scenario.

As can be seen from the figure, the majority of the energy efficiency potential is captured through change within the industry, that is without the implementation of any special policies or pricing. Improvements beyond this, particularly in the technical runs, show only marginal gains in energy efficiency. This is primarily a result of a lack of new and evolving energy efficient process technologies within the industry.

Energy savings in the refining sector

In the model all energy consumption is classified into four categories of end-use energy services. These include: auxiliary equipment (fans, pumps, motors, process drives, etc.); heaters, to provide direct process heat; boilers and cogenerators, for the provision of steam; and, process technologies such as catalytic crackers which consumer energy directly (i.e.: petroleum coke) in addition to any of the other end-use services.

Analysis of model results indicates that the provision of heat and steam services consume 90% of the sector’s energy. The model indicates that there is a large potential for reduced energy consumption by adopting technologies that demand less heat and steam to produce the same final product. Modest additional savings result from higher efficiency equipment supplying heat and steam (i.e.: boilers and heaters).
Auxiliary equipment and the end-use services they provide also have opportunities for reduced energy consumption both through demand reduction and efficiency improvements. These however are also modest in comparison to the energy savings resulting from reduced heat and steam demand.

Over the modeling horizon (20 years), the energy consumption of the total stock of process technologies actually increases. Although, more efficient process technologies are available, the need for increased refining, discussed above, overwhelms these other savings.

**Lessons Learned**

From the perspective of this neophyte ISTUMite several simple concepts stand out as being important to understanding ISTUM and the modeling process:

1. Energy consumption, though reflected by the demand for products and services, is determined through the choice of technologies used to produce them.

2. The energy consumption of these technologies depends most on their requirements for energy end-use services such as heat, light and motive force. As such, energy savings can result from either adopting technologies that require less of these services, or improving the efficiency with which they are provided.

3. The evolution of technologies (and their associated demand for energy services) are economically driven by the purchasing behavior of facility designers and operators. Within the model, economic variables can easily be manipulated to simulate various policies and the affect they have on the choice of technologies.

By keeping these concepts in mind throughout this first and subsequent modeling exercises, it has helped me improve my understanding of the modeling process and the many cause and affect relationships between variables, assumptions and the model results.

John Oliver

### What's Going On?

The ISTUM-PC user group is open to all, is growing and includes ERG, BC Hydro, Natural Resources Canada (NRCan), the Ontario Ministry of the Environment and Energy, the Saskatchewan Energy Conservation and Development Authority Willis Energy Services Ltd, Battelle Pacific Northwest Labs and the University of Washington.

Most of the ERGers are involved with the completion of their program-required projects. Often projects are undertaken for interested utilities and other organizations. New projects requested by various energy focused organizations are always considered, and may be completed depending of the availability of student and supervisory time.

### ERG and ERG-News on the Internet

Andrew Pape, the editor of ERG News, will be setting up an Internet service provider capability (Worldwide-Web) in September, 95 to disseminate information about the Energy Research Group, to provide on-line access of ERG-News issues, and for interaction between ISTUM users and people interested in energy-environment issues. Please email him any suggestions for this development: apape@sfu.ca.

### Correspondence

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