SMART ENERGY: RENEWABLES AND NEW TECHNOLOGIES

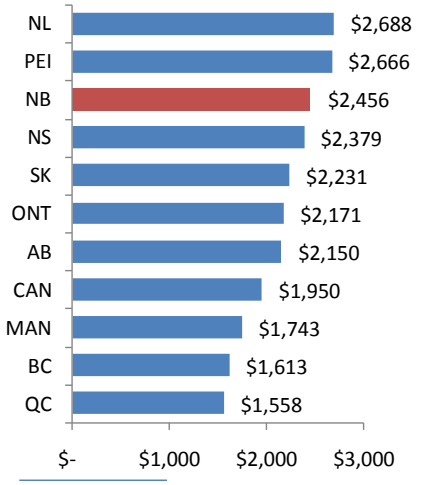
Prepared by: Atlantica Centre for Energy, June 2010

Much has been said about the need for us to become smarter with the use of energy in our economies activity and in our daily lives. There will be environmental and economic benefits to being more careful and deliberate about our energy choices and our energy uses.

Smart energy is about efficiency and conservation. It's about the intelligent use of new, clean and sustainable energy sources. It's also about the smart electricity grid and having the systems and processes that help us make better decisions about energy usage.

But smart energy is also about economic development. It's potentially hundreds of millions of dollars in economic activity from making our homes and businesses more energy efficient. It's economic potential derived from fostering renewable energy sources such as wind, solar, tidal and biomass and from migrating out of coal and oil into a much more environmentally beneficial fuel - natural gas. It's also about the economic potential of becoming an exporter of renewable energy and natural gas into the lucrative North-eastern U.S. market.

Figure 1: Average Annual Spending on Household Fuel and Electricity



For principal accommodation. Source: Statistics Canada. Table 203-0003 - Survey of household spending (SHS), household spending on shelter (2008).

New Brunswick, and the rest of Atlantic Canada, is well positioned to turn this potential into economic benefit while becoming better stewards of our environment.

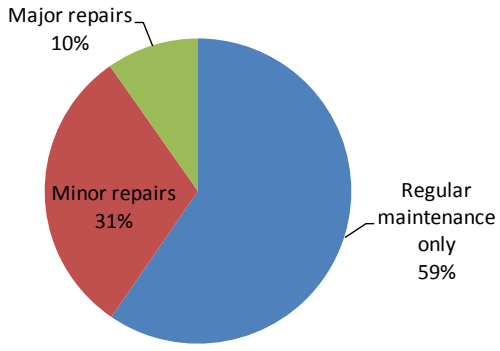
1. ENERGY EFFICIENCY: DOING MORE WITH LESS

Reflecting the idea of efficiency, there is a saying that the cheapest kWh of electricity is the one that isn't used. Despite some positive steps in recent years, there is no question that New Brunswick has a long way to go to be energy efficient in our homes and our businesses. New Brunswick is the second most reliant on electricity to heat its homes than all other provinces in Canada except Quebec[1]. Relatively cheap electricity costs in the past meant there was little economic incentive to become more energy efficient.

But electricity rates are going up - faster than other provinces and that translates into an economic rationale to become more energy efficient. Among the ten provinces in Canada, New Brunswick households now spend the third most on fuel and electricity each year (to power and heat homes). As a percentage of total household expenditures, the average New Brunswicker spends 50 per cent more on fuel and electricity than the average Canadian (Figure 1)[2].

New Brunswick also has relatively older housing stock compared to most other provinces and according to the 2006 Census, 41 per cent of homes are in need of either minor or major repairs (Figure 2).

Figure 2: Condition of New Brunswick Homes (% of Total)



Source: Statistics Canada 2006 Census.

[1] Particularly electric baseboard heat which is relatively high cost and not efficient.

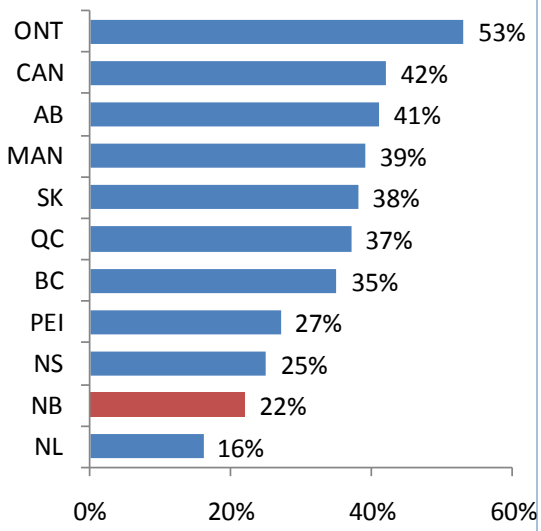
[2] The average Canadian household spends 2.8% of its total expenditures on fuel and electricity. In New Brunswick, it is 4.2% (50% higher than the national average) and rising faster than the rest of Canada.

Efficiency NB, the provincial agency tasked with supporting smarter use of energy in New Brunswick, has helped start the process of energy efficiency in the province but there is much more opportunity. According to Statistics Canada's Households and the Environment survey, in 2007 only 22 per cent of New Brunswick households had a programmable thermostat - the second lowest rate among the ten provinces in Canada and almost 50 per cent less than the national average (Figure 3).

New Brunswick's Climate Change Action Plan: 2007–2012 (released in June 2007) included an aggressive agenda for energy efficiency that featured a focus on energy efficient homes and businesses. The plan talked about adopting an energy performance standard that goes beyond the federal Canadian model building energy code, for both new and renovated buildings in the residential and commercial markets, to be implemented in increments.

Beyond residential cost and environmental benefits, there is another strategic benefit from reducing our electricity use in the winter months. New Brunswick households are more reliant on electricity for heat than all other provinces in Canada expect British Columbia and Quebec. Because of NB Power's generation mix and capacity, the need to accommodate peak winter load has been a significant factor in the rise of electricity rates. Reducing our demand for winter electricity will strengthen NB Power's business model over time[3].

Figure 3: Percentage of Households with a Programmable Thermostat



Source: Statistics Canada. Table 153-0060 - Households and the environment survey (2007).

Direct Economic Impact

It is important to note there are significant economic benefits to New Brunswick from building an energy efficient province. If over the next 10 years, 50 per cent of our homes and small businesses spent an average of $12,000 each to become more energy efficient, install more energy efficient furnaces or convert to natural gas, that would generate $2 billion in direct local economic activity in New Brunswick. This translates into about $660 million in payroll over the 10 years and 19,000 person years of work. It also translates into in the range of $400 million in new income tax and HST revenue to governments[4]. On an ongoing basis, it translates into higher property values and more property tax for governments as well.

Industrial energy efficiency

It is equally important for New Brunswick's industries to be energy efficient. Seven of the top 20 energy intensive industries in Canada have a significant presence in New Brunswick (Table 1). In addition, there has been significant upward pressure on electricity and natural gas costs in the province.

On this front the province has made important inroads in recent years. Most of the large industrial energy users in the province have been investing in new equipment and processes to make them more efficient.

[3] Converting from electric to natural gas heating systems will also benefit the system. See *Natural Gas: Achieving the Full Potential* - an associated paper in this series.

[4] Using Statistics Canada's standard economic multiplier estimates for the residential construction sector in New Brunswick.

Table 1: Direct plus indirect energy intensity, by industry*
Gigajoules per thousand current dollars of production

Industry:	Gigajoules	Energy Intensity Rank:
Electric power generation, transmission and distribution	46.5	1
Pipeline transportation	32.2	2
Pulp, paper and paperboard mills	25.6	4
Pesticides, fertilizer and other agricultural chemical manufacturing	23.8	5
Petroleum and coal products manufacturing	18.1	9
Crop and animal production	13.2	15
Converted paper products manufacturing	12.0	19

*Canada-wide in 2005. Source: Statistics Canada. Table 153-0031 - Direct plus indirect energy intensity, by industry, annual.

Efficiency NB's efforts to help large industrial companies in New Brunswick become more energy efficient recently won an international award. The New York-based Alliance to Save Energy awarded Efficiency NB the International Star (I-Star) Award for Energy Efficiency for its program to help large industry develop creative energy efficiency programs and innovative solutions. The Efficiency NB Large Industrial Program involves the province's 30 main industrial facilities in an energy management partnership. It is based on three objectives: identifying and encouraging the adoption of energy-efficiency projects; implementing energy management information systems; and educating participants about the importance of accurate and sustained energy savings.

District Heating: An Opportunity?

There is another industrial energy efficiency tool that could have both cost and environmental benefits in areas where there is a large industrial process such as a paper mill. These large forest products mills generate an enormous amount of excess heat that can be used to provide residential and commercial heating requirements such as space heating and water heating. District heating plants are said to provide higher efficiencies and better pollution control than localized boilers. A recent study found that district heating with combined heat and power is the cheapest method of cutting carbon, and has one of the lowest carbon footprints[5].

In Finland district heating accounts for about 50 per cent of the total heating market with much of it coming from forest products manufacturing facilities. Sweden and Denmark also use district heating for around 50 per cent of their heating needs. There are a few small district heating applications underway in the Maritime Provinces. The J.D. Irving paper mill in Saint John provides heat to the company's tissue plant and they are looking at extending this to other industrial and government clients. The company claims there is enough excess heat to service the entire Saint John market. There is also a small eight kilometre district heating system in Charlottetown that serves about 100 government, institutional and multi-family buildings in the city.

Demand Side Management - Smart Grid

Energy demand management, also known as demand side management (DSM), involves efforts to influence the quantity or patterns of use of energy consumed by end users, such as targeting reduction of peak demand during periods when energy-supply systems are constrained. There is potential for more DSM in New Brunswick. The New Brunswick's Climate Change Action Plan: 2007–2012 stated that NB Power could realize a reduction of up to 2 Mt below 2003 greenhouse gas levels by 2020, through a province-wide application of demand-side management measures in the residential, commercial and industrial sectors, as well as the implementation of the Province's Renewable Portfolio Standard.

[5] From a study done in 2009 in the United Kingdom. The results of the study can be found at: http://bit.ly/cGeEIX.

The recent *Advisory Panel on the Proposed Sale of NB Power to Hydro-Quebec* confirmed the potential of demand side management in New Brunswick. The Panel recommended that "the Province require by regulation, in the new regulatory framework, greatly expanded investment by all electricity distribution utilities in energy efficiency and demand side management (DSM) in partnership with Efficiency NB".

Other provinces are far ahead of New Brunswick in the development of the smart grid that enables DSM. The provinces of Ontario, British Columbia and Alberta are all rolling out smart meters. Scheduled to be fully implemented by 2011, Ontario is introducing smart meters with "time of use rates" for residential and small business customers.

Nova Scotia is spending $23 million per year on demand side management and forecasts a demand reduction from DSM efforts of 6.8 MW in 2009 to 63.5 MW in annual demand savings by 2013.

2. Renewable Energy: Environmental and Economic Benefits

The other way to be smarter with energy is to use more clean and renewable sources. Renewable energy is energy which comes from natural resources such as water, wind, sunlight, tides, and geothermal heat, which are naturally replenished. The creation of bioenergy from sources such as wood, crops and garbage is also a source of renewable energy.

All three Maritime Provinces have developed targets for renewable energy. New Brunswick's plant requires NB Power to purchase 10 per cent of its electricity from new renewable sources by 2016. Nova Scotia has set a target of 25 per cent of its electricity from renewable sources by 2015 and has a goal of 40 per cent renewable electricity by 2020. Some of this generation will come from biomass[6] but the bulk is expected to come from wind energy. Prince Edward Island has an aggressive plan to bring a total of 500 MW of wind power online by 2013, of which 100 MW will be for domestic use. The province also is targeting a 50 per cent increase in biomass energy.

Wind Energy

All three Maritime Provinces have been embracing wind energy. At the end of 2009, New Brunswick had the most installed wind capacity in the region (195 MW). Nova Scotia and Prince Edward Island also have considerable wind generation already in place. Table 2 provides a list of all installed wind energy projects at the end of 2009.

In total, New Brunswick is targeting wind power generation capacity of over 400 megawatts once all projects in the pipeline are completed. The Feed in Tariff in New Brunswick is meant to foster small scale wind energy projects. However, the Feed-in tariff as of April 2009 is 9.445 cents per kWh - much lower than the program in Ontario and elsewhere and there has been limited uptake by power producers.

One of the key challenges with wind energy is connecting them to the transmission infrastructure. Most of the areas with the most wind are not in the path of current transmission infrastructure. However, there are two large scale projects currently operational in New Brunswick (Table 2).

[6] Including a large 60 MW biomass energy project between Nova Scotia Power and the forest products firm NewPage.

Table 2: Wind Energy Projects in the Maritime Provinces

Wind/Farm/Site	Prov.	Date Installed	Turbines / Total Installed Capacity	Company
Kent Hills	NB	2008/12	32 X 3MW Vestas turbines / 96.0 (MW)	TransAlta Corp.
Caribou Wind Park	NB	2009/11	33 X 3 MW Vestas turbines / 99.0 (MW)	GDF Suez
Brookfield	NS	2005/11	1x Turbowinds T-600 / 0.6000 (MW)	Renewable Energy Services Limited
Digby Limited	NS	2006/12	1x Enercon E48 800 kW / 0.80 (MW)	Renewable Energy Services Limited
Fitzpatrick Mountain	NS	2006/12	1x Enercon E48 800 kW / 0.80 (MW)	Renewable Energy Services Limited
Fitzpatrick Mountain	NS	2006/04	1x Enercon E48 800 kW / 0.80 (MW)	Renewable Energy Services Limited
Glace Bay & Donkin	NS	2005/11	2x Enercon 800 kW / 1.6000 (MW)	Cape Breton Power
Grand Etang	NS	2002/10	1x Vestas V47-660 (660 kW) / 0.66 (MW)	Nova Scotia Power
Goodwood	NS	2005/11	1x Turbowinds 600 kW / 0.60 (MW)	Renewable Energy Services Limited
Higgins Mountain Riverhurst	NS	2006/12	3x Vensys 1.2 MW / 3.60 (MW)	Vector Wind Energy/Spring Hill
Lingan	NS	2007/01	5x E70 2MW / 10.0 (MW)	Cape Breton Power
Lingan	NS	2006/06	2x E70 2 MW / 4.0 (MW)	Cape Breton Power
Little Brook	NS	2002/10	1x Turbowinds T600 / 0.60 (MW)	Nova Scotia Power
Marshville Limited	NS	2006/12	1x Enercon E48 800 kW / 0.80 (MW)	Renewable Energy Services
Point Tupper	NS	2006/04	1x Enercon E48 800 kW / 0.80 (MW)	Renewable Energy Services Limited
Pubnico Point - Phase 1	NS	2004/01	2x Vestas 1.8 MW / 3.60 (MW)	FPL Energy
Pubnico Point - Phase 2	NS	2005/01	15x Vestas 1.8 MW / 27.0 (MW)	FPL Energy
Springhill Project	NS	2005/12	1x Vensys 1.2 MW / 1.2000 (MW)	Vector Wind Energy
Springhill Riverhurst	NS	2006/12	1x Americas Wind Energy / 0.90(MW)	Vector Wind Energy/Springhill
Tiverton Riverhurst	NS	2006/12	1x Americas Wind Energy / 0.90(MW)	Vector Wind Energy/Springhill
Lingan	NS	2005/12	2x E48 800 kW / 1.6000 (MW)	Cape Breton Power
Dalhousie Mountain project	NS	2009/12	34 x GE Energy 1.5 MW / 51.0 (MW)	RMSenergy
Maryvale wind project	NS	2010/02	4 x Vensys 1.5 MW turbines / 6.0 (MW)	Maryvale Wind LP
Vestas Prototype	PE	2004/01	1x Vestas V90 3 MW / 3.0 (MW)	TransAlta Wind and Vestas
Aeolus Wind Farm	PE	2003/08	1x Vestas V90 / 3.0 (MW)	Aeolous PEI Wind
Eastern Kings Wind Farm	PE	2007/01	10x Vestas V90 3 MW / 30.0 (MW)	PEI Energy Corporation
North Cape Wind Farm	PE	2004/01	8x Vestas V47-660 (660 kW) / 5.28 (MW)	Prince Edward Island Energy Corp.
North Cape Wind Farm	PE	2001/11	8x Vestas V47-660 (660 kW) / 5.28 (MW)	Prince Edward Island Energy Corp.
Norway Wind Park	PE	2007/06	3 X Vestas V90 3 MW / 9.0 (MW)	Suez Renewable Energy NA
West Cape Wind Farm	PE	2007/05	11x Vestas V80 1.8 MW / 19.80 (MW)	Suez Renewable Energy NA
West Cape Phase 2	PE	2009/08	44 x Vestas 1.8 MW turbines / 79.2(MW)	GDF Suez
Summerside Wind Project	PE	2009/12	4 x Vestas 3 MW / 12.0 (MW)	

Source: Canadian Wind Energy Association.

Tidal Energy

An estimated 100 billion tonnes of seawater flows in and out of the Bay of Fundy each tide cycle — more than the combined flow of the world's freshwater rivers. There are efforts underway to determine the potential to turn this raw energy potential into a reliable source of energy. According to research done by the Electric Power Research Institute, the Minas Channel alone in the Bay of Fundy has the potential of at least 330 megawatts of electric power. The total energy potential of the Bay of Fundy may be considerably higher but this will depend on the emergence of cost effective technology to harness this energy.

In June 2010, Nova Scotia Power provided a project update on one of the in-stream tidal turbines being tested in the Bay of Fundy. Preliminary analysis of the images by engineers has lead to the conclusion that the turbine rotor may have been damaged and the company will be looking to recover the unit in the fall of 2010.

Despite this setback, Nova Scotia is still looking for more partners to develop more tidal energy demonstration projects. The Fundy Ocean Research Centre for Energy is evaluating potential sites in the Bay of Fundy and is looking for commercial developers to help develop these test sites.

In New Brunswick, Irving Oil has partnered with the Huntsman Marine Science Centre to undertake a two-year study of 11 possible tidal generating locations on the Bay of Fundy. The $600,000 study will examine tidal patterns, climate, and the behaviour of aquatic life and determine the feasibility of tidal power generation in each 25 hectare region. It is estimated that a generating station in one of these regions could have an output capacity of up to 30MW.

Other Renewable Energy Sources

There are other sources of renewable energy in the region. There is limited solar power use expect in very small specialty applications. Geothermal power is also limited as an energy source in the region. Large scale hydro-electricity is not feasible but there is some potential for small scale projects. New Brunswick's Climate Change Action Plan: 2007–2012 mentions small scale hydro-electricity as one potential source of new renewable energy.

Bioenergy is being increasingly used in the Maritime Provinces - particularly the use of waste forest biomass for co-generation within the forest products sector in the region. In New Brunswick, the largest project is Twin Rivers Paper Company's 38 megawatt cogeneration in Edmundston. AV Cell Inc.'s Atholville mill; AV Nackawic Inc.'s Nackawic mill; J.D. Irving, Limited's Lake Utopia Paper mill in St. George; Irving Pulp and Paper Ltd. in Saint John; Groupe Savoie Inc. in Saint-Quentin; and a J.D. Irving, Limited mill in Chipman are also using biomass for energy in their facilities.

In Nova Scotia and New Brunswick, there are also wood pellet manufacturing facilities producing pellets for both domestic and international markets.

Other limited bioenergy projects include: bio-refining and transforming municipal waste into an energy source.

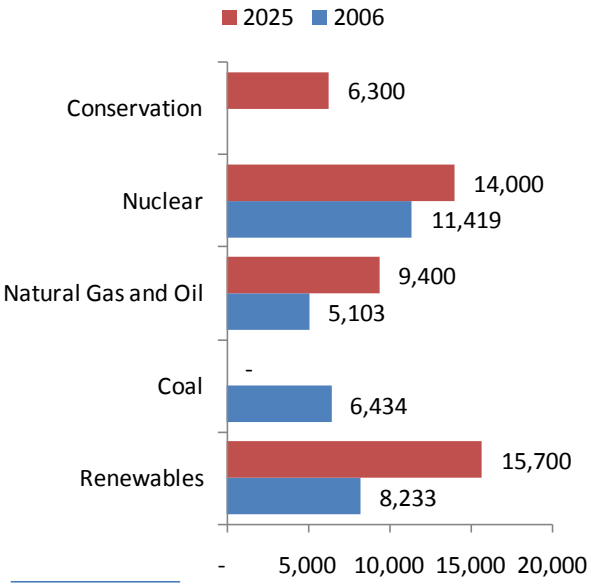
Renewable Energy and Economic Development

The economic potential from renewable energy comes from a broad value chain. There is some initial economic activity from the installation of the infrastructure but the ongoing operation of the energy generation systems requires relatively little economic activity.

The bulk of the economic activity from the renewable energy sector comes from direct jobs in research and development, testing, energy systems manufacturing, maintenance, repair and overhaul, back office, etc.

The province of Ontario has been the most aggressive in Canada with its plans to use the renewable/green energy sector for direct economic development. Ontario is deliberately using its electricity system to foster the creation of a new manufacturing, service and research cluster. The government believes this industry could be a major driver of the economy over the next 20 years.

Figure 4: Ontario Electricity In-Service Capacity Mix (Current & Projected)



Source: Government of Ontario (2008).

Ontario recently announced a $7 billion deal with the international firm Samsung to anchor the creation of a green energy cluster. Samsung will create over 4,000 manufacturing jobs in the province in the short term and sustain over 2,000 in the long term. In order to attract Samsung, the Ontario government provided them with a very large, lucrative and long term wind energy supply contract and over $400 million in direct financial incentives.

Ontario has also attracted a number of other wind and solar manufacturing companies since the announcement of the new green energy strategy in 2009. The key feature of this policy is the ability for suppliers of renewable energy to bring power on the grid through a feed-in tariff system at levels well above most other sources of energy. For example, wind, biomass or small hydro projects will be paid from 13.50 to 19.00/cents kWh and photovoltaics (solar power) will be brought on the grid from 42 cents kWh up to 80.2 cents/kWh. These are significant price premiums over other sources.

Ontario is gambling that by giving a part of its energy requirement to the renewable energy sector at premium costs it will be able to build a massive industry creating thousands of good paying jobs and tens of millions per year in tax revenue to government. Figure 4 shows the breakdown of electricity generation capacity by source in Ontario in 2006 and forecasted to 2025 under the new green energy strategy. Even with the aggressive renewable energy targets, solar and wind will only make up about 15 per cent of the total in-service capacity by 2025[7]. There is concern about the impact of the green energy strategy on electricity rates for the rest of the province.

[7] The rest of the in-service capacity under the renewable energy category is hydro-electricity.

Nova Scotia is also looking to generate economic activity beyond just the installation and operation of renewable energy infrastructure. In May of this year, the province commissioned a study to determine how to generate maximum economic benefits from its renewable energy goals. According to government data, Nova Scotia's interim target of 25 per cent renewable electricity by 2015 is expected to generate 5,000 to 7,500 person years of employment in construction, supply, manufacturing and maintenance. The province already has a number of firms that are active in the green energy infrastructure manufacturing sector and recently attracted the Korean firm Daewoo to set up a large scale wind energy systems manufacturing plant in Pictou County.

The challenge for New Brunswick and the rest of the Maritimes is the size of the market. Ontario can use just 15 per cent of its total electricity generation capacity to attract the companies and the investment to build a green energy cluster that will service much of North America. That is much harder in a small market. It is possible to attract firms that manufacture green energy infrastructure and systems without using the local market as a draw but with the amount of financial incentives and guaranteed green power contracts being offered in other Canadian Provinces and U.S. states - it is hard for a place like New Brunswick to compete.

The broader challenge is related to the correlation between renewable energy and energy rates for consumers and businesses - particularly industries that are large users of electricity. New renewable energy such as wind, solar and tidal is still far more expensive than most other traditional sources of electricity generation. If bringing these new sources on the grid drives up electricity costs and drives out business investment, the province and region could end up with less economic activity and not more.

The British Columbia Example: A Better Model for the Maritime Provinces?

British Columbia's New Clean Energy Act, rolled out in 2010 has three main areas of priority: ensuring electricity self-sufficiency at low rates; harnessing B.C.'s clean power potential to create jobs in every region; and strengthening environmental stewardship while reducing greenhouse gases. By building in low cost electricity, British Columbia is explicitly stating the vital importance of low cost power for the province's economic development. Like New Brunswick, B.C. has a large forest products industry and has reiterated its commitment to low cost power for this industry, among others.

Renewable Energy and Regional Cooperation

One of the main challenges associated with wind, solar and eventually tidal energy is the intermittent nature of the energy flow. Hydro-electricity, nuclear and coal-fired electricity (as examples) provide a mostly consistent flow of energy but these renewable sources provide energy only 20-40 per cent of the time. A key issue, then, is how to balance the flow of renewable-sourced electricity to ensure a constant and steady flow into the market.

Regional cooperation is critical to ensuring that renewable energy can be effectively balanced with traditional sources of energy generation.

A new $32 million project is underway to build increased intelligence into the regional electricity grid and allow for better integration of wind energy. The *Customer Load Control for Wind Integration Project* was announced early in 2010 and is expected to be completed by 2014. The project will utilize new technology to provide fast acting ancillary services for wind integration, by controlling commercial and residential loads without affecting the customer. Communication devices will be installed to thermal equipment and appliances in customers' homes and businesses to allow for non–intrusive control of electricity consumption to match variable supply from wind turbines. Each utility in the project will monitor a set of customers in their own jurisdiction - a total of 750 homes and businesses will participate - to identify opportunities to curb their use of water heaters, heat pumps, air conditioners and other equipment.

The partners in the project are: NB Power, Nova Scotia Power, Maritime Electric Co., the University of New Brunswick, Saint John Energy and the New Brunswick System Operator.

POLICY OPTIONS

Energy Efficiency/Demand Side Management
The New Brunswick government should consider significantly expanding its efforts to foster energy efficiency and set hard targets for residential and business sectors in the province. This should include fostering a faster residential and business uptake of natural gas. There is a public interest in promoting more energy efficiency in New Brunswick among residents, businesses and industrial companies. In addition to environmental benefits, there are cost benefit to residents and businesses and it will lead to a better electricity system through lower reliance on electricity to provide heating during the winter months. However, New Brunswickers have the second lowest average income level among the 10 provinces in Canada and, therefore have relatively less income to allocate to home renovations and energy equipment upgrades.

Incentivize energy efficiency - When developing programs that provide incentives to homeowners or businesses to invest in energy efficiency, governments need to consider the economic benefits from the conversion. A significant increase in residential construction could generate many new jobs and considerable tax revenue for government.

Expand public awareness activities - New Brunswickers need to have a better understanding of energy in New Brunswick and its role in our future economic development. They need to understand that more efficient homes helps build a stronger electricity system and hedges their exposure to future rate increases. They need to understand that more residential and business adoption of natural gas is beneficial both to the direct consumer but also to the wider economy as a whole.

Consider the potential of district heating - Deploying district heating infrastructure will involve upfront costs but could have a strong payback over time and at the same time provide more competitive energy costs for important large industrial facilities.

Renewable Energy
The New Brunswick government should pursue renewable energy options but in the context of the province's need to have competitive industrial electricity rates. High cost electricity will drive investment out of the province and eventually lead to very high energy costs for all remaining business and residential users.

On a regional basis, there may be some potential to attract green energy systems manufacturing, maintenance and repair operations. The regional market for wind power, as an example, may be a reasonably sized market to attract this value added economic activity. Otherwise, the industry will service the Maritime Provinces market from afar - Ontario, Quebec and the United States. Daewoo in Pictou County is one example but there may be other opportunities for energy systems manufacturing and the ongoing maintenance, overhaul and repair of these systems.

On tidal energy, the province should consider it to be in a research phase rather than close to being commercially viable as an energy source. Estimates out of the U.K. where there are test sites providing electricity into the grid suggest the market price will initially come in at 100 cents/kWh or maybe higher. It may be possible that this cost structure will be dramatically reduced over time through new technology and through broad deployment -pushing down production costs. However, it is not advisable for New Brunswick to be an early adopter of this technology at a very high cost only to have other jurisdictions adopt later on at a much lower cost.

There could be significant value, however, from tidal energy research and systems development. Technology and systems developed and patented from test sites in the Bay of Fundy could lead to this region becoming a leader in supplying technology and systems to the world market. However, this doesn't necessarily require a broad deployment of tidal energy infrastructure for use in the local electricity grid at very high costs to the end customer.