ERG/201003

Nova Scotia's Demand Side Management program: Concerns and recommendations

Larry Hughes, PhD
Energy Research Group
Department of Electrical and Computer Engineering
Dalhousie University
http://lh.ece.dal.ca/enen

19 April 2010

Text and slides of presentation originally presented to the Nova Scotia Utility and Review Board regarding the province's Demand Side Management program,19 April 2010.

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Good afternoon and thank you for allowing me time to talk to the UARB. Given time restrictions, I will discuss only two of my concerns regarding Nova Scotia's Demand Side Management (DSM) program.

My first concern is with respect to the projected or anticipated volume of reduction in electrical consumption as shown in NSP's 2009 Integrated Resource Plan (IRP) energy reduction wedges. The wedges suggest that NSP's consumers will reduce their consumption of electricity by 30% to 40% over the next 20 years (Figure 1).

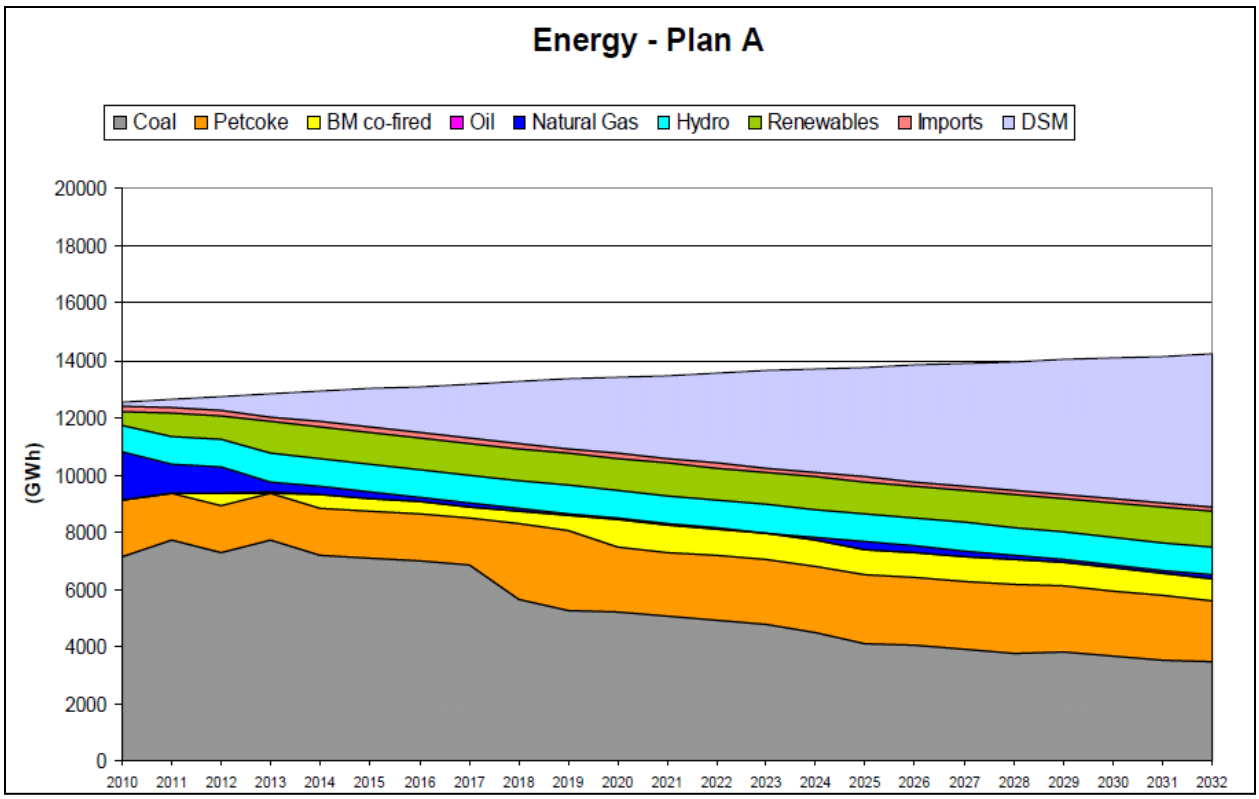

Figure 1: Sample DSM wedge from NSP's Integrated Resource Plan (NSPI 2009)

[1] Presented to Nova Scotia Utility and Review Board DSM Hearings, 19 April 2010.

Short of closing one or more of NSP's major electrical consumers or the complete shutdown of a number of its thermal stations due to a lack of fuel, I cannot see how such energy reduction wedges for electricity are possible (Hughes 2009).

The reason for this is quite simple and deals with our need for **energy security**—if an energy source becomes unaffordable or unavailable, or both, we will seek out replacement sources (APERC 2007, Hughes and Shupe 2010).

We now live in an age of rising competition for oil products: China and other emerging market economies are increasing their consumption of oil at breathtaking speed. This is occurring at a time of increasing production challenges in many oil-producing nations, meaning that affordable and available oil is becoming harder to obtain (Figure 2).

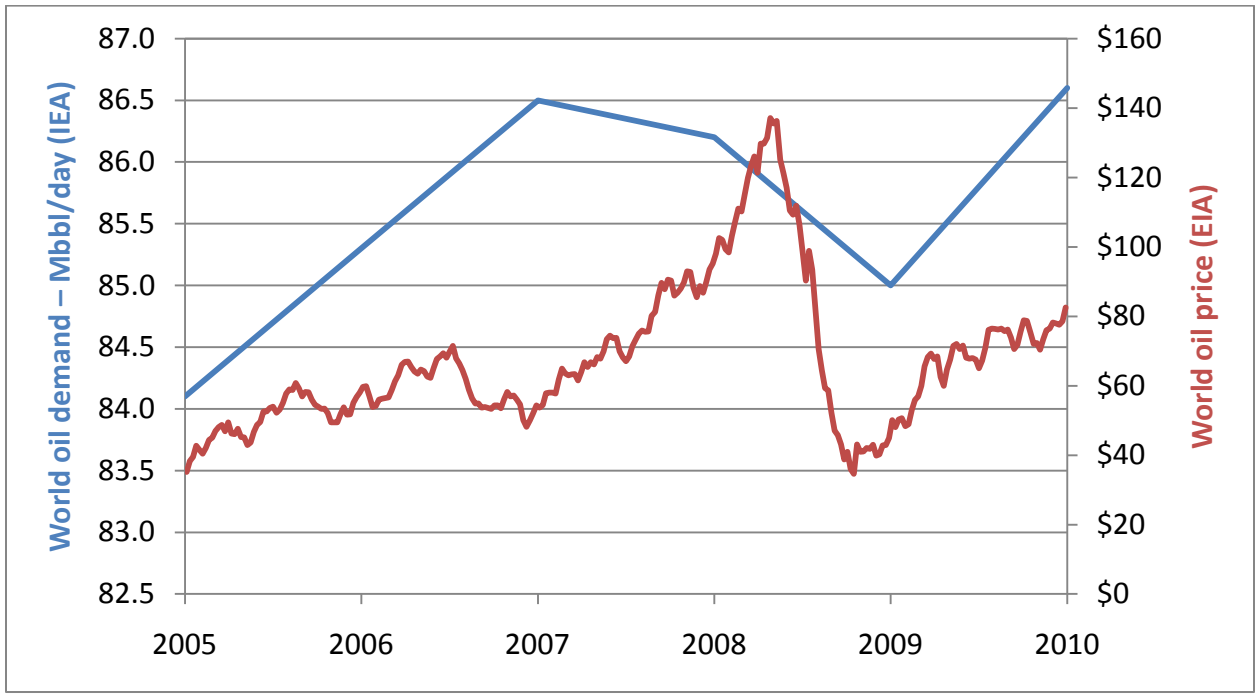

Figure 2: World oil demand and prices (EIA 2010, IEA 2010)

Nova Scotia is particularly vulnerable to changes in oil's affordability and availability given the province's reliance on oil products to meet most of our heating and transportation energy requirements. Most of Nova Scotia's oil is imported from three countries: Norway (which is in decline), Saudi Arabia (which appears to have peaked), and Iraq (which has not peaked but is unstable); even offshore Newfoundland and Labrador (which meets about 26% of Atlantic Canada's crude oil demand) is in decline (Hughes 2010).

One of my neighbours is an 82 year old gentleman who, like over 60% of Nova Scotian households, heats his home with oil (Nova Scotia Finance 2007). When we discussed the issue of oil affordability and availability, he said that if fuel oil became too expensive or unattainable, he'd shut off most of the rooms in his house and plug-in a couple of electric heaters to stay warm. This past winter the average price of fuel oil rose to about 86-cents-a-litre (NRCan 2010). The following chart shows that it now costs about the same to heat an average home

with electricity as it does with a 60% efficient oil furnace. Although the difference is larger for more efficient furnaces, if oil prices continue to rise, the gap will close (Figure 3).

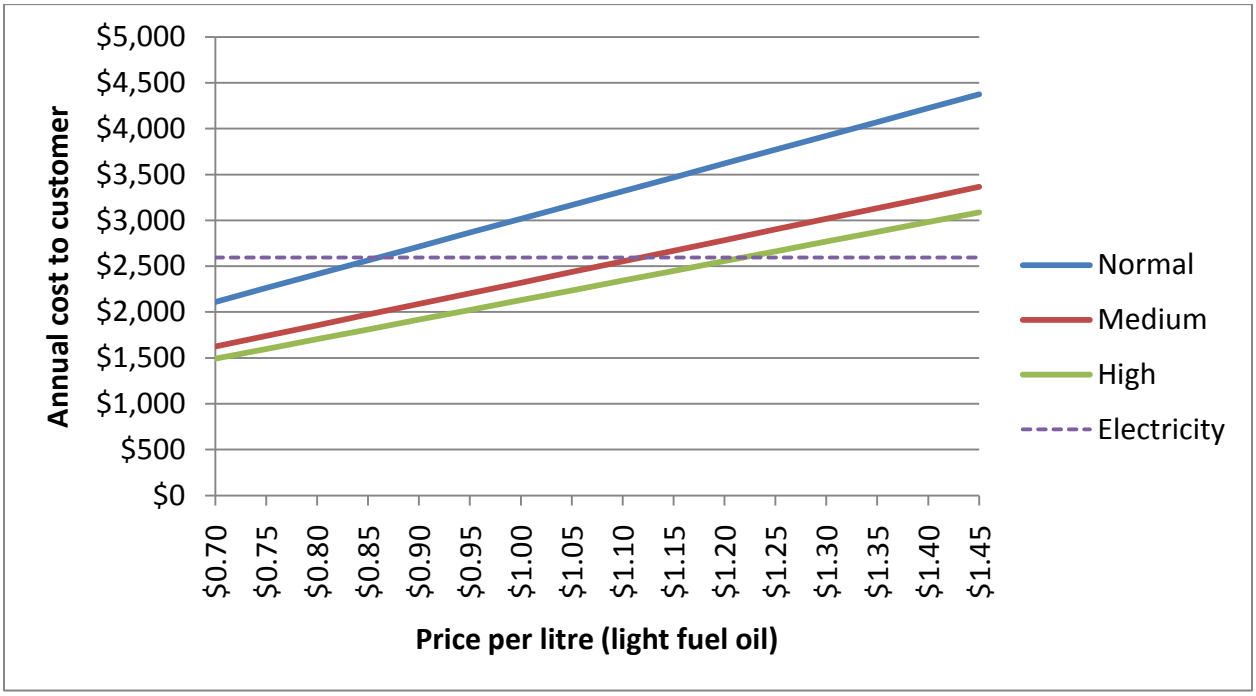

Figure 3: Space heating replacement: Electricity for light fuel oil[2]

As fuel oil prices rise, one can expect to see additional demand being put on the electrical system to meet some of the space heating requirements of Nova Scotians: either as their primary energy source or as an energy source used in a heating emergency (Hughes and Ron 2009).

The other day, one of my colleagues at the university said that he was doing everything he could to keep his existing car running because his next car would be a plug-in electric vehicle or PEV. The good news, at least for him, is that most major vehicle manufacturers are either producing PEVs right now or plan to introduce them within the next 12 months. To most people, a PEV would probably appear to be some sort of rich person's toy until they saw the price differential between gasoline and electricity, as shown in Figure 4.

[2] The figure is based upon an average Nova Scotian house requiring 70GJ for space heating. At 277.7 kWh/GJ, the house requires a total of 19,444 kWh (19.4 MWh) of electricity for heating. Electric heating is assumed to be 100% efficient, meaning that the total heating demand is 19,444 kWh. The cost of the electricity is based upon $0.1180/kWh or $2294 for the energy charge. The remaining charges are annual connection charge (12 months at $10.83 or $130), 7% sales tax ($170), for a total of $2,593.

The three furnace efficiencies are Normal (60%), Medium (78%), and High (85%) (OEE 2009). The total oil demand assumes 38.68GJ per m^3 (1,000 litres) of oil. For 70GJ, the house would require 1,809.7 litres of fuel oil (at 100% efficiency). Taking the efficiencies into account, the volume of fuel oil required is Normal (3,016 litres), Medium (2,302 litres), and High (2,129 litres).

The total (annual) cost of fuel oil will vary depending upon the price per litre.

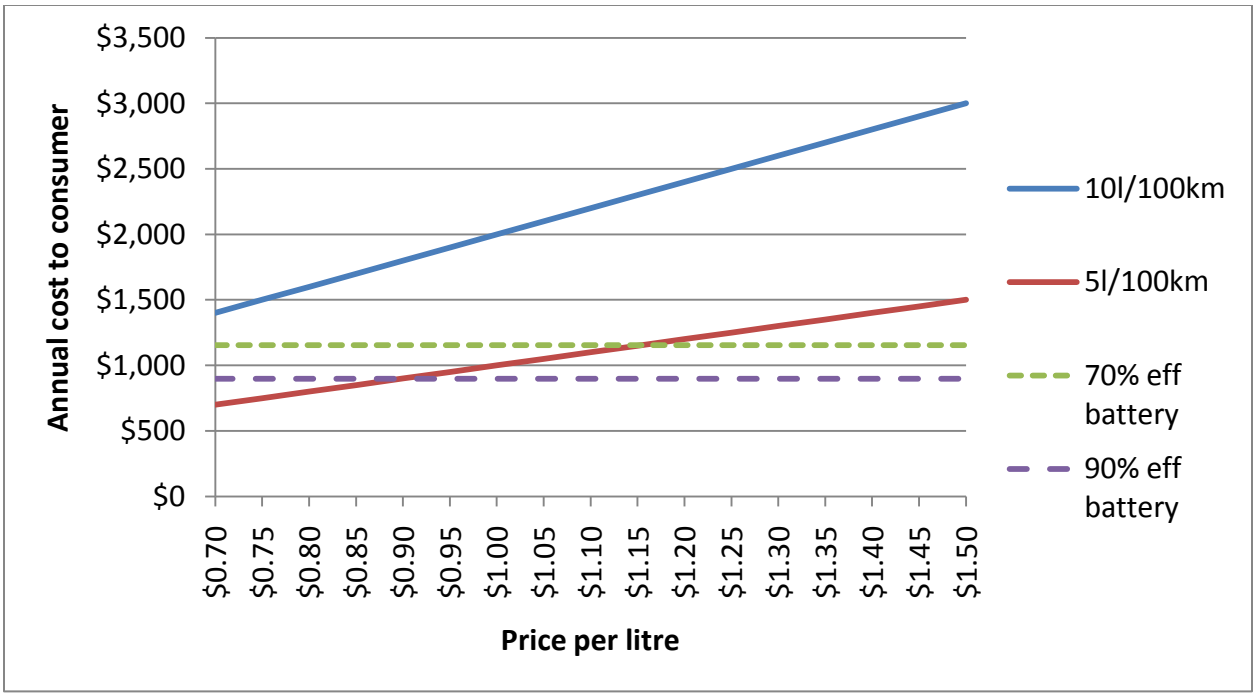

Figure 4: Transportation replacement: Electricity for oil[3]

It is still an issue of affordability and availability. With today's gasoline prices, it is now cheaper to drive a plug-in electric vehicle with a 90% efficient battery charged at NSP's residential rate than it is to drive a highly fuel-efficient car. As gasoline prices continue to rise, PEVs with less efficient batteries will also become less expensive to operate than gasoline vehicles.

Despite the suggested impact of DSM on Nova Scotia's electrical demand, the growing demand for electricity in transportation and heating will, in the best case, somehow be offset by the DSM program. In the worst case, electricity demand will continue to rise, meaning that the DSM program will have little impact on Nova Scotia's electrical demand, despite the monies raised by the "energy efficiency" tax.[4]

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[3] The calculations for this figure assume the average, annual vehicle distance driven to be 20,000km. A vehicle travelling at 10L/100km would consume 2,000L per year, whereas a highly fuel-efficient vehicle travelling at 5L/100km would consume 1,000L per year. Varying fuel prices (including taxes) gives the annual cost to the vehicle owner.

The PEV is assumed to require the energy equivalent of the 2,000L per year vehicle. In this case, the energy content in 2,000L is 69GJ (34.66GJ per 1,000L). The overall efficiency of an internal combustion engine to propel a vehicle is about 28% (engine to the wheel), meaning that only 19.3GJ are actually used to propel the vehicle. Since an electric motor is about 90% efficient, a total of 21.5GJ or about 5,400kWh of electricity is required. Battery efficiencies must be considered as well; if the batteries are 90% efficient, 6,600kWh are needed, while a 70% efficient battery requires 8,600kWh. Other losses, such as charger efficiency, are ignored.

The annual cost of driving the electric vehicle is based upon an estimated residential charge rate of $0.135/kWh (includes connection charges and taxes).

[4] The "energy efficiency" tax is the per-kilowatt-hour levee charged by the DSM program on all NSP residential customers; at present it is $0.00193/kWh. In 2010, the tax is estimated to raise about $42 million. All residential customers are required to pay the tax, regardless of whether they can benefit from it or not. For example,

My second concern is with respect to the use of the energy efficiency taxes collected and their disbursement.

Given the overwhelming importance of space heating, the DSM program should be required to put more effort into reducing the space heating needs of Nova Scotian homes. The following shows both why and where (Table 1):

- 27% of single-detached homes are at least 50 years old; that is, pre-1960. (Shown in light blue in the table.)
- Old homes have a higher energy intensity than do newer homes (for example, 0.711GJ/m^2 for a pre-1946 home vs. 0.289GJ/m^2 in a home built in 2006-07; shown in light green). Older homes are also smaller (average 143m^2) than new homes (average 190m^2).
- On average, older homes consume more energy than newer homes (101.8GJ/home vs. 55GJ/home; shown in rose). Note that the numbers are worse for single-detached homes where the average energy demand for a pre-1946 home is more than double that of a home constructed in 2006-07 (peach).
- The majority of older homes use oil heating, which means that despite the fact that their occupiers pay the energy efficiency tax—their home cannot be retrofitted by the program.

Table 1: Average residential space heating demand (OEE 2009)[5]

Vintage	Single Detached				Single Attached			
	Total	Percent	Demand GJ/m^2	Demand GJ/home	Total	Percent	Demand GJ/m^2	Demand GJ/home
Pre-1946	51,122	19.20%	0.711	101.8	3,754	16.20%	0.640	99.6
1946-1960	21,222	8.00%	0.640	74.2	1,602	6.90%	0.576	87
1961-1977	37,706	14.20%	0.540	67.4	2,783	12.00%	0.486	67
1978-1983	28,610	10.70%	0.459	63.4	2,102	9.10%	0.413	41
1984-1995	70,022	26.30%	0.390	63	7,759	33.40%	0.351	46.7
1996-2000	27,022	10.10%	0.332	59	2,233	9.60%	0.298	42.4
2001-2005	22,215	8.30%	0.322	61.2	1,981	8.50%	0.289	46.2
2006-2007	8,366	3.10%	0.289	55	993	4.30%	0.261	41.6

In closing, I would like to make three recommendations:

The first recommendation is that *the energy efficiency tax-rate should reflect the anticipated cost of the proposed program for a given year*. By summing the projected costs of the different activities for the year and then dividing by the anticipated demand for the year would give a more accurate energy efficiency tax-rate:

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apartment renters cannot directly participate in the program (only the landlord could), whereas home owners are able to participate.

[5] The table only lists those residential structures that can benefit from the energy efficiency tax, notably single-detached and single-attached homes (73.5% of Nova Scotian homes). Apartment dwellers (22.1%) are excluded, although they still must pay the tax. Mobile home owners can benefit as well.

$$Fee = \frac{\sum Applicances + \sum Lighting + \cdots + \sum Home\ Retrofits}{Annual\ Demand}$$

There is a precedent for this approach. One of the more compelling arguments for NSP having the FAM was that it would more accurately reflect the cost of fuel, making it fairer to both NSP and its ratepayers. In DSM, the monies collected would be used for targeted activities, rather than collecting untold millions for activities that may or may not use the funds.

The second recommendation is that *the primary application of the energy efficiency tax should be on reducing residential heating demand, especially in older homes occupied by seniors and those on low-income—regardless of the space heating fuel used*.

As it stands, a senior or someone on low-income in need of a home retrofit who happens to use fuel oil is still required to pay the energy efficiency tax—although they cannot benefit from it. Any monies collected by the tax should be targeted to those in greatest need, regardless of how they heat their homes. This is, after all, another way of reducing greenhouse gas emissions.

My third and final recommendation is that *all heating fuels should be subject to the same energy efficiency tax and all building retrofit programs should be controlled by one agency*.

Quite simply, taxes should be fair and the province cannot afford to duplicate these services.

Thank you.

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