From: [redacted]
To: ito@pub.nf.ca
Subject: ROTATING POWER OUTAGE INQUIRY
Date: Fri, 31 Jan 2014 15:36:07 -0300
Public Utilities Board
St John's Nfld.

Attention Cheryl Blundon

I request that the PUB investigate the following issues and concerns, in regard to the recent power outages and as to future reliability of our power systems.

1. Our winter peak load is about 3 times our summer peak load. This is due to a continuous increase in the winter electric heat load, lasting just 4 months of winter, and a falling industrial load, which operates steady year round. Depicted on a chart, this peak load is presented as a huge hump, for Dec, Jan, Feb, And Mar. The primary cause of this winter peak hump is:
a) the inefficient resistance electric heating elements for space and water heating, a technology that is extremely wasteful of electricity and is over a century old.
b) the high air exchange rate in the majority of older houses (almost 6 air changes per hour compared with 1 air change in modern constructed houses), and adds an additional very high heating load in windy/ blizzard conditions.
c) poorly insulated house basements
d) inefficient windows losing excessive heat
e) no advantage being taken to gain passive solar heat with proper orientation of windrows for solar gain.
All of this can be addressed by our Conservation Plan, with Efficiency improvements by customers, assisted by rebates to the customers, similar to what other jurisdictions are doing under their EFFICIENCY PROGRAMS.
f) as your inquiry is to address forecasts for power, it seems appropriate to question the assumption that our houses have reached a saturation point in terms of efficiency: New codes reduce energy by about 27 percent, and efficient heating another 25 percent in winter months. And we now have the first NET Zero house proceeding with construction at Flatrock. In the USA thousands of such houses are now being build.

2 Other jurisdictions are are proportionally spending 5 times more for efficiency improvements in terms of electricity sales revenue (one half of one percent here and two and a half percent or more in some other jurisdictions, and achieving 10 times the results that we do in this province. Our Efficiency program results in no meaningful saving to the customer, and no meaningful reduction in peak winter peak demand and energy savings.
a)Nfld Power is providing loans at 7 percent interest for minisplit heatpumps, many that are low quality, and provide no energy savings and no peak demand reductions below -10C, whereas good quality units provide energy savings and significant demand reductions to -20C.
b) And many ducted systems are likewise poor quality in terms of performance at lower temperatures, offering little saving to the owner or benefit to the grid (to keep the peak demand down)

c) Our power companies don't engage in end-use research, which other utilities do, as a part of best practises. And so they cannot verify expected savings, and leave it to the contractors as to quality and performance.
d) Some products promoted by the Take Charge program for energy savings are subject to "interactive effect" whereby most of what energy is saved by one devise, is then consumed by another devise, leaving little net reduction, and is misleading to the customer. They suggest 60 percent of the saving is lost (in the Consultants report) but may very well be 80 percent lost. And the consumer is not informed of this effect.
e) Despite an ORDER by the PUB to report on the performance of the efficient minisplit heatpumps, no end use analysis is being performed by the power companies. And by providing loans for inferior products, this will bias the results of surveys.
f) Programmable thermostats, as promoted by the power companies and government, appear to be counterproductive during a crisis when generation for peak load is a problem. These thermostats generally cannot be turned down once the power is off. So a public call to turn down the thermostat before being reenergized is not possible. And after a few hours without electricity, housed them consume twice the power for heating in cold conditions. And even when normally operated, the house is cooled at night, and heaters then come on at full capacity in the morning, and must stay at full capacity when in the auto mode, until the house is warm. This helps increase the peak load in early morning. Further, the savings are little and must be weighted against discomfort and possible humidity problems in the house shell, leading to damage and mould. This policy of promoting programmable thermostats is very questionable in regards to crisis situations.

3. The alternate approach to meeting high peak winter loads, and the one used here, is to keep adding more and more expensive infrastructure to serve the winter peak: more generating capacity, more thermal ((oil or gas fired) for backup, more expensive transmission capacity, with associated line loss of energy, and more expensive distributions assets for the houses and business that are wasting half of the energy through inefficient construction and heating and air leakage. This is a regressive, costly and obsolete way of managing a power system and a waste of our electrical energy resource. Large scale energy efficiency studies in North America shows that Efficiency is 1/3 the cost of new generation and more infrastructure. Efficiency keeps customer power bills lower.

4. Power rates here give large discounts for large commercial customers when they use MORE electricity. This is counterproductive to reduce winter peak demand. And a disincentive to install more efficient heating systems.

5. Wind generation was largely dismissed as a valuable source of energy for the island system, and we have only 54 MW. In 2012 Manitoba Hydro stated we could add another 100 to 150 MW, on a technical basis. Our wind generation is not constant, and averages about 43 percent of it's capacity, being subject to the wind speeds.
For Jan 4, 2014, Nalcor stated that our wind was at 87 percent of its capacity. When winds are high, heat loss in our houses increases. The wind generation works well, in most cases, to maximize its output in accordance with high wind speeds to assist the air leakage heat load.
At the same time both Nfld Hydro and Nfld Power had significant power reduction at some hydro facilities due to icing problems. This shows that under adverse conditions, wind can be more reliable than some hydro sites. An evaluation of more wind to give added reliability to our systems should be a priority.

6. To the questions of whether Muskrat Falls (being 1200 miles from St. John's) will add to our reliability, I would note the following
a) The northern peninsula is exposed to unusually high winds with salt laden air. This causes flashovers and outages, more often than most of our 230kv lines. Yet Nalcor says reliability it will be comparable to our 230 kv lines. This is incorrect, since most of our 230KW lines are further inland and more protected.

Further , salt in itself is a contaminant for transmission line insulators. Yet Nalcor says it is not a contaminant.

7. Nfld has one of the highest GIC (geomagnetic induced currents) incident rate in the world. GICs can destroy transformers and cause a cascade of outages, such as the one in 1989 that knocked out much of the US Northeast and Quebec. It costs billions in damages. Hydro Quebec spent 1 billion dollars for better protection following that.
GICs are a serious problem 3 years out of 12, and caused by solar flares. Factors contributing to GICs are : long transmission lines, lines running in a east -west direction, lines terminating in a coastal region. I have read nothing to suggest that Nalcor has addressed this issue as to a reliability risk for power outages from MF.

8. My concerns on some of this has previously been filed with the PUB at the MF review and last year Nfld Power Rate application, and in some letters published by the Telegram in the fall of 2012.(copy attached for ratepayers who may have an interest in this subject and it's ability to keep electricity costs low)

9 At the recent night time temperature of minus 19C , I can confirm that all 4 efficient heating systems I have monitored operated successfully at minus 19C. I monitored the current on one and saw that it was maintaining interior temperatures of 74F while using 2 watts per square ft. Many houses are using 5 to 10 watts per sq ft. This is research that the power companies should be doing, to keep winter peak demand lower, to help avoid rotating outages.

Sincerely
Winston Adams, [redacted]

The Telegram

Bringing efficiency to the energy equation

Published on October 09, 2012

By Winston Adams

Our American neighbours do a good job of reducing wholesale prices for electricity and keeping retail prices stable. Cheap gas for electricity generation is not the only tool they use. The American Council for an Energy Efficient Economy (ACEEE) advises power utilities and governments throughout the U.S. on energy issues.

According to the ACEEE, "energy efficiency remains the lowest cost energy resource available to utilities by a wide margin. It is about one-third the cost of new generation resources." And their research report U123, released June 27, says, "Utilities across the country are increasingly turning to energy efficiency as the lowest cost energy resource."

Utilities "are defining efficiency as a energy resource capable of yielding energy and demand savings that can displace electrical generation from coal, natural gas, nuclear, wind and other supply-side resources. Defining it as a resource and integrating it into utility decisions makes it especially critical because of the clear resource cost advantage of energy efficiency. "

Efficiency is not conservation or deprivation. In terms of fuel and other energy resources, efficiency means getting more for less.

Locally, for the supply side, we see Nalcor procure testing for hydro turbine models for optimum energy efficiency and replacing aged transformers at the Churchill Falls power plant with new and higher efficient units, whereby a couple of percentage points in efficiency is significant. So too, on the consumer side, according to ACEEE, "energy savings from customer energy efficiency programs are typically achieved at one-third the cost of new generation resources. ... It can also offset the need to add new peak generation capacity, and therefore fossil fuel use."

Vermont is the leader in this. Vermont currently uses 4.4 per cent of the revenue from electricity sales for their energy efficiency rebate program.

Vermont, whose electricity use is a bit less than Newfoundland's, pumped $30 million into the program in 2008 and saved 2.5 per cent in energy use.

A study for non-transportation energy in the U.S. in 2008 by the international consulting firm

McKinsey & Co. found that energy efficiency, by 2030, could save hundreds of power plants from being built, and found "a holistic approach, executed to scale, would yield energy savings worth more than $1.2 trillion and reduce end-use energy consumption by 2020, roughly 23 per cent of demand."

The study found that "the compelling benefits of energy efficiency warrants this energy resource being a national priority." This study is based on the residential sector accounting for 35 per cent of the end-use efficiency potential, commercial 25 per cent and industrial 40 per cent.

Upfront costs to capture energy efficiency could be recovered through a system-benefit charge of 0.6 cents per kWh over 10 years. This represents an increase in average customer energy costs of eight per cent, which would be more than offset by the average bill savings of 24 per cent.

A study by the Electric Power Research Institute showed similar results.

In recent years, following Vermont's example and the data from these studies, 44 states and several Canadian provinces now have embraced this energy efficiency model. Massachusetts embraced energy efficiency with one per cent energy saving in 2009, 1.4 per cent in 2010, two per cent in 2011, 2.4 per cent planned for 2012 and 2.5 for 2013-2015.

Massachusetts uses about one-quarter of a cent per kWh for funding their program. Customer rebates for energy efficiency are usually 40 to 60 per cent of the cost. Their verified savings are posted on their websites: Efficiency Vermont, Efficiency Massachusetts, etc.

Here in Newfoundland, in forecasting our future electricity needs, Nalcor considers energy efficiency referred to as "technology change" factor. Unfortunately, we have no mandated efficiency targets with yearly goals. Nalcor's "plan," as shown in its submission to the PUB, is to have energy efficiency savings of 178 gigawatt hours total over 20 years, (about 8.9 gWh per year). This is about two-tenths of one per cent a year.

Vermont is already exceeding this tenfold, with verified efficiency savings averaging 2.1 per cent per year over the last four years. Nalcor, for the Muskrat Falls project, forecasts a demand increase on the island of about one per cent a year.

If we were to match Vermont in efficiency savings, it would make the Muskrat Falls power for the island unnecessary well into the future, likely a decade and more, as well as reduce oil consumption and pollution at Holyrood.

It appears we could match and possibly exceed what Vermont has achieved, at comparative very low cost to new generation.

How have those other jurisdictions achieved such significant efficiency savings?

For a program to be effective, one necessity is to decouple the present disincentive whereby a power company's profits are tied to sales.

The government achieves this by enacting a separate efficiency corporation with a specific mandate to achieve efficiency savings.

Power companies are rewarded, not punished, when savings by efficiency are realized.

The solutions for efficiency savings can vary for different geographic locations, as the type of electrical loads and climate may favour some solutions over others. Some technologies are climate sensitive. And the need to verify the expected savings is essential.

Another necessary requirement is awareness: that the public understand that efficiency savings doesn't mean that electricity rates will drop, but that the consumer's power bill will certainly drop because less electricity is used for the same benefits and comfort levels.

In addition, electricity rates can be stabilized at or near present levels when new generating capacity is avoided.

I'll explain how it can work in this province in a future letter.

Winston Adams is a engineer living in Logy Bay, with experience in electrical power generation and distribution and heating systems.

The Telegram

Bringing energy efficiency to the equation

Published on October 31, 2012

In a piece I wrote that was published in The Telegram on Oct. 7, and posted online Oct. 9, we saw that a key finding of the McKinley study in the United States was that a program offering 50 per cent rebates, funded by an electricity rate increase of only four per cent, gives a 24 per cent "reduction" in customers' electricity bills.

By spending 10 times more than we do to assist "customers" with energy efficiency, they also reduce system demand by more than two per cent per year, often saving the expense of a new generation source, and at one-third the cost.

For Newfoundland there are important differences. We use electricity for heating, and they use gas. Our residential consumption is high, at 50 per cent of total. Our load is skewed. The high winter demand, at more than twice the summer load, is problematic. The winter peak demand is beyond the capacity of our hydro generation, so 12 per cent is supplied by the Holyrood oil-fired plant.

Nalcor correctly states that our winter electric heat has been the main driver for increased demand. Our residential load is 69 per cent for heat, 11 per cent for hot water, 20 per cent for appliances, lights and other products. Houses use less energy per unit, but more and larger houses and conversions from oil heat is the rationale for a new generation source.

Conservation would pay off

Nevertheless, the size and season of these heating loads is a very fortunate combination. The energy-

efficiency approach, when specifically applied to electric heating, would give more savings than the McKinley study found for the U.S. The solution offers many benefits:

1. It reduces instead of increases customer electricity bills.

2. It reduces transmission losses, a utility expense.

3. It allows us to reach 98 per cent green energy.

4. It will incrementally reduce Holyrood oil consumption allowing some fuel cost savings to be passed back to consumers.

5. It saves on water resources, important in dry years when rainfall is low.

6. It reduces air pollution.

7. It aids our commitment on the environmental global warming issue.

8. It helps flatten our load curve with less winter demand, which reduces the size and cost of future replacement backup generation systems.

9. It brings synergy savings (where technology works together) and would more than double the savings from efficient compact bulbs, fridges, TVs and hot water tanks.

Such good fortune lies in the fact that our winter heating load is an excellent fit for the heating technology that has matured, is reliable, and suitable for our climate. It's an opportunity to benefit from these latest advances and high efficiencies. The relatively low equipment cost is due to the mass production by several world class manufacturers.

The familiar way of heating with electricity is to heat direct with a resistance heating element. It is cheap and reliable, but a century old and very wasteful of electricity. The newer way heats indirectly. Powered by electricity, it transfers energy from the adjacent earth, water or air, into the house. It elevates the temperature suitable for residential space heat or for hot water.

This method is not new to Newfoundland, having been used for more than 20 years, and is now mandatory for our large government buildings. Worldwide, smaller residential units are used for heating, cooling and humidity control.

Efficiency is the great advantage. During winter cold snaps these units produce the same heat as regular heaters, but use about one-third the power. At milder temperatures, in minimum heat mode, newer models can use as little as one-sixth the power.

A hydro source that would normally supply 1,000 houses with heat and hot water could supply 3,000 houses in cold conditions, and 4,000 or more at other times. The equipment cost, in kilowatts of heat supplied, continues to drop, while power generation plant and transmission costs escalate.

Big savings

If efficiency is a viable contribution to avoid new generation, one must first consider the magnitude of this resource. An analysis to quantify the extent of such savings on an island-wide basis is readily done using Nalcor's data: 50 per cent of the island load is residential, of which 69 per cent is for electric heat and, applying the 65 per cent efficiency factor (7,642 x 0.5 x 0.69 x 0.67) gives the saving of 1,766 gigawatt hours. This is 23 per cent of our yearly total generation.

More importantly, it is 206 per cent of the yearly generation production of Holyrood. Such large savings would, first and foremost, go to offset the expense of oil and reduce pollution.

There are other significant savings from commercial heat, residential and commercial hot water, at about 774 gigawatt hours. Basement insulation and efficient appliances can offer savings of 840 gigawatt hours. And transmission loss savings, another 100, for a total of 3,480 gigawatt hours. A potential savings of 45.5 per cent of all generation is almost twice the 26 per cent saving potential in the U.S.

It should not be surprising that our potential is twice that of the U.S. given that we use so much electricity for heat. What is surprising is that Nalcor proposed to save only nine gigawatt hours per year for the next 20 years. Manitoba Hydro International concurred with this, saying "technology efficiency savings were approaching a saturation point." They reasoned that most upgrades for the housing sector are already done. But this applies only to the building shell construction. The serious oversight and error in their analysis is in excluding the savings of proven technology to the space heating and hot water for both residential and commercial sectors.

For all potential saving of the domestic plus commercial sectors of 3,480 gigawatt hours, it is four times last year's 855 gigawatt hour total production from Holyrood.

I will look at achieveable saving and costs in a future letter.

Winston Adams lives in Logy Bay. He has a B.Eng. (electrical) and experience in generation and distribution and heating systems. He is not a member of the Professional Engineers and Geoscientists Newfoundland and Labrador.

The Telegram

Energy efficiency by the numbers

Published on November 24, 2012

In my letter to the editor published Oct. 9 ("Bringing efficiency to the energy equation"), I pointed out that a key finding of the McKinley study in the United States was that a program offering 50 per cent rebates, funded by an electricity rate increase of only four per cent, gives a 24 per cent reduction in customers' electricity bills.

Many American jurisdictions spent 10 times more than we do to help their customers save energy, and thereby avoid expensive new generation expenses, at only one third the cost.

My next letter, published Oct. 31, showed we have more potential here for efficiency savings than in the U.S. if we use efficient heating plus others sources of efficiency.

Potential reductions of 45 per cent of our total production were identified, most being in the presently inefficient heating sector.

Potential savings were four times the 885 gigawatt energy production of Holyrood for the year 2011.

It is necessary to quantify the saving and cost effectiveness for the customer and the power companies of the efficient heating systems. There are three types.

Type 1, earth or water source, is the most efficient, using 75 per cent less electricity and is effectively used in large government and commercial buildings. For residential homes, it has limited use.

It is expensive, with an installed cost about $4,000 per 1,000 watts of heat.

Type 2, air source ducted, generally cannot fully heat during very cold conditions and needs backup electric heaters. They are about 35 per cent less efficient than type 1 and provide little offset against the system peak demand reduction. The installed cost is about $2,000 per 1,000 watts of heat, and problematic for older houses, because of the need to install ducts.

Type 3, air source mini-split variable speed, reduces electricity by 50 to 80 per cent, about 67 per cent on average for our climate, and can provide full heat under cold conditions without backup electric heaters. They give excellent peak demand reductions, 50 per cent at

-15C, 60 per cent reduction with modest oversizing.

This nearly matches the cold weather performance of type 1, and some models operate down to -25C. At an installed cost of about $1,500 per 1,000 watts of heat (at -15C), they are the most cost-effective. Across the country, shipments rose 46 per cent in 2011 over the year 2010. They also cool and dehumidify in summer.

Installations in Newfoundland often use a central heater to serve 70 per cent of the heating load. More complete coverage would have two or three heaters on the main level and one or two in the basement. Inverter technology and other advances has increased reliability and life expectancy can be 20 to 25 years, with compressor warranties from seven to 10 years. Installed cost for an average house would be $8,000.

High efficiency stand-alone hot water heaters save about 60 per cent on energy use and cost about $1,800 installed.

An average electric heated house consumes 15,000 kWh per year, with heat 69 per cent of the total, and each contributes 5.2 kw towards the system peak demand.

Type 3 heaters reduce average household demand of about 55 per cent, 2.86 kw each.

For Newfoundland Power's 151,000 residential electric heat customers (a portion of the total) this would mean a 432 megawatt system reduction.

Hot water consumes 11 per cent of domestic energy, 792 kWh on average.

Efficient hot water tanks saves another 30 MW on the system peak demand, for a total of 462 MW, or almost equal to the full peak 490 MW maximum capacity of Holyrood, and 1.5 times the full 300 MW allocation of Muskrat Falls power for the island.

The energy savings of 5,619 kWh for heat and hot water per house (for 151,000 houses) is 848 gWh system saving, 96 per cent of the full production (885 gWh) of Holyrood last year. Allowing a 20 per cent "rebound effect," it would be 77 per cent of Holyrood production in 2011. Assuming 13,000 residential conversions per year, 40 MW system demand reduction per year would reduce Holyrood to zero production in 12 years, achieving 98 per cent green energy. An eight per cent surcharge on rates (0.9 cents per kWh) for residential and commercial would generate about $52 million per year.

This would allow for a 40 per cent rebate to 13,000 customers, where the installed cost for the heating is $8,000 and for hot water is $1,800. The cost for 151,000 units would be $1.5 billion.

With conversion for commercial, all residential and other efficiency options, demand reductions well exceeds Holyrood's capability and can give total energy savings well exceeding our forecast needs to the year 2030.

Efficient space heating would save 32 per cent on the overall residential bill, and that's a conservative estimate. An average power bill of $200 per month, with an eight per cent surcharge and 32 per cent saving gives a net $53 per month reduction. A $300 per month present bill would see a reduction of $80 per month.

Even with the surcharge, this is a 26 per cent saving. Efficient hot water would save another five per cent ($11 to $16 per month), for a total of about 31 per cent. This is 29 per cent more than the typical American efficiency saving of 24 per cent.

These savings would allow the customer payback in 7.5 years, not including interest costs, and net savings of over $11,000 over the life of the equipment. For 151,000 residential conversions, it represents $120 million annual customer savings, and over $100 million in oil expenses savings for Newfoundland Hydro.

Efficiency savings from heating, hot water and all other efficiency options is massive, very cost effective and can be staged and ramped up to offset thermal generation.

It can achieve the additional energy needs up to the year 2030 and satisfy peak demand requirements.

These savings are self-financing with a surcharge and consumer savings on power bills. Wind energy, according to Manitoba Hydro's latest report, is reliable, up to 10 per cent of our generation. This amount of extra wind allows wind to triple from 54 to 162 MW at a cost of about $240 million. The extra 77 MW of small hydro costs $398 million.

The island wind and hydro together are $638 million. Efficiency would be the major cost-effective source and, in combination with small hydro and wind, would be the least-cost option by far. It would carry our power needs to 2041 or longer, and achieve 98 per cent green energy. Any retail electricity price increases would be more than offset by customer energy savings. Staged wind and small hydro additions, concurrent with efficiency savings, could reduce Holyrood production to zero in seven to eight years.

Even without an efficiency rebate program, customer conversions to these efficient systems have compelling economics and presents a serious risk to the load growth forecast. By assuming that efficiency has reached a saturation point, Nalcor and Manitoba Hydro International's error is a serious risk in forecasting island power needs, and may lead to a serious financial burden for our province.

Winston Adams lives in Logy Bay. He has a B.Eng. (electrical) and experience in generation and distribution and heating systems. He is not a member of the Professional Engineers and Geoscientists Newfoundland and Labrador.