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Canadian Nuclear Workers' Council

Conseil Canadien des Travailleurs du Nucléaire

December 2021

National Director's Message

OPG's selection of a technology partner for the Darlington New Nuclear Project (DNNP) is very welcome news. Congratulations to GE Hitachi Nuclear Energy (GEH).

This is an important milestone that demonstrates the continued progress of the DNNP and the Government of Ontario's continued commitment to the development and deployment of Small Modular Reactors (SMR) in Canada.

CNWC National Director Bob Walker

OPG's decision means a GEH BWRX-300 SMR could be in operation at the Darlington site by the end of this decade. This sets the stage for a future deployment in Saskatchewan, and possibly Alberta. New Brunswick also continues to advance SMR development in partnership with ARC and Moltex. The success of these projects is of great importance to all Canadians.

The other great news is the continuing success of the ongoing refurbishment projects at the Darlington and Bruce sites. These are both massive clean-energy infrastructure projects—among the largest in Canada—and both are progressing very well.

The OPG and Bruce refurbishments will secure the emissions-free electricity supply from those units for decades. They are also an enormous economic benefit to the local host communities as well as to all communities across the entire nuclear supply chain.

Those are good news stories, but we need to be planning ahead for much more. Ontario's electricity supply currently has a very low carbon intensity thanks mostly to nuclear and hydro. That will change when Pickering ceases commercial operations. The Pickering units are operating extremely well but are currently only approved to operate until 2024. When the 3,100 MW of emissions-free electricity from Pickering comes off-line, the only incremental source of reliable electricity available for Ontario will be from fossil gas.

Meanwhile, eliminating carbon emissions in the other major energy consuming sectors of our economy, transportation and heating, will require electrification. Obtaining the air quality and climate change benefits from electrification requires emission-free sources of generation.

What we need now is thoughtful demand forecasting that considers scenarios with broad electrification in transport and heating. Planning new base load generation to meet future demands needs to start early. Replacing Pickering's emission-free electricity and meeting new demand from electrification will require thousands of megawatts of new nuclear generation. Proactive, preliminary planning should start now!

A 300 MW SMR at the Darlington site is an excellent start but if you do the math, it's clear that we will need much, much more. The good news is, we've done it before. Ontario transitioned from a hydro-coal electricity system to a predominantly nuclear one in two and a half decades—we went from zero to sixty (percent) in that time. We can do it again, and we should.

I hope everyone has a happy and healthy holiday season and all the best in the New Year.

The Council extends our warmest wishes to Patrick Dillon for a healthy, happy and lengthy retirement. Patrick is the Business Manager and Secretary Treasurer of the Provincial Building and Construction Trades Council of Ontario and a past CNWC Board Member. Congratulations, Pat.

Bob Walker

Ontario entering the Third Electrification, doesn't know it

From cosmic cataclysms in deep time to a carbon-free hot shower in 2030: return to Genesis The most easily decarbonized energy in Ontario would be domestic and commercial hot water. Most is heated today by burning natural gas. In August, the lowest gas demand month, minimum residential and commercial gas usage, measured in energy units, is over 3 billion kilowatt hours. That's the output of a 4,500 MW power plant running full blast through the month. Only nuclear could decarbonize this baseload energy demand. Ontario's two nuclear utilities, OPG and Bruce Power, are natural contenders for that business—should it become available.

Decarbonizing water heating in Ontario would in a sense be returning to the original, primordial mechanism for heating water. Much of the heat for all natural hot springs on Planet Earth comes from the release of energy stored for billions of years in the materials naturally present in Earth's crust, specifically those that make up the U-238 decay series: isotopes of uranium, thorium, radium, radon, polonium, bismuth, and lead.

The parent in that series, uranium, was manufactured in the unimaginable heat and pressure of ancient cosmic events like supernovas and neutron star collisions. (Yes, nuclear is truly the original solar power.) Distributed throughout the expanse of time and space that makes up the Universe, uranium was a component of the stardust whose accretion eventually made the planets in our solar system. Uranium was literally "present at the creation" of Earth.

Uranium radio-dating is how we know Earth is 4.5 billion years old, and the uranium that fuels Canadian nuclear power reactors comes from the Canadian Shield, the oldest geological formation on the planet. Isn't it quite amazing that water heated with electricity made by nuclear reactors running on Shield uranium is just another version of the radioisotope heating of water that has occurred naturally since our planet's birth?

GM enters electric Last Mile space When a major economy-scale player jumps into a newly developing market, everybody watches the splash. In the October 2020 *CNWC Newsletter* we noted the major policy initiatives in the US for e-trucks. Since that time, many new startups have entered the commercial e-truck space. At an investor event in early October of this year the mighty General Motors joined the pack, announcing among other things its intent to accelerate roll out of its BrightDrop EV600, a fully electric delivery van manufactured by a recently acquired standalone startup, to Q4 2021—well ahead of the 2025 date it gave as recently as January.

Specific to Canada, GM says it will make the BrightDrop at its CAMI plant in Ingersoll Ontario. GM says the cab will be heated with "waste" heat from the batteries. How significantly can that lower mileage loss in winter? Toronto e-buses need separate diesel heaters bolted onto them, but passenger buses have a much higher heat demand than delivery truck cabs. Still, winter conditions present formidable challenges for BEVs. We'll watch this with interest.

GM told investors it plans to sell one million EVs by 2025. For perspective, there are today over 23 million cars and light trucks registered in Canada. EVs have a way to go before they are mainstream. But they could travel that distance fast.

EVs have far fewer parts than conventional internal combustion engine vehicles. Manufacturing EVs is less electricity intensive. It is encouraging that GM is still willing to locate manufacturing in Ontario, where electricity costs more than twice as much as in Tennessee and Kentucky—where competitor Ford recently announced new manufacturing megaplants for vehicles and batteries (see below). But Ontario can become a true centre of BEV manufacturing only if it reduces electricity costs for companies seeking manufacturing locations. To achieve this, it must reduce the cost of supply.

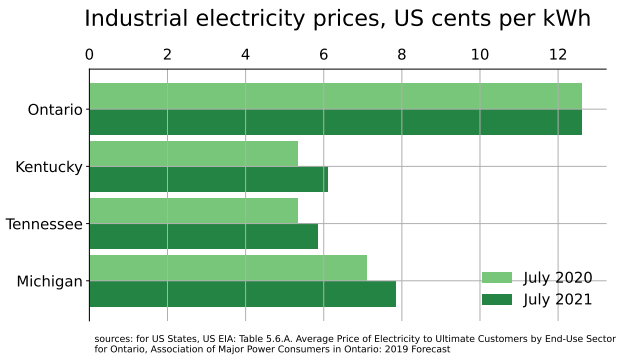
Urgent need to begin Ontario RFP process for clean baseload electrical supply Within three years Ontario will lose 3100 megawatts of zero-emitting generation, when Pickering goes out of service. The province plans to replace Pickering's output with gas-fired generation. That will add 10 million tons per year to the provincial and national inventories. Queen Elizabeth was overheard, just prior to the Glasgow COP26 meeting, expressing irritation with leaders who won't walk their talk on climate. What will the Queen think of Canada's grand promises while it allows Ontario to literally triple its annual electricity CO_2 emissions.

The only way to prevent this is to either refurbish Pickering or replace its capacity with new nuclear. The station is an invaluable asset, and must play a leading role in Ontario's electrical future. Its proximity to Toronto, the largest load centre in the nation, and its connection infrastructure are too valuable to be scuttled.

By the numbers

Ontario continues losing auto manufacturing to low-cost US electricity Ford Motor Company announced in early October it would open two new megaplants in Tennessee and Kentucky, to launch its new lineup of battery-electric vehicles, including the hugely hyped F-150 Lightning. Observers in the state of Michigan wondered why it, as the birthplace of the iconic automaker, was not among the host jurisdictions. Ontario might also wonder.

A glance at industrial electricity prices gives the answer. Nuclear-powered Tennessee and coal-powered Kentucky can entice prospective manufacturers with industrial prices of 6 US cents per kWh, 2 cents less than Michigan. Ontario at over 12 cents s not even close to Michigan, let alone the first two. Ford Motor Co.'s talk of "renewable" powered manufacturing in Ontario was likely just talk—padding for the obligatory ESG component of corporate communications, obviously not part of actual company strategy. Ontario was likely never even under consideration as a location for these plants.



This points up a problem that won't go away until we make it go away. Electricity prices in Ontario, the result of misguided provincial policies in the early 2000s, make the cleanliness of Ontario electricity completely irrelevant in consumers' choices about what kind of energy to buy, and in industries' choices about where to locate factories. The only choice Ontario consumers really have today, energy wise, is electricity or natural gas for heating. For Ontario retail consumers, electricity is 5 times as expensive as gas (the prices in the chart are what *industrial* customers pay). For consumers, that's all that matters. But as the chart illustrates, there are plenty of alternatives for industries looking for host jurisdictions. Ontario priced itself out of that market.

An immediate solution to this is to enable long term power purchase agreements, guaranteed by the provincial government, for firm zero-emitting electrical output, at a price that represents the average cost of supply today—roughly 8 cents per kWh. Is there a generating entity today in this province that can profitably provide power at that cost? Then the PPA should be awarded to that entity.

Our major employers

Bruce Power crashes through ESG wall with first nuclear green bond Is nuclear energy "green"? Bruce Power went to the capital markets to find out, more precisely to those who vet securities for green-ness. It got a lukewarm positive answer. In our view, the answer should have been unequivocally yes, in bold capital letters, double-underlined. The green ratings agency that vetted it for ESG-worthiness would have rated it "darkest green" had it looked at actual data instead of canvassing "elite" green opinion. The fact the agency returned a "medium green" rating illustrates the usual approach of ratings agencies, whose primary business when it comes to energy-related securities appears to be greenwashing wind and solar.

Nonetheless, Bruce Power's green bond was way ahead of its time. While the European Investment Bank has endlessly filibustered the issue of whether or not nuclear is "green," Bruce simply went ahead and issued a green bond. Green ratings agencies, out of step with physical reality and arithmetic, are in danger of proving themselves as irrelevant as the EIB.

OPG receives Darlington site preparation renewal, license amendment for Mo-99 Darlington, a prime site for new build, got the green light from the regulator for both preparatory work for construction and license amendment to produce the critical medical isotope Mo-99 in existing reactors. CNSC says DNGS can accommodate another 4,800 MW—coincidentally, about the same amount that could decarbonize Ontario's baseload hot water power demand.

OPG also decided which SMR will go into Darlington—the GE-Hitachi BWR SMR. This will be a first for Canada: light water, enriched fuel. It will also open the door to deep nuclear load following, which is significant. The sheer size of hot

water demand in Ontario (4,500 MW; see page 2), and the reality that only nuclear-generated electricity could credibly meet it, suggests more than one 300-MW machine is needed. OPG hasn't ruled out more than one SMR at Darlington, and let's not forget that Ontario perfected the multi-unit nuclear station. This is going to be interesting.

NB Power awaits clarity from province on meaning of "non emitting" electricity New Brunswick's biggest non emitting generator is the Point Lepreau CANDU. Nonetheless, NB Power is obliged to wait for the provincial energy ministry to decide how to interpret the NB *Energy Act* on the issue of what constitutes non emitting power. The sticking point is that the *Act* specified that by 2020 the province was to have generated 40 percent of electricity with specifically "renewable" sources. The energy minister says ultimately NB will generate all power with "non emitting" sources, which is encouraging. Germany's grid CIPK is a disgraceful 400+ grams because of myopic focus on renewables. Had Germany simply prioritized non emitting generation, and not handcuffed its national utilities with anti-nuclear strictures, it would be on its way to catching up to France as the leading European exemplar of a low emitting electricity sector. As it is, France need not worry.

Meanwhile, the Canadian federal government plows ahead with its initiative to "phase out coal" from provincial electricity grids by 2030. This really targets four provinces: Alberta, Saskatchewan, Nova Scotia, and New Brunswick. The task force to oversee this initiative lacks representation from Ontario, the only province that has actually phased out coal.

Kinectrics enters Lu-177 target manufacturing business
As part of Isogen, Kinectrics's joint venture with Framatome to manufacture and market the cancer fighting isotope Lutetium-177, Kinectrics will provide high-purity Ytterbium-176, the stable target feedstock for Lu-177. Using Yb-176 rather than Lu-176 as a target ensures the final product will not contain any "carriers"—radioisotopes of Lutetium other than the desired one with mass 177. This reduces precautionary workload at non-hospital clinics, so that patients can safely receive the isotope without time-consuming overnight stays and other protective measures.

The neutrons that turn Yb-176 into Lu-177 come from fissioning U-235 and Pu-239 in the CANDU reactors that Bruce Power uses to make a third of Ontario's electricity. The main use of Lu-177, a beta emitter with a half life of 6.65 days, is to fight prostate cancer. But compounds containing it are currently in development for other types of cancer. You could say this, along with natural hot springs, is another example of the healing power of nuclear energy.

Core samples from bedrock in the Ignace area. NWMO reports it has taken 6 kilometres of such samples, which it will assess for suitability for sequestering high-level radioactive used fuel.

Kinectrics is taking care of the main company business too, arranging, among other things, for seminars on new approaches to transmission lightning protection—a critical issue as thunderstorms become more prevalent with more heat and water in the atmosphere.

SNC Nuclear rebrand suggestion, while Pickering continues to require nuclear replacement at scale The Enhanced CANDU 6 (EC6), for which SNC has exclusive license rights from the Government of Canada, is the most likely and realistic basis for replacing the 6 Pickering units slated to cease operations in 2024. No one would know it from the energy commentary in Ontario, but of all contenders for new nuclear capacity in the province, SNC Nuclear is by far the best placed—it is the only reactor vendor whose technology is currently in licensed operation anywhere in the world.

Also, while everyone has heard of SNC, very few know CANDU Energy. If the company wants outside advice regarding a corporate rebrand, CNWC humbly offers its own two cents: we really like the name CANDU Energy. In two short words, it tells exactly what the technology is about, and puts SNC's best and most profitable and least controversial foot forward. There's nothing wrong with the name SNC. But CANDU Energy instantly matches company name with company business.

NWMO educates on borehole ins and outs How deep are the boreholes NWMO has been drilling so as to characterize the bedrock of its two possible sites in South Bruce and Ignace? A CFL football field is just over 100 meters; an NFL one is just shy of 110 meters. NWMO recently took a borehole sample near Ignace that was 313 meters long: because it went in at an angle, the depth from the surface to the end of the borehole was 294 meters—nearly 3 football fields, regardless of the league.

Video Watch

Africa4Nuclear showcases South African energy literacy Highlighting the imperative to fix energy poverty while cutting CO_2, this impressive new group has posted an excellent summary of energy choices not just in Africa but everywhere. https://youtu.be/Z1KhlrALMpE

Gerry Thomas on radiation Al Scott of *A Rational View* interviews one of the world's foremost authorities on ionizing radiation. This is worth watching.
See https://youtu.be/GCTHsXGbpfs

In short…

Quebec the continent's great innovator in electric heating In the December 2020 edition of the *CNWC Newsletter*, we noted Hydro Quebec's innovative energy storage and frequency control pilot involving residential electric water heaters: the utility would take control of a number of heaters, and during a low frequency excursion would turn them off until supply caught up with demand. The great provincial utility has begun a new heating-related pilot, this time based on ceramic space heating storage. Eligible participants must have a Steffes ETS model 4120 installed, and programmed to power off through the morning and afternoon electricity peak hours—3 hours in the morning, 4 hours in the evening.

Quebec is North America's biggest electric heating jurisdiction. Hydro Quebec are the experts in maneuvering around the breathtaking demand fluctuations that occur through the province's brutal heating season. This will be interesting.
See https://www.hydroquebec.com/data/accumulateur-chaleur/pdf/participant-guide.pdf

Refusing refuse truck garbage, by electrification Could there be an end to the annoyance of a revving garbage (refuse) truck engine drowning out all other sound as it proceeds along its route? Several heavy-truck manufacturers appear to be making a serious effort to answer yes. Mack, Lion, Daimler, BYD, Peterbilt—serious players in the heavy truck space—have all announced models. When it comes to deals for selling these models, the recent weeks (as of late November 2021) have belonged to China's BYD. But Canada's Lion is also making a run.

Noise is just one of the pollutants of a typical garbage truck. Another is CO_2, along with the usual bona fide air pollutants NO_x, SO_x, and particulates. But the sheer noise is what everybody really notices. Eliminating noise would give urban taxpayers the most immediate and obvious benefit of electrification. The beefy charging infrastructure—Lion says its Refuse REL could charge its 336-kWh batteries in 2 hours, suggesting a charge rate upwards of 150 kW—would accelerate the "inward expansion of the grid" CNWC has been advocating in its Electrification Policy Series. Every city needs significantly greater electrical capability. Electrifying heavy equipment like garbage trucks is a critical first step to achieving this.
See Lion's 2019 video https://youtu.be/lAsNQwjXDP4

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Canadian Nuclear Workers' Council
The collective voice of organized labour in the nuclear industries
The Canadian Nuclear Workers Council (CNWC) is an umbrella organization of Unions representing workers in all sectors of the Canadian nuclear industry. Founded in 1993, it represents sectors including electric power utilities, uranium mining and processing, radioisotope production for medical and industrial purposes, nuclear research, construction and trades in Ontario and labour councils in host communities.

Members include Locals of: International Association of Firefighters ● Atomic Energy Allied Council ● Canadian Union of Public Employees ● International Brotherhood of Electrical Workers ● International Association of Machinists & Aerospace Workers ● International Federation of Professional and Technical Engineers ● Power Workers' Union ● Provincial Building and Construction Trades Council of Ontario ● Professional Institute of The Public Service of Canada ● Society of United Professionals ● Society of Professional Engineers and Associates ● United Steel Workers ● UNIFOR ● District Labour Councils (Grey/Bruce, Durham, Lindsay, Northumberland, and Saint John).

What others are saying

As winter approaches, a reminder that the Texas effort to reform the electricity grid so as to avoid a repeat of the February 2021 debacle continues. A federal post-mortem politely reminded readers that 2021 was similar to 2011. Excerpt below.

" The Event began with extreme cold temperatures and freezing precipitation. Both open-frame generating units, common throughout Texas and the South Central U.S., and natural gas production infrastructure, with its associated water, are known to be vulnerable to freezing. In addition, wind turbines are known to be vulnerable to blade icing because of freezing precipitation. The extent to which the Event was caused by the failure of all types of generating units to prepare for extreme cold weather or associated freezing precipitation, cannot be overstated.

...

"Outages of wind generating units rose early in the Event, starting February 10, and reached a plateau of 20 to 25 GW that sustained through February 18. Natural gas and coal generating unit outages rose on February 15, with natural gas-fired generating unit outages nearly doubling in two days, from 25 GW to 50 GW by February 17.

...

"The principal cause of generating unit outages was freezing components and systems resulting from the cold temperatures and precipitation. **Freezing issues and fuel issues combined to cause 75 percent of all unplanned generating unit outages, derates and failures to start during the Event**.

...

"Despite multiple recommendations since 2011 that generating units should take actions to prepare for the winter (including detailed recommendations for winterization plans), 49 generating units in Southwest Power Pool (15 percent), 26 in [the Texas system] (7 percent), and 3 units in Midcontinent Independent System Operator South (4 percent), did not prepare any winterization plans. As further evidence that generating units could be better prepared for winter, **81 percent of the generating unit outages**, derates or failures to start **occurred at temperatures above the unit's ambient design temperature**. " [*emphasis in original*]

Source: Federal Energy Regulatory Commission et al, *The February 2021 Cold Weather Outages in Texas and the South Central United States*, November 2021, pp. 162–166. https://www.ferc.gov/news-events/news/final-report-february-2021-freeze-underscores-winterization-recommendations

Worth repeating (and an explanation of why 2011 recommendations were not followed)

"'We must build more gas plants so that our dispatchable resources have the capacity to cover our electric needs now and going forward. One option is to incentivize investors to build more plants by leveling the playing field between renewables and dispatchable thermal energy. Renewables receive massive federal subsidies as well as some state incentives.

"Thermal plants are also required to replace any power they cannot generate on the spot market. Wind and solar are not. That partly explains why we have seen little investment in new thermal plants over the past decade.'

Source: "Lt. Gov. Dan Patrick: Texas needs more electricity now" *The Dallas Morning News*, June 29 2021 https://www.dallasnews.com/opinion/commentary/2021/06/29/lt-gov-dan-patrick-texas-needs-more-electricity-now/#