



Canadian Nuclear Workers' Council

Conseil Canadien des Travailleurs du Nucléaire

Fall 2022

National Director's Message

Concerns about climate change and energy security have prompted a global re-think on nuclear energy. At COP 27 nuclear energy was discussed more openly than in previous gatherings and advocates drove the message that effective action to fight climate change needs nuclear energy.

Canada has a strong nuclear industry and is recognized as a pioneer in the peaceful use of nuclear energy. Continuing strength is demonstrated by the excellent operational performance of Canada's CANDU reactors. With Countries around the world examining the promise of nuclear energy Canada is in a great position to provide expertise and leadership.

The impressive progress of refurbishments at the Bruce and Darlington Nuclear Generating Stations validate the skills of our nuclear workforce and the strength our nuclear supply chain. These refurbishments will secure decades of clean energy for Ontario and support a business case for both Pickering refurbishment and new build nuclear. Announcements on SMR development and deployment in Ontario, New Brunswick and Saskatchewan will keep Canada at the forefront of new nuclear innovation. Further to this: Canada's continuing leadership on the research, development and production of medical isotopes is saving countless lives every year.

Our Federal Government has been demonstrating explicit support for nuclear energy. It is encouraging to see



CNWC National Director Bob Walker

them acknowledge the environmental and economic benefits of nuclear energy. All of this great news positions Canada well to meet the challenges ahead.

Electrification of Canada's economy will significantly increase our demand for low-carbon energy. We need highly developed demand forecasting to keep well ahead of this. The scope of the challenge isn't broadly recognized but many estimates indicate we'll need to triple our electricity supply. Meeting that demand will require all sources of clean carbon-free energy including SMRs and larger conventional reactors.

The recent CNWC Conference in Hamilton brought all of this together in an incredibly optimistic event. The research and innovation at McMaster University's nuclear facilities is inspiring and our tour of the Nuclear Waste Management Organization's Oakville facility demonstrated the progress of Canada's long-term plan to safely manage used nuclear fuel. Our panel discussion on nuclear advocacy brought together advocates from within Canada's Nuclear Workforce and advocates from Grassroots Organizations. Groups such as [Canadians For Nuclear Energy](#) and [Green Nuclear Deal](#) has been very effective at communicating the facts. We welcome and appreciate their efforts.

The CNWC will continue saying what we've been saying for years: Our economy and our way of life require a secure, reliable supply of electricity and nuclear provides that without carbon emissions. Nuclear also supports about 76,000 good domestic jobs, contributes \$17 Billion to the Canadian economy and nuclear medicine is saving lives.

In Summary: We need nuclear energy.

Clean Energy – Clean Air – Modern Medicine – Great Jobs

Bob Walker



Great news on Pickering

Swimming vs treading water We were pleased to see the Ontario Energy Minister and OPG agree to revisit the closure of Pickering at the end of 2024. This was exactly what [CNWC had urged those two parties to do](#): life-extend, then either refurbish or replace with new nuclear of equivalent capacity. We applaud the Energy Minister and OPG CEO for this. We should keep in mind that nothing has been decided, other than OPG will revisit PNGS's end-of-2024 closure. It is possible that CNSC will reject OPG's request for an extension, and it is possible that OPG's fresh look at the case for refurbishment could confirm the original no-refurb case.

New build nuclear The fact remains that at this time (late Nov. 2022), the only nuclear "game" is the Darlington and Bruce refurbishments, and the only new build is the 300 MW LWR at Darlington. CNWC supports the development and deployment of SMRs but we have a concern. The Darlington Site is the only location in Canada licenced for new nuclear with a valid Environmental Assessment (EA). The EA allows for up to 4 units and up to 4,800 MW. Four BWRX-300s will generate only ¼ of the 4,800 MW approved under the EA. Is work underway to find a location for large new build?

We are pleased to see continued progress on SMRs in [Saskatchewan](#), [New Brunswick](#), and [Ontario](#), and that [SMRs are eligible for the new federal clean energy tax credit](#).

Unit upgrades In 2016 Site output at Bruce Power peaked at about 6,300 MW. The new Site generation peak is 6,550 MW and [Bruce Power plans to increase that to 7,000 MW by 2030](#). That is an incredible achievement.

The strength of CANDU We are troubled by the absence of discussion about CANDU, which serves Ontario so well with reliable bulk power and also energy security (the entire fuel cycle is in Canada) and medical isotopes. The notion that this is "yesterday's technology" ignores the tremendous constant innovation and value extraction—site uprates and isotopes—from this Canadian invention. With electricity demand expected to increase threefold as transport and heating are electrified, Canada will need multiples of Pickering-size generating capacity. If these multiples of 3,000 MW are to be nuclear, then *what* nuclear? We are proudly pro-CANDU, which was invented expressly to circumvent the U.S. monopoly on uranium enrichment. It uses hundreds of small individual pressurized fuel channels, thereby freeing buyers from competing for production slots at large steel forgers, of which Canada has none. CANDU also is the only power reactor technology in the world that easily allows for medical isotope production.



Chris Keefer and Madi Hilly representing at CNWC 2022. Effective climate action requires nuclear. Be sure to sign the [C4NE petition to make CANDU eligible for federal clean energy tax credits](#).

Nuclear representation at COP27 For most of the international Conferences of the Parties (COP) that have occurred over the past quarter century, nuclear energy—the most effective weapon against man-made CO₂ emissions—has been either deliberately shut out or ignored. This time, there was more representation from supporters. *Reuters* [ran a short piece](#) describing nuclear industry and activist efforts to "polish the industry's spotty image." Some of this representation was from CNWC's very own Michelle Johnston; see the photo.

Municipalities sitting on a gold mine and don't know it Muni investors will soon realize the potential for electrification to turn municipalities into cash generators several times their current size. Upward of three-quarters of the amount of energy used in municipalities today has yet to be electrified. Let that statement sink in. Those three-quarters of the kilowatt hours purchased inside municipalities are "stored" in gasoline, diesel, and natural gas. Those fossil fuels are marketed by private companies whose profits are taxed at 15 percent. Under electrification,

some multiple of those kilowatt hours will be delivered to customers by the municipal electric utility, whose revenues will at least double, probably triple and may even quadruple, and whose profits may well go into general city revenue. Electrification will be a fiscal revolution at the municipal level.



By the numbers

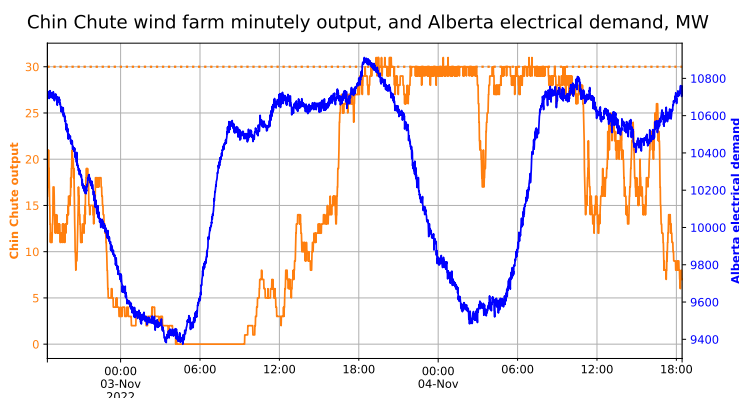
Oil sands operators omni-directional on ESG comms The Muskeg River “cogeneration” power plant in Alberta, owned and operated by Heartland Generation, with Athabasca Oil Sands Project as the [power purchase agreement counterparty](#), made 7.9 billion kilowatt hours of energy in 2019, of which 5.2 billion (66 percent) were for power generation for the grid and 2.6 billion were for process heat.

The process heat side of Muskeg River helps extract 155,000 barrels per day of heavy crude, which is sent south to Fort Saskatchewan to Shell’s Scotford Upgrader which turns it into synthetic crude—one of Alberta’s, and Canada’s, most important export commodities.

Oil sands extraction is a 24/7 operation, so we can assume that the 2.6 billion process heat kWh came from over 300 MW of capacity, running 24/7, accounting for losses and maintenance downtime. We can say that Muskeg River mine’s baseload heat demand is roughly 300 MW. That’s 300 MW, every minute of every day.



Michelle Johnston, CNWC Chair and President, Society of United Professionals, at centre, attending the IEAE Atoms for Climate panel at COP27.



utes in early Nov. 2022 was all over the place, only approximating 30 MW capacity in the middle of the night as demand receded. Mean output over the period was 17 MW.

Meeting Muskeg River’s 300 MW process heat demand with wind power would require far more than 300 MW of wind capacity, if we extrapolate from Chin Chute. Shell surely has a non-oilsands customer in mind as it advances the energy transition. Oil sands operators tick all the ESG boxes, except CO₂. Their focus should be on where they shine: they operate in a country that leads the world in governance and social responsibility. And they should implement SMRs.

Industrial heat demand is the same as all baseload demand. Supply must match it, every minute of the day.

Shell Canada, an AOSP partner, has [agreed to purchase the output](#) of the Alberta Hand Hills Wind Project, 100 MW, saying it “demonstrates how Shell is seeking opportunities to advance the energy transition in Canada.”

Hand Hills has yet to report output, but wind output is highly correlated across all farms, and we can simply look at the output of nearby wind farms like Chin Chute. As you can see in the figure, Chin Chute’s output over 2,800 min-

Our major employers

Nuclear remains single biggest SNC revenue earner SNC reported Q3/2022 results on November 4, and as always the Nuclear Line of Business segment represented the largest non-Engineering Services line. Recall we reported in the December 2020 *Newsletter* that SNC refocused and reorganized away from lump sum turnkey projects and toward engineering services. The Nov 4 report reflects that refocus. Nuclear, which had been reported in the Engineering Services segment is now its own standalone segment. CANDU nuclear is a pandemic-proof revenue earner for companies in the space, and an inflation-proof power generator for ratepayers.

Bruce begins producing Lu-177 commercially Bruce unit 7 is now officially a cancer fighter, having recently been fitted with a device in which [fission neutrons bombard Ytterbium 176 to produce Lutetium-177](#), the active ingredient in



radiopharmaceuticals that target prostate cancer. As mentioned in previous *Newsletters*, this innovation is the result of a partnership of Kinectrics, Framatome, ITM (a German biotech firm), the Saugeen Ojibway Nation, and Bruce Power.

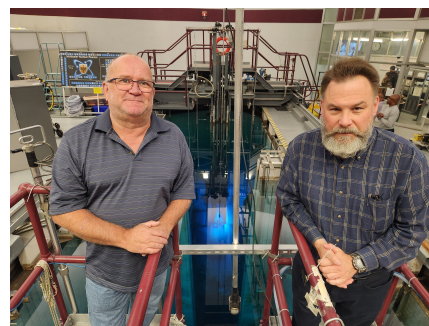
No other power reactor technology in the world has this capability to make Lu-177. Along with production capability for Cobalt-60 and Molybdenum-99—two other lifesaving medical isotopes—the CANDU community has over the years reinvented the machine to serve modern society in ways that go beyond non-emitting bulk power generation.

OPG revisits PNGS as power supply crunch looms As mentioned above, we are delighted OPG will seek to extend Pickering's life beyond 2024 and determine if refurbishment of the B station is viable. We also applaud the Canada Infrastructure Bank's commitment of \$970 million to the initial phase of OPG's SMR at Darlington.

OPG's commitment to be "net zero" by 2040 remains a daunting challenge, however. That commitment means that within 18 years, OPG will phase out of service more than 4,800 MW of gas fired power generation. Unlike the coal phase-out, Ontario, under current plans for procurement of new generation, will not have at its disposal 5,000 MW of refurbished nuclear capacity to replace the gas it is phasing out. It will only have 300 "new" MW on top of what it has today. That assumes PNGS B will be refurbished. In other words, we cannot see how our employer can meet the net-zero-by-2040 target under current plans.

We are puzzled as to why, in an era where it is universally agreed that major swaths of fossil fuel usage will be replaced with electricity, the only extant plan for new nuclear construction is for 300 MW. CNWC analysis suggests the demands for electrification of the personal motor vehicle fleet in Ontario alone would require at least 5,000 MW of new generating capacity—the equivalent of roughly ten Pickering-size units—on top of what exists now.

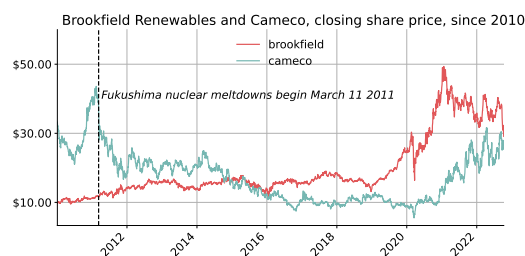
In light of this, we urge the Independent Electricity System Operator, and our employers OPG and Bruce Power, to reconsider the implications of electrification in a carbon-constrained world. By simple math, Ontario's planned capacity additions seem inadequate to handle this coming major development.



PWU Darlington Chief Stewards Martin Wagget (left) and Scott Thompson touring the McMaster University reactor

Cameco partners with Brookfield Renewables to buy Westinghouse

The blockbuster nuclear deal of 2022 occurred in early October, when CNWC employer Cameco teamed up to buy the legendary PWR vendor Westinghouse. With Russia likely out of the PWR game for the foreseeable future, this leaves the AP1000 and EPR as the only "Ontario Darlington 2009" designs whose vendors are still standing. How will the capital markets react to this deal? The chart shows both partners' stock market fortunes since 2010. Look at what happened to Cameco after Fukushima. Its stock price has taken 11 years to recover from that PR debacle (and that doesn't include inflation).



Video Watch

DeGroote Business School's fresh take on nuclear as green energy Prof. Goran Calic takes an informed outsider's view of what constitutes green energy, and suggests some ways to further nuclear's expansion in grids across the world. <https://youtu.be/iqlqdatGOgM>

Finland jumps into the lead in radwaste management An excellent rundown of Finland's recent nuclear history, focusing on Olkiluoto 3, but wait till it gets to Finland's newly approved DGR. https://youtu.be/kYpiK3W-g_0

UK nuclear development: should they have copied Canada? The UK was "present at the creation" of the nuclear industry, just as Canada was. The UK took a different technology development path, choosing gas-cooled graphite-moderated machines while Canada of course opted for pressurized heavy water. This fascinating video suggests how the UK got off



track. While Canada was inarguably more successful, a half century later we appear ready, for opaque bureaucratic and political reasons, to embrace the very light water world we expressly invented CANDU to avoid. <https://youtu.be/p-wrruwzASC>

In short...

Fantasy energy stories continue to dominate REIT ESG space Lineage Logistics, a major temperature controlled industrial real estate investment trust (REIT), claims that a combination of rooftop solar panels and “linear generators”—piston engines that directly convert motion into electricity, without the losses that occur when there are connecting rods—[“will produce 100% of \[a California temperature-controlled warehouse’s\] energy consumption on a net basis.”](#)

Lineage claims its linear generators will produce 460 kW of power. Given that solar does not produce at night, can we assume Lineage’s refrigerated warehouse total electrical power demand is 460 kW? Of course not. The solar array total capacity is 3.3 MW, and Lineage says it will generate 5.4 million kWh over a year. That would imply a solar capacity factor of roughly 19 percent. So 5.4 million kWh produced only during daylight hours (7,095 hours per year, if we believe the 19 percent CF) is an average of 761 kW. Note, that’s *average* output. Daily solar output ranges from zero to close to maximum panel capacity. In this case let’s assume 0.38 kW per panel, so 8,426 panels would generate at maximum roughly 3 MW.

Lineage won’t use 3 MW to power its temperature controlled facility. If it were, the 460 kW from the linear generators would be inadequate. So what is happening to the 3 MW? It is going to the grid. Where it will receive the usual solar subsidies: production tax credits, renewable energy credits, priority dispatch, and exemption from system cost penalties.

Lineage’s numbers quoted in the article suggest that power demand for that facility is roughly 700 kW. So for the period that the solar panels plus the linear generators are collectively generating less than 700 kW, the difference is coming from the grid. The excess solar generation is sold to the grid, and that’s the “net basis” of the 100 percent energy claim.


What gets lost in the description of linear generators is that, being piston engines, they are still driven by combustion. Wouldn’t it be better, environmentally speaking, if Lineage simply used the California grid, whose CO₂ intensity per kilowatt hour (CIPK) is in the 250 gram range? Natural gas, which is what will fuel the linear generators, has a minimum CIPK of 188 grams. Very likely the CIPK of electricity from a perfect linear generator is not much less than 255 grams.

This is a complicated and costly way to pretend that a refrigerated warehouse does not need baseload electric power.

Cryo-reefer the gateway to electric rail? Rail reefer has become for the Class 1 carriers another loss to trucking. Rail dominated temperature controlled transport from its inception in the 1850s right up to the 1950s, but the U.S. Interstate highway system and trucks ended that. In the era of climate change, you would think rail could eat away at the truck empire simply on the basis of cost and air emissions, but you’d be wrong. In the current Precision Scheduled Railroading era, none of the Class 1s that subscribe to PSR seems to have any desire to dedicate capital to de-dieseling mechanical reefer cars, which according to rail expert Jim Blaze’s [early 2020 estimate](#) cost \$300,000 apiece.

But mechanical isn’t the only option, and besides how do you electrify reefer without general rail electrification, which doesn’t seem imminent? Well, you “go cryo”—replace mechanical with cryogenic refrigeration, an approach with huge potential and at least one potential uptaker so far. That uptaker is none other than Lineage Logistics, which in 2020 purchased Cryo-Trans, once the biggest cryo rail carrier. CT now only owns mechanical and some insulated reefers.

What does this have to do with nuclear energy? Cryogenic reefer could radically disrupt temperature controlled shipping, especially in congested urban areas with noise restrictions. Only rail has the wherewithal to pull off cryo shipments spanning continents. If Class 1s take it up, the door opens wide for general electrification of rail. Electrification represents major cost savings for railroads, and huge new load on grids which can only be met with bulk zero carbon generation. One component of that load would be air separation to obtain liquid nitrogen, the only climate-friendly cryogen. Lineage, a self-styled innovation leader, would dramatically lower its CO₂ footprint with this approach.

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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

Investment bankers the frontlines of ESG realism: a Canadian first cut

“Building a lot of new generation today, into an uncertain demand outlook, risks increasing system costs significantly. Analysis for Ontario already shows that electricity generation costs will rise, although overall energy bills could fall as consumers with EVs avoid gasoline costs.

“While wind and solar grids can be built quickly, they still have challenges. Take the European experience this summer: with a dearth of Russian gas, climate change-driven disruptions have acutely affected power prices. Drought has led to low hydro reservoirs in usually wet parts of Norway, and record heatwaves have lowered wind power availability and warmed rivers so much that nuclear plants can’t use them to cool reactors without environmental waivers.

...

“[Nuclear and hydro go] back to the foundations of Canada’s existing electricity system. As electricity demand rises, **we’ll need to provide more power in almost all hours of the day**. Such ‘baseload’ power needs have often been met by hydro, and in some cases, nuclear power. There are reasons to think we will need them again.

“For one, nuclear power stations have been declining in scale: Ontario Power Generation (OPG) will install a new, small nuclear reactor about a third of the size of traditional ones at Darlington. As a test case, it could provide learnings for an expansion of nuclear to other parts of the country that are phasing out coal and struggle with hydro for storage, and to other industries. In this case, it would replace some renewables buildout and help keep the share of intermittent electricity lower, helping to lower storage costs. Learnings from deploying these smaller reactors could help lower costs for future ones.

“Still, like all major projects, hydro and nuclear face fiercer local opposition. While hydro is in some cases more expensive than renewables, cost challenges are even more relevant for nuclear. Regardless, one scenario where select provinces add more hydro, nuclear, and fewer batteries to displace gas generation adds *4 billion in costs (as compared to 7 billion for an all-renewables scenario with storage)*.

[Emphasis added]

Source: Colin Guldemann, “The Price of Power: How to cut Canada’s Net Zero electricity bill,” *RBC Economics and Thought Leadership climate series* September 20, 2022. <https://thoughtleadership.rbc.com/the-price-of-power-how-to-cut-canadas-net-zero-electricity-bill/>

Worth repeating (on Poland’s nuclear energy decree)

“The implementation of [the Polish Nuclear Energy Program] will allow for:

- fundamental diversification of Poland’s energy mix, while ensuring optimal domestic production capacities, as the basis for the country’s energy security;
- replacement of dominant carbon-based powers;
- meeting the growing demand for electricity and ensuring grid stability in connection with the large-scale introduction of distributed renewable energy sources (RES);
- limiting the role of natural gas as a transition fuel for balancing unstable renewable energy sources.”

[Translation by Google Translate]

Source: “Resolution on the construction of large-scale nuclear power plants in the Republic of Poland” *Government of Poland*, November 2, 2022 <https://www.gov.pl/web/premier/uchwala-w-sprawie-budowy-wielkoskalowych-elektrowni-jadrowych-w-rzeczypospolitej-polskiej>