Canadian Nuclear Workers' Council
Conseil Canadien des Travailleurs du Nucléaire
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National Director's Message

Canada is at the forefront of a global surge in support for nuclear energy. We're seeing the good news continue in 2024.

CNWC National Director Bob Walker

The list is long, and positive. It begins with Ontario CANDU reactors' outstanding operational performance, among the very best in the world. It continues with the major CANDU nuclear projects completed on budget and on schedule. Ontario's support for Pickering refurbishment, and its affirmation of support for nuclear in the newly released Sustainable Bond Framework.

The ongoing discussion and growing government support for SMRs and MMRs in Alberta, Saskatchewan, Ontario and New Brunswick is also hugely positive. So is federal government support for new large nuclear in Ontario. Record attendance at the 2024 CNA Conference, BWXT's expansion of their Cambridge manufacturing facility, and increased production of medical isotopes.

Following up on COP28, the IAEA held the first ever World nuclear energy summit which highlighted the role of nuclear energy in reducing carbon emissions, enhancing energy security and boosting economic development.

This is all great news but there is genuine cause for concern. We know nuclear energy is a reliable, low-carbon source of energy but we need to start building it now or we risk energy shortages. In Ontario that includes new large nuclear. Many provinces are recognized for their reliable low-carbon electricity systems but we are at risk of losing that status along with the many investment opportunities that will demand it.

Plans to electrify transportation and other large decarbonization projects require a low-carbon electricity grid. But the PWU, in a hard-hitting new discussion paper, warn that Ontario's planning approach is a major barrier to achieving a low-carbon electricity grid. "The People Who Help Keep the Lights On" believe the current planning emphasis, on just-in-time solutions based on flawed modelling and forecasts, will lead to brownouts and high prices. We should listen to them. Ontario needs new large nuclear now!

As we plan our clean energy future we need to maximize economic opportunities for Canada, maximize high quality employment opportunities for Canadians and protect Canadian energy security. CANDU is the only reactor technology that provides all three. Canada has the industrial capacity to manufacture CANDU Reactor components and Canada mines and refines uranium and manufactures CANDU fuel, all within our national borders.

Canada does not, however, have the ability to enrich nuclear fuel. Nor are we likely to get permission to acquire it. For this reason, the selection of a reactor technology for new nuclear construction is a critical infrastructure decision that will affect millions of Canadians and touch on national security for many decades to come. Fuel security needs to be a criterion in that selection. Our Provincial and Federal governments need to have a role in these processes.

Canada has a great opportunity to use our well established and successful nuclear supply chain and highly skilled nuclear workforce to build a net-zero economy for the benefit of all Canadians.

Reliable Energy – Clean Air – Leading Edge Healthcare – Great Opportunities.

Bob Walker

And the (friendly) war came: Canadian nuclear at the crossroads

Yttrium at Darlington: fighting cancer from the inside, without needing foreign permission In yet another outside-the-box feat of innovation involving CANDU, our employer OPG teamed up with employer BWXT and another company to produce a formidable weapon in the fight against cancer. That weapon is a radioisotope called Yttrium-90. It will be manufactured in one of the Darlington CANDUs.

One of the major fission products in used nuclear fuel is Strontium-90. Sr90's half life is 29 years, and its daughter product is Yt90. Yt90's half life is just under 64 hours, and it decays to stable Zirconium 90 via β-emission, with decay energy of 940,000 electronvolts. This energy can propel Yt90's β particle into human tissue to a depth of 2.4 mm. This makes the isotope ideal for targeted radiotherapy to fight liver cancer. In contrast with external beam radiotherapy (which uses gamma rays often from a radionuclide like Cobalt-60), targeted radiotherapy requires radiation with only a very limited path length.

While you can obtain Yt90 by separating its parent Sr90 from used nuclear fuel, you can also make it by bombarding stable Yt89 with neutrons. CANDU reactors, with their high neutron economy, are well suited for this, and that's how Yt90 will be made at Darlington.

This method of manufacture would be too inefficient using any other power reactor than a CANDU. Like CANDU, a light-water reactor produces Yt90 via the fission product Sr90, but the Sr90 would have to be separated from the used fuel. To go that route in Canada—i.e., to get Yt90 from the Sr90 in LWR used fuel—would require permission from the country that supplied the fuel; Canada does not enrich uranium. Given that that country would also likely veto, and actually has vetoed, Canada's request to acquire enrichment capability, it is doubtful that the same country would approve Canada's request to harvest isotopes from used fuel. Three guesses which country we're talking about.

So it's CANDU to the rescue, just as it rescues Ontarians and New Brunswickers from a non-electrified or badly-electrified, life, every second of nearly every day. Canadian taxpayers got their money's worth and more from the small federal investment in CANDU in the 1950s and 1960s.

Alberta Premier Smith considers new conventional nuclear In the Christmas 2023 edition of the *CNWC Newsletter*, we urged Alberta premier Danielle Smith to seriously consider nuclear power as the only way to abate her province's massive greenhouse gas emissions, most of which come from oilsands processing and electric power generation—and in the case of baseload powergen, often from the same location.

In late March 2024, *CBC News* reported Alberta is doing just that. Nathan Neudorf, Smith's Affordability and Utilities minister, replying to a question about Alberta's interest in SMRs, said "We're also very interested in looking at conventional nuclear and what that could possibly provide for Alberta in ... the longer term."

CNWC appreciates this positive response from the Smith government. As an organization comprised of representatives of the people whose daily work life is directly involved in the entire gamut of electric power in the real world—from uranium mining and refining, fuel manufacturing, and bulk power generation, to power transmission and distribution—we offer some suggestions on how Alberta could approach a discussion about introducing conventional nuclear power.

CNWC advice to the Alberta government Most Alberta baseload electrical supply is gas-fired, and almost all in the form of "cogeneration" plants that provide process heat for oil sands. As of this writing (mid April 2024), there are 40 of these plants. Their collective capacity is just over 5,200 MW. Typically they collectively produce at between 60 and 80 percent of their collective capacity.

That is what has to be decarbonized under Canada's international commitments. Well, 5,200 MW is roughly the output of 7 CANDU 6 units, or 5 CANDU MONARKs.

Now, why would Alberta's oil sands majors stop using natgas for (1) process heat for oil production and (2) powergen as a side business to supplement the tens of billions of dollars annually from bitumen sales? Well, there is now a global LNG market. A major aspiring LNG supplier is now no longer in the running for that business. Also, electrical demand is projected to possibly triple under electrification, just from displacement of fossil fuels for transport and heating.

"Data is the new oil"... actually, data is electricity But when you consider the sheer opportunities available this early in the Century of Data, who's quibbling. Data *is* electricity, and with the entire Internet now a giant training/testing set for countless AI/ML applications, data centres are rapidly becoming strategically significant economic enablers. And, because data is electricity, data centres are significant electrical load centres too. Needless to say, data should be emission-free. That means the electricity that makes it must be emission-free.

Alberta is ideal for this industry. Aside from the occasional heat wave, its climate is still mostly cool enough to present serious cooling cost savings through the year. All of the other criteria for choosing a business location—political stability, rule of law, public confidence in financial disclosures in the capital markets—apply to Alberta in spades. The only blemish is the province's flirtation with renewable energy, which destabilizes the electrical grid and drives power prices up. Data centres rely on stable, affordable, 24/7 electrical power.

Will Alberta's flirtation with renewable energy—which cannot provide 24/7 power and therefore cannot meet data centre load—turn into a marriage? That would ruin the province's prospects for becoming a major world data hub.

Alberta's long term prospects for global LNG and free world data Russia's full scale invasion of Ukraine effectively destroyed Russia's prospects of becoming a global LNG supplier. Nobody wants to do business with a pariah. The global LNG market now belongs to producers that observe the rule of law.

Data also now presents an enormous opportunity, for a reason also relating to Russia. China had hoped to become the world's leading data nation. Due to its support of Russia, and also to near-constant public revelations of election meddling in democratic countries including Canada, China is now, like Russia, recognized as a miscreant that cannot be trusted.

Both developments present major opportunities for Alberta, provided the province is strategic and smart as it goes about entering these markets. China's 2021 plans for 200 exaflops (2×10^{20} floating point operations per second) of compute performance by 2023 were likely not reached, and certainly not by using "lithium batteries, hydrogen storage, and flywheel energy storage" as China claims.

Here's the kicker: if China does reach that goal, its 200 exaflops will be fossil powered. Batteries, hydrogen, flywheels are just greenwash to make it look like the thousand-megawatt-scale electric power driving the 200 exaflops will come from renewable energy, which it will not. Alberta's goal should be non-emitting exaflops. If nuclear power underpins this, and only nuclear power can, then that goal is easily met, and the energy storage and flywheel benefits of China's technicolor dream will be literally inherent to the power source.

By the numbers

Ontario electricity heated West-Quebec homes November 2023–March 2024 Can Quebec supply Ontario with enough electricity that Ontario could shut down its nuclear plants? Those who answer "yes" to that question need to look at the figure on page 4. Note: the residential space heating demand category (middle column) is **additional** to grid electricity. As you can see in the right column, Quebec's demand for Ontario electricity was near-constant. Compared with flows across the big Quebec-Ontario intertie over the previous six years, that was very unusual.

It's clear from the figure that Ottawa homes were not heated electrically. Heating demand was highest midnight to 6 a.m. (the blue circles), which is when Ottawa grid electricity demand is lowest. But most Quebec homes *are* heated electrically. It's not a stretch to say West Quebec homes were seeing a similar heating demand to Ottawa homes, and despite the warm weather, Ottawa's residential heating demand maximum exceeded its zonal grid demand maximum.

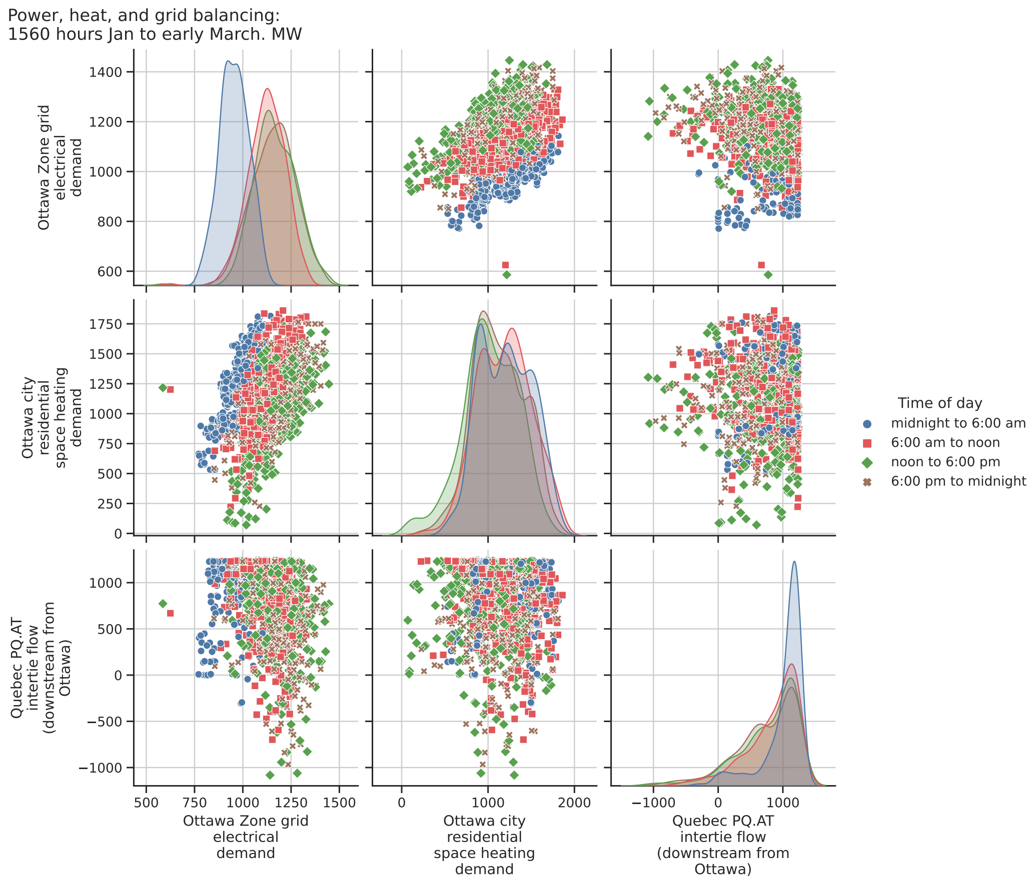
Would Quebec have taken more Ontario electricity if it could? Obviously yes: as you can see, exports through all times of the day butted up against the hard infrastructure limit, regardless of heating demand (temperatures in Gatineau, the most populous West Quebec community, are not much different from those at the Ottawa airport, from which Ottawa City heating demand was derived).

... in an unusually warm winter The odd thing about this is Ottawa experienced its warmest February ever. That means Gatineau, which heats predominantly with electricity, likely did too. So why such persistent, and high, flows of Ontario electricity to Quebec? Normally Ontario exports to Quebec overnight, then at around six a.m. the flow turns negative, i.e. Quebec exports to Ontario. The level of Quebec exports to Ontario builds and builds to around eight p.m., then falls off and becomes positive again.

As you can see, that's not what's happened January to early March 2024. So what disrupted that pattern? Well, hydro reservoirs were low in Quebec, due to a general decline in groundwater resources across all of Canada beginning in 2023. Second, the Quebec government has encouraged Quebec citizens to buy electric vehicles. Quebeckers have responded, with the highest t EV uptake of any Canadian province. Could EV recharging power demand have tapped out Quebec's already diminished resources and caused them to demand more from Ontario?

Third, and most important: Quebec opted to not refurbish the Gentilly-2 CANDU 10 years ago. They could use its 700 MW today, and indeed the government is considering reviving the refurb project.

Regardless, there is no way Ontario could do without nuclear today, much less when residential space heating and vehicles have been electrified. Note that Ottawa city space heating demand is almost entirely met with natural gas, not electricity—that is why Ottawa's grid electrical demand is lowest midnight to six a.m.



Under an electric heating scenario, overnight demand would be much higher, and on cold nights could reverse today's pattern. This must be taken into consideration by our electricity system operator as it develops long term infrastructure plans. The demand from Quebec altered flow patterns at the major interties with New York and Michigan. Ontario still mostly exported power across those, but in smaller amounts than usual.

The three interties—the Quebec one shown in the figure, plus New York and Michigan—are Ontario's most important balancers of supply with demand. The impact of electric space heating in Ontario *and neighbouring grids* must be taken into account.

Our major employers

Gloves are off in Second Ontario Big Reactor war In the Christmas 2023 edition of the *CNWC Newsletter* we celebrated AtkinsRéalis's new commitment to CANDU. With its unveiling of the 1000-MW MONARK, ATR picked up where its predecessor AECL had left off in the mid-1990s—pitching a bigger-than-Darlington reactor for its biggest reactor customer Ontario Power Generation. But did that ship already sail?

OPG appears willing to talk with and about any reactor vendor whose offering is based on fuel that is not made in Canada. ATR's offering was invented precisely so that its entire value chain stays in this country.

This is concerning to us. We worry our employer OPG is on the verge of making a misguided and short sighted decision.

Trade disruptions, real and threatened OPG's predecessor Ontario Hydro co-invented CANDU in partnership with AECL expressly to ensure energy security. This wasn't an abstract concept, then or now. We love Americans, but we cannot ignore the near century of real or threatened trade disruptions caused by our American cousins, from Smoot-Hawley, the Nixon Shock, and the Clinton Softwood Tariffs, to the Trump NAFTA re-write, Biden's cancellation of Keystone XL, Trump/Biden Buy-American, and the Line 5 dispute.

In the nuclear space, the U.S. has refused to support Canada's bid to acquire enrichment capability. It then cut off our supply of enriched uranium. This had devastating consequences for Canadian medicine and our nuclear industry.

How wise is it for us to adopt technology that makes us dependent on a foreign supplier of enriched fuel? CANDU is armour that permanently protects us from all of this. It keeps our lights on, our fridges running, our toilets flushing—and our medical system well-supplied with lifesaving isotopes—safely and pollution-free, no matter the geopolitical circumstances or who's in the White House or who holds the U.S. Senate and House, or state governorships, senates, and houses.

Crazy politics insurance In view of the latter point, we think that jumping into the light water reactor world would be a more serious mistake today than it would have been in the 1960s—and it would have been a serious mistake then. Inventing CANDU, a power generation technology that shields us from self serving foreign political and commercial machinations, was both brilliant and supremely prudent, and that was in a time when politics in the U.S. was balanced and coherent. It's not that way today. It has great potential to get much worse. That's a major risk for Canada.

Embracing LWR exposes critical Canadian electricity production to the whims of a capricious foreign fuel supplier. Our employer OPG should reconsider its decision to embrace LWR, and rediscover the energy security, domestic employment, and medical isotope benefits of CANDU.

Kinectrics picks its side in the Ontario Reactor debate Calling CANDU a "national strategic asset," Kinectrics stepped firmly onto the right side in what we hope is a short, spirited, but civil competition for Ontario's, and Canada's, electrical future. This debate belongs in the public sphere, and we suspect the reason it has stayed behind closed doors (except in this publication and a few others) is because pro-LWR arguments simply could not survive an open debate.

Kinectrics was spun out of the R&D division of the old Ontario Hydro. That utility in its latter days was a nuclear utility, and more specifically a CANDU utility. Its entire technological being revolved around natural uranium and heavy water. Kinectrics points out that that's still true today. "CANDU technology ... renowned for its safety, efficiency, and versatility, stands as a source of pride for Canadians and remains a leading force in nuclear innovation worldwide. Six decades after it was first developed, it stands as the linchpin of a vibrant Canadian nuclear ecosystem that supports over 76,000 stable and well-remunerated jobs across a wide variety of professional and skilled trades fields, not to mention researchers at our world-class universities and research institutions." We couldn't have said it better.

A second Pt. Lepreau refurbishment? NB Power doesn't say no How long can a CANDU plant run? Answering that question involves delving into operational concepts like equivalent full power hours (EFPH), and integrity of major plant components. These bear on major decisions, like plant life extension and refurbishment. Pt. Lepreau has not performed as hoped after its first refurbishment, and consensus over why that is seems to be coalescing around (1) decisions taken about what exactly to refurbish, and (2) how to operate the plant post refurbishment in light of (1).

Lepreau's current EFPH hold point is 210,000 hours (sound familiar?). At current rates of performance, and with an additional program to address components that weren't part of the original refurbishment, the refurbished plant would reach 210k by 2041. At that point it could be refurbished again, perhaps depending on EFPH findings from Pickering.

All of this occurs in the context of an arrangement between NB Power and OPG to tackle exactly these performance issues. This arrangement could develop into formal co-ownership of Lepreau. We are confident our employers will successfully sort out the plant's issues, and that Lepreau will soon see Ontario-like performance, which is the best in the world.

Is there a role for private finance here? Any, say, Big Five Canadian bank looking for a power purchase agreement (PPA), with a generator capable of bona fide non-emitting output that you can literally take to the bank, should at least inquire. CNWC published a series of articles on how one of the Big Five, RBC, could solve some persistent image problems while making money being truly green. It's never too late to do the right thing.

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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 ● 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 ● Public Service Alliance of Canada ● Society of United Professionals ● Society of Professional Engineers and Associates ● United Steel Workers ● UNIFOR ● District Labour Councils (Grey/Bruce, Durham, Lindsay, Northumberland, Ottawa, and Saint John).

What others are saying
(Alberta, take note)

Commissioner Mark Christie, who is a strong advocate for grid reliability, took the opportunity to talk about the week's winter storms during a Federal Energy Regulatory Commission (FERC) January 18, 2024, open meeting. Commissioner Christie commended the nation's system operators for a job well done in maintaining power throughout frigid temperatures and snow that blanketed much of the country. He spoke about the energy supply mix in the PJM and Midcontinent Independent System Operator (MISO) regions during the previous several days, specifically offering January 17 as an example of the performance of dispatchable resources.

On that day, PJM saw electricity demand peak at around 135 gigawatts (GW) with 90 percent of generation supplied by dispatchables that kept "the heat pumps going so people wouldn't freeze." MISO peaked at around 105 GW with dispatchable resources providing 77 percent of electricity, natural gas and coal each providing 34 percent of generation, and nuclear 9 percent.

But about the future, Commissioner Christie had this to say, "We know in PJM, because they've already told us, they're going to lose anywhere from 40 to 50 GW of dispatchable resources in the next few years. We know that MISO is losing dispatchable resources. They've warned that they're going to be looking at a shortfall of around 5 GW within just a few years."

The North American Electric Reliability Corporation (NERC) has been warning that the pace of the energy transition to wind and solar is unsustainable primarily because of the expected loss of dispatchable resources. NERC's 2023 Long-Term Reliability Assessment reported that the nation could expect to lose almost 83 GW of dispatchable resources, mostly coal and nuclear, within the next decade.

That worries Commissioner Christie who pointed out that the nation is headed toward a "very bad place" if the pace continues. Directing his comments to PJM and MISO, Commissioner Christie cautioned that "If you don't maintain these dispatchable resources until you have adequate replacements, we're not going to have the success we had in the last three or four days. And instead of having those lights stay on and those heat pumps keep running, they're not."

Commissioner Christie concluded with one last observation, "The pace of retirements is a significant issue that we all have to deal with because that's the threat that's coming." We anticipate more winter storms over the next several months and we expect that FERC and Commissioner Christie will continue to keep the pressure on grid operators and utilities to take responsible action to ensure grid reliability.

Source: "FERC Commissioner Mark Christie – we're headed toward a very bad place" *America's Power*, January 24, 2024 https://americaspower.org/ferc-commissioner-mark-christie-were-headed-toward-a-very-bad-place/

Worth repeating

Leif Sollid, the manager of communications for the AESO, spoke to Global News on Monday and acknowledged "the power grid has been under a lot of pressure" ever since particularly cold weather arrived in Alberta last week.

"We set an all-time record last Thursday for power demand," he recounted. "We were able to get through that OK. We had a lot of wind on the system. We didn't have really any natural gas facilities offline. So we got through that fine.

"But since then, Friday, Saturday, Sunday and even this morning, we've been under what we call a grid alert condition — that's where we've used all available power to meet demand and we're now having to use backup power because we've exhausted our available supply."

Source: "Alberta Electric System Operator lifts Monday morning grid alert as cold snap continues" *Global News*, January 15, 2024 https://globalnews.ca/news/10226206/electricity-grid-western-canada-cold/