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Written submission from Kenneth C Johnson

Mémoire de Kenneth C Johnson

In the Matter of the

Ontario Power Generation Inc.

Application for a licence to construct one BWRX-300 reactor at the Darlington New Nuclear Project Site (DNNP)

Commission Public Hearing
Part-2

January 8, 2024

À l'égard d'

Ontario Power Generation Inc.

Demande visant à construire 1 réacteur BWRX-300 sur le site du projet de nouvelle centrale nucléaire de Darlington (PNCND)

Audience publique de la Commission
Partie-2

8 janvier 2024

Canada

Small Modular Reactors: Still too expensive, too slow and too risky

Submission to the CNSC January 2025 Hearings

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November 2, 2024

"**The rhetoric from small modular reactor (SMR) advocates is loud and persistent:** This time will be different because the cost overruns and schedule delays that have plagued large reactor construction projects will not be repeated with the new designs. But the few SMRs that have been built (or have been started) paint a different picture—one that looks startingly similar to the past. Significant construction delays are still the norm and costs have continued to climb."

"IEEFA has taken a close look at the data available from the four SMRs currently in operation or under construction, as well as new information about projected costs from some of the leading SMR developers in the U.S. The results of the analysis show little has changed from our previous work. **SMRs still are too expensive, too slow to build, and too risky to play a significant role in transitioning from fossil fuels in the coming 10 to 15 years."**

"It is vital that this debate consider the opportunity costs associated with the SMR push. **The dollars invested in SMRs will not be available for use in building out a wind, solar and battery**

storage resource base. These carbon-free and lower-cost technologies are available today and can push the transition from fossil fuels forward significantly in the coming 10 years—years when SMRs will still be looking for licensing approval and construction funding."

Institute for Energy Economics and Financial Analysis
June 2024

Introduction:

At a time when there is exponential growth in renewable energy across the planet, including in the United States, it is extremely worrying that Ontario has been taking the cavalier position of blocking the buildout of renewables and going all in on a risky gambit to expand nuclear power generation through the build out of Small Modular Reactors (SMR's).

This strategy almost guarantees that Ontario will fall far short in it's ability to meet our Paris goal of reducing our carbon footprint in half by 2030. It will leave Ontario as a shameful laggard in Canadian and international efforts to maintain a livable planet and keep global warming to 1.5 C. It will also leave Ontario with very expensive new electricity and serious debt.

SMRs - Too Slow, Too Expensive, Too Risky

There have been almost no reactors built in the last 30 years across North America, and that alone should give Ontario pause.

The few SMRs that have been built internationally have gone significantly over budget (See Figure 1 and Figure 2):

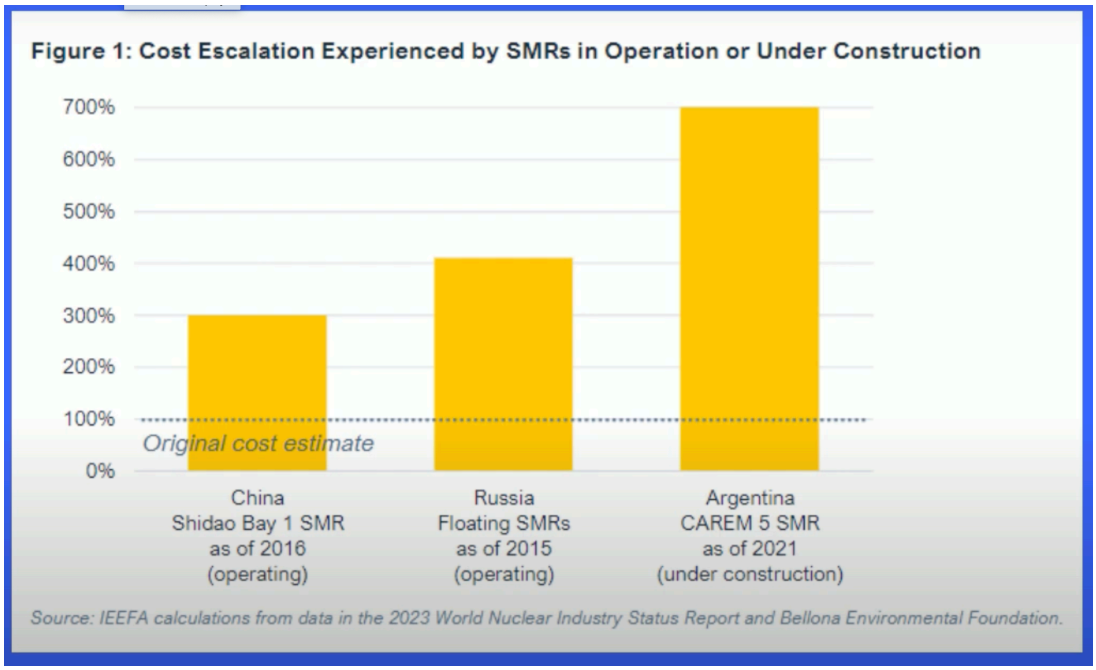
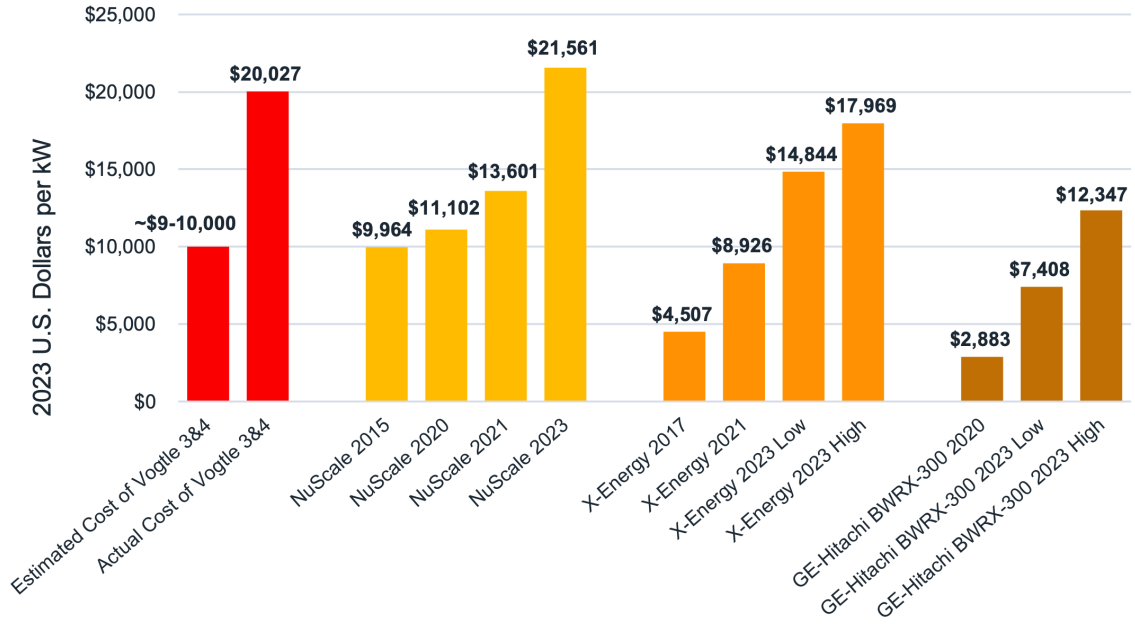
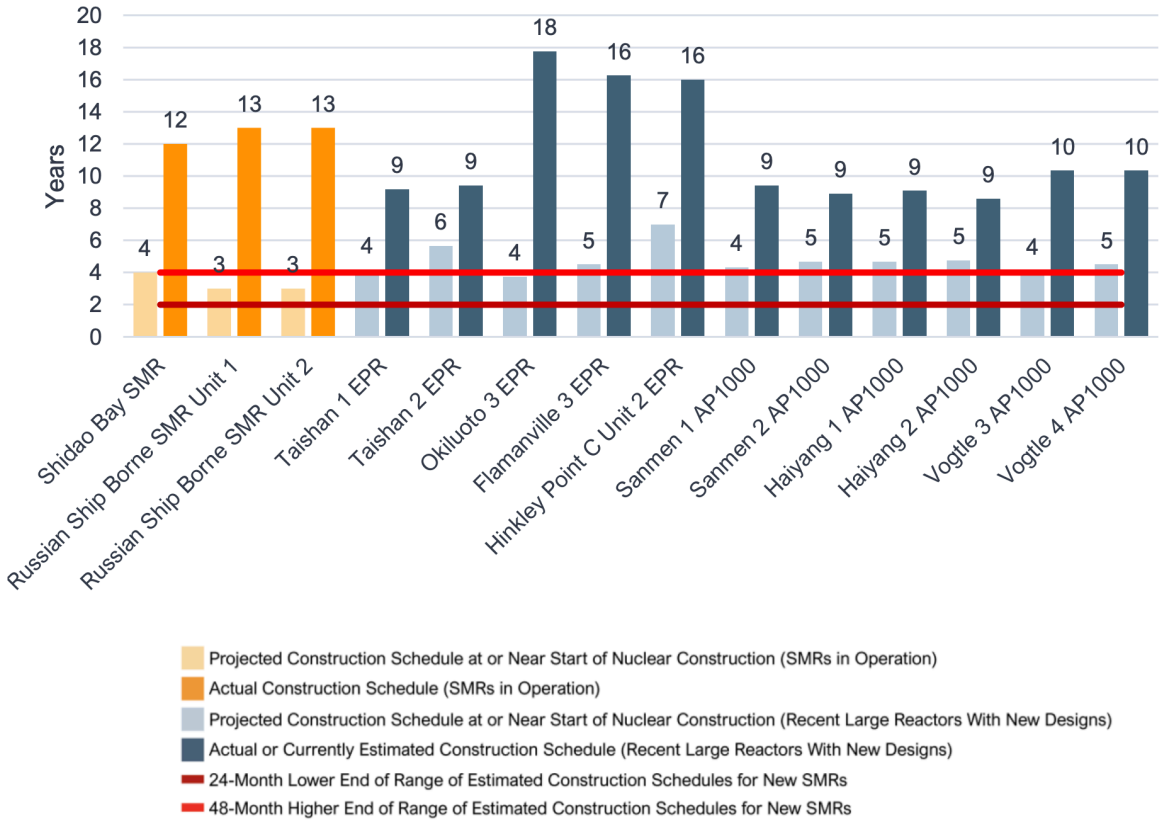


Figure 2: Projected Cost Increases for Proposed U.S. SMRs



Source: IEEFA calculations based on public data for each of the projects converted to 2023-year U.S. dollars. For example, see the GE Hitachi website, Four reactors could cost Saskatchewan $12 to $20 billion,, X-Energy and ARES Acquisition Corporation Announce Strategic Update, Georgia Power Company's monthly and Quarterly Reports to the Georgia Public Service Commission

Figure 4: Nuclear Construction Reality vs. Rhetoric



Source: IAEA Power Reactor Information System, EDF, 2023 World Nuclear Industry Status Report.

And the recently built nuclear plants have taken much longer than the proponents estimated.(Figure 4)

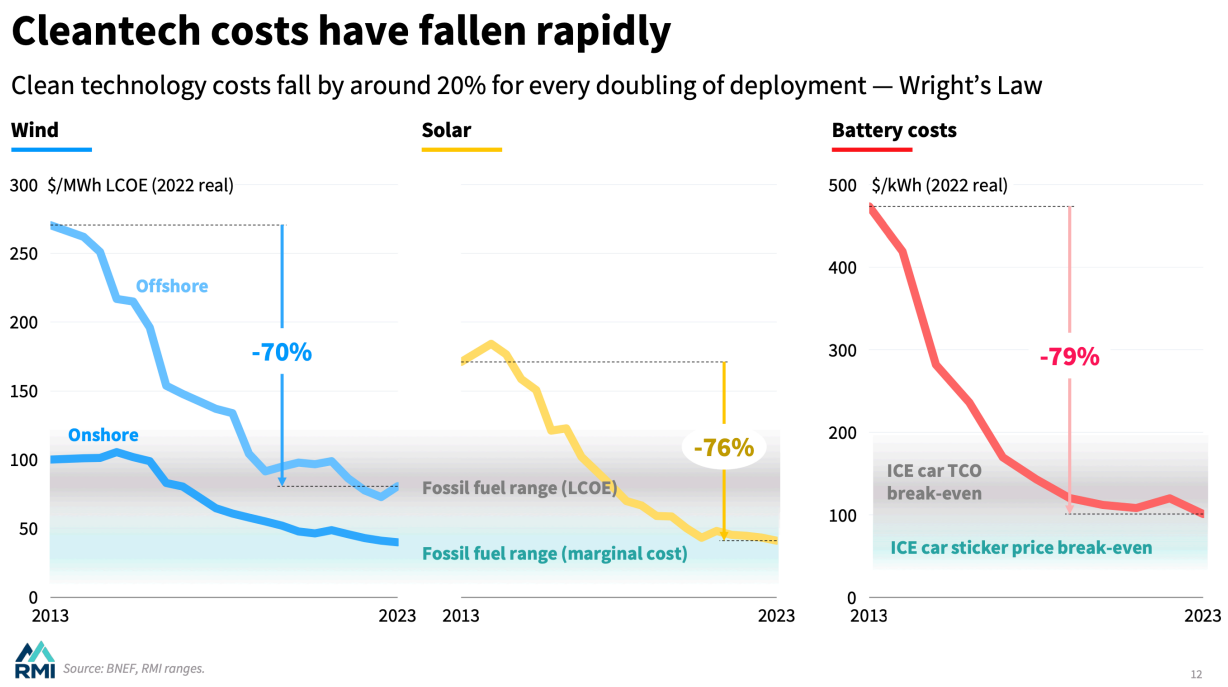
The pattern of spiralling costs and spiralling build times almost guarantee that Ontario's planned SMR's at Darlington will result in extremely expensive electricity that will not come online for close to a decade or more. This will contribute to a reduction in Ontario's industrial competitiveness.

In the mean time, the opportunity costs associated with tying up so much capital in these SMRs will undermine Ontario's ability to build out renewables that would cut our carbon footprint far sooner and provide competitive electricity prices. Ontario will once again be piling up nuclear debt - the kind of debt that resulted in the the breakup of Ontario Hydro.

Renewables

On the other hand, renewable energy - wind, solar and batteries have been on a very different path - consistently falling costs and exponential growth.

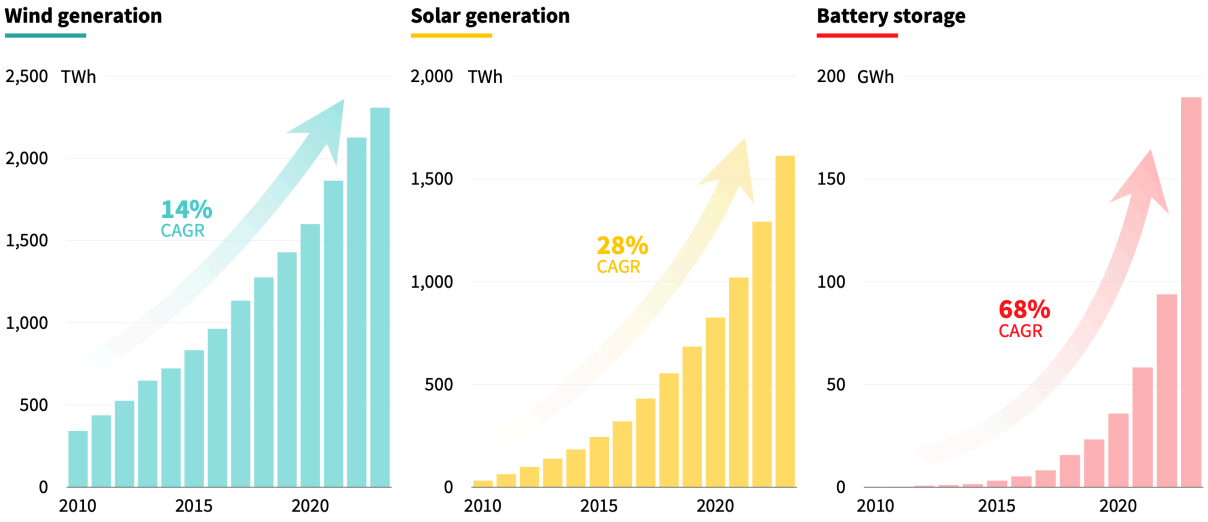
Cost reductions over the last decade have been astounding: offshore wind and dropped 70% in cost; solar has dropped 76% and battery costs are down 79%.



The rapidly falling costs of renewables, and the fact that solar and wind are now the cheapest way to create electricity almost everywhere, combined with countries' Paris Agreement commitments have resulted in astonishingly fast build out of renewables over the last decade:

Leading to exponential growth in renewables

Global solar generation has been doubling every 2–3 years, and battery storage capacity every year



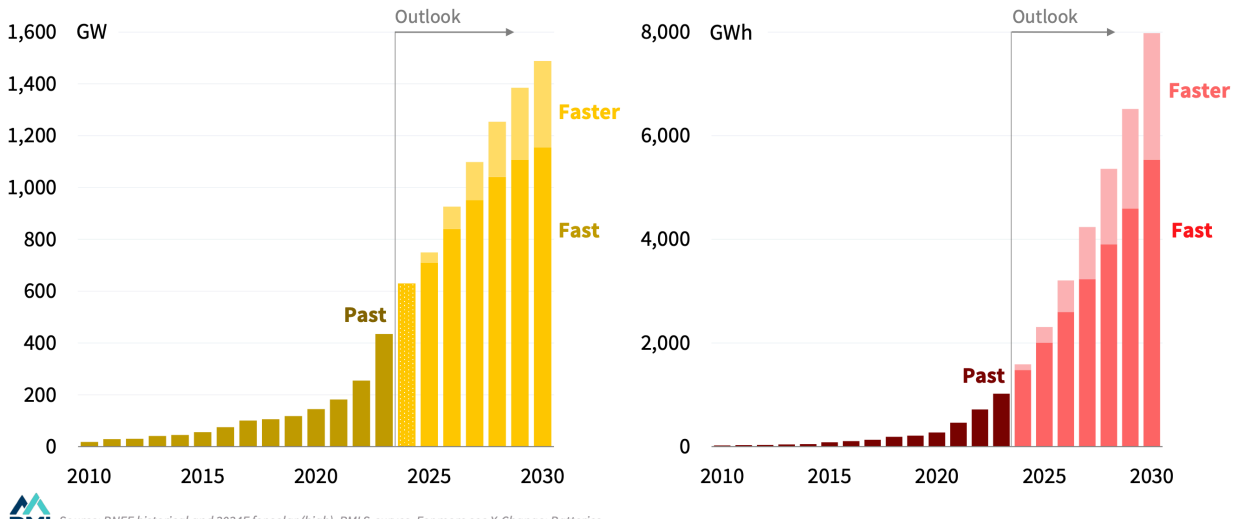
Source: IEA, BNEF; Note: CAGR is the compound annual growth rate between 2013 and 2023.

And here's where the world is heading on renewables - continued and accelerating exponential growth. In fact the world may be almost on target to meet the recent COP commitment of tripling renewables by 2030.

Super-fast growth in solar and battery sales

Solar sales are on track for over 1,000 GW per year by 2030

Battery sales are likely to be over 6,000 GWh a year by 2030



Source: BNEF historical and 2024E for solar (high), RMI S-curves. For more see X-Change: Batteries.

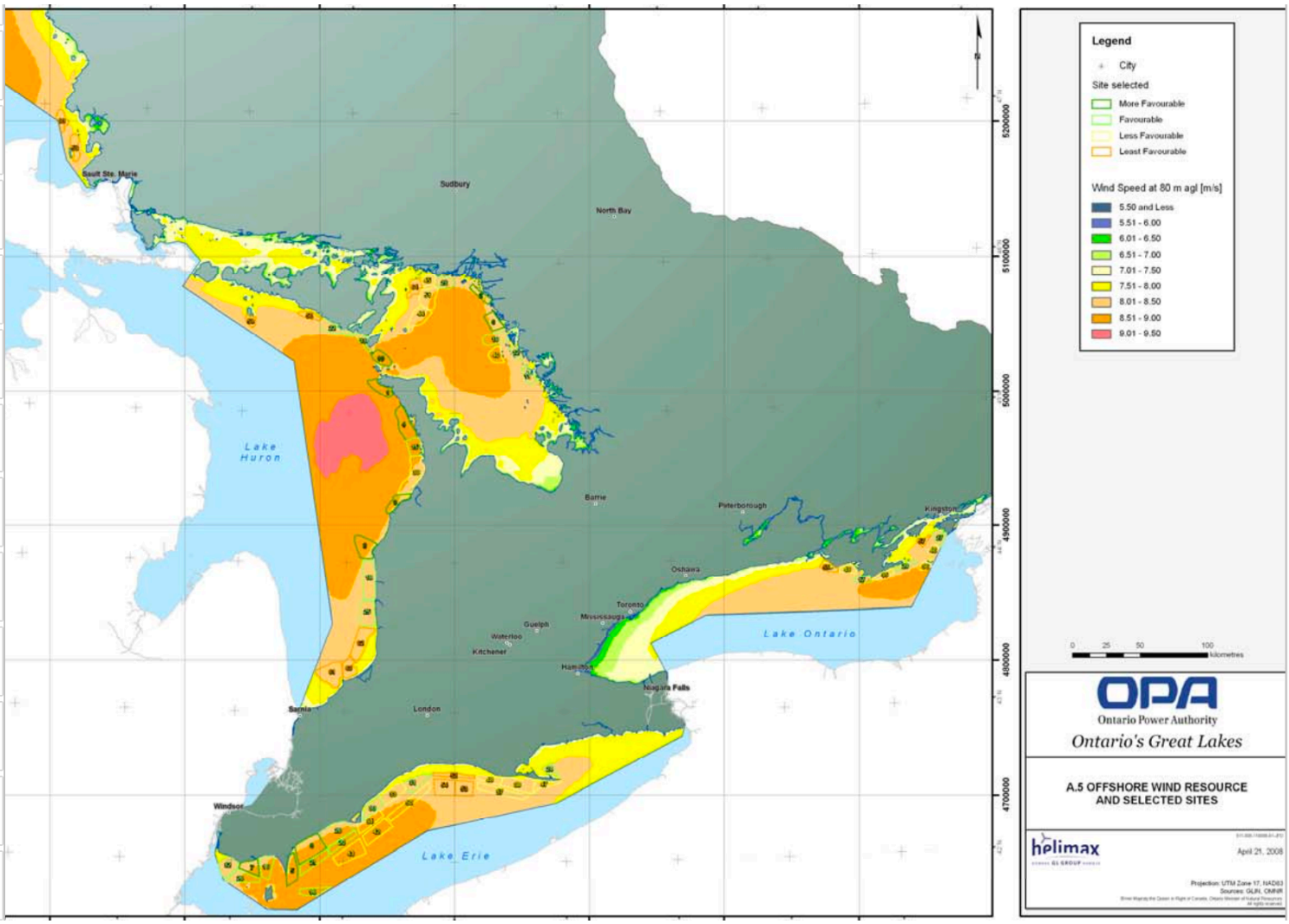
Renewables in Ontario

The cost of renewables has become more than competitive with fossil fuels let alone with the higher cost energy from nuclear plants. I worry about the economic disadvantage that Ontario will sustain if we build more nuclear plants given the high cost of building them and the premium-priced electricity they will produce. The inevitable cost over runs and the long time to build them at the best of times, will unnecessarily saddle Ontario with high-priced electricity from these SMR's.

The IEA has made it clear that this is the decade where we have to cut missions by 50% to have any chance of staying within reasonable climate bounds. And yet the drive to go nuclear in Ontario is a false solution — 10 years from now, when the SMR costs have likely spiralled and we're still trying to get the first of these new types of reactors running, we could have installed offshore wind parks that could be dealing with new electricity demand in Ontario with competitive-costed electricity.

Offshore Wind in the Great Lakes - A Smarter More Prudent Path

Hélimax corporation was commissioned in 2008 by the Ontario Government to examine the potential for offshore wind in the Great Lakes to power Ontario's grid. What they came up with was that it was not only feasible but viable. Sixty-four locations were identified that met strict criteria: depths no more 30 metres; average wind speeds more than 8 metres/second to guarantee the efficiency of the turbines; and strict criteria for social, socio- economic and environmental factors.


Legend
City
Site selected
More Favourable
Favourable
Less Favourable
Least Favourable
Wind Speed at 80 m agl [m/s]
5.50 and Less
5.51 - 6.00
6.01 - 6.50
6.51 - 7.00
7.01 - 7.50
7.51 - 8.00
8.01 - 8.50
8.51 - 9.00
9.01 - 9.50
Sault Ste. Marie
Sudbury
North Bay
Lake Huron
Barrie
Peterborough
Kingston
Oshawa
Toronto
Mississauga
Guelph
Waterloo
Kitchener
Hamilton
Niagara Falls
Lake Ontario
Sarnia
London
Windsor
Lake Erie
0 25 50 100
kilometres
OPA
Ontario Power Authority
Ontario's Great Lakes
A.5 OFFSHORE WIND RESOURCE AND SELECTED SITES
helimax
April 21, 2008
Projection: UTM Zone 17, NAD83
Sources: GLFI, OMNR

With the dramatic decrease in the cost of wind energy over the last decade and a half and the technological improvements in offshore turbine technology, the case in 2024 is far stronger than it was in 2008.

Renewables Variability and Collaboration with Quebec

The variable energy produced by wind turbines and solar are always held up as a reason that it cannot provide dependable grid electricity. That is simply not the case in Ontario. A strategy has been developed to export electricity to Quebec when we have excess power from renewables, which would allow Quebec Hydro to hold water in their northern Quebec dams and then when Ontario needs the energy the northern damns could create electricity and export it to Ontario on largely existing power lines. This would be by far the most cost-effective way to deal with the renewable storage issue.

At the same time there are other a number of other possible strategies. Battery technology is improving very quickly and the costs are plummeting for lithium ion battery packs of all sizes. Furthermore, with the increasing fleet of electric cars, there's the potential to contract with owners to use electric car batteries as grid storage, providing energy when demand is high and storing energy when excess electricity is available.

Conclusions:

I would suggest that Ontario's desire to significantly increase the amount of nuclear power is both shortsighted doesn't deal with the existing problems with nuclear and will cost once again cost Ontario an enormous amount of debt. We should not forget the break up Hydro was the result of the billions of dollars in debt that the nuclear industry in Ontario and has never properly dealt with other than charging consumers more and carrying enormous debt high, we move

to a more economic strategy with less risks and more benefits for Ontario.

In its recent report, "Small Modular Reactors: Still too expensive, too slow and too risky" the Institute for Energy Economics and Financial Analysis provided key takeaway messages. I recommend that the CNSC adopt them:

- Regulators who will be asked to approve utility or developer-backed SMR proposals should craft restrictions to prevent delays and cost increases from being pushed onto ratepayers.
- Utilities that are considering SMRs should be required to compare the technology's uncertain costs and completion dates with the known costs and construction timetables of renewable alternatives. Utilities that still opt for the SMR option should be required to put shareholder funds at risk if costs and construction times exceed utility estimates.
- State and federal governments should require that estimated SMR construction costs and schedules be publicly available so that utility ratepayers, taxpayers and investors are better able to assess the magnitude of the SMR-related financial risks that they may be forced to bear.
- Finally, it is vital that this debate consider the opportunity costs associated with the SMR push. The dollars invested in SMRs will not be available for use in building out a wind, solar and battery storage resource base. These carbon-free and lower-cost technologies are available today and can push the transition from fossil fuels forward significantly in the coming 10 years—years when SMRs will still be looking for licensing approval and construction funding.