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Rethinking Ontario's Long-Term Energy Plan

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This paper was influenced by the author's previous in-depth and detailed assessment of the 2010 LTEP and Ontario's electricity sector. This work, entitled "Ontario Electricity Options Comparison", was a submission during the LTEP 2013 consultation process.

Mr. Brouillette is currently acting as both a nuclear and financial advisor to Natural Resources Canada on the restructuring of Atomic Energy of Canada Limited's nuclear science and technology laboratory. He can be reached at marc@strapolec.ca.

Declaration of Interest

The analyses presented in this CCRE publication were motivated by the personal curiosity of the author to evaluate how the 2013 LTEP reflected the author's previous assessments. As such, the views expressed in this paper are the personal views of Marc Brouillette and should not be viewed as representing the views of any of his present or previous employers, clients, or business associates.

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Rethinking Ontario's Long-Term Energy Plan

Marc Brouillette

The 2013 Ontario Long-Term Energy Plan (LTEP) is a roadmap claiming to "provide clean, reliable and affordable energy Ontario will need now and into the future." However, compared to other options in the 2010 LTEP it replaces, this 20-year plan represents a cost of $60 billion and 110,000 jobs to Ontario's economy. As well, implementing this plan increases greenhouse gas (GHG) emissions by 50 per cent.

Why these serious downsides? For one thing, the plan places too much emphasis on renewables, specifically wind, at the expense of reducing the nuclear power generation capacity that would best meet future energy needs. Independent analysis (Brouillette, 2013) has shown that, among the available supply-mix choices, a greater emphasis on nuclear, such as in the previous 2010 LTEP, is a much better route to achieving the current plan's stated objectives.[1]

"2013 LTEP is far from the 'clean, reliable and affordable' energy Ontario needs"

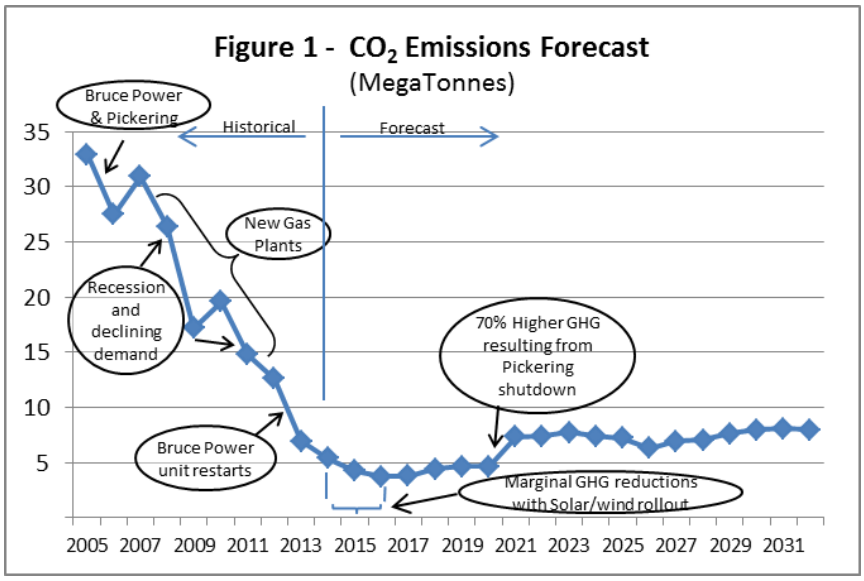
The consequence is that, far from being "clean, reliable and affordable," the 2013 LTEP supply mix represents a decision:[2]
- against a greener electricity system;
- against greater system reliability;
- against the lowest-cost solution for ratepayers;
- against growth in Ontario's economy; and,
- against a better footing from which to build Ontario's energy future.

1) AGAINST A GREENER ELECTRICITY SYSTEM

The 2013 LTEP infers that the *Green Economy Act* (Ontario 2009) is responsible for the phase-out of coal and associated GHG reductions. Yet, the true enabler of the coal phase-out has been nuclear refurbishment and new natural gas capacity. Together along with the recent recession, they have removed 85 per cent of the CO2 emissions from Ontario's electrical generation system since 2005 – a reduction of 25 megatonnes/year. Figure 1 reflects the LTEP plan to triple wind and solar capacity and forecasts only a modest 1.7 megatonnes/year reduction in GHG by 2017.

[1] Brouillette (2013) considered the viability of various alternatives, including such topics as the physical limitations of increasing hydro and importing capacity.

[2] These assessments are based on the 2013 LTEP stated assumptions.

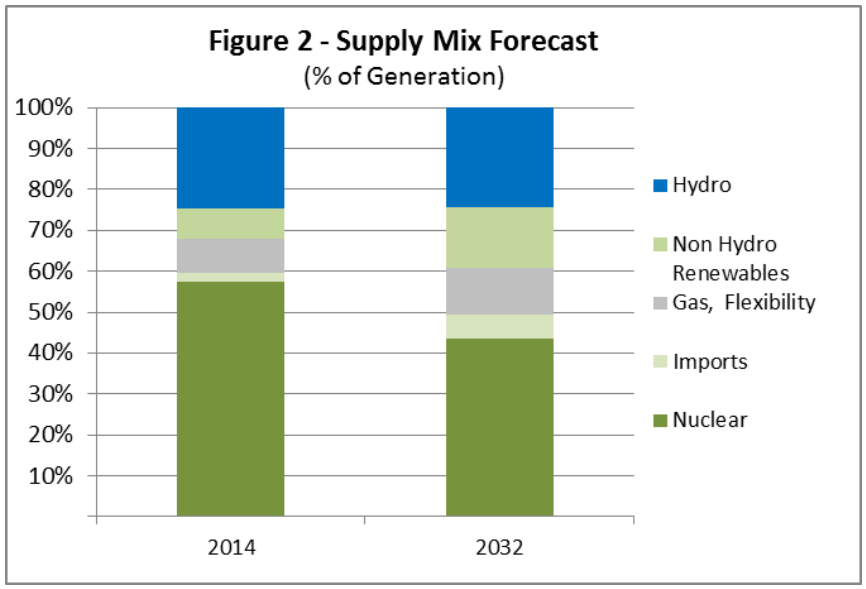


Source: Ontario MOE data files, Strapolec analysis

"Wind's Gas-fired backup increases total electricity GHG emissions by 70%"

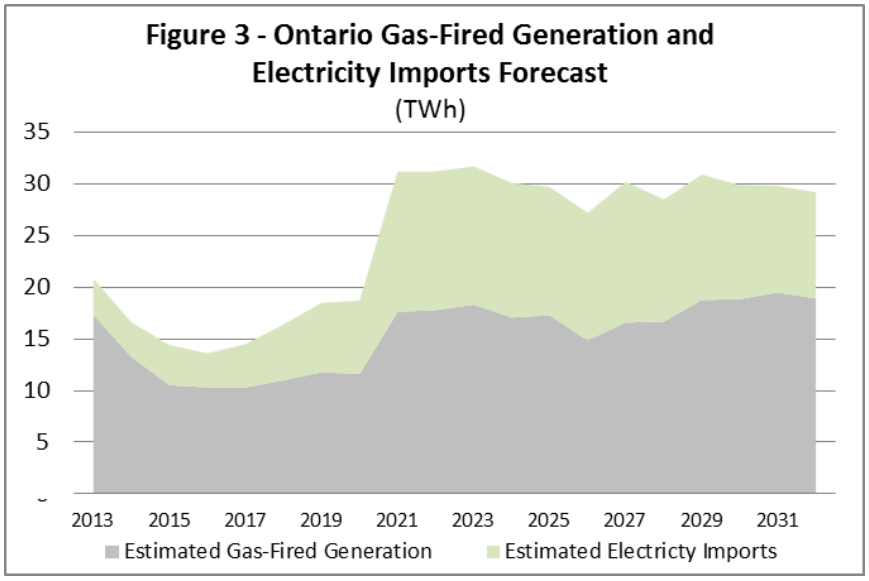
By cancelling plans for new nuclear, the LTEP emphasis on intermittent and unreliable wind supply requires additional gas-fired generation as backup. After Pickering's scheduled closure in 2020, this generation will increase GHG emissions by 70 per cent or four megatonnes/year. The 2010 LTEP plan that included new-build nuclear would have obviated this.

Indeed, the LTEP data shows that renewables won't reduce GHG emissions, replace coal or reduce gas-fired generation but will displace non-GHG producing nuclear generation.



Source: Ontario MOE data files, Strapolec analysis

Between 2014 and 2032, the LTEP calls for more than doubling non-hydro renewables to become 15 per cent of the supply mix, and gas-fired generation increasing to 11 per cent of total supply. Over the same period, nuclear generation drops from 57 per cent to 44 per cent of the total.



Source: Ontario MOE data files, Strapolec analysis

"Wind is not reliable or 'always there, always on' "

Furthermore, the 2013 LTEP forecast of GHG emissions is predicated on doubling electricity imports to six per cent of the supply mix. Achieving this level of imports faces several serious challenges. Intertie transmission capacity may be inadequate[3] and if imports are to displace on-peak gas-fired generation they will be expensive. The LTEP states that these uncertainties could be addressed by additional gas-fired generation which could increase GHG emissions by a further 30 per cent to 40 per cent.

Clearly, in contrast to the previous 2010 LTEP's planned sustainment of Ontario's nuclear capacity, the current plan's growth in renewables will cause an increase in gas-fired generation and, therefore, result in an electricity system that is less "green," as measured by GHG emissions.

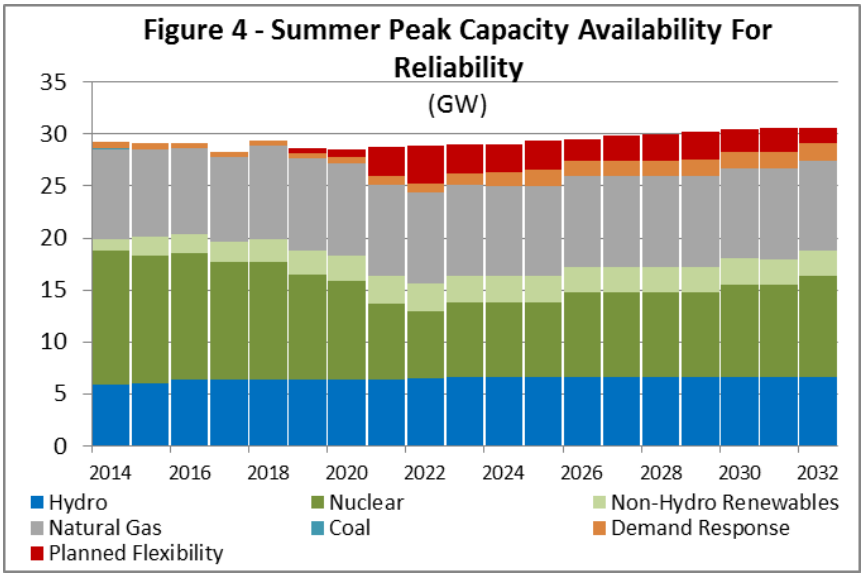
2) AGAINST GREATER SYSTEM RELIABILITY

Wind is not a reliable source of power because it is intermittent and may not be available to meet varying demand. It may not be there when demand requires it. Intuitively, reliability means, as with nuclear or gas-fired generation, "always there, always on." Wind is not that.

It is a conundrum that the LTEP is promoting wind to displace nuclear which is the most reliable, clean baseload generation available. To compensate for wind's unreliability, the plan will require redundant, GHG-producing gas-fired generation capacity to fill the gaps. Nuclear capacity, on the other hand, directly addresses reliability.

Also, installed wind capacity does not satisfy international standards for electricity reliability. These standards are a prerequisite for interconnection with neighbours and the imports the LTEP counts on. When applying the North American Electric Reliability Corporation (NERC) standards[7] to Ontario's peaks, wind capacity is substantially de-rated, particularly in the summer.

[3] Analysis (Brouillette 2013) of diurnal supply and demand patterns shows that the current interties' peak capacity will be reached more frequently, and sometimes substantially exceeded, with a supply mix similar to that proposed by the 2013 LTEP.
[4] NERC standards are used to ensure system reliability throughout North America, including Ontario.

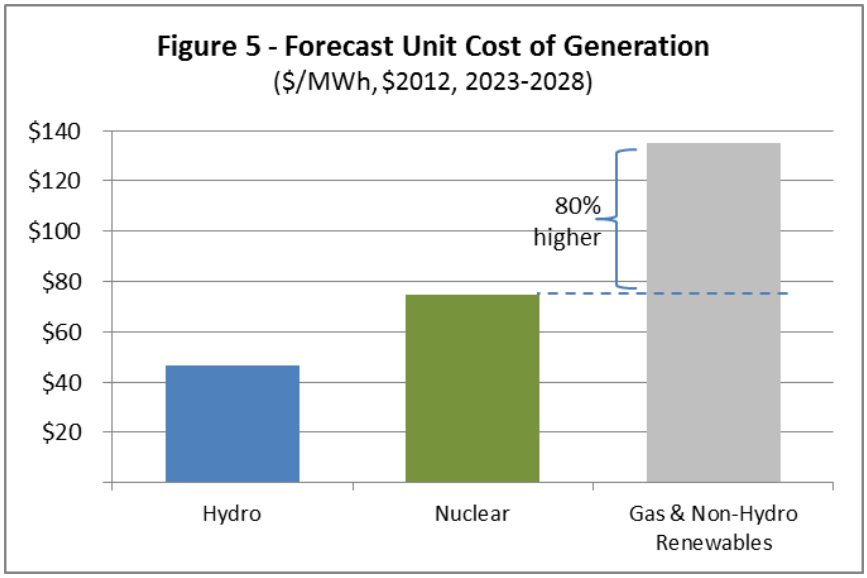


Source: Ontario MOE data files, Strapolec analysis

"Compared to hydro, other renewables cost twice as much for one-third less power"

3) AGAINST THE LOWEST-COST SOLUTION FOR RATEPAYERS

The projected 2013 LTEP average generation unit costs for 2023 to 2028 show hydro is the lowest cost at $50/megawatt hour (MWh) and will account for about one-quarter of supply at an annual cost of $2 billion. Nuclear is the next cheapest source at $75/MWh, covering 40 per cent of the supply and costing $4.6 billion annually. The blended cost of natural gas and non-hydro renewables at $135/MWh is the highest, almost double the cost of nuclear, and costing $6 billion per year to fulfil less than one-third of demand. The non-hydro renewables alone, at only 16 per cent of the supply, will cost over $4 billion/year, twice as much as hydro for one-third less power.



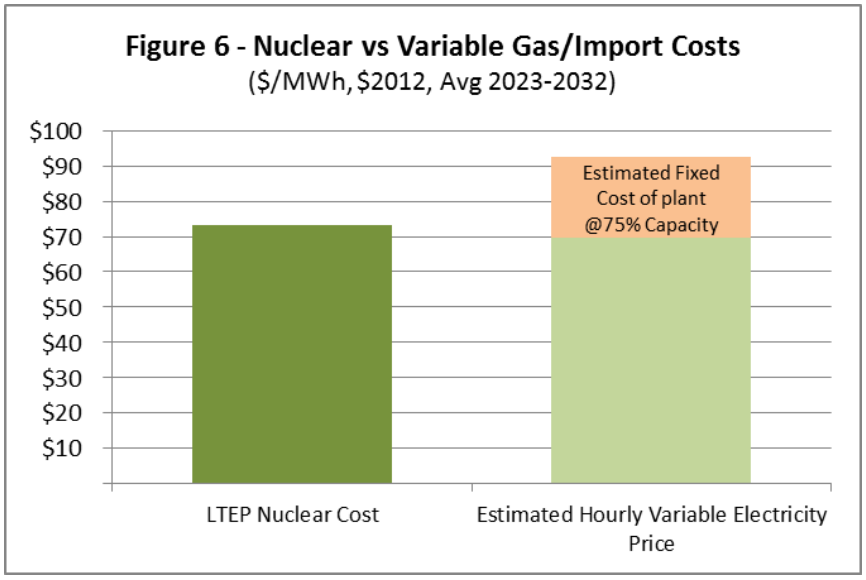
Source: Ontario MOE data files, Strapolec analysis

In contrast, adding the 2010 LTEP planned 2,400 MW of new-build nuclear at $90-$100/MWh[5] to displace wind and gas-fired additions would reduce the total annual cost of Ontario's supply by $650 million to $900 million.

4) AGAINST GROWTH IN ONTARIO'S ECONOMY

Over its 20-year timeframe and in comparison to the 2010 LTEP, the 2013 LTEP's choice of wind over nuclear has been shown to have potential negative impacts of $60 billion on the economy and 110,000 person-years in job losses (Brouillette 2013). These are direct impacts that consider the cost of electricity and domestic spending by Ontario business on both capital and operations. These negative consequences of the 2013 LTEP result from its indefinite deferral of new nuclear build, lack of full commitment to nuclear refurbishment[6] and potentially early Pickering closure.

"Ontario economy could lose $60B and 110,000 jobs"



Source: Ontario MOE data files, Strapolec analysis

An example of a contribution to this negative economic impact is that the average variable costs alone for electricity imports and new natural gas plants in the final decade of the LTEP are similar to the annualized average *full life-cycle costs*[7] of the refurbished nuclear generation. Nuclear would have to experience over 25 per cent higher cost growth before it compared to the fixed cost of the additional gas plants.

An additional impact of the 2013 LTEP is that the cost of importing electricity represents cash that leaves the province while 70-80 per cent of nuclear expenses go to Ontario residents and businesses. The LTEP projections suggest that Ontario will spend over $1 billion annually for imported energy after Pickering closes in 2021. Over the remaining LTEP horizon, this could cost the Ontario economy more than $10 billion.

[5] Analysis (Brouillette 2013) of nuclear-cost estimates, including from the OECD's Nuclear Energy Agency and the U.S. Energy Information Administration, was applied to the Ontario situation, including financing costs. A 10 per cent margin was added to create the full life-cycle cost range of $90-$100/MWh, which is encompassed by the 2013 LTEP ranges of $85 to $140/MWh, albeit at the lower end.

[6] The 2013 LTEP has included the refurbished nuclear fleet in its plan, but is very clear that this inclusion is strictly dependent on the ability of the nuclear industry to ensure the timely and cost-effective achievement of the refurbishments. It is not clear what that means as, even with significant cost overruns, nuclear would remain well below the cost of wind and not suffer the GHG downside of wind's gas-fired backup. The nuclear industry has created several action committees to address the cost risks of refurbishment.

[7] It is noteworthy that, throughout, the LTEP uses full life-cycle costs for nuclear but not for wind or gas-fired generation.

5) AGAINST A BETTER FOOTING FROM WHICH TO BUILD ONTARIO'S ENERGY FUTURE

The 2013 LTEP commits to a supply mix that not only displaces nuclear today but also limits options for nuclear decisions in the future. This is because increasing installed wind capacity undermines the cost effectiveness of subsequent nuclear power. The intermittent wind supply is predominantly produced during low-demand times that would normally be supplied by Ontario's existing clean baseload supply (both hydro and nuclear).

As the first wind farms will reach their end-of-life five years before the 2033 horizon of the LTEP, a fundamental question is whether the LTEP includes like-for-like end-of-life replacement of wind capacity and its necessary gas-fired backup. Since wind and gas-fired generation projects have lead times of less than five years, the LTEP's silence on their replacement reflects political expediency and implies an unstated likelihood of ongoing replacement. Nuclear decisions, in contrast, require explicit long-term thinking as they involve 10 years to implement in return for a multi-decade payback. The LTEP over-commitment to wind today will likely preclude any future nuclear capacity decision for more than two decades.

"Locked into costly GHG-producing future"

For the period beyond those decades, the LTEP refers to emerging issues that may influence longer-term decisions. But will there be a 10-year notice period for considering these undefined "emerging issues"? Or a transition that enables a nuclear debate to be engaged? The short-term focus that produced the LTEP is an unlikely vehicle. With the 2013 LTEP, Ontario is at risk of being locked into a costly GHG-producing gas-fired future that will be very expensive to exit.

CONCLUSION

Implementing the 2013 LTEP supply mix would have irreversible consequences leading to significantly fewer jobs, sustained higher costs, sustained higher emissions and a greater provincial trade deficit. It is truly puzzling why Ontario has chosen to continue aggressive wind capacity build-out and curtail previous nuclear plans when nuclear not only represents a significant employer of Ontarians and provincial export business, but is also much greener and lower in costs.

REFERENCES

Brouillette, Marc. "Ontario Electricity Options Comparison." Submission to the Ontario Long-Term Energy Planning Consultation Process by Strategic Policy Economics (Strapolec). July 2013

Ontario Ministry of Energy. "Achieving Balance: Ontario's Long-Term Energy Plan." December 2013. Available at http://www.energy.gov.on.ca/en/ltep.

Legislative Assembly of Ontario. Green Energy and Green Economy Act, 2009. Available at http://www.e-laws.gov.on.ca/html/source/statutes/english/2009/elaws_src_s09012_e.htm.

Ontario Ministry of Energy. Excel data files available at http://www.energy.gov.on.ca/en/ltep/detailed-ltep-information-breakdown/