

Perspectives on Role of Natural Gas in Ontario's LTEP

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LTEP Forecast Gas Production and Capacity

Implications on GHG

Pricing implications to rate payers

Evaluation the Role of Natural Gas Generation in Ontario's Electricity Supply Mix

Questions posed to the Panel that are discussed here

- Explore the current and future state of gas generation in Ontario's supply mix
- Assess natural gas generation as a supply replacement for nuclear units undergoing refurbishment.
 - What impact will this have on Ontario's emission targets?
- How will the increased use of gas for generation affect Ontario ratepayers?

A Game of "What Ifs" that Span 20 Years

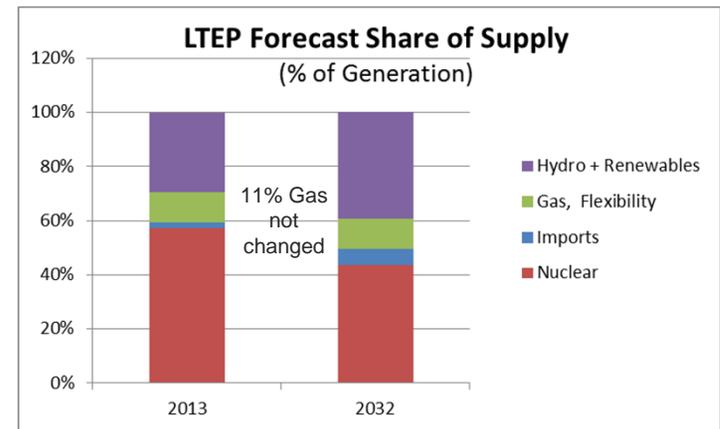
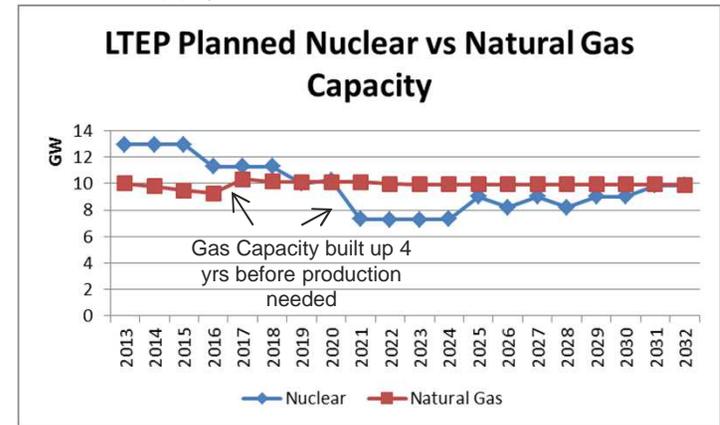
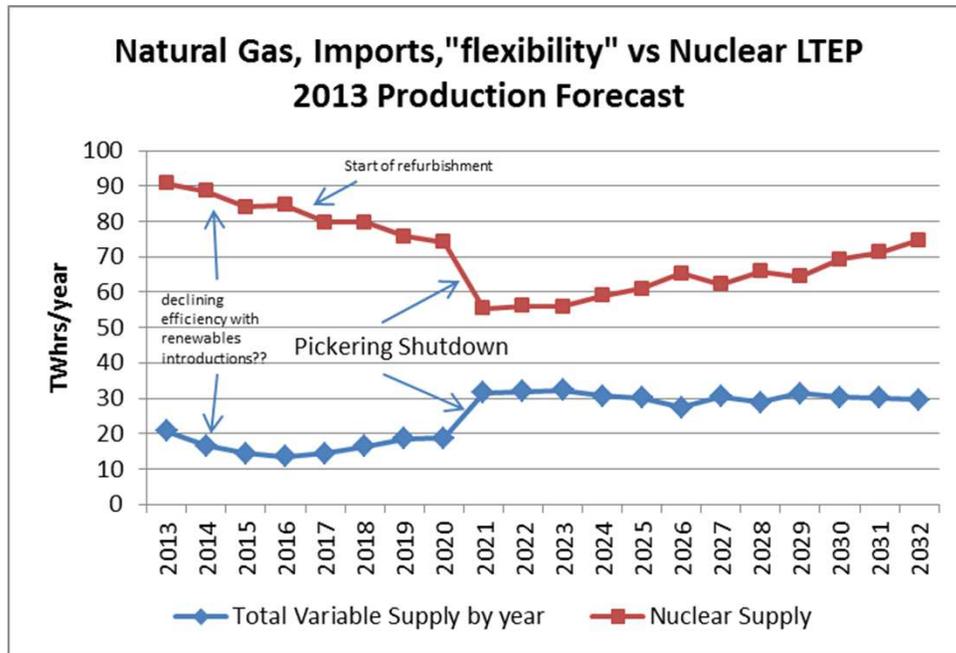
• What If:

- Nuclear refurbishments do not proceed or proceed faster, slower
- Renewables do not proceed, or proceed faster, slower
- US race accelerates to replace coal fired stations with natural gas fired generation
 - Is shale supply big enough
 - Can they get the supply to market
- Carbon gets attributed a cost
- The IESO market migrates towards greater regulated pricing based supply mix

LTEP 2013 Natural Gas Fired Generation Forecast Assumptions

Ontario's Supply Mix is migrating towards greater Gas-Fired Generation

- Utilization of Gas-fired assets will decline in near term but will return to 2013 levels in long term
- Gas fired generation is forecast to remain at about 11% of the production supply mix

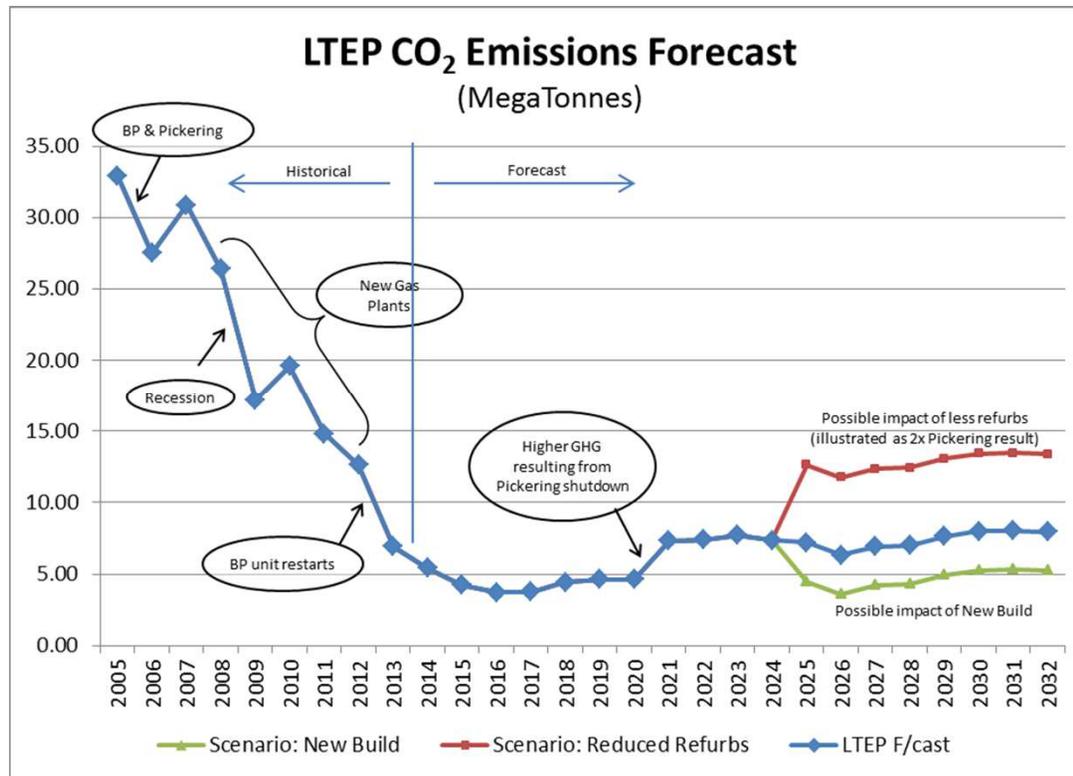


Note: imports are included here along with Gas as that is how OPA has released the info. Planned flexibility is included because it's growth is correlated with the Pickering shutdown and is only 1% of mix. Flexibility consists of clean imports, renegotiated NUG contracts, demand response, and conservation. OPA has combined flexibility with gas generation costs in its tables, Growth in imports appears to account for approximately 50% of the required generation shortfall when Pickering closes.

There are GHG emissions implications

Natural Gas Fired Generation, along with Nuclear, has played a role in reducing GHG emissions

- LTEP 50% CO₂ emission growth with Pickering shutdown assumes half required capacity will come from imports
 - Note that will be a quadrupling of imports over historical levels
- GHG emissions in future likely most impacted by nuclear capacity decisions affecting gas fired production



Scenario Illustration:

- Carbon premium of \$30/tonne (BC example)
- Cost to rate payer could swing \$250M/year or 10-15% on total cost of gas fired generation
- What is the possible range of related carbon premiums?

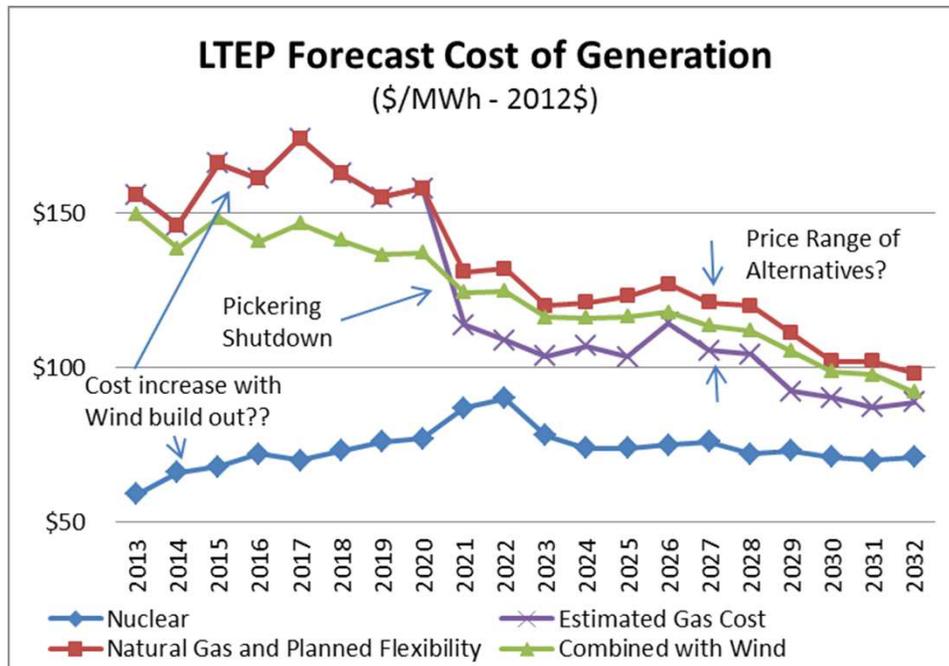
Real costs of Gas fired generation are forecast to decline, but remain higher than nuclear

Blended Cost of Gas fired generation is reported by OPA in two ways

- 1) Combined with “flexibility” and 2) Combined with Imports

Assessing impact on rate payers should consider cost of Wind for which Gas is a backup

To estimate gas-fired generation per unit costs, the estimated cost and supply of imports are removed



Blended costs of gas, wind and flexibility will decline, **but all of these assets will be requiring renewal by the end of the forecast period**, which could increase costs again

In the long term, gas fired generation costs reduce towards the cost of nuclear → But remain 25% higher

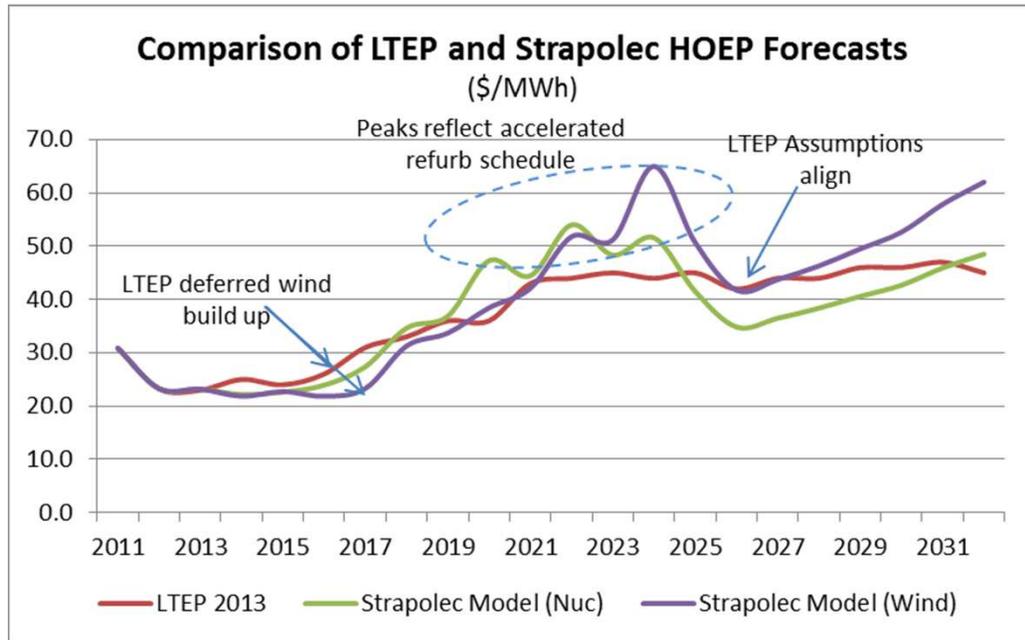
- And only because of significant gas fired production volume increase with Pickering shutdown
- *It is not clear why OPA projects nuclear cost increase in 2021/22*

Gas-Fired Generation has two costs → Fixed and Variable

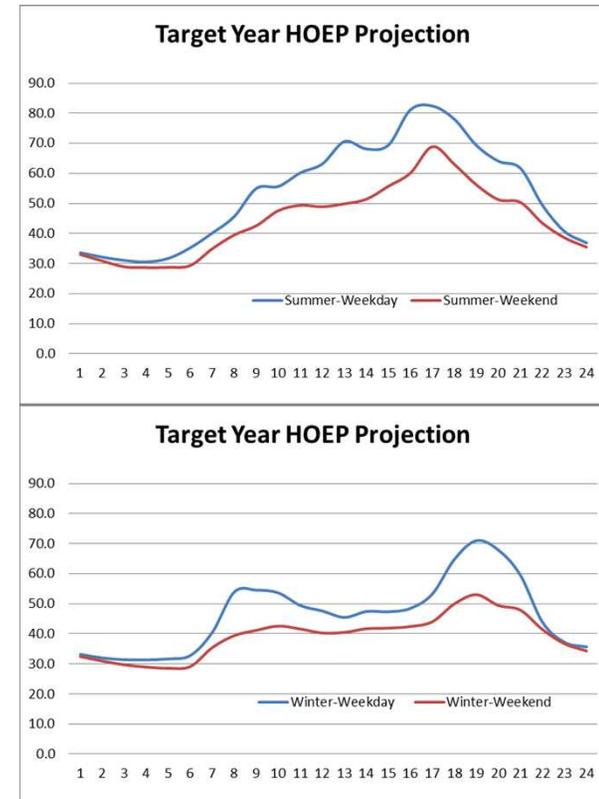
Fixed Costs, guaranteed by contract with the OPA, have a reducing contribution to \$/MWh charged to rate payers as production volume increases and escalation rules come into effect

Variable costs presented to rate payers are a function of HOEP

- For gas-fired generation (and imports), the HOEP in effect at the time of the generation forms the cost of gas-fired generation, which is 20-30% higher than the market average



Sample 2026 HOEP Diurnal Forecast



HOEP during peak hours is determined by Gas generation supply conditions

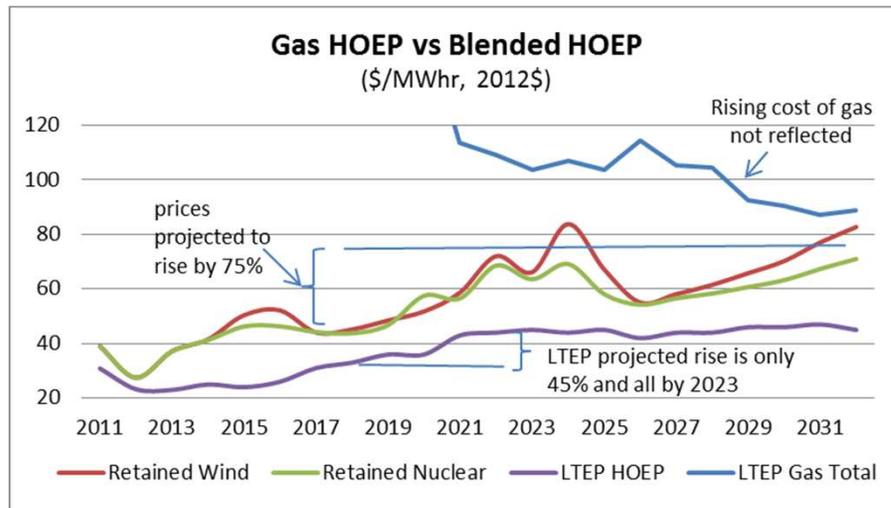
HOEP during times when Gas-fired generation is active is higher than overall market HOEP

- Two main factors; 1) capacity available; and 2) Cost of natural gas

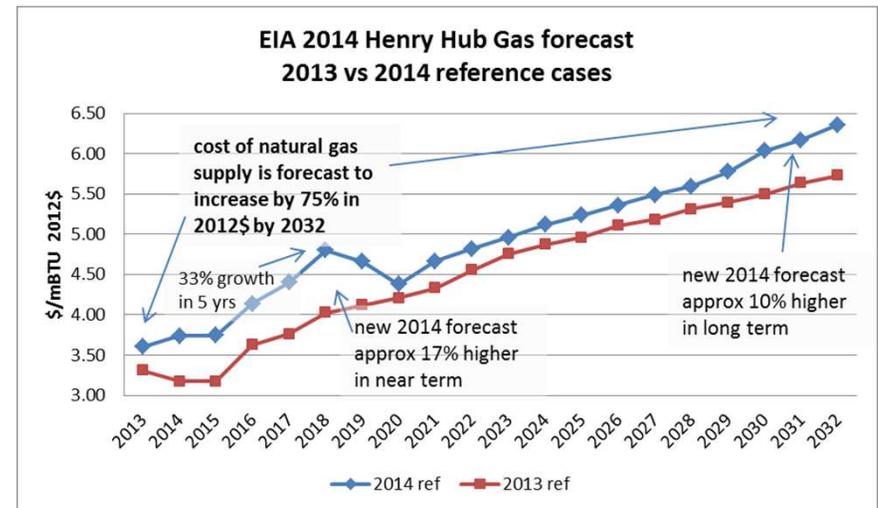
EIA Natural gas cost growth forecast is almost twice as high as LTEP HOEP

- Recent EIA estimates increased forecast assumptions since LTEP developed
- Driven by examination of shale gas development, coal conversions in the US, distribution capacity, and time to develop them
 - Projecting 19% in real growth from 2026 to 2032, where LTEP project Gas costs are declining as HOEP projected to remain flat

LTEP HOEP projection flat; Projected Gas-fired costs declining



Long Term Natural Gas prices are currently projected to be significantly higher in near and long term

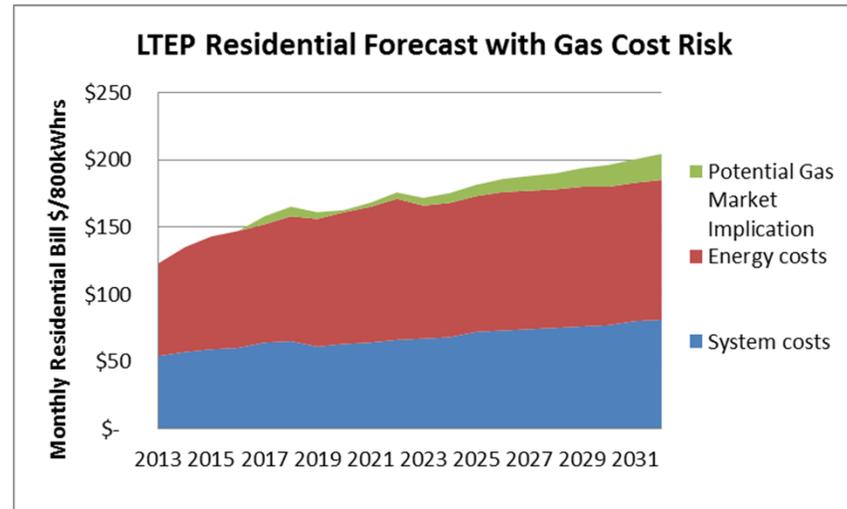


It is unlikely that the long term HOEP forecast for gas fired generation will be as low as the LTEP suggests, and hence gas induced impacts on rate payers can be expected

Illustrative Residential Cost Impact of HOEP risks

→ Uncertainties have different implications on Cost and Emissions

Long term total monthly bill increase could be on order of 10%



Any changes that impact the use of Gas fired generation also impact the GHG emissions

Supply consideration	Illustrative Supply change	Impact on Cost	Impacts on Emissions	
Nuclear	Up	↓	↓	} Nuclear is only supply choice that both reduces cost and GHG emissions
	Down	↑	↑	
Wind	Up	↑	↑	}
	Down	↓	↓	
Solar	Up	↑	↓	}
	Down	↓	↑	
Carbon Penalty/CCS	Up	↑	↓ ??	} In Ontario's hybrid market it is hard to correlate physical production with external price issues Policy role establishes constraints
Gas supply capacity	Up	↓	↑ ??	
	Down	↑	??	

Discussion Questions

Is there a more optimum supply mix for Ontario?

- Are we pursuing a supply mix that both increases cost and increases GHG emissions?

What is the optimum capacity utilization for Ontario gas-fired generation?

What are the implications on GHG emissions of the need to ramp gas generation to track wind?

What risks may increase the costs of gas-fired generation?