



# The Price is Right: The Quebec-Ontario Hydro Deal

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## INTRODUCTION

Quebec (QC) and Ontario (ON) have important decisions to make regarding the sustainability of their current energy strategies.

- Recent development of shale gas in the US has reduced the cost of natural gas power and undermined QC's market. [1]
- A significant portion of ON's electricity needs come from nuclear and natural gas, both of which have uncertain costs.[2]
- ON's nuclear plants are approaching the end of their licenses in 2015. With the large capital investment required to refurbish a plant, cheaper alternatives could be desirable. [1]
- ON is aiming to significantly reduce their emissions by 2020. In order to do so a clean alternative power source is required. [3]
- A long term energy contract between ON and QC could address these issues. Our study looks into the feasibility of such a deal.

## METHODS

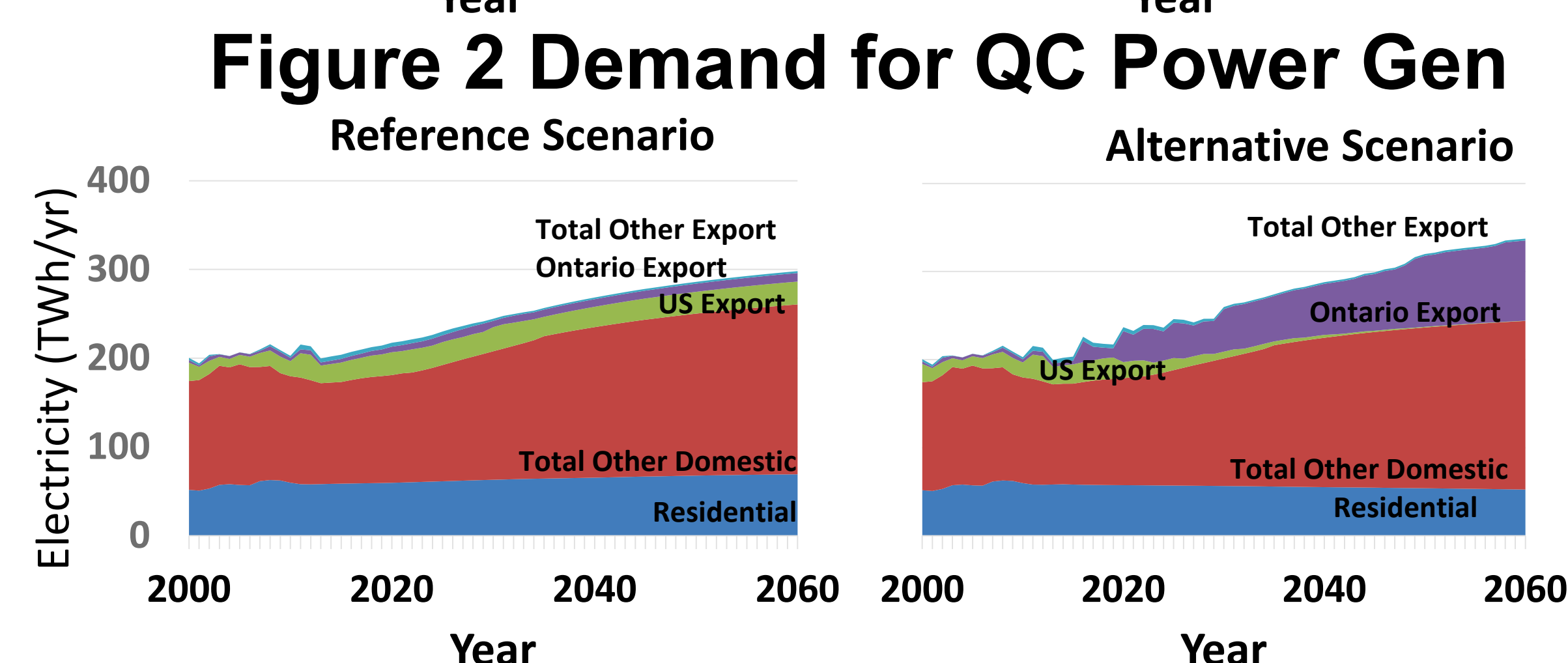
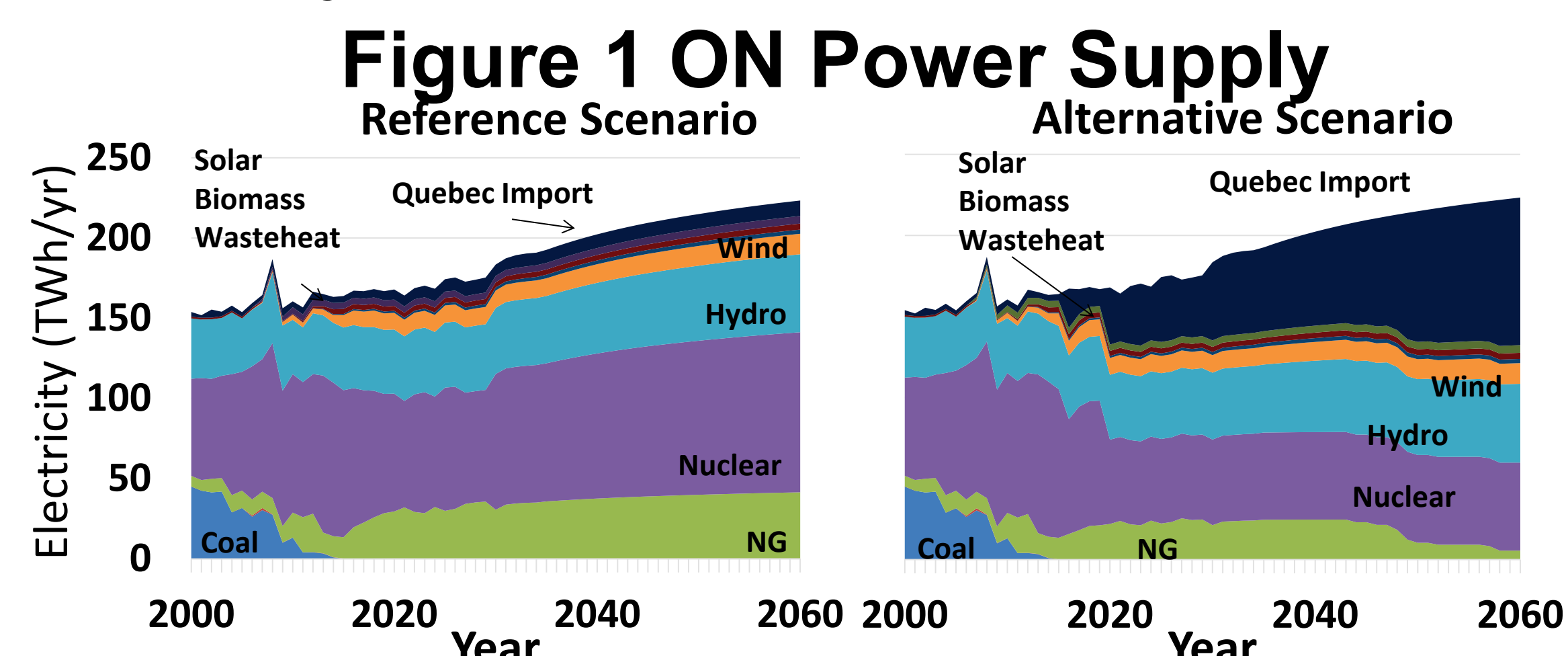
Figures 1&2 are the reference and alternative cases of QC and ON's respective electricity demands. [2] For the alternative cases, the following 'levers' has been pulled to change the composition of the energy system:

QC levers:

- Export to the US, Hours of hydro operation, switch natural gas for electricity heating in QC

ON Levers:

- Phasing out plants at end of lifetime



## Greenhouse Gas Emissions

Lifecycle-based CO<sub>2</sub>e factors were applied to electricity generated from various sources.[4] Results are shown in Figure 3.

ON emissions reduce as natural gas and nuclear are replaced with hydro

QC emissions increase from additional production and switching homes to natural gas heating to meet Ontario's demand

## Quebec Profit

The price of QC's exports to ON have been manipulated to present 4 cases in figure 4.

- Reference price taken at 50\$/MWh
- Operating costs of 47.8\$/MWh, [1]
- Natural Gas cost for home heating 0.6852\$/m<sup>3</sup>
- 5\$/MWh internalized to expand the grid
- 60\$/MWh is roughly the selling price now.
- At 85\$/MWh, roughly the cost of electricity from Ontario's refurbished nuclear plants. [5]
- At 105\$/MWh, Quebec is taking advantage of the fact that Ontario doesn't want to refurbish.

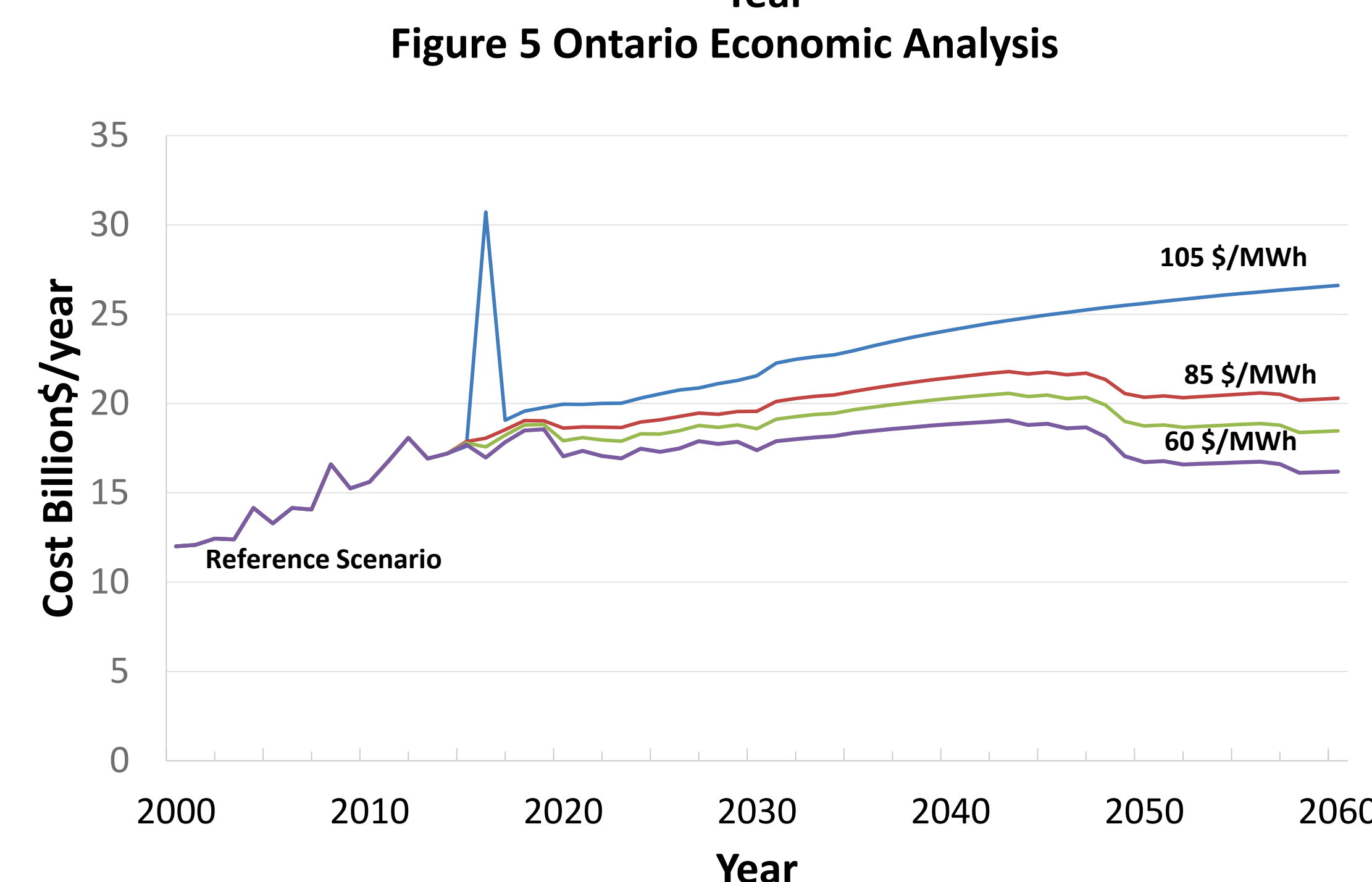
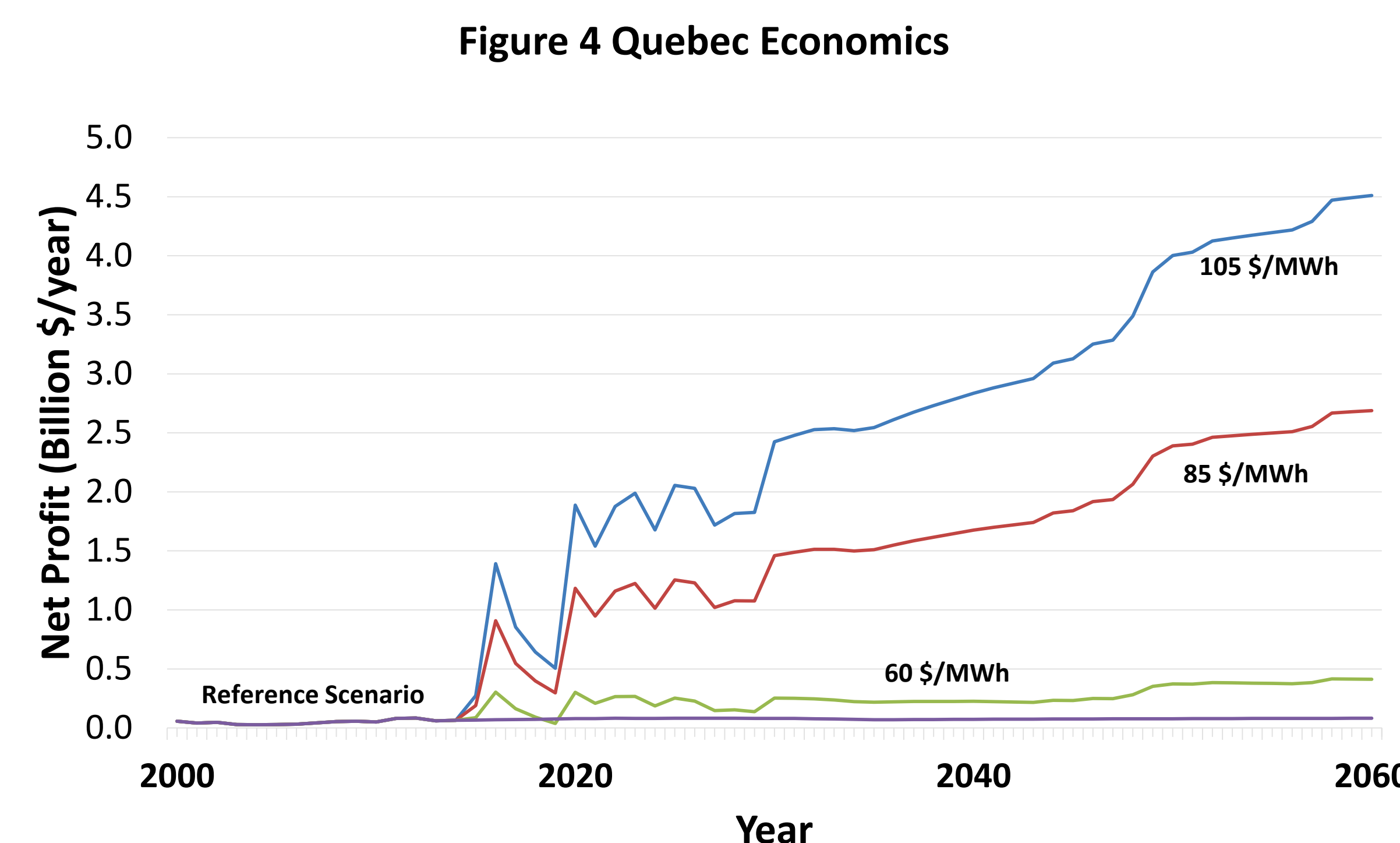
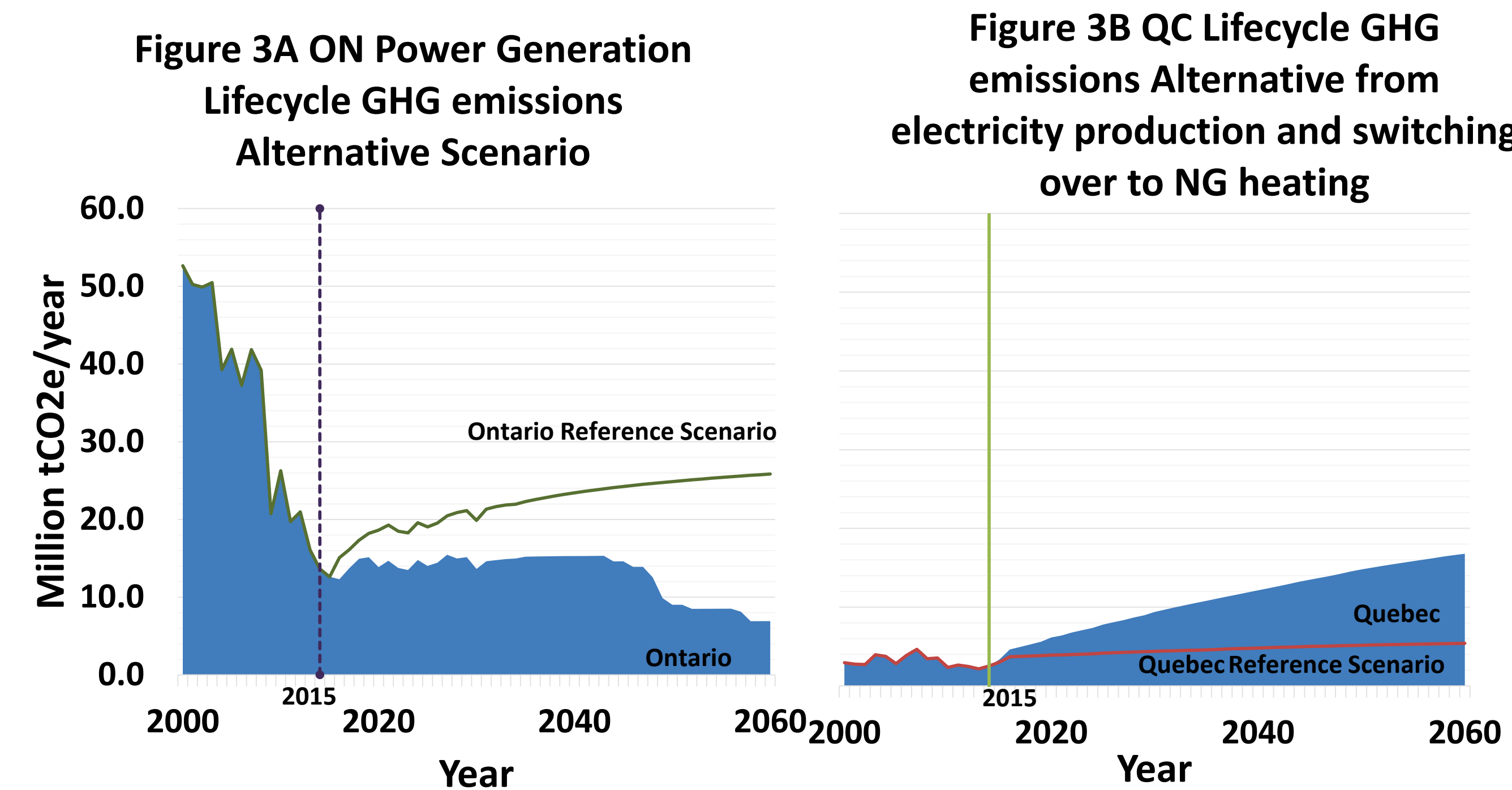
## Ontario Costs

A reference case for the cost of all power generated in ON is presented in Figure 5.

Cases where nuclear and natural gas are substituted for hydro from QC at varying prices are compared to the base case.

The peak in the reference case is the cost to refurbish Darlington Nuclear Generating Station (12 billion dollars). [3]

## RESULTS



## DISCUSSION

QC stands to make 8.4-122.7 billion dollars over the next 60 years depending on the price of exported electricity. ON can save 148-262 billion dollars over the next 60 years.

Now would be an opportune time to discuss this possibility, as ON's nuclear plants are reaching the end of their operating lives. If a deal isn't made soon, ON would likely have to wait for the natural gas plants' licenses to expire in 2030.

Home heating is a more efficient use of natural gas than electricity generation. Our case substituted QC hydro for ON's current natural gas and nuclear power sources. New homes in QC were switched to natural gas heating to free electricity to meet ON's demands. The total net reduction for both provinces in the alternative case is 123 million tons of CO<sub>2</sub> over 60 years.

While the deal makes sense from an environmental and economic perspective there are several political issues to consider.

- Loss of jobs in ON when plants shut down will be unpopular.
- ON may be resistant to having to depend on QC for such a large percentage of their power needs.
- QC residents will not want to switch over to natural gas heating without an incentive.

## CONCLUSIONS

Both provinces stand to benefit from a Quebec-Ontario hydro deal. Quebec alone could make tens of billions of dollars over the course of a long-term contract (our model predicts 8.4-122.7 billion dollars, depending on what they charge for their electricity). The exploration of the Canadian electricity market would also allow for the expansion of Quebec's hydroelectric capacity. This would also free Ontario of the necessity of its nuclear and natural gas plants.

## ACKNOWLEDGEMENTS

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