# Examination of Alternative Price Designs for the Recovery of Global Adjustment Costs from Class B Consumers in Ontario

Staff Research Paper

Technical Meeting for Stakeholders

March 21, 2019

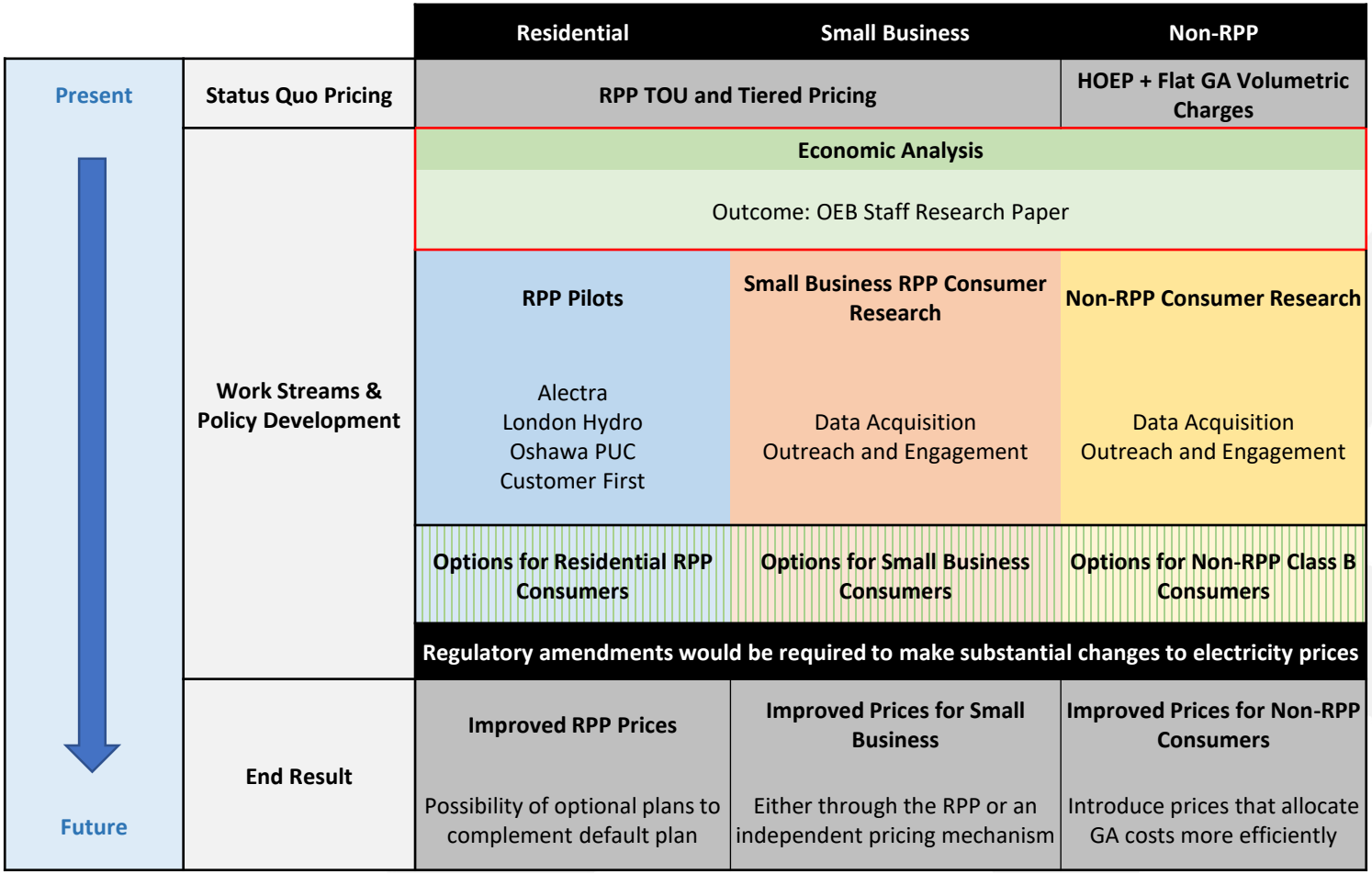
# Goals of Today's Technical Meeting

- Present the methodology and primary findings of the OEB's staff research paper on alternative price designs for the recovery of Global Adjustment (GA) costs
- Address technical questions from readers regarding the methodology and results of the OEB staff research paper
- Discuss priorities and interests regarding a more dynamic GA
- Lay groundwork to obtain feedback – both today and through written submissions – to refine analysis and hone options for further exploration

# Context: Roadmap to Renewing RPP

- In 2015, the OEB published the *Regulated Price Plan (RPP) Roadmap* (herein referred to as the *Roadmap*) which describes the OEB's plan for renewing the RPP
- OEB activities following from the *Roadmap* include
  - Residential pilots – testing different pricing frameworks and technologies; results expected in late 2019
  - Analysis of consumer data – comprehensive database of consumption profiles currently being developed
  - **Economic analysis – the subject of the published OEB staff research paper and this meeting**
  - Business consumer engagement – currently seeking direct feedback from consumers through meetings and written responses
- Taken together, these activities are the core of a multi-year plan to explore options for improving electricity prices for the majority of Ontario consumers
- Implementation of substantive changes to current pricing approaches would require regulatory amendments
  - The *Roadmap* commits the OEB to working with the Government of Ontario and the Independent Electricity System Operator to address identified issues

# Context: Overview of work under the *Roadmap*




The subject of this meeting

The Staff Research Paper (highlighted in red) serves as the analytical foundation for all other ongoing activities that engage directly with consumers

# Research Paper: Motivation for Economic Analysis

- A change to the way that GA costs are recovered from Class B consumers could take advantage of price signals to:
  - Support greater alignment in GA recovery from RPP and non-RPP class B consumers (as discussed in the *Roadmap*)
  - Defer the need for new capacity with the potential of saving billions in avoided costs over the long term
  - Make better use of energy resources in the short term
  - Inform consumers of the value of power at different times

# Research Paper: Summary of Results

- The OEB staff paper analyzed the economic efficiency and consumer cost impact of several broad options for how GA can be more efficiently recovered from Class B consumers
- Analysis highlights the need to balance electricity system savings with consumer benefits of electricity consumption
  - Prices that induce a strong consumer response may defer electricity system infrastructure needs and lower cost over the long term but run the risk of decreasing the benefits consumers gain from electricity consumption
- Of alternatives studied, a GA price that is directly correlated with hourly Ontario electricity demand (what we call the “demand-shaped” price) yields the greatest net positive economic efficiency results
  - Such a price is effective at inducing demand response when it is most valuable to the system over the long term without inducing overly costly curtailment in hours where consumer response is not as valuable

# Economic Analysis: Overview of Methodology used in Research

**Pricing Prototypes**

Each prototype defines a different hourly electricity price for all class B consumers.

Each is defined to recover all forecasted revenues over the years 2018-2031

- Flat
- Time-of-Use (for all Class B)
- Demand-Shaped
- Supply-Shaped
- High N

**Estimated Demand Response**

We calculate the expected change in electricity demand that would result from each prototype relative to the status quo price

Alternative demand profiles induced by each pricing prototype

**Economic Efficiency Evaluation**

We calculate the avoided system cost and induced consumer benefit** of each alternative demand profile for each year 2018-2031

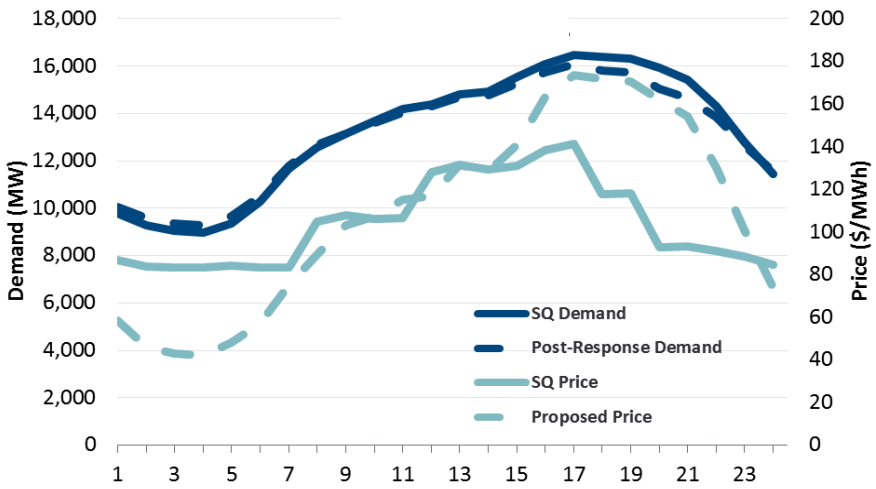
Avoided Cost
+
Consumer Benefit
=
**Net Benefit**

**Consumer benefit is defined to mean the direct benefit or cost to consumers of the change in electricity demand induced by each example

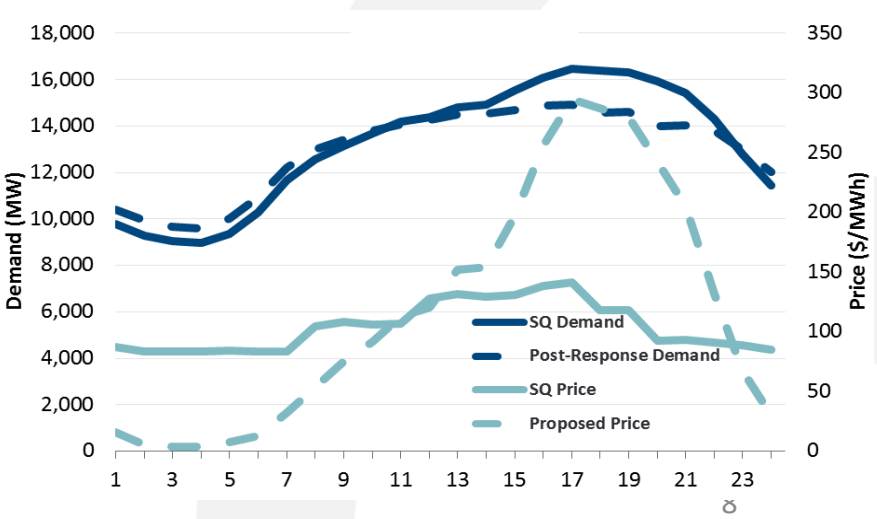
# Economic Analysis: Demand Response

- An alternative demand profile for each pricing option was estimated based on a survey of studies on the elasticity of electricity demand
- This estimation incorporates both an own-price elasticity as well as a cross-price elasticity between the consumer's exposure to high and low price periods relative to the status quo pricing applied to those consumers
- The result is a re-estimated demand curve that reflects the changes in price for each hour

## Demand-shaped, exp = 2




## Demand-shaped, exp = 6



# Economic Analysis: Avoided Costs

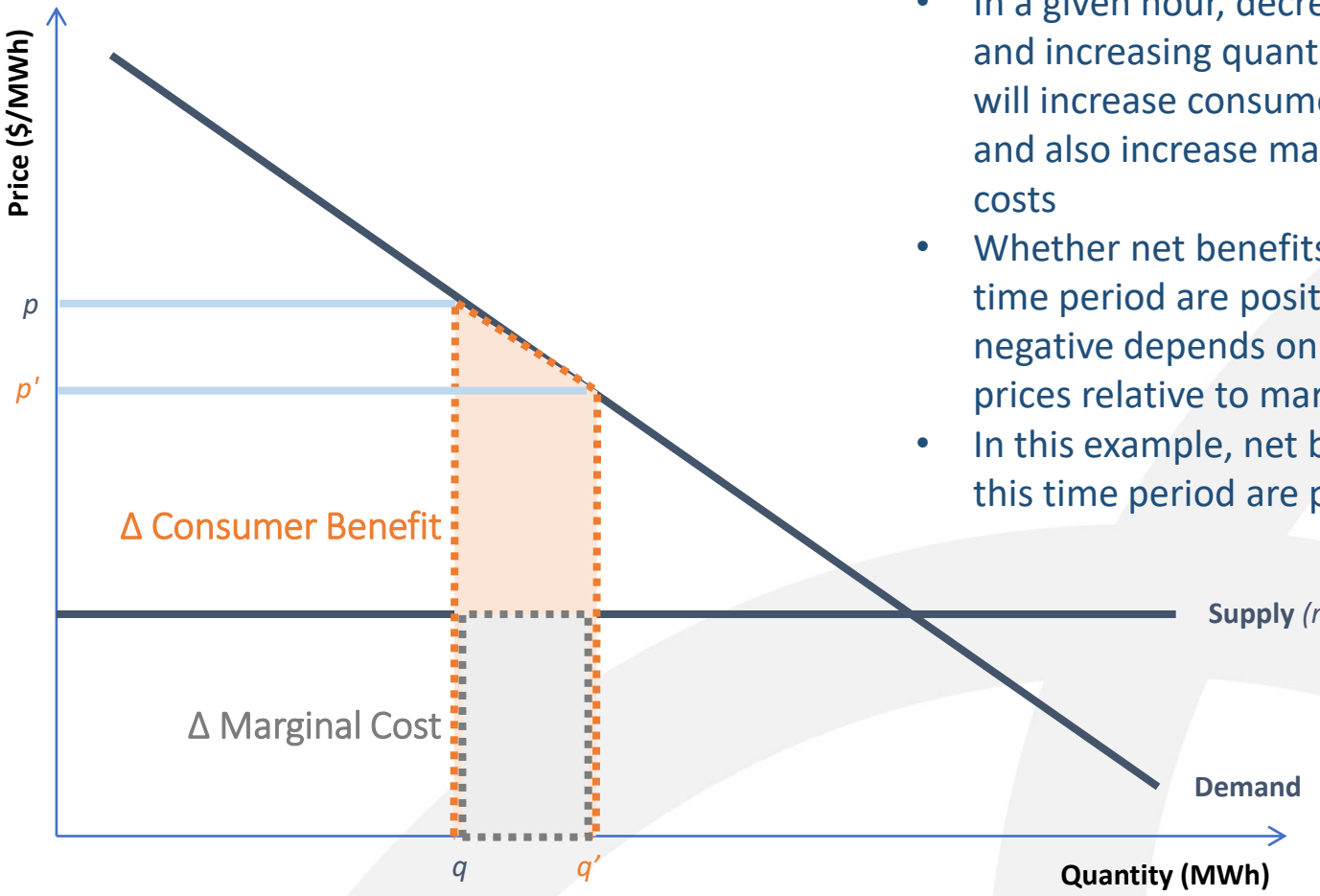
- The avoided costs of the expected demand response of each pricing option were calculated over the period 2018-2031 using forecast data from the IESO
- The following cost drivers were considered when estimating the avoided cost of each pricing example:
  - Marginal energy costs
    - $\Delta D \cdot \mathrm{HOEP}$
  - Capacity costs
    - Annual $/MW-yr value of peak reduction based on recent clearing prices in the IESO demand response auction and estimates of the cost of building new capacity
    - Forecasted annual value of capacity rises to $143,531/MW-yr in 2022 then rises with inflation thereafter
  - Ancillary services costs
    - Minor compared to other costs, omitted
  - Transmission costs
    - Omitted since forecasted transmission projects are unlikely to be avoided by an overall decrease in province-wide peak demand
- These primary drivers reflect the recommendations of a recent Brattle report on best practices for valuing demand response

# Economic Analysis: Net Benefit Approach

- Economic efficiency involves more than avoided costs
  - If economic efficiency depended only on avoided system cost, it would imply that electricity at peak demand should be priced arbitrarily high enough to ensure there is never again a need for any new investment in capacity
- Concentration solely on avoided cost fails to consider the value of consumption, or the cost to consumers of not consuming when it would otherwise be economic for them to do so, such as:
  - The value businesses derive from using electricity to produce goods and services, and
  - The value residential consumers derive from amenities that use electricity
- Our current analysis aims to factor in both these elements into the assessment:

Net Benefit = Avoided Cost + Consumer Benefit

# Economic Analysis: Net Benefit

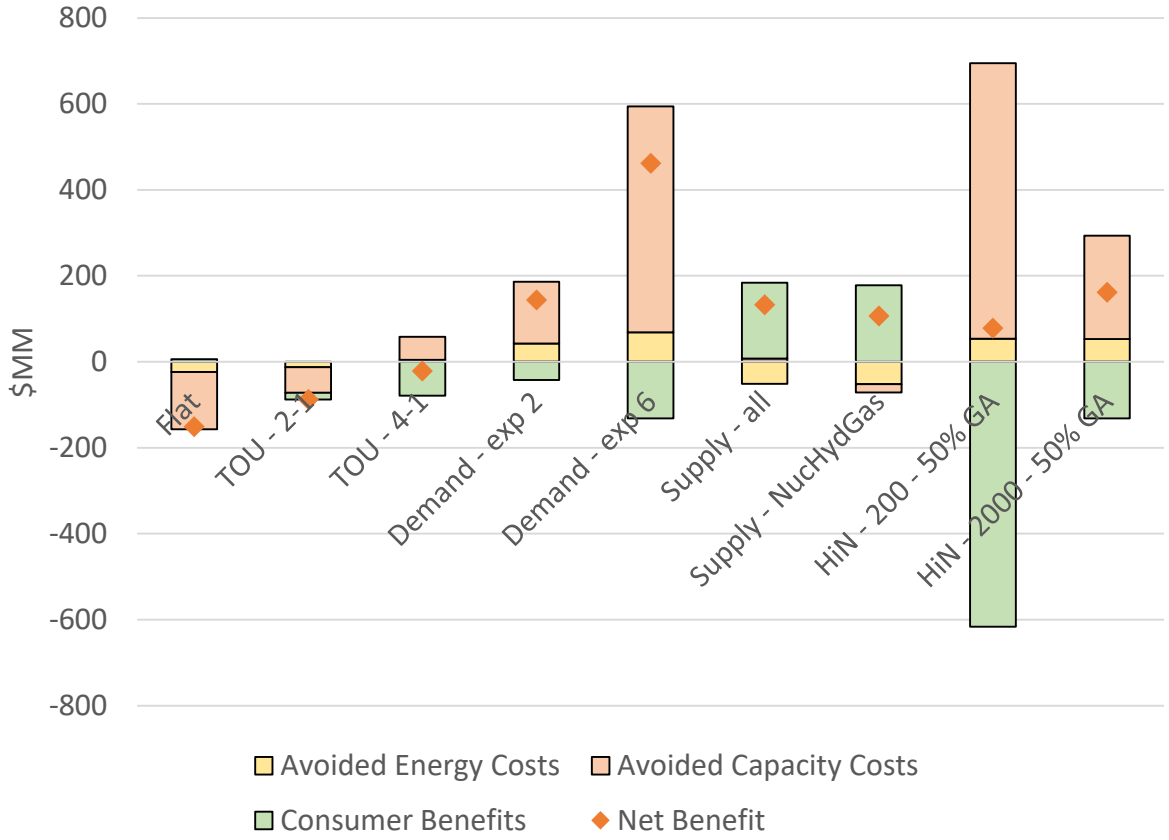



- In a given hour, decreasing price and increasing quantity demanded will increase consumer benefits and also increase marginal energy costs
- Whether net benefits in a single time period are positive or negative depends on the level of prices relative to marginal cost
- In this example, net benefits in this time period are positive

Note: this pictorial representation does not portray the value of avoided capacity cost

# Economic Efficiency: Comparative Results

## Forecast Year 2030




- Graph shows the relative economic efficiency of each pricing variant in forecast year 2030
- The net benefit is the sum of avoided costs and consumer benefit

# Economic Efficiency: Comparative Results

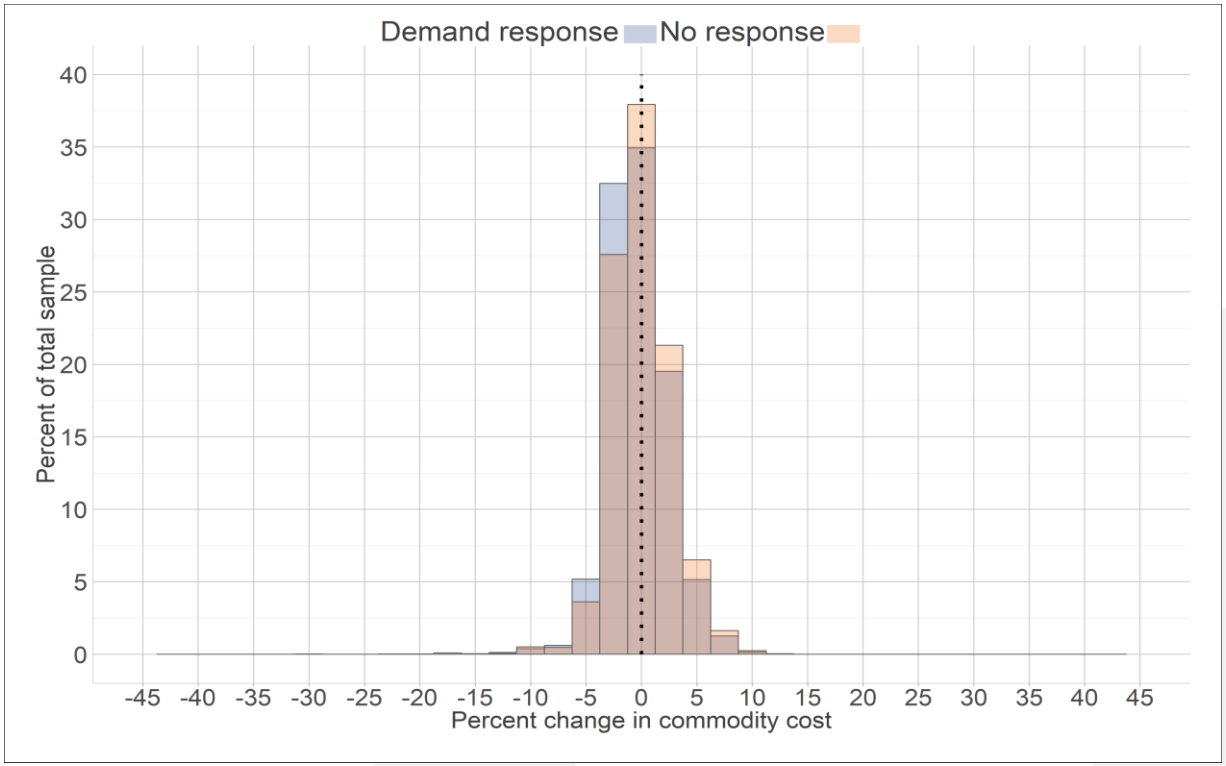
Forecast Period: 2018-2031

| | Flat | TOU - 2-1 | TOU - 4-1 | Demand - exp2 | Demand - exp6 | Supply - All | Supply - NucHydGas | HiN - 200 - 50% GA | HiN - 2000 - 50% GA |
|---|---|---|---|---|---|---|---|---|---|
| **Average percentage change in annual peak demand** | 2.3% | 0.6% | -2.0% | -2.9% | -11.5% | 0.1% | 0.5% | -12.7% | -4.8% |
| **NPV Avoided Cost ($M)** | -$943 | -$361 | $626 | $1,338 | $4,180 | -$294 | -$446 | $4,429 | $1,996 |
| **NPV Consumer Benefit ($M)** | $48 | -$54 | -$1,135 | -$230 | -$1,478 | $1,666 | $1,724 | -$5,972 | -$1,138 |
| **NPV Net Benefit ($M)** | -$896 | -$415 | -$508 | $1,108 | $2,703 | $1,372 | $1,278 | -$1,543 | $858 |

- The focus of this analysis is to determine the value of each pricing option relative to alternatives studied rather than to predict the total amount of benefit or cost

# Sample of Consumer-Level Commodity Cost Analysis

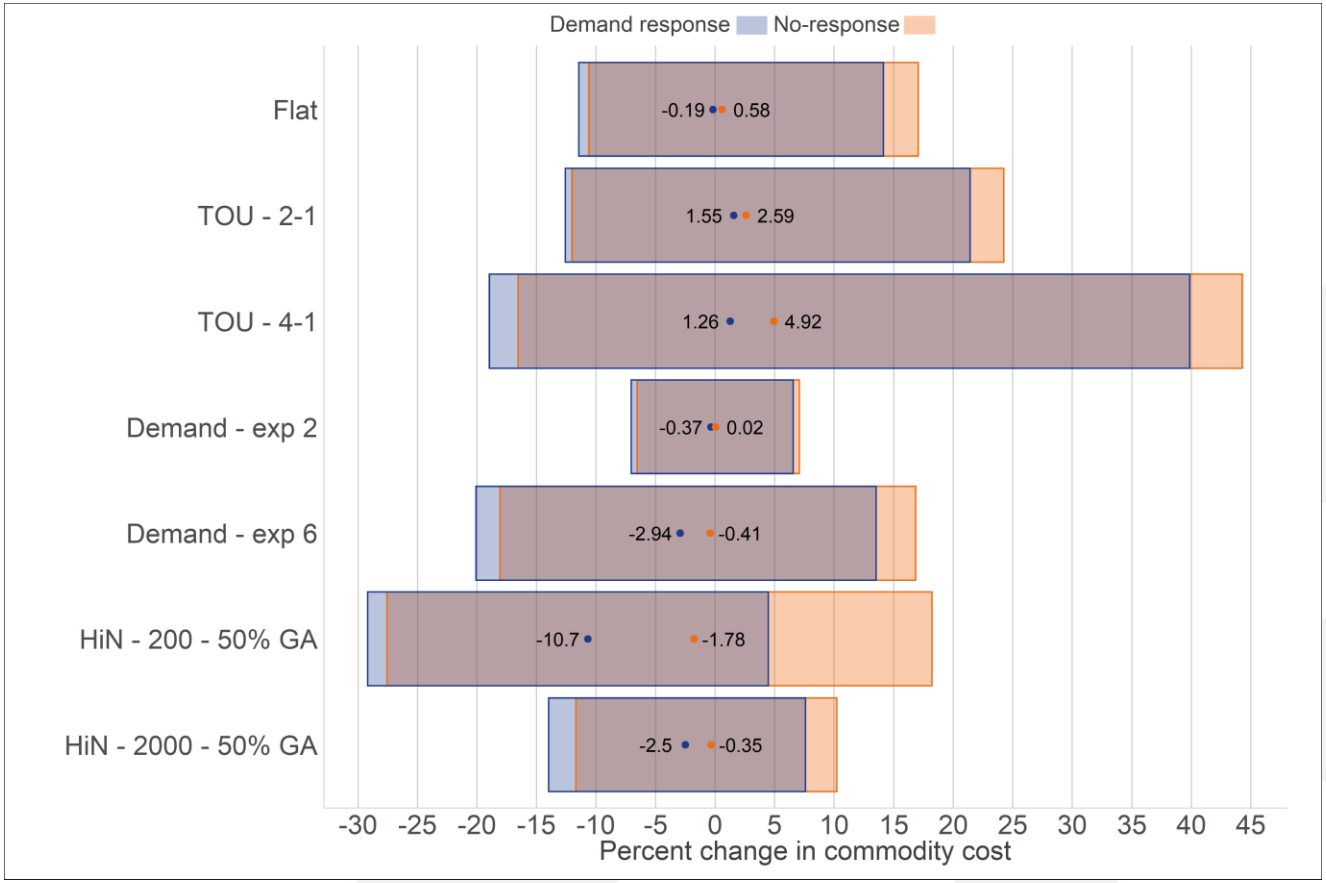
- Preliminary analysis has been conducted estimating the commodity cost impact of each pricing option on a collection of historical hourly consumption profiles of close to 7,000 general service consumers with peak demand 50kW-1000kW under two scenarios
  - No Response: consumers do not change consumption behavior relative to new prices
  - With Response: consumers adjust consumption in response to higher and lower prices (relative to status quo prices) in each hour




Example:
Demand-shaped
Exp = 2

| Response Type | Percentage of Customers that Experience a Cost Decrease |
|---|---|
| No response | 55 |
| Demand response | 59 |

# Consumer-Level Commodity Cost Impact




- Average impacts are indicated by the points
- Each bar represents an impact interval that contains 98% of consumers

# Lessons Learned

1. **Need to balance system savings with consumer benefit**
   Prices that produce strongly demand-responsive behavior can defer electricity system infrastructure needs but run the risk of decreasing overall net benefit because they induce consumers to avoid consuming even when it would otherwise be rational for them to do so.

2. **Correlating GA prices with electricity demand yields positive economic efficiency results**
   Allocation of GA costs more in line with system demand can yield higher economic benefits relative to both the current Class B price design as well as relative to other scenarios studied. It is effective at inducing demand response without inducing overly costly curtailment.

# Lessons Learned

3. **GA prices that reflect the hourly generation mix are not optimal**
   Allocation of GA costs in line with resource (supply) type and cost (the "supply-shaped" prototype) is less economically efficient than other prototypes studied. It is less effective at spurring demand responsive behavior because such prices do not always align high prices with periods of high demand.

4. **Reductions in consumer benefit can swamp system savings for Class A-like GA allocation**
   Allocation of GA costs into the highest electricity demand hours (the "High N" prototype), a design similar to Class A GA pricing, is effective at deferring new system needs but yields significant reductions to consumer benefit such that the likelihood of overall negative net benefits rises as the number of targeted higher-priced hours diminishes.

# Lessons Learned

5. **Reallocation of GA can reduce costs for consumers able to respond to better price signals, but greater information regarding consumer acceptance is required**
   An analysis of the consumption patterns of about 7,000 larger general service customers confirms that the cost consequences of alternatives to the status quo Class B GA price can generate moderate savings on average and individual savings for those consumers who can respond to price signals. However, more work remains to be done to confirm results with a sample known to be representative, and to understand consumers' views about price changes and their capacity to respond to them.

# How Research Paper will Supplement Other *Roadmap* Activities

- RPP Pilots
  - Final results of pilots (expected late 2019) will help validate or correct the assumptions made in the paper as to the degree of demand response to different prices that can be expected from residential consumers
- Business and Non-RPP Consumer Impact Analysis
  - OEB staff are developing comprehensive databases of hourly consumption profiles for general service customers, including detail on property attributes and business type
  - OEB staff have begun using this data with a view to improving the preliminary consumer cost impact analysis introduced in the paper in order to gain a more comprehensive understanding of the breadth of impacts to expect from different pricing alternatives across the entire province
- Engagement with General Service customers
  - The results of the paper, together with updated cost impact analysis and feedback, will serve as the informational foundation for further engagement activities

# Discussion

- OEB staff are seeking feedback related to the Staff Research Paper
  - Technical stakeholder meeting (now)
  - Written comments on the staff research paper (can be submitted by April 18, 2019)
  - Future stakeholder activities (TBD)
- Feedback topics related directly with the methodology and results of the Staff Research Paper
  - Are there other sources of economic value to be considered in evaluating such pricing prototypes?
  - Are there any other prototypes for Class B GA pricing design (significantly different from those introduced in the paper) that should be examined?
  - Any other concerns with the methodology and conclusions of the paper?

# Discussion

- Feedback topics beyond those examined in the Staff Research Paper
  - The alternatives discussed today are assessed by reference to economic efficiency and consumer cost impact. What non-economic factors should be considered in the evaluation of pricing designs going forward?
  - The results of this analysis show that dynamic pricing designs that respond to real-time conditions provide more value to consumers than less dynamic designs
    - What does the experience with Time-Of-Use or other variable prices (e.g., HOEP) suggest about the merits and drawbacks of exposing consumers to more dynamic prices?
    - How far in advance do electricity prices in each hour need to be communicated to consumers under variable pricing approaches? Need the time period be as long as those available under forward price plans like the RPP?
    - What value do customers place on less dynamic prices and how might that value be reflected? For instance, would general service customers be willing to pay a premium to be insulated from dynamic prices?