ieso
Power to Ontario.
On Demand.

# Export Transmission Service Tariff Study

## Observed Impacts on Surplus Base Load Generation Events

June 25, 2009

# Potential Limitations

- Assessment of future occurrences of SBG events is a complex exercise.
- We recognize that there may be certain limitations to the SBG findings given the adoption of certain assumptions.
- The IESO has provided insights into potential impacts on future surplus base-load events under these assumptions.

# Key Objective

- Observe potential impacts of each ETS tariff option on surplus base-load generation (SBG) events (e.g., magnitude, duration and timing).
- Ascertain whether the ETS tariff can materially impact SBG events.

**Definition:**

- An SBG event is defined as an event where the base-load generation (e.g., non-storable resource such as nuclear) is required to be manoeuvred down because demand in the load block results in a situation of low market demand and surplus base load generation. The SBG analysis is dependent on the assumptions about the merit order as well as the demand values used in the load blocks.

# Assumptions

- In the CRA model the merit order is as follows; base load hydro, wind, nuclear, coal, gas, peaking hydro, and pumped storage.
- Imports' position in the order is based on the cost of the imports(source plus transmission charges).
- Wind output is modeled base on observed historical wind production profile. Wind is modeled as a non-dispatchable resource.
- Hydro generation is based on monthly energy forecast, but assumed to run flat across each load block. In reality, hydro production levels may be higher in the shoulder months and lower in the winter and summer months. This may result in slightly more SBG events in the spring months and fewer SBG events in winter months.
- Non-utility generators (NUGs) are treated as being more costly than nuclear in the model. In reality most NUGs are also likely to be running during off-peak hours. This may also result in slightly more SBG events.

# Assumptions cont'd

- The CRA Model uses a load duration curve with 120 load values. As we move across load blocks, the demand values change and the generation mix (after accounting for planned outages) that is required to meet market demand also changes to satisfy overall demand at the least possible cost.
- Hourly demand was provided by IESO for 2010. CRA used this to derive the load shape. Total annual demand was provided by IESO for 2010 and 2015. CRA used the derived load shape in both years along with the annual GWh of demand.

# Example of SBG Events

## Status Quo July 2015

| Impact on Surplus Base-load Resource -2015 | | | | |
|---|---|---|---|---|
| | Observed SBG Events | | Period | |
| ETS Option | Base-load Manoeuvred (MW) | Duration (Hrs) | Season | Month |
| Status Quo | 108 | 5 | Winter | Jan |
| | 15 | 5 | Winter | Jan |
| | 131 | 6 | Winter | Jan |
| | 36 | 4 | Winter | Feb |
| | 19 | 5 | Winter | Feb |
| | 413 | 16 | Summer | Jun |
| | 1,131 | 8 | Summer | Jun |
| | 774 | 34 | Summer | Jul |
| | 1,888 | 10 | Summer | Jul |
| | 2,153 | 5 | Summer | Jul |
| | 469 | 34 | Summer | Aug |
| | 861 | 10 | Summer | Aug |
| | 734 | 5 | Summer | Aug |
| | 219 | 33 | Winter | Nov |
| | 910 | 6 | Winter | Nov |
| | | | ıter | Dec |
| | | | ıter | Dec |
| | | | ıter | Dec |

| | | | |
|---|---|---|---|
| July loadblock # | 68 | 69 | 70 |
| Hours | 34 | 10 | 5 |
| (1) Load (MW) | 13036 | 11853 | 11350 |
| (2) Net Exports (MW) | 3840 | 3839 | 3839 |
| (3) Pumped Storage (MW) | 122 | 122 | 122 |
| (4) Wind (MW) | 565 | 634 | 550 |
| (5) Hydro (MW) | 4271 | 4133 | 3978 |
| (6) Landfill Gas (MW) | 4.7 | 4.7 | 4.7 |
| (1-3) less (1-6) | 12,157 | 11,042 | 10,778 |
| Nuclear (MW) | 12,970 | 12,970 | 12,970 |
| Min. Nuclear Threshold | 40 | 40 | 40 |
| Base-load Manoeuvred (MW) | -813 | -1,928 | -2,192 |

# Test Year 2010, All Options

| Impact on Surplus Base-load Resource -2010 | | | | |
|---|---|---|---|---|
| | Observed SBG Events | | Period | |
| ETS Option | Base-load Manoeuvred (MW) | Duration (Hrs) | Season | Month |
| Option 1 | 40 | 5 | Summer | Jul |
| Option 2 | 43 | 5 | Summer | Jul |
| Option 3-Scenario 1 | 214 | 16 | Summer | Jun |
| | 732 | 8 | Summer | Jun |
| | 628 | 34 | Summer | Jul |
| | 1,666 | 10 | Summer | Jul |
| | 1,952 | 5 | Summer | Jul |
| | 320 | 34 | Summer | Aug |
| | 753 | 10 | Summer | Aug |
| | 751 | 5 | Summer | Aug |
| | 598 | 13 | Winter | Dec |
| | 872 | 6 | Winter | Dec |
| Option 3-Scenario 2 | 42 | 5 | Summer | Jul |
| Option 4-Scenario 1 | 40 | 5 | Summer | Jul |
| Option 4-Scenario 2 | 41 | 5 | Summer | Jul |

# Test 2015, Status Quo

| Impact on Surplus Base-load Resource - 2015 | | | | |
|---|---|---|---|---|
| | Observed SBG Events | | Period | |
| ETS Option | Base-load Manoeuvred (MW) | Duration (Hrs) | Season | Month |
| Status Quo | 108 | 5 | Winter | Jan |
| | 15 | 5 | Winter | Jan |
| | 131 | 6 | Winter | Jan |
| | 36 | 4 | Winter | Feb |
| | 19 | 5 | Winter | Feb |
| | 413 | 16 | Summer | Jun |
| | 1,131 | 8 | Summer | Jun |
| | 774 | 34 | Summer | Jul |
| | 1,888 | 10 | Summer | Jul |
| | 2,153 | 5 | Summer | Jul |
| | 469 | 34 | Summer | Aug |
| | 861 | 10 | Summer | Aug |
| | 734 | 5 | Summer | Aug |
| | 219 | 33 | Winter | Nov |
| | 910 | 6 | Winter | Nov |
| | 507 | 49 | Winter | Dec |
| | 1,294 | 13 | Winter | Dec |
| | 1,390 | 6 | Winter | Dec |

# Test Year 2015, Option 2

| Impact on Surplus Base-load Resource -2015 | | | | |
|---|---|---|---|---|
| | Observed SBG Events | | Period | |
| ETS Option | Base-load Manoeuvred (MW) | Duration (Hrs) | Season | Month |
| Option 2 | 111 | 5 | Winter | Jan |
| | 17 | 5 | Winter | Jan |
| | 127 | 6 | Winter | Jan |
| | 36 | 4 | Winter | Feb |
| | 18 | 5 | Winter | Feb |
| | 413 | 16 | Summer | Jun |
| | 1,132 | 8 | Summer | Jun |
| | 773 | 34 | Summer | Jul |
| | 1,887 | 10 | Summer | Jul |
| | 2,155 | 5 | Summer | Jul |
| | 468 | 34 | Summer | Aug |
| | 862 | 10 | Summer | Aug |
| | 739 | 5 | Summer | Aug |
| | 218 | 33 | Winter | Nov |
| | 914 | 6 | Winter | Nov |
| | 507 | 49 | Winter | Dec |
| | 1,294 | 13 | Winter | Dec |
| | 1,391 | 6 | Winter | Dec |

# Test year 2015, Option 3, Scenario 1

| Impact on Surplus Base-load Resource -2015 | | | | |
|---|---|---|---|---|
| | Observed SBG Events | | Period | |
| ETS Option | Base-load Manoeuvred (MW) | Duration (Hrs) | Season | Month |
| Option 3-Scenario 1 | 1,548 | 5 | Winter | Jan |
| | 1,221 | 5 | Winter | Jan |
| | 1,966 | 6 | Winter | Jan |
| | 1,246 | 4 | Winter | Feb |
| | 1,920 | 4 | Winter | Feb |
| | 1,669 | 5 | Winter | Feb |
| | 613 | 8 | Winter | Mar |
| | 892 | 5 | Winter | Mar |
| | 276 | 8 | Winter | Apr |
| | 621 | 8 | Winter | Apr |
| | 559 | 18 | Summer | May |
| | 642 | 12 | Summer | May |
| | 1,322 | 43 | Summer | Jun |
| | 2,069 | 16 | Summer | Jun |
| | 2,868 | 8 | Summer | Jun |
| | 2,375 | 34 | Summer | Jul |
| | 3,490 | 10 | Summer | Jul |
| | 3,738 | 5 | Summer | Jul |
| | 2,077 | 34 | Summer | Aug |
| | 2,464 | 10 | Summer | Aug |
| | 2,272 | 5 | Summer | Aug |
| | 506 | 18 | Summer | Sep |
| | 899 | 11 | Summer | Sep |
| | 1,824 | 33 | Winter | Nov |
| | 2,483 | 6 | Winter | Nov |
| | 2,109 | 49 | Winter | Dec |
| | 2,896 | 13 | Winter | Dec |
| | 2,970 | 6 | Winter | Dec |

# Test Year 2015, Option 3, Scenario 2

| Impact on Surplus Base-load Resource -2015 | | | | |
|---|---|---|---|---|
| | Observed SBG Events | | Period | |
| ETS Option | Base-load Manoeuvred (MW) | Duration (Hrs) | Season | Month |
| Option 3-Scenario 2 | 110 | 5 | Winter | Jan |
| | 17 | 5 | Winter | Jan |
| | 128 | 6 | Winter | Jan |
| | 36 | 4 | Winter | Feb |
| | 18 | 5 | Winter | Feb |
| | 413 | 16 | Summer | Jun |
| | 1,132 | 8 | Summer | Jun |
| | 773 | 34 | Summer | Jul |
| | 1,888 | 10 | Summer | Jul |
| | 2,157 | 5 | Summer | Jul |
| | 468 | 34 | Summer | Aug |
| | 863 | 10 | Summer | Aug |
| | 740 | 5 | Summer | Aug |
| | 218 | 33 | Winter | Nov |
| | 916 | 6 | Winter | Nov |
| | 507 | 49 | Winter | Dec |
| | 1,294 | 13 | Winter | Dec |
| | 1,392 | 6 | Winter | Dec |

# Test Year 2015, Option 4, Scenario 1

| Impact on Surplus Base-load Resource -2015 | | | | |
|---|---|---|---|---|
| | Observed SBG Events | | Period | |
| ETS Option | Base-load Manoeuvred (MW) | Duration (Hrs) | Season | Month |
| Option 4-Scenario 1 | 108 | 5 | Winter | Jan |
| | 14 | 5 | Winter | Jan |
| | 130 | 6 | Winter | Jan |
| | 35 | 4 | Winter | Feb |
| | 18 | 5 | Winter | Feb |
| | 413 | 16 | Summer | Jun |
| | 1,130 | 8 | Summer | Jun |
| | 774 | 34 | Summer | Jul |
| | 1,888 | 10 | Summer | Jul |
| | 2,152 | 5 | Summer | Jul |
| | 469 | 34 | Summer | Aug |
| | 861 | 10 | Summer | Aug |
| | 732 | 5 | Summer | Aug |
| | 219 | 33 | Winter | Nov |
| | 907 | 6 | Winter | Nov |
| | 507 | 49 | Winter | Dec |
| | 1,294 | 13 | Winter | Dec |
| | 1,389 | 6 | Winter | Dec |

# Test Year 2015, Option 4, Scenario 2

| Impact on Surplus Base-load Resource -2015 | | | | |
|---|---|---|---|---|
| | Observed SBG Events | | Period | |
| ETS Option | Base-load Manoeuvred (MW) | Duration (Hrs) | Season | Month |
| Option 4-Scenario 2 | 109 | 5 | Winter | Jan |
| | 16 | 5 | Winter | Jan |
| | 127 | 6 | Winter | Jan |
| | 34 | 4 | Winter | Feb |
| | 17 | 5 | Winter | Feb |
| | 415 | 16 | Summer | Jun |
| | 1,125 | 8 | Summer | Jun |
| | 774 | 34 | Summer | Jul |
| | 1,885 | 10 | Summer | Jul |
| | 2,156 | 5 | Summer | Jul |
| | 469 | 34 | Summer | Aug |
| | 860 | 10 | Summer | Aug |
| | 735 | 5 | Summer | Aug |
| | 219 | 33 | Winter | Nov |
| | 906 | 6 | Winter | Nov |
| | 507 | 49 | Winter | Dec |
| | 1,293 | 13 | Winter | Dec |
| | 1,391 | 6 | Winter | Dec |