Pollution Probe INTERROGATORY #47 List 5

Interrogatory

Ref. Response to Pollution Probe Interrogatory No. 7 List 1 (Exh. C / T 2 / S 7)

Issue Number 2.0
2.0 Issue: Project Alternatives

Request

a) Please provide all workpapers associated with the computation of lockedin energy quantities listed in the "undelivered energy (MWh)" table for parts a) through e) of the response. Provide these workpapers in Excel or equivalent spreadsheet format with formulas intact.
b) Please describe in complete detail the analysis conducted to obtain the estimate of locked-in energy provided in the "undelivered energy (MWh)" table as a response to parts a) through e) of the interrogatory. Please include descriptions of the temporal detail for each component of the response (e.g. for wind, nuclear, and transmission components).
c) Please provide the estimates of locked-in energy for the finest level of temporal detail calculated.
d) Please provide the "probabilistic distributions" for both wind and nuclear generation that was developed as part of the response.
e) Please provide the "probabilistic distribution of total generation in the Bruce area" that was developed as part of the response.
f) Please provide the "transfer-capability probability distributions" that were developed as part of the response.
g) Please describe the specific assumptions made concerning the overall state of the Ontario transmission system for the periods in which Bruce area transfer-capability probability distributions were developed.

Response

a) Hydro One and OPA have declined to answer this Interrogatory due to its confidential and commercial sensitivity. Please refer to correspondence on behalf of Hydro One dated March 13, 2008.

b) The analysis used to respond to Pollution Probe Interrogatory 7 is based on the fact that the output of wind generation and nuclear generation, and the capability of the Bruce transmission system are not constant. The OPA's Financial Evaluation Model ("Model") uses probabilistic distributions developed from historical data for wind and transmission capability information, and from estimates of nuclear unit availability from a probabilistic derivation. The Model considers eight different time periods within a year (to match the time periods used in the energy cost tables and as described in response to Pollution Probe Interrogatory 24) and three different refurbishment states (these refurbishment states are user-selected in operating the Model) in its calculations. In order to simplify the calculations, the Model uses a representative sample from each distribution.

With regard to each distribution, the variability of wind generation output is modeled using the simulated hourly data from the AWS True Wind Report. The wind generation output distributions for each time period are created by allocating the AWS data to each of the eight time periods.

The nuclear generation distribution modeling is based on the number of units in operation (i.e. eight units less the number removed for refurbishment, as selected by the user), the units' Effective Forced Outage Rate (EFOR) and the units' planned outage assumptions. A two-state model is used in conjunction with these assumptions.

Transmission capability is determined based on normal system conditions established by the IESO, less a reduction (referred to as a penalty) to reflect other real-time system limitations on the Bruce Area transmission system. The Model uses a penalty distribution based on Bruce Area transmission system historical performance data between 2005 and 2007.

Total generation distributions cannot be created by adding the wind generation and nuclear generation distributions together. It is assumed that the wind and nuclear generation are independent events. Therefore, the Model conducts a convolution of the wind generation and nuclear generation distributions to determine the total generation distribution for the Bruce Area. (A convolution of a discrete number of samples is conducted by taking every possible combination of two points, one from each distribution. The number of samples is chosen by the model user.)

Undelivered energy distributions are determined by conducting a convolution of the transmission capability and total generation distributions. The expected values of these distributions are scaled to represent the number of hours in the corresponding time period. The only temporal parts of the Model's analysis are created when these expected values are assigned to the user-selected monthly refurbishment profile. These monthly values are then totaled to provide annual results.

c) A supplementary response is filed as Attachments A, B and C. This material is being filed in response to the Board's April 7 Order in respect of Generation Forecast Information. It includes two redacted tables (Attachment B and Attachment C). The OPA plans to make a separate filing in respect of these tables under the Board's Practice Direction on Confidential Filings.

d) The Model used to determine the amount of undelivered energy considers probabilistic distributions for wind and nuclear generation for each year of study. The wind generation is modeled for each of the eight time periods discussed in the above-referenced response. The nuclear generation is modeled for two time periods (winter/summer and shoulder) and three different states at Bruce NGS (zero, one and two units removed for refurbishment). There are 266 probabilistic distributions representing nuclear and wind generation for the entire study period between 2012 and 2030. All of the distributions are similar; therefore only one wind generation probabilistic distribution and one nuclear generation probabilistic distribution are shown in Figures 1 and 2 below. The Model cannot process the entire distribution and needs to sample it in order to conduct its calculations. The sampled distribution is shown by the red line that moves stepwise. The Model uses an average sampling method and does not take into account the peak values (making any calculations conservative ones, such as those in the response to the referenced interrogatory).

Figure 1

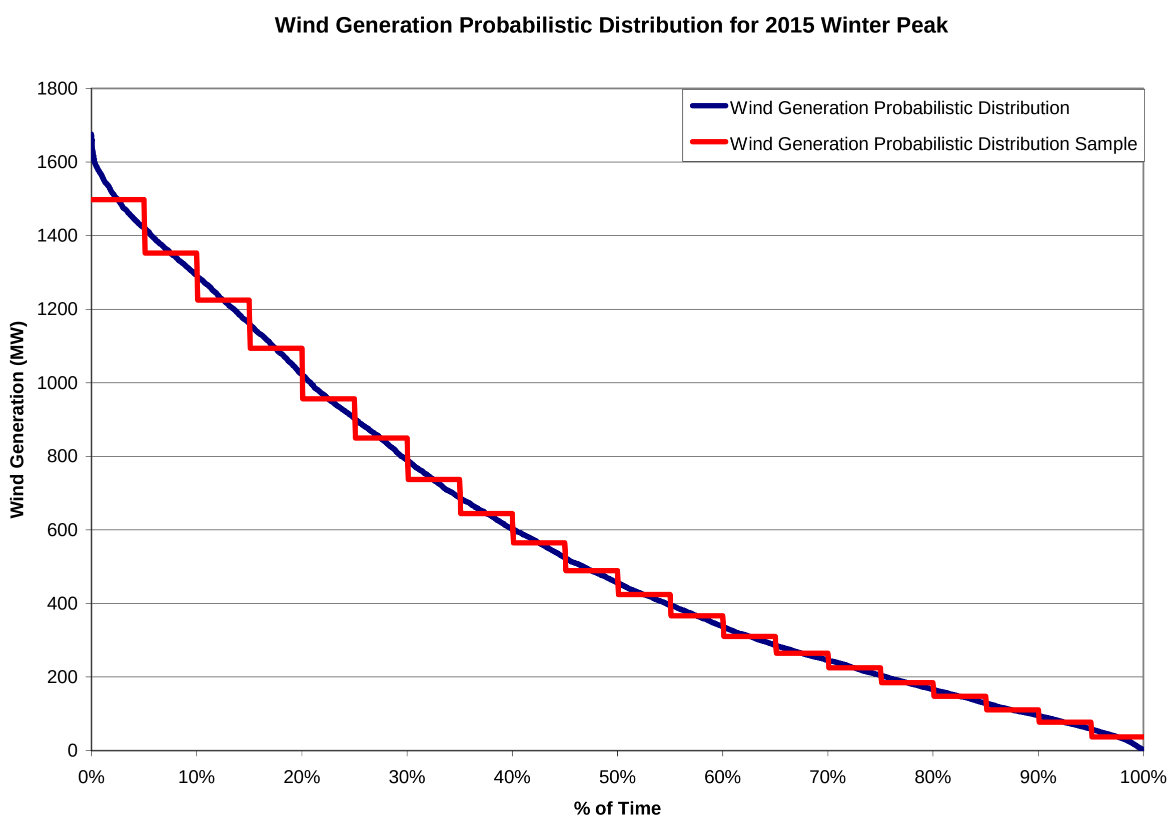
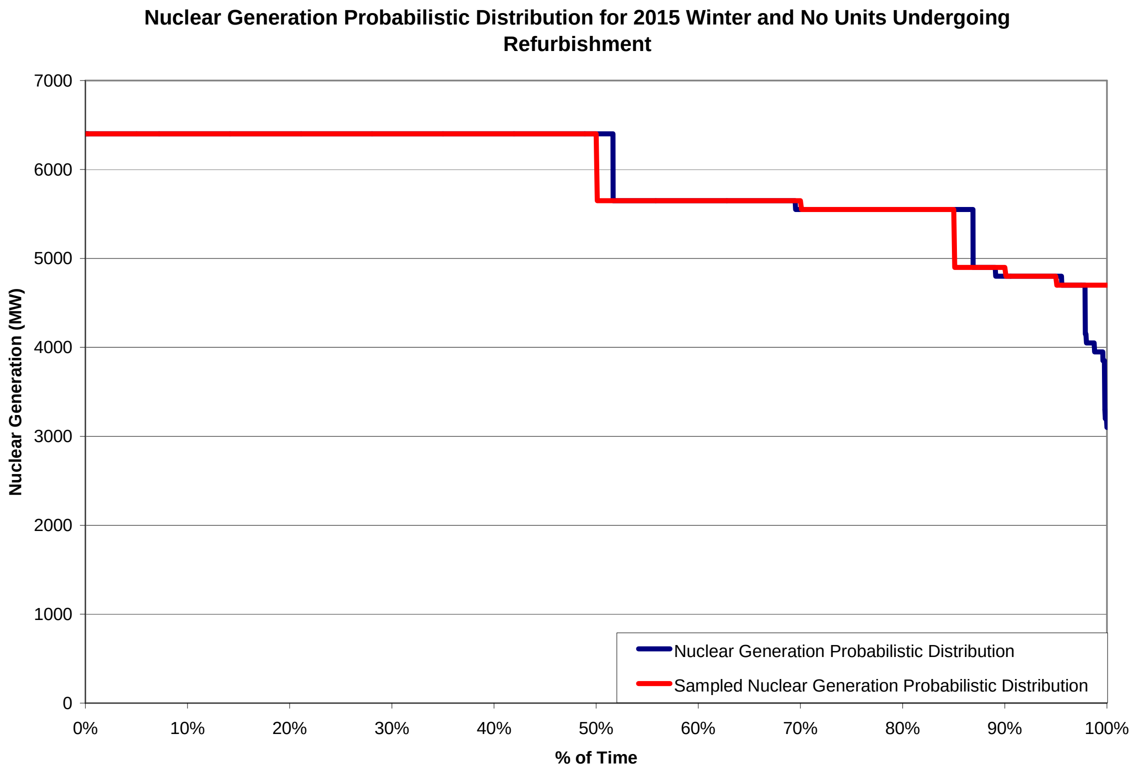
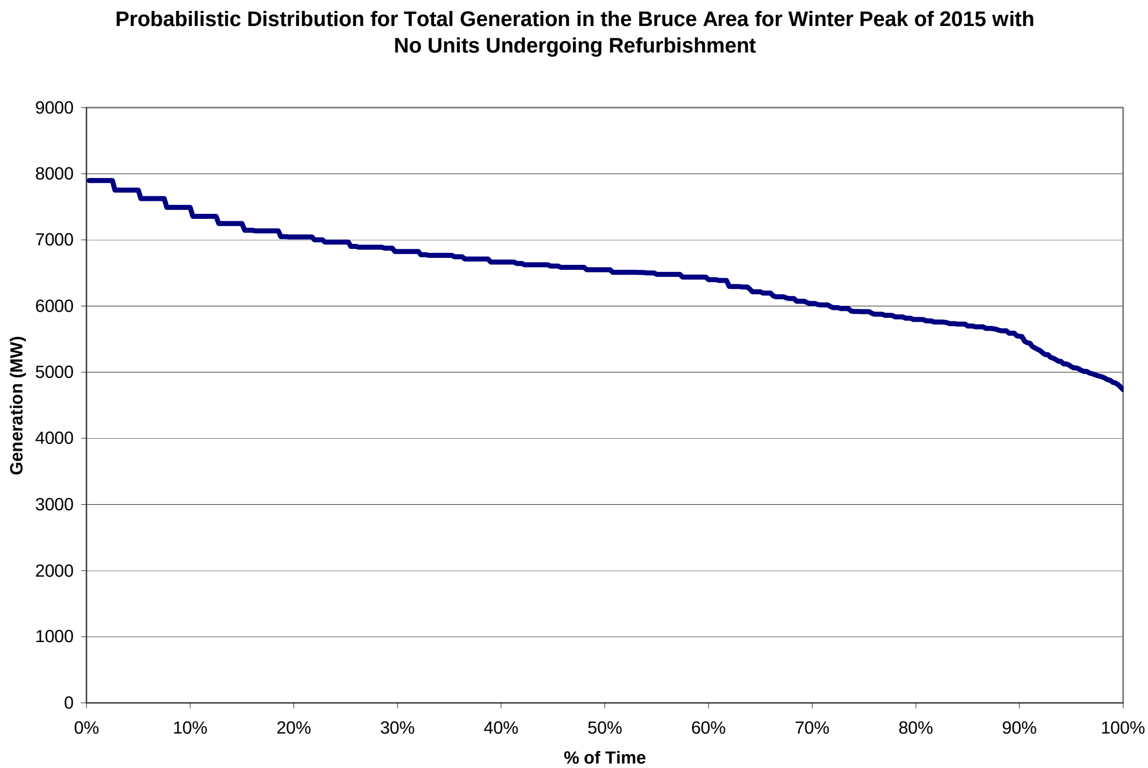


Figure 2



e) There are 24 total generation cases modeled for each year of study. This totals 456 distributions for the study period. Again, because all of the distributions are similar, only one example of this distribution is shown in Figure 3 below.

Figure 3



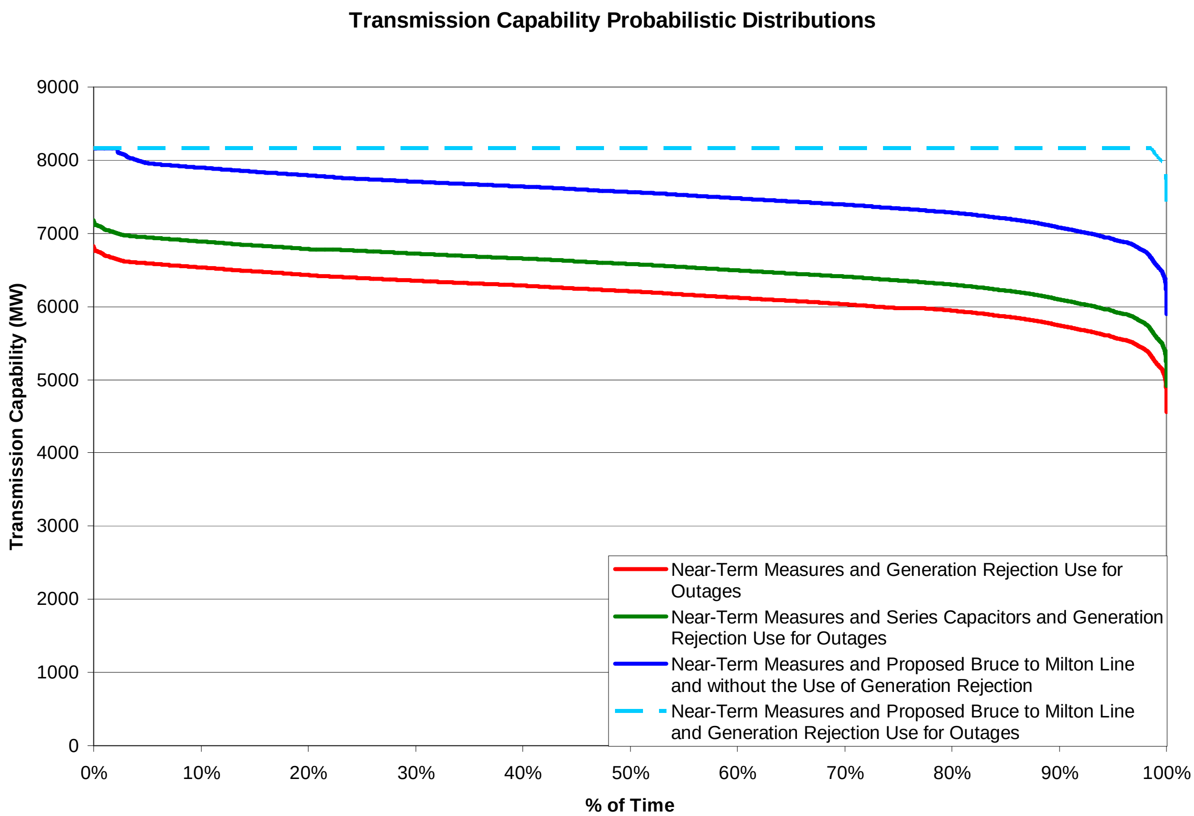
f) As explained in the response to part b) of this Interrogatory, transmission capability is modeled using normal system limits calculated by the IESO and historical transmission system penalty information. The Model takes into account historical de-rating patterns and uses these results in the consideration of future transmission capability. The resulting reduction in the transmission capability (i.e. the penalty) to the Bruce Area transmission system would be the same for each transmission system configuration (e.g., series capacitors, new Bruce to Milton line, etc.). The Model also assumes that the penalty would be the same for the study duration. Both of these assumptions are conservative as it is likely that a transmission system employing the new Bruce to Milton line would be more robust and would have a lower penalty due to transmission system outages, as compared to one employing series capacitors. This is because stress caused to the existing system using series capacitors would expected to be much higher and a larger transmission penalty (i.e. consequences) would likely result for any particular outage.

Also, it is expected that as the transmission system ages, outages would become more frequent and cause a larger penalty sustained for a longer period of time in the future.

Figure 4 shows transmission capability for each of the systems that the OPA modeled. Note that the capability of the proposed Bruce to Milton line drops below the 8,100

MW level in the distribution. This is due to the fact that generation rejection was not modeled for this option under outage conditions, while it was modeled for the other two cases. If generation rejection were to be assumed for the Bruce to Milton option under outage conditions (which will be the normal operating mode), the capability of the Bruce to Milton option would be able to be maintained at the 8,100 MW level throughout the period as illustrated in Figure 4 by the dashed line on the graph. This comports with the identified level of required or needed transfer capability fro the Bruce Area.

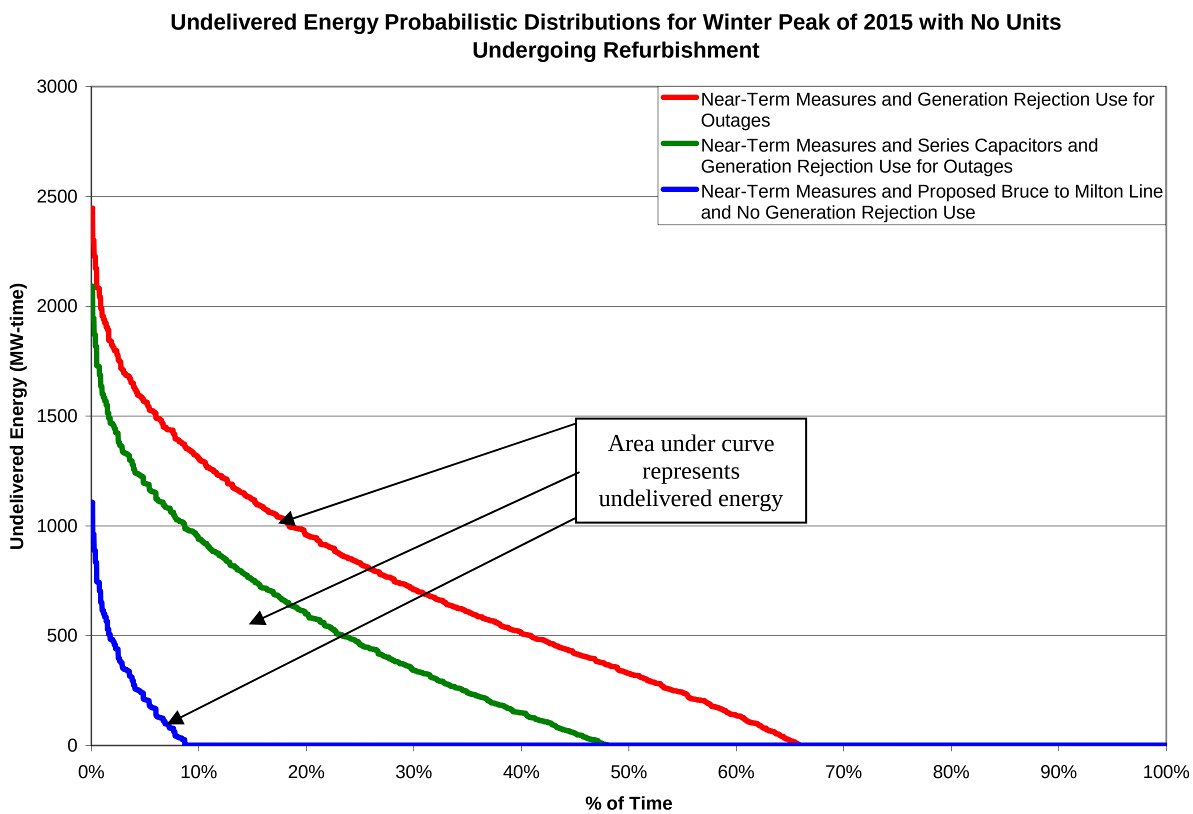
<u>Figure 4</u>



The transmission capability distributions shown in Figure 4 are then sampled in the same way as those for nuclear and wind generation. The transmission capability and total generation distributions are then convolved to derive the undelivered energy distribution. There are 456 undelivered energy distributions for each transmission system modeled. An example of the undelivered energy distribution for the winter peak in 2015 with no units undergoing refurbishment for both the proposed Bruce to Milton line (without any GR use) and for the series capacitor option (with GR use under outage conditions) is shown in Figure 5 below.

The undelivered energy is determined by using the expected value (mean) of these distributions to calculate undelivered energy for a certain period of time. Figure 5 below shows the undelivered energy calculated for the 2015 winter peak period. The winter peak period is one of the eight time periods used for the annual calculation. The area under each of the curves is a component of the amount of the 2015 undelivered energy in the table of undelivered energy values provided in the response to Pollution Probe Interrogatory 7.

Figure 5



The results of the OPA's analysis show that the Bruce transmission system reinforced with the Bruce to Milton line will have minor amount of undelivered energy incurred during equipment outage conditions. That small amount would be eliminated through the infrequent use of GR under those conditions. On the other hand, Figure 5 also depicts that the Bruce transmission system when reinforced only with series capacitors (and assuming the use of GR only under outage conditions) is expected to result in a significant amount of undelivered energy. For 2015 this amount is expected to be 1.3 TWH and is approximately 20% of the energy output of a Bruce A unit operating 100% of the time at 750 MW. Using the OEB-approved CDM avoided cost forecast as a proxy for the price of the replacement energy in 2015, the amount would be $63 million expressed in 2007 dollars. Please refer to Pollution Probe

Interrogatory 9. Over the entire study period, the net present value of the undelivered energy for the series capacitors option is $540 million expressed in 2007 dollars. This amount does not take into account transmission losses.
Figure 5 also shows the undelivered energy associated with reinforcing the Bruce transmission system with only the near-term measures. For 2015, undelivered energy is 2.6 TWH or 40% of the energy output of a Bruce A unit operating 100% of the time at 750 MW. Using the OEB-approved CDM avoided cost forecast as a proxy for the price of the replacement energy in 2015, the amount would be $120 million expressed in 2007 dollars. Please refer to Pollution Probe Interrogatory 9. Over the entire study period, the net present value of the undelivered energy for the near term measures option is approximately $1.1 billion expressed in 2007 dollars. This amount does not take into account transmission losses.

While the amount and cost of undelivered energy are important considerations, the frequency of exposure to congestion on the Bruce transmission system is also a critical measure of the impact of system constraints. As shown in Figure 5, the system is expected to be congested for a large percentage of time (e.g. approximately 50 % of the time for series compensation and close to 70% of the time for the near-term only measures option). Operation of the system with congestion would create complexities and create operational inefficiencies. For example, the Bruce nuclear units would have to operate with constrained output, there would be need for more frequent arming of the wind and nuclear units for rejection, and, when the limit of the ability to maneuver the output of the Bruce units is reached, there would be need to curtail the output of wind generation.

g) Please refer to the response to part f) above.

OPA's Bruce to Milton Financial Evaluation Model Assumptions

1.0 Purpose

The methodology of the OPA's Financial Evaluation Model ("Model") was described in detail in the response to Pollution Probe Interrogatory 47. This document describes the assumptions the Model uses to determine the undelivered energy and other results presented in the responses to various Interrogatories. These assumptions can be varied using the Model provided in the response to Pollution Probe Interrogatory 9.

2.0 Assumptions

All of the OPA's assumptions, with the exception of the Bruce unit refurbishment schedules, were included with the Model attached as part of the response to Pollution Probe Interrogatory 9. The monthly "in-service" schedule that the Model utilizes to determine the number of units out of service for refurbishment has been included as Attachment C to the updated response to Pollution Probe Interrogatory 47 (Exhibit C Tab 2 Schedule 47 Attachment C).

2.1 Wind Generation Assumptions

The Model uses wind data supplied to the OPA by AWS TrueWind, LLC. The Model incorporates the AWS data for Group No. 6 and the proportion of Group No. 0 that is in the Bruce Area. These Groups are defined in the AWS TrueWind Report, which is available on the OPA website. This data is sorted into each of the 8 time periods defined in the response to Pollution Probe Interrogatory 24. These time period definitions have been reproduced below as Tables 1 and 2. This data is used by the Model to determine the probabilistic distribution of wind generation described in the response to Pollution Probe Interrogatory 47 (d).

Table 1 – Definition of Seasons used by the Model

Season	**Months Included**
Winter	December – March
Summer	June – September
Shoulder	April, May, October, November

Table 2 – Definition of Time Periods used by the Model

	Winter	**Summer**	**Shoulder**
Peak	07:00-11:00 and 17:00 – 20:00 Weekdays	11:00-17:00 Weekdays	None
Mid-Peak	11:00-17:00 and	07:00-11:00 and	07:00-22:00 weekdays

	2000-2200 Weekdays	17:00-22:00 Weekdays	
Off-Peak	00:00-07:00 and 22:00-24:00 Weekdays; All hours weekends	00:00-07:00 and 22:00-24:00 Weekdays; All hours weekends	00:00-07:00 and 22:00-24:00 Weekdays; All hours weekends

The 700 MW of committed wind is assumed to be in-service by 2009. The 1,000 MW of future planned wind is assumed to begin coming in-service in 2013 and the full 1,000 MW of future planned wind is assumed to be in-service in 2015.

2.2 Nuclear Generation Assumptions

The Model utilizes performance information based on the average 2005-2006 availability of the Bruce B units. The average 2005-2006 availability of the Bruce B units was 86.1%. Each unit was assumed to undergo 45 days of planned outage every two years for maintenance. The Model assumes that all planned outage takes place during the Shoulder period (refer to Table 1). An effective forced outage rate (EFOR) of 8% was assumed in order to obtain an availability of 86.6%.

The Bruce A units were assumed to leave service for refurbishment and return to service after refurbishment as planned in the Bruce contract. Each Bruce B unit is assumed to require 2.5 years to refurbish. The first Bruce B unit is assumed to leave service for refurbishment in 2018. The second Bruce B unit is assumed to leave service for refurbishment in 2019. The third Bruce B unit is assumed to leave service for refurbishment at the same time that the first Bruce B unit returns to service after refurbishment. The fourth Bruce B unit is assumed to leave service for refurbishment at the same time that the second Bruce B unit returns to service after refurbishment.

The Model assumes that each of the Bruce A units have a net generation capacity of 750 MW. The Model assumes that each of the Bruce B units have an average net generation capacity of 820.95 MW in 2009, and increases linearly to a net generation capacity of 850 MW in 2013.

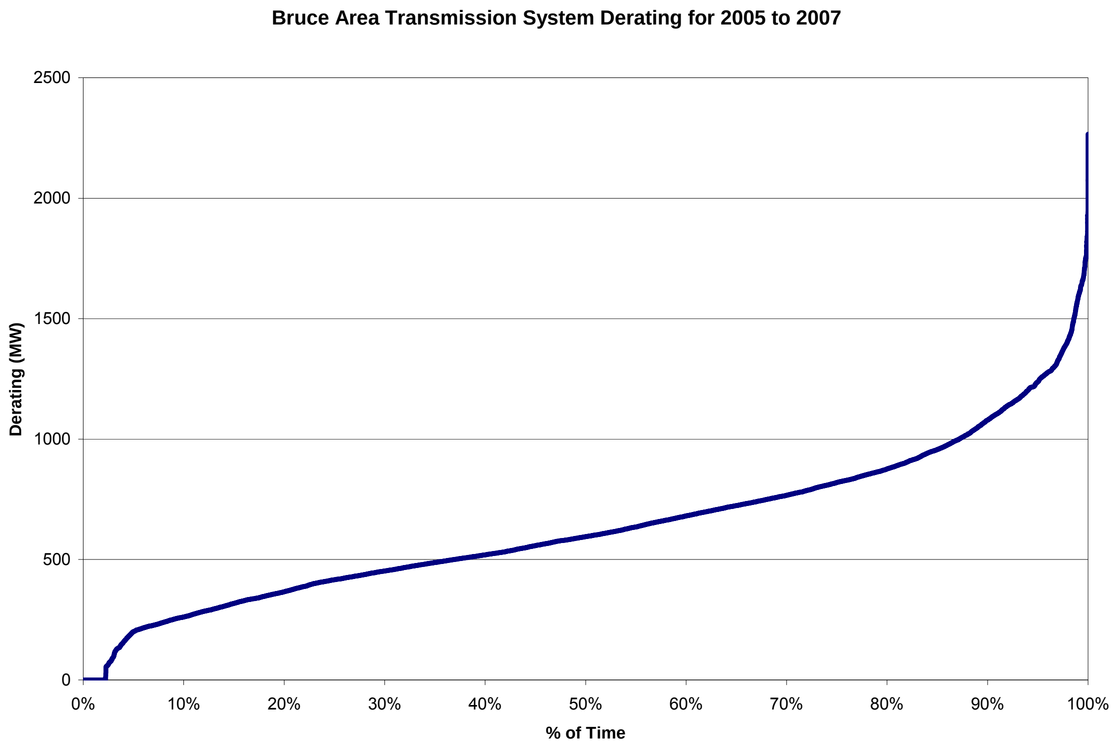
2.3 Transmission System Capability Assumptions

The Model uses normal system transmission limits calculated by the IESO for each of the transmission configurations to be studied (e.g. the implementation of Near-Term Measures and the new Bruce to Milton Line) based on a 500 MW flow from London eastward (“NBLIP=500MW”). These normal system transmission limits are shown in Table 3 below. The Model takes into account historical derating patterns when assessing the Bruce Area transmission capability (please refer to the response to Pollution Probe Interrogatory 47 (f) for details regarding the methodology of the Model). The Model utilizes historical transmission system derating data for the Bruce Area transmission system for 2005 to 2007. This data is shown in the duration curve in Figure 1 below.

Table 3 – Normal System Transmission Limits @ NBLIP = 500 MW

Normal System Transmission Limits (MW)	Near-Term Measures	Near-Term Measures + GR (Short-Term Use)	Near-Term Measures + SCAP	New BxM Line
Elements Out-of-Service (use GR)	6821	6821	7176	8160
All Elements In-Service	5976	6821	6776	8160

Figure 1 – Bruce Area Transmission System Derating Data



2.4 Discount Rate Assumptions

The Model utilizes a real discount rate of 4%.

2.5 Capital Costs Assumptions

The Model uses capital costs that exclude escalation and interest. These were provided by Hydro One and are shown below in Table 4.

Table 4 – Capital Costs (M$)

Year	NTM	NTM + GR	NTM + GR + SCAP	NTM + GR + BxM Line
2009	66	66	98	322
2010	150	157	209	341
2011	0	0	0	115

NTM ≡ Near-Term Measures
GR ≡ Generation Rejection (Expansion of the Bruce Special Proection System)
SCAP ≡ Series Capacitors
BxM ≡ Bruce to Milton

2.6 Energy Costs Assumptions

The Model uses the avoided energy costs from Table 11 of Navigant's "Avoided Cost Analysis for the Evaluation of CDM Measures". For the years 2025 to 2030 it is assumed that real energy prices are constant. The energy costs are shown below in Table 5.

Table 5 – Avoided Energy Costs (2005$/MWh)

Year	WinPeak	WinMid	WinOff	SumPeak	SumMid	SumOff	ShoMid	ShoOff
2009	91.4	64.7	41.7	86.6	67.9	40.8	68.1	37.5
2010	90.4	63.3	43.5	86.5	67.1	40.3	64.7	36.6
2011	85.6	61.8	42.8	81.3	66.1	39.6	63.7	35.4
2012	85.2	61.5	42.3	87.0	67.1	40.8	65.3	38.3
2013	92.6	65.7	46.4	87.7	70.6	42.0	66.6	40.7
2014	90.7	68.6	47.4	93.7	73.1	43.0	69.4	41.6
2015	89.7	68.5	51.3	108.3	78.6	46.2	70.4	44.7
2016	90.4	68.7	50.9	106.3	77.7	46.1	69.8	44.6
2017	91.1	68.9	50.6	104.3	76.8	46.0	69.3	44.6
2018	91.7	69.0	50.2	102.4	75.8	45.9	68.7	44.5
2019	92.2	69.1	49.8	100.5	74.9	45.7	68.1	44.4
2020	92.6	69.1	49.4	98.7	74.0	45.5	67.5	44.3
2021	92.5	68.9	49.5	96.7	74.0	45.6	67.7	44.4
2022	92.3	68.6	49.6	94.9	74.0	45.7	67.9	44.5
2023	92.0	68.3	49.6	93.0	74.0	45.7	68.1	44.6
2024	91.7	68.0	49.7	91.2	73.9	45.7	68.2	44.6
2025	91.3	67.6	49.6	89.4	73.7	45.7	68.2	44.7
2026	91.3	67.6	49.6	89.4	73.7	45.7	68.2	44.7
2027	91.3	67.6	49.6	89.4	73.7	45.7	68.2	44.7
2028	91.3	67.6	49.6	89.4	73.7	45.7	68.2	44.7
2029	91.3	67.6	49.6	89.4	73.7	45.7	68.2	44.7
2030	91.3	67.6	49.6	89.4	73.7	45.7	68.2	44.7

2.7 Peaker Costs Assumptions

The Model uses the capacity cost of a Simple-Cycle Gas Turbine ("SCGT") to determine the cost of capacity lost at the time of system peak. This was determined to be approximately 66.9 $/kW-year. The information used to determine the cost of 66.9 $/kW-year is presented below in Table 6.

Table 6 – SCGT Information

Capital Cost (2007 C$/kW)	$665
Fixed Operating Cost (2007 C$/kW-year)	$16
Project Life (years)	20
Average Annual Availability (%)	97%
Real Discount Rate (%)	4%

2.8 Losses Assumptions

The model assesses two different types of losses: (1) energy losses, and (2) capacity losses at system peak. Energy losses are calculated for a system load of 22,000 MW. The cost of energy losses are assessed using the avoided energy costs described in section 2.6 above. Capacity losses at system peak are calculated for a system load of 28,400 MW. The cost of capacity lost at system peak is determined using the peaker cost described in section 2.7 above.

The two losses described above are determined for different configurations of the Bruce Area transmission system (e.g. the implementation of Near-Term Measures and the new Bruce to Milton Line) at 17 different Bruce Area generation levels. PSS/E was used to determine the system losses at different levels of Bruce Area generation for different transmission system configurations. The PSS/E results used for the energy losses (system load of 22,000) are shown in Table 7 below. The PSS/E results used for the capacity losses at system peak (system load of 28,400) are shown in Table 8 below.

Table 7 – System Losses at a System Load of 22,000 MW

	System Losses (MW)			
Bruce Area Generation (MW)	NTM	NTM + GR	NTM + GR + SCAP	NTM + GR + New BxM Line
3500	519	519	519	504
3750	522	522	522	505
4000	526	526	527	507
4250	532	532	533	509
4500	539	539	540	513
4750	547	547	549	518
5000	557	557	559	523
5250	569	569	570	530
5500	581	581	583	537
5750	596	596	597	546
6000	612	612	612	555
6250	629	629	629	566
6500	647	647	647	577
6750	668	668	666	589
7000	689	689	687	603
7250	712	712	709	617
7500	737	737	732	632

NTM ≡ Near-Term Measures
GR ≡ Generation Rejection (Expansion of the Bruce Special Proection System)
SCAP ≡ Series Capacitors
BxM ≡ Bruce to Milton

Table 8 – System Losses at a System Load of 28,400 MW

	System Losses (MW)			
Real Flow Buckets (MW)	NTM	NTM + GR	NTM + GR + SCAP	NTM + New BxM Line
3500	997	997	998	983
3750	999	999	1000	982
4000	1003	1003	1003	983
4250	1008	1008	1008	984
4500	1015	1015	1014	986
4750	1022	1022	1022	990
5000	1031	1031	1031	994
5250	1042	1042	1042	999
5500	1054	1054	1053	1006
5750	1067	1067	1067	1013
6000	1081	1081	1081	1021
6250	1097	1097	1098	1031
6500	1114	1114	1115	1041
6750	1132	1132	1134	1052
7000	1152	1152	1154	1065
7250	1173	1173	1176	1078
7500	1195	1195	1199	1093

NTM ≡ Near-Term Measures
GR ≡ Generation Rejection (Expansion of the Bruce Special Proection System)
SCAP ≡ Series Capacitors
BxM ≡ Bruce to Milton

The Model analyzes 8 different time periods and 3 different refurbishment states as described in the response to Pollution Probe Interrogatory 47 (d). Flows away from the Bruce area are assessed for all of these different states. The flows are constrained by each transmission system configuration's capability.

2.8.1 Energy Losses Methodology

The Model assigns the modelled flows into each of the 17 generation levels. System losses are determined by taking the average of these loss distributions in the same way that undelivered energy is determined (see the response to Pollution Probe Interrogatory 47 (f)). The cost of energy losses is then assessed relative to the transmission system configuration employing the new Bruce to Milton line.

2.8.2 Capacity Losses at System Peak Methodology

The Model analyzes the modelled flows for the Summer period (Summer Peak, Summer Mid-Peak, Summer Off-Peak periods described in Table 2 above) and determines the maximum flow during the Summer period for each state analyzed. The capacity losses at system peak are determined by assessing the system losses for the maximum Summer period flow. The cost of the capacity losses at system peak are determined relative to the transmission system configuration employing the new Bruce to Milton line.

Undelivered Energy (MWh)

Date	Part a)	Part b)	Part c)	Part d)	Part e)
Jan-12	[redacted]				
Feb-12					
Mar-12					
Apr-12					
May-12					
Jun-12					
Jul-12					
Aug-12					
Sep-12					
Oct-12					
Nov-12					
Dec-12					
Jan-13					
Feb-13					
Mar-13					
Apr-13					
May-13					
Jun-13					
Jul-13					
Aug-13					
Sep-13					
Oct-13					
Nov-13					
Dec-13					
Jan-14	314426	314426	169899	169899	77929
Feb-14	314426	314426	169899	169899	77929
Mar-14	314426	314426	169899	169899	77929
Apr-14	36687	36687	12140	12140	4305
May-14	36687	36687	12140	12140	4305
Jun-14	216665	216665	96803	96803	41597
Jul-14	216665	216665	96803	96803	41597
Aug-14	216665	216665	96803	96803	41597
Sep-14	216665	216665	96803	96803	41597
Oct-14	36687	36687	12140	12140	4305
Nov-14	36687	36687	12140	12140	4305
Dec-14	314426	314426	169899	169899	77929
Jan-15	355256	355256	203198	203198	96848
Feb-15	355256	355256	203198	203198	96848
Mar-15	355256	355256	203198	203198	96848
Apr-15	49810	49810	19127	19127	7081

May-15	49810	49810	19127	19127	7081
Jun-15	238269	238269	112758	112758	49615
Jul-15	238269	238269	112758	112758	49615
Aug-15	238269	238269	112758	112758	49615
Sep-15	238269	238269	112758	112758	49615
Oct-15	49810	49810	19127	19127	7081
Nov-15	49810	49810	19127	19127	7081
Dec-15	355256	355256	203198	203198	96848
Jan-16	355256	355256	203198	203198	96848
Feb-16	355256	355256	203198	203198	96848
Mar-16	355256	355256	203198	203198	96848
Apr-16	49810	49810	19127	19127	7081
May-16	49810	49810	19127	19127	7081
Jun-16	238269	238269	112758	112758	49615
Jul-16	238269	238269	112758	112758	49615
Aug-16	238269	238269	112758	112758	49615
Sep-16	238269	238269	112758	112758	49615
Oct-16	49810	49810	19127	19127	7081
Nov-16	49810	49810	19127	19127	7081
Dec-16	355256	355256	203198	203198	96848
Jan-17	355256	355256	203198	203198	96848
Feb-17	355256	355256	203198	203198	96848
Mar-17	355256	355256	203198	203198	96848
Apr-17	49810	49810	19127	19127	7081
May-17	49810	49810	19127	19127	7081
Jun-17	238269	238269	112758	112758	49615
Jul-17	238269	238269	112758	112758	49615
Aug-17	238269	238269	112758	112758	49615
Sep-17	238269	238269	112758	112758	49615
Oct-17	49810	49810	19127	19127	7081
Nov-17	49810	49810	19127	19127	7081
Dec-17	355256	355256	203198	203198	96848
Jan-18	85491	85491	33733	203198	96848
Feb-18	85491	85491	33733	203198	96848
Mar-18	85491	85491	33733	203198	96848
Apr-18	4762	4762	883	19127	7081
May-18	4762	4762	883	19127	7081
Jun-18	33400	33400	9258	112758	49615
Jul-18	33400	33400	9258	112758	49615
Aug-18	33400	33400	9258	112758	49615
Sep-18	33400	33400	9258	112758	49615
Oct-18	4762	4762	883	19127	7081
Nov-18	4762	4762	883	19127	7081
Dec-18	85491	85491	33733	203198	96848
Jan-19	6338	6338	1073	203198	96848
Feb-19	6338	6338	1073	203198	96848
Mar-19	6338	6338	1073	203198	96848
Apr-19	0	0	0	19127	7081

May-19	0	0	0	19127	7081
Jun-19	1037	1037	96	112758	49615
Jul-19	1037	1037	96	112758	49615
Aug-19	1037	1037	96	112758	49615
Sep-19	1037	1037	96	112758	49615
Oct-19	0	0	0	19127	7081
Nov-19	0	0	0	19127	7081
Dec-19	6338	6338	1073	203198	96848
Jan-20	6338	6338	1073	33733	15907
Feb-20	6338	6338	1073	33733	15907
Mar-20	6338	6338	1073	33733	15907
Apr-20	0	0	0	0	0
May-20	0	0	0	0	0
Jun-20	1037	1037	96	96	48
Jul-20	1037	1037	96	96	48
Aug-20	1037	1037	96	96	48
Sep-20	1037	1037	96	96	48
Oct-20	0	0	0	0	0
Nov-20	0	0	0	0	0
Dec-20	6338	6338	1073	1073	537
Jan-21	6338	6338	1073	1073	537
Feb-21	6338	6338	1073	1073	537
Mar-21	6338	6338	1073	1073	537
Apr-21	0	0	0	0	0
May-21	0	0	0	0	0
Jun-21	1037	1037	96	0	0
Jul-21	1037	1037	96	0	0
Aug-21	1037	1037	96	0	0
Sep-21	1037	1037	96	0	0
Oct-21	0	0	0	0	0
Nov-21	0	0	0	0	0
Dec-21	6338	6338	1073	0	0
Jan-22	6338	6338	1073	0	0
Feb-22	6338	6338	1073	0	0
Mar-22	6338	6338	1073	0	0
Apr-22	0	0	0	0	0
May-22	0	0	0	0	0
Jun-22	1037	1037	96	0	0
Jul-22	1037	1037	96	0	0
Aug-22	1037	1037	96	0	0
Sep-22	1037	1037	96	0	0
Oct-22	0	0	0	0	0
Nov-22	0	0	0	0	0
Dec-22	6338	6338	1073	0	0
Jan-23	85491	85491	33733	0	0
Feb-23	85491	85491	33733	0	0
Mar-23	85491	85491	33733	0	0
Apr-23	4762	4762	883	0	0

May-23	4762	4762	883	0	0
Jun-23	33400	33400	9258	0	0
Jul-23	33400	33400	9258	0	0
Aug-23	33400	33400	9258	0	0
Sep-23	33400	33400	9258	0	0
Oct-23	4762	4762	883	0	0
Nov-23	4762	4762	883	0	0
Dec-23	85491	85491	33733	0	0
Jan-24	355256	355256	203198	0	0
Feb-24	355256	355256	203198	0	0
Mar-24	355256	355256	203198	0	0
Apr-24	49810	49810	19127	0	0
May-24	49810	49810	19127	0	0
Jun-24	238269	238269	112758	0	0
Jul-24	238269	238269	112758	0	0
Aug-24	238269	238269	112758	0	0
Sep-24	238269	238269	112758	0	0
Oct-24	49810	49810	19127	0	0
Nov-24	49810	49810	19127	0	0
Dec-24	355256	355256	203198	0	0
Jan-25	355256	355256	203198	0	0
Feb-25	355256	355256	203198	0	0
Mar-25	355256	355256	203198	0	0
Apr-25	49810	49810	19127	0	0
May-25	49810	49810	19127	0	0
Jun-25	238269	238269	112758	0	0
Jul-25	238269	238269	112758	0	0
Aug-25	238269	238269	112758	0	0
Sep-25	238269	238269	112758	0	0
Oct-25	49810	49810	19127	0	0
Nov-25	49810	49810	19127	0	0
Dec-25	355256	355256	203198	0	0
Jan-26	355256	355256	203198	0	0
Feb-26	355256	355256	203198	0	0
Mar-26	355256	355256	203198	0	0
Apr-26	49810	49810	19127	0	0
May-26	49810	49810	19127	0	0
Jun-26	238269	238269	112758	0	0
Jul-26	238269	238269	112758	0	0
Aug-26	238269	238269	112758	0	0
Sep-26	238269	238269	112758	0	0
Oct-26	49810	49810	19127	0	0
Nov-26	49810	49810	19127	0	0
Dec-26	355256	355256	203198	0	0
Jan-27	355256	355256	203198	0	0
Feb-27	355256	355256	203198	0	0
Mar-27	355256	355256	203198	0	0
Apr-27	49810	49810	19127	0	0

May-27	49810	49810	19127	0	0
Jun-27	238269	238269	112758	0	0
Jul-27	238269	238269	112758	0	0
Aug-27	238269	238269	112758	0	0
Sep-27	238269	238269	112758	0	0
Oct-27	49810	49810	19127	0	0
Nov-27	49810	49810	19127	0	0
Dec-27	355256	355256	203198	0	0
Jan-28	355256	355256	203198	0	0
Feb-28	355256	355256	203198	0	0
Mar-28	355256	355256	203198	0	0
Apr-28	49810	49810	19127	0	0
May-28	49810	49810	19127	0	0
Jun-28	238269	238269	112758	0	0
Jul-28	238269	238269	112758	0	0
Aug-28	238269	238269	112758	0	0
Sep-28	238269	238269	112758	0	0
Oct-28	49810	49810	19127	0	0
Nov-28	49810	49810	19127	0	0
Dec-28	355256	355256	203198	0	0
Jan-29	355256	355256	203198	0	0
Feb-29	355256	355256	203198	0	0
Mar-29	355256	355256	203198	0	0
Apr-29	49810	49810	19127	0	0
May-29	49810	49810	19127	0	0
Jun-29	238269	238269	112758	0	0
Jul-29	238269	238269	112758	0	0
Aug-29	238269	238269	112758	0	0
Sep-29	238269	238269	112758	0	0
Oct-29	49810	49810	19127	0	0
Nov-29	49810	49810	19127	0	0
Dec-29	355256	355256	203198	0	0
Jan-30	355256	355256	203198	0	0
Feb-30	355256	355256	203198	0	0
Mar-30	355256	355256	203198	0	0
Apr-30	49810	49810	19127	0	0
May-30	49810	49810	19127	0	0
Jun-30	238269	238269	112758	0	0
Jul-30	238269	238269	112758	0	0
Aug-30	238269	238269	112758	0	0
Sep-30	238269	238269	112758	0	0
Oct-30	49810	49810	19127	0	0
Nov-30	49810	49810	19127	0	0
Dec-30	355256	355256	203198	0	0

Comment:	Bruce B Refurb Starts in 2018
Date	# Units I/S
Jan-09	[redacted]
Feb-09	[redacted]
Mar-09	[redacted]
Apr-09	[redacted]
May-09	[redacted]
Jun-09	[redacted]
Jul-09	[redacted]
Aug-09	[redacted]
Sep-09	[redacted]
Oct-09	[redacted]
Nov-09	[redacted]
Dec-09	[redacted]
Jan-10	[redacted]
Feb-10	[redacted]
Mar-10	[redacted]
Apr-10	[redacted]
May-10	[redacted]
Jun-10	[redacted]
Jul-10	[redacted]
Aug-10	[redacted]
Sep-10	[redacted]
Oct-10	[redacted]
Nov-10	[redacted]
Dec-10	[redacted]
Jan-11	[redacted]
Feb-11	[redacted]
Mar-11	[redacted]
Apr-11	[redacted]
May-11	[redacted]
Jun-11	[redacted]
Jul-11	[redacted]
Aug-11	[redacted]
Sep-11	[redacted]
Oct-11	[redacted]
Nov-11	[redacted]
Dec-11	[redacted]
Jan-12	[redacted]
Feb-12	[redacted]
Mar-12	[redacted]
Apr-12	[redacted]
May-12	[redacted]
Jun-12	[redacted]

Comment:	Bruce B Refurb Starts in 2018
Date	# Units I/S
Jul-12	[redacted]
Aug-12	[redacted]
Sep-12	[redacted]
Oct-12	[redacted]
Nov-12	[redacted]
Dec-12	[redacted]
Jan-13	[redacted]
Feb-13	[redacted]
Mar-13	[redacted]
Apr-13	[redacted]
May-13	[redacted]
Jun-13	[redacted]
Jul-13	[redacted]
Aug-13	[redacted]
Sep-13	[redacted]
Oct-13	[redacted]
Nov-13	[redacted]
Dec-13	[redacted]
Jan-14	8
Feb-14	8
Mar-14	8
Apr-14	8
May-14	8
Jun-14	8
Jul-14	8
Aug-14	8
Sep-14	8
Oct-14	8
Nov-14	8
Dec-14	8
Jan-15	8
Feb-15	8
Mar-15	8
Apr-15	8
May-15	8
Jun-15	8
Jul-15	8
Aug-15	8
Sep-15	8
Oct-15	8
Nov-15	8
Dec-15	8
Jan-16	8
Feb-16	8
Mar-16	8
Apr-16	8

Comment:	Bruce B Refurb Starts in 2018
Date	# Units I/S
May-16	8
Jun-16	8
Jul-16	8
Aug-16	8
Sep-16	8
Oct-16	8
Nov-16	8
Dec-16	8
Jan-17	8
Feb-17	8
Mar-17	8
Apr-17	8
May-17	8
Jun-17	8
Jul-17	8
Aug-17	8
Sep-17	8
Oct-17	8
Nov-17	8
Dec-17	8
Jan-18	7
Feb-18	7
Mar-18	7
Apr-18	7
May-18	7
Jun-18	7
Jul-18	7
Aug-18	7
Sep-18	7
Oct-18	7
Nov-18	7
Dec-18	7
Jan-19	6
Feb-19	6
Mar-19	6
Apr-19	6
May-19	6
Jun-19	6
Jul-19	6
Aug-19	6
Sep-19	6
Oct-19	6
Nov-19	6
Dec-19	6
Jan-20	6
Feb-20	6

Comment:	Bruce B Refurb Starts in 2018
Date	# Units I/S
Mar-20	6
Apr-20	6
May-20	6
Jun-20	6
Jul-20	6
Aug-20	6
Sep-20	6
Oct-20	6
Nov-20	6
Dec-20	6
Jan-21	6
Feb-21	6
Mar-21	6
Apr-21	6
May-21	6
Jun-21	6
Jul-21	6
Aug-21	6
Sep-21	6
Oct-21	6
Nov-21	6
Dec-21	6
Jan-22	6
Feb-22	6
Mar-22	6
Apr-22	6
May-22	6
Jun-22	6
Jul-22	6
Aug-22	6
Sep-22	6
Oct-22	6
Nov-22	6
Dec-22	6
Jan-23	7
Feb-23	7
Mar-23	7
Apr-23	7
May-23	7
Jun-23	7
Jul-23	7
Aug-23	7
Sep-23	7
Oct-23	7
Nov-23	7
Dec-23	7

Comment:	Bruce B Refurb Starts in 2018
Date	# Units I/S
Jan-24	8
Feb-24	8
Mar-24	8
Apr-24	8
May-24	8
Jun-24	8
Jul-24	8
Aug-24	8
Sep-24	8
Oct-24	8
Nov-24	8
Dec-24	8
Jan-25	8
Feb-25	8
Mar-25	8
Apr-25	8
May-25	8
Jun-25	8
Jul-25	8
Aug-25	8
Sep-25	8
Oct-25	8
Nov-25	8
Dec-25	8
Jan-26	8
Feb-26	8
Mar-26	8
Apr-26	8
May-26	8
Jun-26	8
Jul-26	8
Aug-26	8
Sep-26	8
Oct-26	8
Nov-26	8
Dec-26	8
Jan-27	8
Feb-27	8
Mar-27	8
Apr-27	8
May-27	8
Jun-27	8
Jul-27	8
Aug-27	8
Sep-27	8
Oct-27	8

Comment:	Bruce B Refurb Starts in 2018
Date	# Units I/S
Nov-27	8
Dec-27	8
Jan-28	8
Feb-28	8
Mar-28	8
Apr-28	8
May-28	8
Jun-28	8
Jul-28	8
Aug-28	8
Sep-28	8
Oct-28	8
Nov-28	8
Dec-28	8
Jan-29	8
Feb-29	8
Mar-29	8
Apr-29	8
May-29	8
Jun-29	8
Jul-29	8
Aug-29	8
Sep-29	8
Oct-29	8
Nov-29	8
Dec-29	8
Jan-30	8
Feb-30	8
Mar-30	8
Apr-30	8
May-30	8
Jun-30	8
Jul-30	8
Aug-30	8
Sep-30	8
Oct-30	8
Nov-30	8
Dec-30	8