GE
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Cricket Valley Energy Project: Security-Constrained Economic Dispatch Analysis

Prepared for: **GE Energy Global Development and Strategic Initiatives**

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imagination at work

Foreword

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1 Executive Summary

GE Energy Global Development and Strategic Initiatives (GDSI) contacted the Energy Consulting (EC) group to conduct a Security-Constrained Economic Dispatch (SCED) study in support of the Environmental Impact Study (EIS) for the proposed 1,000 MW Cricket Valley Energy Project (Cricket Valley) in New York. To perform the SCED study, EC used GE Energy's Multi-Area Production Simulation (GE-MAPS™) software application for a transmission constrained, production simulation of the regions surrounding Cricket Valley within the Eastern Interconnection (EI) for years 2015 through 2020. This was accomplished by incorporating cost and performance assumptions specific to the Cricket Valley in EC's current non-proprietary EI database.

Generally speaking, the addition of Cricket Valley to the New York Pool results in an increase in energy production within the NY Pool, fewer imports from adjacent pools and a lower Total Annual Load-Weighted Cost to Serve (M$ per year) across the region (New York, New England, PJM and Ontario). Generally speaking, both NOx and SO2 production (total tons per year) decrease across the region and within most pools, while Ontario shows a slight increase in both effluents in certain years (due to a slight increase in Ontario coal-fired generation, with the addition of Cricket Valley). Total CO2 production (total tons per year) across the region decreases as a result of Cricket Valley, but the total amount of CO2 produced in the NY Pool increases slightly (about 2% annually over the study period), due to the increase energy production (about 2% annually over the study periods) within the NY Pool.

A sensitivity analysis was also performed to consider the possible retirement of a nuclear generating unit in the region. Currently, the EI database used for this SCED study assumes the Indian Point Units 2 and 3 will receive an operating license extension beyond the current operating licenses, due to expire in September 2013 and December 2015, respectively. For purposes of this study, it did not seem unreasonable to assume a scenario where the operating license for Unit 2 may not be extended beyond September 2013.

The results from the Indian Point Unit 2 sensitivity cases are summarized in Section 4 below. In general, the relative impact of adding Cricket Valley to the New York Pool with Indian Point Unit 2 retired in 2013 is consistent with the observed results assuming Indian Point Unit 2 remains in service beyond the expiration of its current operating license.

Licenses for the GE-MAPS software application and the EI database used for this study are not included as deliverables for this study.

2 Analysis

EC performed the SCED study by incorporating cost and performance assumptions specific to the Cricket Valley in EC's current non-proprietary EI database. (See Appendix A for a summary of the non-proprietary database assumptions.) The assumptions for Cricket Valley are summarized below:

Table 2.1: Cricket Valley Cost and Performance Assumptions

Parameter	Assumption
GE-MAPS Gas Node:	NGNYEAST
Summer Capacity:	912 MW CC (+ 124 MW Duct Firing)
Winter Capacity:	962 MW CC (+ 122 MW Duct Firing)
Summer FLHR:	6,654 Btu/kWh
Winter FLHR:	6,657 Btu/kWh
Duct Firing IHR (Summer):	9,045 Btu/kWh
Duct Firing IHR (Winter):	9,049 Btu/kWh
NOx Rate:	2.0 ppm
Variable O&M:	$2.45/MWh
Fixed O&M:	$12.00/kW-yr
Start-Up Cost:	$36,000/start
COD:	May 1, 2015
Forced Outage Rate:	3.3%
Planned Outage Rate:	4.0%
Min Down Time:	8 hours
Inflation Rate:	2.4%
Interconnection:	345 kV line from Pleasant Valley to Long Mountain approximately 9 miles from Pleasant Valley

Using these assumptions, EC performed a transmission constrained, production simulation using the GE-MAPS software application (see Appendix B for a summary brochure describing the GE-MAPS software application). Two production simulations were performed: one case without Cricket Valley (Base Case) and a second case with Cricket Valley (Cricket Valley Case). Using the results from these two simulations, the impact of Cricket Valley on the New York ISO and on adjacent systems (ISO-New England, PJM, Ontario IESO) was analyzed. The variables selected for this analysis include Total Annual Load-Weighted Cost to Serve (M$), Total Annual Energy Production (GWh) and Total Annual Emissions Production (NOx, SO2 and CO2) for each of the four "pools" analyzed (NY Pool, NE Pool, Ontario and PJM).

The results from these two cases are summarized in Section 3 below.

A sensitivity analysis was also performed to consider the possible retirement of a nuclear generating unit in the region. Currently, the EI database used for this SCED study assumes

the Indian Point Units 2 and 3 will receive an operating license extension beyond the current operating licenses, due to expire in September 2013 and December 2015, respectively.[1] The recent New York State Energy Research Development Authority (NYSERDA) State Energy Plan[2] included a scenario where both Units 2 and 3 were retired in 2015.[3] While the likelihood of retiring both nuclear units in the same year may appear questionable today, it did not seem unreasonable for purposes of this study to assume a scenario where the operating license for Unit 2 may not be extended beyond September 2013.

The results from the Indian Point Unit 2 sensitivity cases are summarized in Section 4 below.

[1] http://www.entergy-nuclear.com/plant_information/indian_point.aspx
[2] http://www.nysenergyplan.com/
[3] http://www.nysenergyplan.com/Supporting_Documents/Electricity%20Modeling%20Assumptions.pdf?cf03800915=C307807C!MjA0MDUxNTAxOmNvcnByYWRpdXNzc286vQh0XRLzhAsnwQhEoGFlnw==

3 Results

Table 3.1 below summarizes the Total Cost to Serve in each of the pools analyzed. The underlying competitive wholesale market structure within each of these pools assumes supply offers based on each individual unit's marginal costs. Generally speaking, the majority of the decrease in Total Cost to Serve is shared between the NY Pool and PJM.

Table 3.1 Total Annual Load-Weighted Cost to Serve (M$) by Pool

		2015	2016	2017	2018	2019	2020
Base Case (M$)	NE Pool	$ 8,215	$ 8,545	$ 8,856	$ 9,090	$ 9,709	$ 9,957
	NY Pool	$ 10,586	$ 11,086	$ 11,400	$ 11,704	$ 12,532	$ 12,842
	Ontario	$ 6,872	$ 7,485	$ 7,678	$ 8,085	$ 8,303	$ 8,635
	PJM	$ 43,081	$ 45,087	$ 45,209	$ 46,964	$ 49,922	$ 51,825
	TOTAL	$ 68,755	$ 72,203	$ 73,143	$ 75,843	$ 80,465	$ 83,259
Cricket Valley Case (M$)	NE Pool	$ 8,124	$ 8,383	$ 8,729	$ 8,903	$ 9,545	$ 9,759
	NY Pool	$ 10,425	$ 10,869	$ 11,211	$ 11,429	$ 12,280	$ 12,608
	Ontario	$ 6,853	$ 7,454	$ 7,677	$ 8,024	$ 8,261	$ 8,564
	PJM	$ 42,911	$ 44,819	$ 44,968	$ 46,727	$ 49,581	$ 51,630
	TOTAL	$ 68,312	$ 71,524	$ 72,585	$ 75,082	$ 79,667	$ 82,562
Increase (Decrease) (M$)	NE Pool	$ (92)	$ (162)	$ (128)	$ (188)	$ (164)	$ (198)
	NY Pool	$ (162)	$ (217)	$ (189)	$ (275)	$ (252)	$ (234)
	Ontario	$ (20)	$ (32)	$ (2)	$ (61)	$ (42)	$ (71)
	PJM	$ (170)	$ (269)	$ (240)	$ (237)	$ (340)	$ (195)
	TOTAL	$ (443)	$ (679)	$ (559)	$ (761)	$ (798)	$ (697)
% Increase (Decrease)	NE Pool	(1.1%)	(1.9%)	(1.4%)	(2.1%)	(1.7%)	(2.0%)
	NY Pool	(1.5%)	(2.0%)	(1.7%)	(2.4%)	(2.0%)	(1.8%)
	Ontario	(0.3%)	(0.4%)	(0.0%)	(0.8%)	(0.5%)	(0.8%)
	PJM	(0.4%)	(0.6%)	(0.5%)	(0.5%)	(0.7%)	(0.4%)
	TOTAL	(0.6%)	(0.9%)	(0.8%)	(1.0%)	(1.0%)	(0.8%)

Table 3.2 below illustrates the impact on total energy production within each pool, as a result of adding Cricket Valley to the NY Pool. Generally speaking, the increase in energy production within New York serves to decrease imports from adjacent pools, thereby lowering energy production in each of those pools.

Table 3.2 Total Annual Energy Production (GWh) by Pool

		2015	2016	2017	2018	2019	2020
Base Case (GWh)	NE Pool	120,492	121,789	122,396	124,031	126,229	127,615
	NY Pool	148,035	149,226	153,738	156,701	158,174	163,212
	Ontario	143,708	144,511	144,216	144,244	144,654	144,829
	PJM	735,037	739,106	747,167	751,786	758,825	757,786
	TOTAL	1,147,272	1,154,633	1,167,517	1,176,762	1,187,881	1,193,441
Cricket Valley Case (GWh)	NE Pool	119,674	120,728	121,214	122,893	125,006	126,396
	NY Pool	150,004	152,267	156,927	159,768	161,550	166,495
	Ontario	143,742	144,363	143,983	144,005	144,417	144,650
	PJM	733,950	737,463	745,492	750,115	756,998	755,926
	TOTAL	1,147,370	1,154,820	1,167,616	1,176,780	1,187,971	1,193,468
Increase (Decrease) (GWh)	NE Pool	(818)	(1,061)	(1,182)	(1,138)	(1,223)	(1,219)
	NY Pool	1,969	3,040	3,190	3,067	3,376	3,283
	Ontario	34	(149)	(233)	(239)	(237)	(178)
	PJM	(1,087)	(1,644)	(1,675)	(1,672)	(1,827)	(1,860)
	TOTAL	98	187	99	17	90	27
% Increase (Decrease)	NE Pool	(0.7%)	(0.9%)	(1.0%)	(0.9%)	(1.0%)	(1.0%)
	NY Pool	1.3%	2.0%	2.1%	2.0%	2.1%	2.0%
	Ontario	0.0%	(0.1%)	(0.2%)	(0.2%)	(0.2%)	(0.1%)
	PJM	(0.1%)	(0.2%)	(0.2%)	(0.2%)	(0.2%)	(0.2%)
	TOTAL	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Tables 3.3 through 3.5 below summarize the total impact on emissions production within each pool as a result of adding Cricket Valley to the NY Pool. Generally speaking, both NOx and SO2 production decrease across the region and within most pools, while Ontario shows a slight increase in both effluents in certain years.

Table 3.3 Total Annual NOx Production (Tons) by Pool

		2015	2016	2017	2018	2019	2020
Base Case (Tons)	NE Pool	14,398	14,529	15,530	14,737	15,068	15,144
	NY Pool	26,254	26,788	27,677	26,998	27,916	27,926
	Ontario	2,102	2,133	2,106	2,100	2,080	2,096
	PJM	320,234	316,280	327,105	318,475	318,351	311,774
	TOTAL	362,988	359,730	372,417	362,310	363,415	356,941
Cricket Valley Case (Tons)	NE Pool	14,249	14,324	15,329	14,518	14,846	14,914
	NY Pool	25,817	26,231	27,118	26,408	27,338	27,308
	Ontario	2,105	2,127	2,096	2,093	2,075	2,096
	PJM	319,756	315,518	326,276	317,679	317,584	311,149
	TOTAL	361,926	358,199	370,818	360,698	361,844	355,466
Increase (Decrease) (Tons)	NE Pool	(149)	(205)	(201)	(219)	(222)	(230)
	NY Pool	(437)	(557)	(559)	(590)	(578)	(618)
	Ontario	4	(6)	(10)	(7)	(5)	(1)
	PJM	(479)	(763)	(829)	(796)	(767)	(626)
	TOTAL	(1,061)	(1,531)	(1,599)	(1,612)	(1,571)	(1,475)
% Increase (Decrease)	NE Pool	(1.0%)	(1.4%)	(1.3%)	(1.5%)	(1.5%)	(1.5%)
	NY Pool	(1.7%)	(2.1%)	(2.0%)	(2.2%)	(2.1%)	(2.2%)
	Ontario	0.2%	(0.3%)	(0.5%)	(0.3%)	(0.2%)	(0.0%)
	PJM	(0.1%)	(0.2%)	(0.3%)	(0.2%)	(0.2%)	(0.2%)
	TOTAL	(0.3%)	(0.4%)	(0.4%)	(0.4%)	(0.4%)	(0.4%)

Table 3.4 Total Annual SO2 Production (Tons) by Pool

		2015	2016	2017	2018	2019	2020
Base Case (Tons)	NE Pool	75,077	75,905	83,425	76,414	77,512	78,309
	NY Pool	51,076	52,364	55,576	53,185	54,031	54,090
	Ontario	20,228	20,449	20,164	20,094	19,668	19,898
	PJM	1,807,060	1,756,709	1,795,020	1,743,189	1,730,725	1,674,074
	TOTAL	1,953,440	1,905,428	1,954,186	1,892,882	1,881,936	1,826,370
Cricket Valley Case (Tons)	NE Pool	74,660	75,354	83,120	76,068	76,957	77,899
	NY Pool	50,437	51,329	55,081	52,465	53,116	53,007
	Ontario	20,267	20,440	20,141	20,119	19,710	19,963
	PJM	1,805,210	1,753,217	1,791,724	1,739,698	1,727,205	1,671,250
	TOTAL	1,950,574	1,900,342	1,950,066	1,888,349	1,876,988	1,822,120
Increase (Decrease) (Tons)	NE Pool	(417)	(551)	(305)	(346)	(554)	(409)
	NY Pool	(638)	(1,035)	(495)	(721)	(915)	(1,082)
	Ontario	39	(9)	(23)	25	42	65
	PJM	(1,850)	(3,491)	(3,296)	(3,491)	(3,520)	(2,823)
	TOTAL	(2,867)	(5,086)	(4,120)	(4,533)	(4,948)	(4,250)
% Increase (Decrease)	NE Pool	(0.6%)	(0.7%)	(0.4%)	(0.5%)	(0.7%)	(0.5%)
	NY Pool	(1.2%)	(2.0%)	(0.9%)	(1.4%)	(1.7%)	(2.0%)
	Ontario	0.2%	(0.0%)	(0.1%)	0.1%	0.2%	0.3%
	PJM	(0.1%)	(0.2%)	(0.2%)	(0.2%)	(0.2%)	(0.2%)
	TOTAL	(0.1%)	(0.3%)	(0.2%)	(0.2%)	(0.3%)	(0.2%)

Table 3.5 below illustrates that, while total CO2 production across the region decreases as a result of Cricket Valley, the total amount of CO2 produced in the NY Pool increases slightly (about 2% annually over the study period), due to the increase energy production (about 2% annually over the study periods) within the NY Pool (Table 3.2).

Table 3.5 Total Annual CO2 Production (Tons) by Pool

		2015	2016	2017	2018	2019	2020
Base Case (Tons)	NE Pool	43,129,318	43,086,285	44,978,154	44,289,028	44,835,766	45,601,366
	NY Pool	43,479,260	43,781,477	45,125,219	44,716,534	46,314,790	46,331,325
	Ontario	9,320,627	9,541,108	9,440,267	9,427,543	9,548,769	9,557,390
	PJM	426,452,174	424,264,527	432,499,292	427,210,980	427,827,876	419,341,384
	TOTAL	522,381,380	520,673,397	532,042,932	525,644,086	528,527,200	520,831,466
Cricket Valley Case (Tons)	NE Pool	42,753,795	42,587,434	44,444,738	43,764,002	44,243,532	45,028,331
	NY Pool	43,986,254	44,688,292	46,123,903	45,664,163	47,390,749	47,351,628
	Ontario	9,335,598	9,471,738	9,331,756	9,323,678	9,451,650	9,491,943
	PJM	425,756,207	423,291,330	431,516,247	426,175,425	426,738,014	418,270,603
	TOTAL	521,831,855	520,038,794	531,416,643	524,927,268	527,823,945	520,142,505
Increase (Decrease) (Tons)	NE Pool	(375,523)	(498,851)	(533,416)	(525,026)	(592,234)	(573,036)
	NY Pool	506,994	906,815	998,684	947,628	1,075,959	1,020,303
	Ontario	14,971	(69,369)	(108,511)	(103,865)	(97,119)	(65,447)
	PJM	(695,966)	(973,197)	(983,045)	(1,035,555)	(1,089,862)	(1,070,781)
	TOTAL	(549,525)	(634,602)	(626,288)	(716,818)	(703,256)	(688,961)
% Increase (Decrease)	NE Pool	(0.9%)	(1.2%)	(1.2%)	(1.2%)	(1.3%)	(1.3%)
	NY Pool	1.2%	2.1%	2.2%	2.1%	2.3%	2.2%
	Ontario	0.2%	(0.7%)	(1.1%)	(1.1%)	(1.0%)	(0.7%)
	PJM	(0.2%)	(0.2%)	(0.2%)	(0.2%)	(0.3%)	(0.3%)
	TOTAL	(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)

4 Indian Point Unit 2 Retirement Sensitivity Results

In general, while the impact of retiring Indian Point Unit 2 results in an increase in the Total Annual Load-Weighted Cost to Serve and overall emissions production across the region (Appendix C), the relative impact of adding Cricket Valley to the New York Pool with Indian Point Unit 2 retired in 2013 is consistent with the observed results assuming Indian Point Unit 2 remains in service beyond the expiration of its current operating license. Table 4.1 below summarizes the impact of Cricket Valley on the Total Cost to Serve in each of the pools analyzed, assuming Indian Point Unit 2 is retired.

Table 4.1 Total Annual Load-Weighted Cost to Serve (M$) by Pool

		2015	2016	2017	2018	2019	2020
Base Case w/ Indian Point Unit 2 Retirement (M$)	NE Pool	$ 8,262	$ 8,570	$ 8,912	$ 9,141	$ 9,759	$ 10,031
	NY Pool	$ 10,940	$ 11,431	$ 11,721	$ 12,053	$ 12,927	$ 13,260
	Ontario	$ 6,847	$ 7,492	$ 7,700	$ 8,091	$ 8,328	$ 8,637
	PJM	$ 43,357	$ 45,405	$ 45,384	$ 47,163	$ 50,074	$ 52,093
	TOTAL	$ 69,406	$ 72,897	$ 73,717	$ 76,447	$ 81,088	$ 84,022
Cricket Valley Case w/ Indian Point Unit 2 Retirement (M$)	NE Pool	$ 8,159	$ 8,407	$ 8,760	$ 8,952	$ 9,589	$ 9,824
	NY Pool	$ 10,792	$ 11,217	$ 11,527	$ 11,814	$ 12,693	$ 13,029
	Ontario	$ 6,841	$ 7,467	$ 7,693	$ 8,056	$ 8,279	$ 8,578
	PJM	$ 43,215	$ 45,164	$ 45,147	$ 46,981	$ 49,816	$ 51,922
	TOTAL	$ 69,007	$ 72,255	$ 73,127	$ 75,803	$ 80,377	$ 83,353
Increase (Decrease) (M$)	NE Pool	$ (103)	$ (163)	$ (152)	$ (189)	$ (171)	$ (207)
	NY Pool	$ (148)	$ (214)	$ (194)	$ (239)	$ (234)	$ (231)
	Ontario	$ (5)	$ (24)	$ (7)	$ (34)	$ (49)	$ (60)
	PJM	$ (143)	$ (241)	$ (237)	$ (181)	$ (258)	$ (170)
	TOTAL	$ (400)	$ (643)	$ (590)	$ (645)	$ (711)	$ (669)
% Increase (Decrease)	NE Pool	(1.3%)	(1.9%)	(1.7%)	(2.1%)	(1.7%)	(2.1%)
	NY Pool	(1.4%)	(1.9%)	(1.7%)	(2.0%)	(1.8%)	(1.7%)
	Ontario	(0.1%)	(0.3%)	(0.1%)	(0.4%)	(0.6%)	(0.7%)
	PJM	(0.3%)	(0.5%)	(0.5%)	(0.4%)	(0.5%)	(0.3%)
	TOTAL	(0.6%)	(0.9%)	(0.8%)	(0.8%)	(0.9%)	(0.8%)

Table 4.2 below illustrates the impact on total energy production within each pool, as a result of adding Cricket Valley to the NY Pool, assuming Indian Point Unit 2 is retired.

Table 4.2 Total Annual Energy Production (GWh) by Pool

		2015	2016	2017	2018	2019	2020
Base Case w/ Indian Point Unit 2 Retirement (GWh)	NE Pool	121,512	122,774	123,449	125,113	127,217	128,676
	NY Pool	144,810	146,109	150,600	153,206	154,922	159,744
	Ontario	143,718	144,518	144,243	144,382	144,744	145,008
	PJM	737,154	741,074	749,241	753,912	760,895	759,867
	TOTAL	1,147,195	1,154,475	1,167,534	1,176,612	1,187,778	1,193,294
Cricket Valley Case w/ Indian Point Unit 2 Retirement (GWh)	NE Pool	120,688	121,692	122,261	123,941	125,960	127,362
	NY Pool	146,962	149,458	154,156	156,684	158,779	163,429
	Ontario	143,763	144,383	144,077	144,090	144,487	144,766
	PJM	735,832	739,110	747,014	752,018	758,693	757,845
	TOTAL	1,147,245	1,154,643	1,167,508	1,176,733	1,187,920	1,193,402
Increase (Decrease) (GWh)	NE Pool	(824)	(1,082)	(1,188)	(1,172)	(1,256)	(1,314)
	NY Pool	2,152	3,349	3,555	3,479	3,857	3,686
	Ontario	45	(135)	(167)	(292)	(257)	(241)
	PJM	(1,323)	(1,964)	(2,227)	(1,894)	(2,202)	(2,022)
	TOTAL	50	168	(26)	121	142	108
% Increase (Decrease)	NE Pool	(0.7%)	(0.9%)	(1.0%)	(0.9%)	(1.0%)	(1.0%)
	NY Pool	1.5%	2.3%	2.4%	2.3%	2.5%	2.3%
	Ontario	0.0%	(0.1%)	(0.1%)	(0.2%)	(0.2%)	(0.2%)
	PJM	(0.2%)	(0.3%)	(0.3%)	(0.3%)	(0.3%)	(0.3%)
	TOTAL	0.0%	0.0%	(0.0%)	0.0%	0.0%	0.0%

Tables 4.3 through 4.5 below summarize the total impact on emissions production within each pool as a result of adding Cricket Valley to the NY Pool, assuming Indian Point Unit 2 is retired. Generally speaking, both NOx and SO2 production decrease across the region and within most pools, while Ontario shows a slight increase in both effluents in certain years.

Table 4.3 Total Annual NOx Production (Tons) by Pool

		2015	2016	2017	2018	2019	2020
Base Case w/ Indian Point Unit 2 Retirement (Tons)	NE Pool	14,508	14,633	15,646	14,822	15,158	15,279
	NY Pool	27,315	27,841	28,502	27,948	28,884	28,855
	Ontario	2,100	2,132	2,102	2,103	2,079	2,098
	PJM	321,177	317,233	327,894	319,300	319,290	312,823
	TOTAL	365,100	361,839	374,144	364,173	365,411	359,055
Cricket Valley Case w/ Indian Point Unit 2 Retirement (Tons)	NE Pool	14,355	14,428	15,428	14,611	14,933	15,005
	NY Pool	26,860	27,237	27,938	27,353	28,297	28,227
	Ontario	2,105	2,127	2,098	2,094	2,076	2,096
	PJM	320,892	316,526	327,054	318,806	318,570	312,073
	TOTAL	364,212	360,316	372,519	362,864	363,874	357,401
Increase (Decrease) (Tons)	NE Pool	(152)	(205)	(218)	(211)	(225)	(275)
	NY Pool	(455)	(604)	(564)	(595)	(588)	(628)
	Ontario	4	(5)	(4)	(9)	(3)	(2)
	PJM	(285)	(707)	(840)	(494)	(721)	(749)
	TOTAL	(889)	(1,522)	(1,625)	(1,309)	(1,537)	(1,654)
% Increase (Decrease)	NE Pool	(1.1%)	(1.4%)	(1.4%)	(1.4%)	(1.5%)	(1.8%)
	NY Pool	(1.7%)	(2.2%)	(2.0%)	(2.1%)	(2.0%)	(2.2%)
	Ontario	0.2%	(0.2%)	(0.2%)	(0.4%)	(0.2%)	(0.1%)
	PJM	(0.1%)	(0.2%)	(0.3%)	(0.2%)	(0.2%)	(0.2%)
	TOTAL	(0.2%)	(0.4%)	(0.4%)	(0.4%)	(0.4%)	(0.5%)

Table 4.4 Total Annual SO2 Production (Tons) by Pool

		2015	2016	2017	2018	2019	2020
Base Case w/ Indian Point Unit 2 Retirement (Tons)	NE Pool	75,733	76,545	83,994	76,769	77,866	79,001
	NY Pool	52,242	53,650	56,392	54,168	54,933	55,053
	Ontario	20,205	20,431	20,118	20,074	19,623	19,851
	PJM	1,811,431	1,761,710	1,799,974	1,747,856	1,735,674	1,678,548
	TOTAL	1,959,611	1,912,336	1,960,477	1,898,866	1,888,096	1,832,453
Cricket Valley Case w/ Indian Point Unit 2 Retirement (Tons)	NE Pool	75,255	76,012	83,588	76,354	77,470	78,299
	NY Pool	51,597	52,472	55,821	53,399	54,151	53,972
	Ontario	20,248	20,430	20,137	20,093	19,686	19,925
	PJM	1,809,912	1,757,783	1,795,792	1,745,013	1,732,221	1,675,649
	TOTAL	1,957,013	1,906,697	1,955,337	1,894,858	1,883,529	1,827,846
Increase (Decrease) (Tons)	NE Pool	(478)	(533)	(406)	(415)	(396)	(702)
	NY Pool	(645)	(1,178)	(571)	(770)	(781)	(1,080)
	Ontario	44	(1)	19	19	64	74
	PJM	(1,519)	(3,926)	(4,182)	(2,842)	(3,453)	(2,899)
	TOTAL	(2,599)	(5,638)	(5,140)	(4,008)	(4,567)	(4,608)
% Increase (Decrease)	NE Pool	(0.6%)	(0.7%)	(0.5%)	(0.5%)	(0.5%)	(0.9%)
	NY Pool	(1.2%)	(2.2%)	(1.0%)	(1.4%)	(1.4%)	(2.0%)
	Ontario	0.2%	(0.0%)	0.1%	0.1%	0.3%	0.4%
	PJM	(0.1%)	(0.2%)	(0.2%)	(0.2%)	(0.2%)	(0.2%)
	TOTAL	(0.1%)	(0.3%)	(0.3%)	(0.2%)	(0.2%)	(0.3%)

Table 4.5 Total Annual CO2 Production (Tons) by Pool

		2015	2016	2017	2018	2019	2020
Base Case w/ Indian Point Unit 2 Retirement (Tons)	NE Pool	43,595,529	43,536,684	45,441,151	44,765,693	45,263,246	46,082,928
	NY Pool	45,955,876	46,180,994	47,356,204	47,068,064	48,517,082	48,376,677
	Ontario	9,322,668	9,542,984	9,441,215	9,483,667	9,577,454	9,625,816
	PJM	427,776,195	425,569,214	433,779,988	428,523,674	429,133,279	420,652,703
	TOTAL	526,650,267	524,829,876	536,018,557	529,841,098	532,491,060	524,738,124
Cricket Valley Case w/ Indian Point Unit 2 Retirement (Tons)	NE Pool	43,206,678	43,017,526	44,902,246	44,216,523	44,669,733	45,448,943
	NY Pool	46,511,440	47,162,600	48,508,642	48,225,565	49,828,127	49,567,089
	Ontario	9,344,530	9,477,979	9,370,594	9,357,031	9,479,169	9,535,539
	PJM	427,010,221	424,422,207	432,517,007	427,495,666	427,920,577	419,477,654
	TOTAL	526,072,869	524,080,313	535,298,490	529,294,785	531,897,606	524,029,226
Increase (Decrease) (Tons)	NE Pool	(388,851)	(519,159)	(538,905)	(549,170)	(593,513)	(633,986)
	NY Pool	555,564	981,607	1,152,439	1,157,501	1,311,045	1,190,412
	Ontario	21,862	(65,004)	(70,621)	(126,636)	(98,285)	(90,276)
	PJM	(765,973)	(1,147,007)	(1,262,980)	(1,028,009)	(1,212,702)	(1,175,048)
	TOTAL	(577,398)	(749,563)	(720,068)	(546,314)	(593,455)	(708,898)
% Increase (Decrease)	NE Pool	(0.9%)	(1.2%)	(1.2%)	(1.2%)	(1.3%)	(1.4%)
	NY Pool	1.2%	2.1%	2.4%	2.5%	2.7%	2.5%
	Ontario	0.2%	(0.7%)	(0.7%)	(1.3%)	(1.0%)	(0.9%)
	PJM	(0.2%)	(0.3%)	(0.3%)	(0.2%)	(0.3%)	(0.3%)
	TOTAL	(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)

Appendix C presents a comparison (Cost to Serve, Energy Production, Emissions Production) for the Base Case (without Cricket Valley), assuming Indian Point Unit 2 receives an operating license extension as compared against its retirement in 2013.

5 *Appendix A* – GE-MAPS™ Database Documentation (Eastern Interconnection (EI) Database, Revision 1.6, August 6, 2010)

6 *Appendix B* - GE-MAPS™ Brochure

7 *Appendix C* - Indian Point Unit 2 Retirement Scenario Comparison

Tables 7.1 through 7.5 below compare the Base Case results from Section 3 (Indian Point Unit 2 operating license extension) against the Base Case results under the Indian Point Unit 2 Retirement Scenario in Section 4.

Table 7.1 Total Annual Load-Weighted Cost to Serve (M$) by Pool:

Indian Point Unit 2 Retirement Scenario Comparison

		2015	2016	2017	2018	2019	2020
Base Case (M$)	NE Pool	$ 8,215	$ 8,545	$ 8,856	$ 9,090	$ 9,709	$ 9,957
	NY Pool	$ 10,586	$ 11,086	$ 11,400	$ 11,704	$ 12,532	$ 12,842
	Ontario	$ 6,872	$ 7,485	$ 7,678	$ 8,085	$ 8,303	$ 8,635
	PJM	$ 43,081	$ 45,087	$ 45,209	$ 46,964	$ 49,922	$ 51,825
	TOTAL	$ 68,755	$ 72,203	$ 73,143	$ 75,843	$ 80,465	$ 83,259
Base Case w/ Indian Point Unit 2 Retirement (M$)	NE Pool	$ 8,262	$ 8,570	$ 8,912	$ 9,141	$ 9,759	$ 10,031
	NY Pool	$ 10,940	$ 11,431	$ 11,721	$ 12,053	$ 12,927	$ 13,260
	Ontario	$ 6,847	$ 7,492	$ 7,700	$ 8,091	$ 8,328	$ 8,637
	PJM	$ 43,357	$ 45,405	$ 45,384	$ 47,163	$ 50,074	$ 52,093
	TOTAL	$ 69,406	$ 72,897	$ 73,717	$ 76,447	$ 81,088	$ 84,022
Increase (Decrease) (M$)	NE Pool	$ 47	$ 25	$ 55	$ 51	$ 50	$ 75
	NY Pool	$ 354	$ 345	$ 322	$ 349	$ 395	$ 418
	Ontario	$ (26)	$ 6	$ 21	$ 6	$ 25	$ 3
	PJM	$ 276	$ 318	$ 176	$ 199	$ 153	$ 268
	TOTAL	$ 651	$ 694	$ 574	$ 605	$ 623	$ 763
% Increase (Decrease)	NE Pool	0.6%	0.3%	0.6%	0.6%	0.5%	0.7%
	NY Pool	3.3%	3.1%	2.8%	3.0%	3.2%	3.3%
	Ontario	(0.4%)	0.1%	0.3%	0.1%	0.3%	0.0%
	PJM	0.6%	0.7%	0.4%	0.4%	0.3%	0.5%
	TOTAL	0.9%	1.0%	0.8%	0.8%	0.8%	0.9%

Table 7.2 Total Annual Energy Production (GWh) by Pool: Indian Point Unit 2 Retirement Scenario Comparison

		2015	2016	2017	2018	2019	2020
Base Case (GWh)	NE Pool	120,492	121,789	122,396	124,031	126,229	127,615
	NY Pool	148,035	149,226	153,738	156,701	158,174	163,212
	Ontario	143,708	144,511	144,216	144,244	144,654	144,829
	PJM	735,037	739,106	747,167	751,786	758,825	757,786
	TOTAL	1,147,272	1,154,633	1,167,517	1,176,762	1,187,881	1,193,441
Base Case w/ Indian Point Unit 2 Retirement (GWh)	NE Pool	121,512	122,774	123,449	125,113	127,217	128,676
	NY Pool	144,810	146,109	150,600	153,206	154,922	159,744
	Ontario	143,718	144,518	144,243	144,382	144,744	145,008
	PJM	737,154	741,074	749,241	753,912	760,895	759,867
	TOTAL	1,147,195	1,154,475	1,167,534	1,176,612	1,187,778	1,193,294
Increase (Decrease) (GWh)	NE Pool	1,020	985	1,053	1,082	988	1,061
	NY Pool	(3,225)	(3,118)	(3,137)	(3,496)	(3,252)	(3,468)
	Ontario	10	7	27	138	90	179
	PJM	2,117	1,968	2,074	2,125	2,070	2,081
	TOTAL	(77)	(158)	17	(151)	(104)	(147)
% Increase (Decrease)	NE Pool	0.8%	0.8%	0.9%	0.9%	0.8%	0.8%
	NY Pool	(2.2%)	(2.1%)	(2.0%)	(2.2%)	(2.1%)	(2.1%)
	Ontario	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%
	PJM	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
	TOTAL	(0.0%)	(0.0%)	0.0%	(0.0%)	(0.0%)	(0.0%)

Table 7.3 Total Annual NOx Production (Tons) by Pool: Indian Point Unit 2 Retirement Scenario Comparison

		2015	2016	2017	2018	2019	2020
Base Case (Tons)	NE Pool	14,398	14,529	15,530	14,737	15,068	15,144
	NY Pool	26,254	26,788	27,677	26,998	27,916	27,926
	Ontario	2,102	2,133	2,106	2,100	2,080	2,096
	PJM	320,234	316,280	327,105	318,475	318,351	311,774
	TOTAL	362,988	359,730	372,417	362,310	363,415	356,941
Base Case w/ Indian Point Unit 2 Retirement (Tons)	NE Pool	14,508	14,633	15,646	14,822	15,158	15,279
	NY Pool	27,315	27,841	28,502	27,948	28,884	28,855
	Ontario	2,100	2,132	2,102	2,103	2,079	2,098
	PJM	321,177	317,233	327,894	319,300	319,290	312,823
	TOTAL	365,100	361,839	374,144	364,173	365,411	359,055
Increase (Decrease) (Tons)	NE Pool	110	104	116	86	90	135
	NY Pool	1,062	1,053	825	949	968	928
	Ontario	(1)	(1)	(3)	3	(1)	2
	PJM	943	952	789	825	939	1,048
	TOTAL	2,113	2,108	1,727	1,862	1,996	2,114
% Increase (Decrease)	NE Pool	0.8%	0.7%	0.7%	0.6%	0.6%	0.9%
	NY Pool	4.0%	3.9%	3.0%	3.5%	3.5%	3.3%
	Ontario	(0.1%)	(0.0%)	(0.2%)	0.1%	(0.0%)	0.1%
	PJM	0.3%	0.3%	0.2%	0.3%	0.3%	0.3%
	TOTAL	0.6%	0.6%	0.5%	0.5%	0.5%	0.6%

Table 7.4 Total Annual SO2 Production (Tons) by Pool: Indian Point Unit 2 Retirement Scenario Comparison

		2015	2016	2017	2018	2019	2020
Base Case (Tons)	NE Pool	75,077	75,905	83,425	76,414	77,512	78,309
	NY Pool	51,076	52,364	55,576	53,185	54,031	54,090
	Ontario	20,228	20,449	20,164	20,094	19,668	19,898
	PJM	1,807,060	1,756,709	1,795,020	1,743,189	1,730,725	1,674,074
	TOTAL	1,953,440	1,905,428	1,954,186	1,892,882	1,881,936	1,826,370
Base Case w/ Indian Point Unit 2 Retirement (Tons)	NE Pool	75,733	76,545	83,994	76,769	77,866	79,001
	NY Pool	52,242	53,650	56,392	54,168	54,933	55,053
	Ontario	20,205	20,431	20,118	20,074	19,623	19,851
	PJM	1,811,431	1,761,710	1,799,974	1,747,856	1,735,674	1,678,548
	TOTAL	1,959,611	1,912,336	1,960,477	1,898,866	1,888,096	1,832,453
Increase (Decrease) (Tons)	NE Pool	656	640	568	355	355	693
	NY Pool	1,166	1,285	816	983	902	963
	Ontario	(23)	(18)	(46)	(21)	(45)	(47)
	PJM	4,371	5,001	4,954	4,667	4,949	4,475
	TOTAL	6,171	6,908	6,291	5,984	6,160	6,084
% Increase (Decrease)	NE Pool	0.9%	0.8%	0.7%	0.5%	0.5%	0.9%
	NY Pool	2.3%	2.5%	1.5%	1.8%	1.7%	1.8%
	Ontario	(0.1%)	(0.1%)	(0.2%)	(0.1%)	(0.2%)	(0.2%)
	PJM	0.2%	0.3%	0.3%	0.3%	0.3%	0.3%
	TOTAL	0.3%	0.4%	0.3%	0.3%	0.3%	0.3%

Table 7.5 Total Annual CO2 Production (Tons) by Pool: Indian Point Unit 2 Retirement Scenario Comparison

		2015	2016	2017	2018	2019	2020
Base Case (Tons)	NE Pool	43,129,318	43,086,285	44,978,154	44,289,028	44,835,766	45,601,366
	NY Pool	43,479,260	43,781,477	45,125,219	44,716,534	46,314,790	46,331,325
	Ontario	9,320,627	9,541,108	9,440,267	9,427,543	9,548,769	9,557,390
	PJM	426,452,174	424,264,527	432,499,292	427,210,980	427,827,876	419,341,384
	TOTAL	522,381,380	520,673,397	532,042,932	525,644,086	528,527,200	520,831,466
Base Case w/ Indian Point Unit 2 Retirement (Tons)	NE Pool	43,595,529	43,536,684	45,441,151	44,765,693	45,263,246	46,082,928
	NY Pool	45,955,876	46,180,994	47,356,204	47,068,064	48,517,082	48,376,677
	Ontario	9,322,668	9,542,984	9,441,215	9,483,667	9,577,454	9,625,816
	PJM	427,776,195	425,569,214	433,779,988	428,523,674	429,133,279	420,652,703
	TOTAL	526,650,267	524,829,876	536,018,557	529,841,098	532,491,060	524,738,124
Increase (Decrease) (Tons)	NE Pool	466,211	450,399	462,997	476,665	427,480	481,562
	NY Pool	2,476,615	2,399,516	2,230,984	2,351,530	2,202,292	2,045,352
	Ontario	2,041	1,876	948	56,124	28,685	68,426
	PJM	1,324,021	1,304,688	1,280,696	1,312,694	1,305,403	1,311,319
	TOTAL	4,268,888	4,156,479	3,975,626	4,197,012	3,963,860	3,906,658
% Increase (Decrease)	NE Pool	1.1%	1.0%	1.0%	1.1%	1.0%	1.1%
	NY Pool	5.7%	5.5%	4.9%	5.3%	4.8%	4.4%
	Ontario	0.0%	0.0%	0.0%	0.6%	0.3%	0.7%
	PJM	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
	TOTAL	0.8%	0.8%	0.7%	0.8%	0.7%	0.8%

8 *Appendix D* – Production Cost Results

Tables 8.1 and 8.2 below compare the impact on total annual production costs as a result of adding Cricket Valley to the NY Pool for the Base Case in Section 3, and for the Base Case under the Indian Point Unit 2 Retirement Scenario in Section 4.

Table 8.1 Total Annual Production Costs by Pool:

Production Cost ($M Dollars)		Year					
Case	Pool_Names	2015	2016	2017	2018	2019	2020
Baseline (EI v14)	NEP	5,158	5,297	5,528	5,691	5,959	6,214
	NYP	5,589	5,726	5,714	5,792	6,153	6,072
	ONT	1,557	1,609	1,618	1,655	1,726	1,748
	PJM	26,641	27,259	27,331	28,763	29,973	30,389
Cricket Valley (EI v15)	NEP	5,106	5,225	5,447	5,610	5,866	6,120
	NYP	5,549	5,690	5,670	5,751	6,114	6,032
	ONT	1,557	1,599	1,602	1,637	1,707	1,732
	PJM	26,578	27,154	27,217	28,650	29,840	30,258
Delta ($M)	NEP	(53)	(72)	(81)	(81)	(93)	(94)
	NYP	(40)	(36)	(44)	(41)	(40)	(40)
	ONT	0	(11)	(16)	(19)	(19)	(16)
	PJM	(63)	(105)	(114)	(113)	(133)	(131)
% Delta	NEP	-1.0%	-1.4%	-1.5%	-1.4%	-1.6%	-1.5%
	NYP	-0.7%	-0.6%	-0.8%	-0.7%	-0.6%	-0.7%
	ONT	0.0%	-0.7%	-1.0%	-1.1%	-1.1%	-0.9%
	PJM	-0.2%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%

Table 8.2 Total Annual Production Costs by Pool: Indian Point Unit 2 Retirement Scenario Comparison

Production Cost ($M Dollars)		Year					
Case	Pool_Names	2015	2016	2017	2018	2019	2020
Baseline IP2 Retirement (EI v16)	NEP	5,218	5,355	5,592	5,761	6,023	6,287
	NYP	6,009	6,151	6,117	6,241	6,599	6,512
	ONT	1,558	1,611	1,621	1,666	1,733	1,763
	PJM	26,771	27,390	27,461	28,902	30,113	30,544
Cricket Valley IP2 Retirement (EI v17)	NEP	5,166	5,282	5,510	5,676	5,928	6,185
	NYP	5,964	6,099	6,066	6,201	6,551	6,466
	ONT	1,559	1,600	1,608	1,644	1,713	1,742
	PJM	26,694	27,266	27,310	28,772	29,957	30,398
Delta ($M)	NEP	(53)	(74)	(82)	(85)	(95)	(102)
	NYP	(45)	(52)	(51)	(40)	(48)	(46)
	ONT	1	(11)	(13)	(22)	(20)	(21)
	PJM	(77)	(124)	(152)	(130)	(156)	(146)
% Delta	NEP	-1.0%	-1.4%	-1.5%	-1.5%	-1.6%	-1.6%
	NYP	-0.8%	-0.8%	-0.8%	-0.6%	-0.7%	-0.7%
	ONT	0.1%	-0.7%	-0.8%	-1.3%	-1.2%	-1.2%
	PJM	-0.3%	-0.5%	-0.6%	-0.4%	-0.5%	-0.5%