



TRC Solutions

Cost and Feasibility Analysis of a Third Converter Station for the Champlain Hudson Power Express Project

October 2013

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I. Executive Summary

This Cost and Feasibility Analysis complements a Power Flow Analysis (PFA) performed by Siemens Power Technologies International (Siemens PTI) that addressed the system impacts to be expected from adding a third 1,000 megawatt (MW) converter station to the Champlain Hudson Power Express Project (Project). Siemens PTI was asked to examine a number of potential locations for such a converter terminal along and in the vicinity of the identified Project route south of Albany, New York.

The PFA concluded that the third converter station could be located in the vicinity of the 345 kilovolt (kV) substation in the Town of New Scotland, Albany County, New York or the 345 kV substation in the Town of Leeds, Greene County, New York. The maximum system benefits would be achieved if the New Scotland location were selected since it would increase transfer capacities on both the UPNY-SENY and the Central East\Total East interfaces. The Leeds location would result in a similar transfer capacity increase on the UPNY-SENY interface but would negatively affect the Central East\Total East interface and thus have significantly lower benefits but a similar capital cost. More specifically, the Leeds option would have \$74 million lower benefit than the New Scotland option while having capital cost that are less than \$25 million lower. These results are summarized in Table I below.

The PFA also addressed the advantages and disadvantages of directly connecting to the New Scotland Substation 99 bus as opposed to tapping into the Marcy-New Scotland 345 kV transmission line, concluding that the direct connection to the substation would entail a possible expansion of the breaker configuration at the substation and result in higher capital costs.

Siemens PTI also concluded that the direct connection would not significantly offer greater system benefits than would a tap, while the costs associated with the substation expansion could fall within a range of 20 to 40 million dollars.

Following completion of the PFA, Transmission Developers, Inc. (TDI) commissioned TRC Solutions (TRC) to study the cost and physical feasibility of adding a third Project Converter Station and associated interconnection facilities tapping into the 345 kV Marcy-New Scotland transmission line in the vicinity of the New Scotland Substation (New Scotland Tap).

As explained in detail herein, TRC estimates that the cost of the facilities associated with the New Scotland Tap over its 40 year expected life will exceed the capacity and energy benefits that would be derived from installing these facilities by between \$244 million and \$60 million. These results are summarized in Table II below.

TRC also notes that any benefits that are derived from installing the third converter station in the vicinity of New Scotland come primarily from an increase in the Central East\Total East interface transfer limits. This increase in transfer capacity is attributable to power flow shifts on the AC network caused by the strategic locating of the third converter station. In this regard, it may be noted that the PFA was not an exhaustive study of alternatives that might increase system transfer capacities on the Central East\Total East interface.

This conclusion is supported by the recently issued NYISO Class Year 2011 studies. These studies include a number of projects that will increase the Central East\Total East interface capacity, all of which are less costly and provide higher benefits than the proposed third converter station.

To further evaluate options for the third converter station, Siemens concluded another study dated September 9, 2013 in which it considered locating the third converter station at Marcy. This option is further described in Section II. This option would require significant modifications to the Marcy to New Scotland 345 kV line or the replacement of one Porter to Rotterdam 230 kV with a 320 kV HVDC line. While detailed studies were not conducted on these options it was the consensus of both Siemens and TRC that these options while providing additional benefits, would not exceed the additional cost. More specifically, TRC estimated that locating the third converter station at Marcy would increase the benefits by about \$40 million, which is believed to be well below the cost of completing the HVDC path between Marcy and New Scotland. As a result, further study to estimate the cost of this option was not undertaken. Also as noted above, there are numerous other proposed projects to enhance the Central East\Total East transmission corridor that have been proposed and that are more cost effective than locating a third converter station at Marcy. These results are summarized in Table I below.

Section II of this Analysis describes the process used to evaluate the cost and physical feasibility of constructing the New Scotland Tap in conjunction with the installation of a third converter station in the vicinity of New Scotland. The total estimated capital cost for this alternative would be \$200 million. This section also concludes that there is no significant impediment to constructing this alternative.

Section III of this Analysis discusses the revenue requirements that would be needed to support the capital investments outlined in Section II, including operation, maintenance, property taxes, insurance, depreciation, and cost of capital. This analysis shows a net present value cost of ownership for the New Scotland Tap to be \$319 million over the 40-year life of the facilities.

Section IV of this Analysis describes the process used to estimate the total system benefits of the third converter terminal. Benefits include both capacity and energy. Total energy savings were estimated at between \$7 million and \$84 million net present value and capacity benefits were estimated at between \$68 million and \$175 million net present value for a total benefit of between \$75 million and \$260 million over the 40 year expected life of the facility. TRC notes that the higher benefit levels were only achieved by ignoring the transmission constraints that currently exist between the NYISO Capital Zone and the NY City Zone.

Table I

Cost/benefit Comparison of Marcy, New Scotland and Leeds Alternatives (1)

	Capital Cost \$ millions	Benefits \$ millions
Marcy	>\$240	\$115
New Scotland	\$200	\$ 75
Leeds	\$175 to \$200	\$ 1

(1) Detailed engineering estimates were not performed on the Marcy and Leeds alternatives as the benefits screening study was sufficient to show that the New Scotland option was superior in delivering overall net savings.

Table II

Summary Results

Third Converter Terminal Located at New Scotland (the New Scotland Tap)

Base Case – Current Conditions

Energy and Capacity Benefits (NPV)	\$ 75 million
Revenue Requirements (NPV)	\$319 million
Net Benefits (NPV over 40 years)	\$(244) million

No Constraint Case

Energy and Capacity Benefit (NPV)	\$260 million
Revenue Requirements (NPV)	\$319 million
Net Benefits (NPV over 40 years)	\$ (60) million

II. Cost Estimate and Physical Feasibility of a New Scotland Tap

The cost of this option is estimated at \$200 million. It was assumed that no additional licensing (Article VII) would be required since the location of the New Scotland Tap would be less than one mile from the existing 345 kV Marcy-New Scotland Transmission Line.

There is a risk that the New York State Public Service Commission would interpret the addition of

the New Scotland Tap as a proposed modification to the Project's Article VII Certificate. If this were to happen or if it were determined that the New Scotland Tap would need to be constructed more than a mile away from the existing 345 kV Marcy-New Scotland Transmission Line, then additional licensing would be required and the cost of the New Scotland Tap option would increase.

The connecting facilities would consist of a three-breaker ring bus with two connections to the 345 kV Marcy to New Scotland Transmission line and the third connection to the HVDC converter. The major cost of the New Scotland Tap, of course, would be the 1,000 MW HVDC converter facility, which, based upon manufacturer estimates, would cost \$175 million. The major equipment for the 345 kV interconnection portion of the New Scotland Tap is based upon the One-Line diagram (Exhibit One) and is estimated to cost \$25 million.

There are no significant physical impediments to the construction of the New Scotland Tap. The general topography in this area is mainly flat farmland/fields, and it is assumed that property would be available for purchase.

In addition to the New Salem tap, Siemens considered locating the third converter station at Marcy. This option would use either the existing Marcy-New Scotland 345 kV line or a Porter to Rotterdam 230 kV line to establish an HVDC path between Marcy and New Scotland\Salem.

The Marcy-New Scotland 345 kV line was originally constructed with a four bundle 1351.5 ACSR conductor for 765 kV operation but was initially operated at 345 kV until a 765 kV network could be established. However, the ground clearance requirements for 765 kV operation were increased as a result of the Massena-Marcy Article 7 certification hearing. It is conceivable that the existing Marcy-New Scotland four bundle 345 kV line could be reconfigured to operate as a double circuit line with one circuit operated as a double bundle 1351.5 ACSR 345kV AC line and the other circuit operated as a double bundle 1351.5 ACSR 320kV HVDC line. The HVDC line could be connected to the Marcy 765 kV bus with a 765/390 kV AC transformer to minimize the impact on existing 345 kV transmission lines in the vicinity of the Marcy/Edic substations.

Alternately, the New York State Transmission Assessment and Reliability Study (STARS) report has identified the Porter-Rotterdam 230 kV transmission lines as high probability candidates for replacement based upon condition in 0-10 years. Rather than replace the circuits in kind, an upgrade to 320 kV HVDC operations would provide more transmission capability and some control of power flows through paralleling AC transmission lines.

III. Revenue Requirements

To evaluate the lifetime cost of ownership of the New Scotland Tap, TRC developed the annual cost of ownership including operation and maintenance, property taxes, insurance, cost of capital, and depreciation.

For the purpose of this analysis TRC assumed operation, maintenance, insurance (insurance includes amounts that would be needed to replace equipment due to failures, for example storm damage, etc.) and property taxes at 5% of first cost escalated by inflation (assumed to be 2% annually). TRC assumed a 40-year life for the facilities and straight-line depreciation. The cost of capital was assumed to be 10%.

Over the life of the facility, the net present value of the cost of ownership for the facilities was \$319 million.

IV. Financial Feasibility

TRC evaluated the financial feasibility of the New Scotland Tap as this option was the alternative that was judged to produce the highest overall net benefit (Total lifetime benefits minus total lifetime cost). TRC used the last twelve months of NYISO real time price data and the NYISO ICAP market prices to value the incremental transfer capacities made available as a result of the New Scotland Tap. The benefits are thus total system benefits and not necessarily what would be available to TDI to offset the cost of adding the additional facilities. Specifically, the following benefits were attributed to the New Scotland Tap:

A. Energy

The New Scotland Tap would allow upstate New York Generators to sell, in direct competition with those exporting into the NYISO market, 1,200 MW to the downstate region (The Siemens study shows a range of increased voltage transfer capacity on the Total East interface ranging from 167 MW to 236 MW depending on system dispatch. For the purpose of this study, TRC assumed an incremental increase of 200 MW). This compares to 1,000 MW of deliveries assumed to be transmitted by the Project as currently designed.

Thus, TRC analyzed 8,760 hours of historical NYISO data, pricing out the value of transferring an additional 1,200 MW from upstate New York (1,000 MW from the Capital Zone and 200 MW across the Central East\Total East interface) to downstate New York. TRC assumed no price and, as noted above, no additional system constraints to such deliveries. TRC subtracted from these values the value of delivering the 1,000 MW assumed to be transmitted by the Project as currently designed. To the degree that this calculation resulted in a negative benefit in any hour, that value was set to zero.

This result was escalated by the Energy Information Administration (EIA) escalator for natural gas prices over the 40 years of the life of the facilities.

The net present value of the energy benefit over the 40-year life of the New Scotland Tap was calculated to be \$7 million.

B. Capacity

The New Scotland Tap may allow upstate New York Generators to sell an additional 1,200 MW of ICAP to the downstate market in competition with the 1,000 MW assumed to be transmitted by the Project as currently designed. The initial 1,000 MW would replace the 1,000 MW of Project capacity in essentially the same load zone, thus providing no incremental benefits. The capacity benefit of the New Scotland Tap flows from the incremental 200 MW of Central East\Total East transfer capacity that is created as a result of adding the additional facilities in the vicinity of New Scotland.

TRC initially looked to price this capacity at the difference between the New York City Load Zone monthly ICAP auction results (weighted average) and the Rest of State Load Zone auction results. This was deemed insufficient inasmuch as the NYISO is in the process of creating a new capacity zone (NCZ) in southeast New York as a way to increase the effectiveness and efficiency of the New York ICAP markets.

To estimate the capacity benefits of the New Scotland Tap, TRC used the NYISO NCZ Additional Impact Analysis study that was presented to the Installed Capacity Working Group on March 28, 2013. After consultation with NYISO staff, TRC used the NYISO 2018 summer simulation assuming 1,000 MW of transmission additions and new generation as simulated by the NYISO.

Unfortunately this simulation was only done for the 2018 summer auction. As a result, TRC used the NYISO summer simulation results of \$12.31 per kW month for the NCZ and the \$9.44 for the NYCA (rest of state) and calculated a winter capacity value for both the NCZ and the NYCA. Specifically, the NYISO also provided a capacity auction simulation for the summer and winter 2013 capability period. The summer NCZ price was \$12.55 per kW month and the winter \$5.35 per kW month. The summer NYCA load zone price was \$6.18 per kW month and the winter was \$2.07 per kW month. Using the ratio of the summer 2013 values to the winter of 2013 values, TRC estimated the 2018 capacity auction values at \$5.25 and \$3.16 per kW month respectively.

These values were escalated by inflation (assumed at 2% per year) over the 40-year life of the additional facilities.

The net present value capacity benefit was calculated to be \$68.1 million,

The total (energy and capacity) benefit was estimated at \$75.1 million (NPV)

TRC also performed a sensitivity analysis whereby it was assumed that there were no downstream

constraints from the Central East\Total East interface. Under this scenario, TRC priced the benefits of the incremental 200 MW of Central East\Total East transfer capacity as the difference between the NYISO Central Zone prices and the NYC Load Zone prices. The energy value from this sensitivity was \$84 million.

TRC repeated the capacity analysis above but instead of using the new NCZ auction prices, TRC used the NYC Load Zone summer 2018 auction price of \$17.80 per kW month. The result was a net present value capacity value of \$175 million.

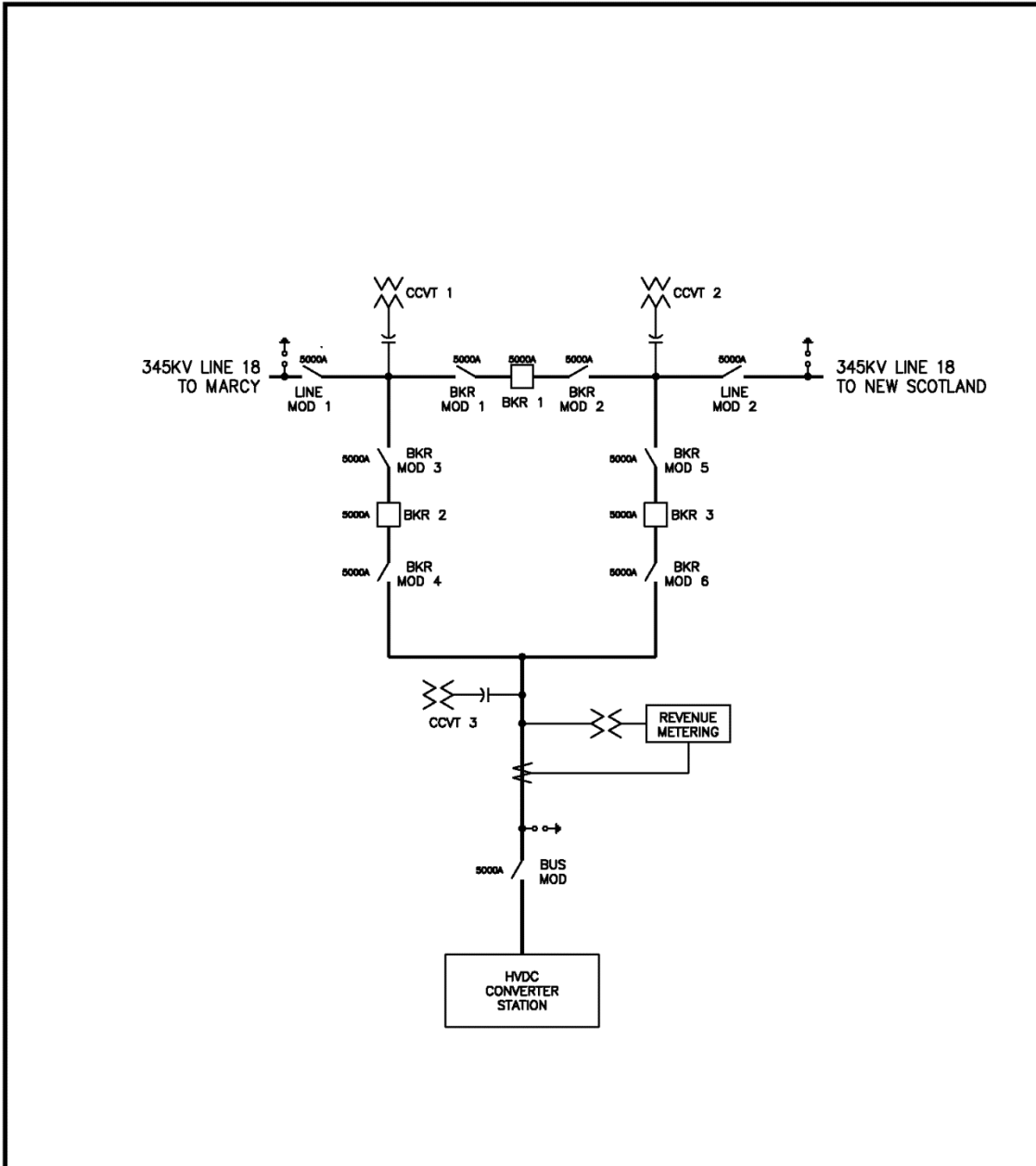
This sensitivity analysis was run to establish an outer bound of what the benefits could be if there were no additional constraints downstream of the Central East\Total East. While this scenario is not realistic, it does give an outer bound on the potential benefits of adding the New Scotland Tap.

TRC compared the above benefits to the annual revenue value of the New Scotland Tap as discussed in Section III. The net present value benefit of the additional facilities is estimated at between minus \$244 million and minus \$60 million.

The above calculations are shown in Exhibit 2, **Summary Excel Spreadsheet of Revenue Requirements and Benefits.**

Exhibit 1

One Line Diagram of New Scotland Tap




 10 MAXWELL DRIVE, SUITE 200 CLIFTON PARK, NY 12065 PROJECT NO: 202264		DGB/TRC DESIGNED	TRANSMISSION DEVELOPERS INC. PROPOSED 3RD CONVERTER STATION NEW SALEM SUBSTATION TAP						
		DGB/TRC DRAWN							
REV	DESCRIPTION	DATE	DES	CHK	APP	CHECKED	5/6/13	ONE LINE	REV. 1
1	ISSUED FOR REPORT	5/6/2013	DGB	DGB	-	APPROVED			

Exhibit 2

Summary Excel Spreadsheet of revenue requirements and benefits

New Scotland Tap

Assumptions

Initial Capital Cost	\$200 million	Energy Benefit	\$382,424	
Cost of Capital	10.0%	Capacity Benefit	\$5,946,897	2018 \$
O&M (% of Initial Capital Cost)	3.0%			
Property tax (% of Initial Capital Cost)	2.0%			
Inflation	2.0%			

All values in millions of dollars

Year	Capital	Depreciation	Interest	O&M	Prop Tax	Total Cost	Energy Benefit	Capacity Benefit	Total Benefit	Net Benefit
2014	\$200.00	\$5.00	\$20.00	\$6.00	\$4.00	\$35.00	\$0.45	\$5.71	\$6.16	(\$28.84)
2015	\$195.00	\$5.00	\$19.50	\$6.12	\$4.08	\$34.70	\$0.46	\$5.82	\$6.28	(\$28.42)
2016	\$190.00	\$5.00	\$19.00	\$6.24	\$4.16	\$34.40	\$0.47	\$5.94	\$6.41	(\$27.99)
2017	\$185.00	\$5.00	\$18.50	\$6.37	\$4.24	\$34.11	\$0.53	\$6.06	\$6.58	(\$27.53)
2018	\$180.00	\$5.00	\$18.00	\$6.49	\$4.33	\$33.82	\$0.56	\$6.18	\$6.74	(\$27.09)
2019	\$175.00	\$5.00	\$17.50	\$6.62	\$4.42	\$33.54	\$0.59	\$6.30	\$6.90	(\$26.64)
2020	\$170.00	\$5.00	\$17.00	\$6.76	\$4.50	\$33.26	\$0.62	\$6.43	\$7.05	(\$26.22)
2021	\$165.00	\$5.00	\$16.50	\$6.89	\$4.59	\$32.99	\$0.64	\$6.56	\$7.20	(\$25.79)
2022	\$160.00	\$5.00	\$16.00	\$7.03	\$4.69	\$32.72	\$0.66	\$6.69	\$7.35	(\$25.37)
2023	\$155.00	\$5.00	\$15.50	\$7.17	\$4.78	\$32.45	\$0.69	\$6.82	\$7.52	(\$24.93)
2024	\$150.00	\$5.00	\$15.00	\$7.31	\$4.88	\$32.19	\$0.73	\$6.96	\$7.69	(\$24.50)
2025	\$145.00	\$5.00	\$14.50	\$7.46	\$4.97	\$31.93	\$0.75	\$7.10	\$7.85	(\$24.08)
2026	\$140.00	\$5.00	\$14.00	\$7.61	\$5.07	\$31.68	\$0.77	\$7.24	\$8.01	(\$23.67)
2027	\$135.00	\$5.00	\$13.50	\$7.76	\$5.17	\$31.44	\$0.80	\$7.39	\$8.19	(\$23.25)
2028	\$130.00	\$5.00	\$13.00	\$7.92	\$5.28	\$31.19	\$0.82	\$7.53	\$8.35	(\$22.84)
2029	\$125.00	\$5.00	\$12.50	\$8.08	\$5.38	\$30.96	\$0.85	\$7.68	\$8.53	(\$22.43)
2030	\$120.00	\$5.00	\$12.00	\$8.24	\$5.49	\$30.73	\$0.88	\$7.84	\$8.72	(\$22.01)
2031	\$115.00	\$5.00	\$11.50	\$8.40	\$5.60	\$30.50	\$0.90	\$7.99	\$8.90	(\$21.60)
2032	\$110.00	\$5.00	\$11.00	\$8.57	\$5.71	\$30.28	\$0.94	\$8.15	\$9.09	(\$21.19)
2033	\$105.00	\$5.00	\$10.50	\$8.74	\$5.83	\$30.07	\$0.97	\$8.32	\$9.28	(\$20.78)
2034	\$100.00	\$5.00	\$10.00	\$8.92	\$5.94	\$29.86	\$1.01	\$8.48	\$9.49	(\$20.37)
2035	\$95.00	\$5.00	\$9.50	\$9.09	\$6.06	\$29.66	\$1.06	\$8.65	\$9.72	(\$19.94)
2036	\$90.00	\$5.00	\$9.00	\$9.28	\$6.18	\$29.46	\$1.12	\$8.83	\$9.95	(\$19.51)
2037	\$85.00	\$5.00	\$8.50	\$9.46	\$6.31	\$29.27	\$1.20	\$9.00	\$10.20	(\$19.07)
2038	\$80.00	\$5.00	\$8.00	\$9.65	\$6.43	\$29.08	\$1.28	\$9.18	\$10.46	(\$18.63)
2039	\$75.00	\$5.00	\$7.50	\$9.84	\$6.56	\$28.91	\$1.35	\$9.37	\$10.72	(\$18.19)
2040	\$70.00	\$5.00	\$7.00	\$10.04	\$6.69	\$28.73	\$1.40	\$9.55	\$10.95	(\$17.78)
2041	\$65.00	\$5.00	\$6.50	\$10.24	\$6.83	\$28.57	\$1.46	\$9.74	\$11.21	(\$17.36)

2042	\$60.00	\$5.00	\$6.00	\$10.45	\$6.96	\$28.41	\$1.54	\$9.94	\$11.48	(\$16.93)	
2043	\$55.00	\$5.00	\$5.50	\$10.66	\$7.10	\$28.26	\$1.63	\$10.14	\$11.77	(\$16.49)	
2044	\$50.00	\$5.00	\$5.00	\$10.87	\$7.25	\$28.11	\$1.72	\$10.34	\$12.06	(\$16.23)	
2045	\$45.00	\$5.00	\$4.50	\$11.09	\$7.39	\$27.98	\$1.81	\$10.55	\$12.36	(\$16.06)	
2046	\$40.00	\$5.00	\$4.00	\$11.31	\$7.54	\$27.85	\$1.91	\$10.76	\$12.67	(\$15.62)	
2047	\$35.00	\$5.00	\$3.50	\$11.53	\$7.69	\$27.72	\$2.01	\$10.97	\$12.99	(\$15.19)	
2048	\$30.00	\$5.00	\$3.00	\$11.76	\$7.84	\$27.61	\$2.12	\$11.19	\$13.32	(\$14.29)	
2049	\$25.00	\$5.00	\$2.50	\$12.00	\$8.00	\$27.50	\$2.24	\$11.42	\$13.65	(\$13.84)	
2050	\$20.00	\$5.00	\$2.00	\$12.24	\$8.16	\$27.40	\$2.36	\$11.65	\$14.00	(\$13.39)	
2051	\$15.00	\$5.00	\$1.50	\$12.48	\$8.32	\$27.31	\$2.49	\$11.88	\$14.37	(\$12.94)	
2052	\$10.00	\$5.00	\$1.00	\$12.73	\$8.49	\$27.22	\$2.62	\$12.12	\$14.74	(\$12.48)	
2053	\$5.00	\$5.00	\$0.50	\$12.99	\$8.66	\$27.15	\$2.77	\$12.36	\$15.12	(\$12.02)	
2054	\$0.00	\$5.00	\$0.00	\$13.25	\$8.83	\$27.08	\$2.92	\$12.61	\$15.52	(\$11.56)	
						Net Present Value	\$319.5	\$7.23	\$68.14	\$75.37	(\$244.08)

New Scotland Tap

Assuming no downstream constraints from Central East\Total East to the New York City Load Zone

Assumptions									Annual	
Initial Capital Cost					\$200	million		Energy Benefit	\$4,451,886	
Cost of Capital					10.0%			Capacity Benefit	\$15,309,096	2018 \$
O&M (% of Initial Capital Cost)					3.0%					
Property tax (% of Initial Capital Cost)					2.0%					
Inflation					2.0%					

All values in millions of dollars

Year	Capital	Depreciation	Interest	O&M	Prop Tax	Total Cost	Energy Benefit	Capacity Benefit	Total Benefit	Net Benefit
2014	\$200.00	\$5.00	\$20.00	\$6.00	\$4.00	\$35.00	\$5.22	\$14.70	\$19.92	(\$15.08)
2015	\$195.00	\$5.00	\$19.50	\$6.12	\$4.08	\$34.70	\$5.34	\$14.99	\$20.33	(\$14.37)
2016	\$190.00	\$5.00	\$19.00	\$6.24	\$4.16	\$34.40	\$5.47	\$15.29	\$20.77	(\$13.64)
2017	\$185.00	\$5.00	\$18.50	\$6.37	\$4.24	\$34.11	\$6.13	\$15.60	\$21.72	(\$12.39)
2018	\$180.00	\$5.00	\$18.00	\$6.49	\$4.33	\$33.82	\$6.47	\$15.91	\$22.38	(\$11.44)
2019	\$175.00	\$5.00	\$17.50	\$6.62	\$4.42	\$33.54	\$6.90	\$16.23	\$23.13	(\$10.41)
2020	\$170.00	\$5.00	\$17.00	\$6.76	\$4.50	\$33.26	\$7.18	\$16.55	\$23.73	(\$9.53)
2021	\$165.00	\$5.00	\$16.50	\$6.89	\$4.59	\$32.99	\$7.42	\$16.88	\$24.30	(\$8.69)
2022	\$160.00	\$5.00	\$16.00	\$7.03	\$4.69	\$32.72	\$7.69	\$17.22	\$24.91	(\$7.80)
2023	\$155.00	\$5.00	\$15.50	\$7.17	\$4.78	\$32.45	\$8.09	\$17.56	\$25.65	(\$6.80)
2024	\$150.00	\$5.00	\$15.00	\$7.31	\$4.88	\$32.19	\$8.50	\$17.92	\$26.41	(\$5.78)
2025	\$145.00	\$5.00	\$14.50	\$7.46	\$4.97	\$31.93	\$8.79	\$18.27	\$27.06	(\$4.87)
2026	\$140.00	\$5.00	\$14.00	\$7.61	\$5.07	\$31.68	\$9.01	\$18.64	\$27.65	(\$4.03)
2027	\$135.00	\$5.00	\$13.50	\$7.76	\$5.17	\$31.44	\$9.33	\$19.01	\$28.35	(\$3.09)
2028	\$130.00	\$5.00	\$13.00	\$7.92	\$5.28	\$31.19	\$9.55	\$19.39	\$28.95	(\$2.25)
2029	\$125.00	\$5.00	\$12.50	\$8.08	\$5.38	\$30.96	\$9.89	\$19.78	\$29.67	(\$1.29)
2030	\$120.00	\$5.00	\$12.00	\$8.24	\$5.49	\$30.73	\$10.22	\$20.18	\$30.39	(\$0.33)
2031	\$115.00	\$5.00	\$11.50	\$8.40	\$5.60	\$30.50	\$10.52	\$20.58	\$31.10	\$0.60
2032	\$110.00	\$5.00	\$11.00	\$8.57	\$5.71	\$30.28	\$10.91	\$20.99	\$31.91	\$1.62
2033	\$105.00	\$5.00	\$10.50	\$8.74	\$5.83	\$30.07	\$11.26	\$21.41	\$32.67	\$2.61
2034	\$100.00	\$5.00	\$10.00	\$8.92	\$5.94	\$29.86	\$11.72	\$21.84	\$33.56	\$3.70
2035	\$95.00	\$5.00	\$9.50	\$9.09	\$6.06	\$29.66	\$12.37	\$22.28	\$34.64	\$4.99
2036	\$90.00	\$5.00	\$9.00	\$9.28	\$6.18	\$29.46	\$13.08	\$22.72	\$35.80	\$6.34
2037	\$85.00	\$5.00	\$8.50	\$9.46	\$6.31	\$29.27	\$13.97	\$23.18	\$37.15	\$7.88
2038	\$80.00	\$5.00	\$8.00	\$9.65	\$6.43	\$29.08	\$14.84	\$23.64	\$38.48	\$9.40
2039	\$75.00	\$5.00	\$7.50	\$9.84	\$6.56	\$28.91	\$15.75	\$24.11	\$39.86	\$10.96
2040	\$70.00	\$5.00	\$7.00	\$10.04	\$6.69	\$28.73	\$16.28	\$24.59	\$40.88	\$12.14
2041	\$65.00	\$5.00	\$6.50	\$10.24	\$6.83	\$28.57	\$17.04	\$25.09	\$42.13	\$13.56

2042	\$60.00	\$5.00	\$6.00	\$10.45	\$6.96	\$28.41	\$17.97	\$25.59	\$43.56	\$15.15
2043	\$55.00	\$5.00	\$5.50	\$10.66	\$7.10	\$28.26	\$18.95	\$26.10	\$45.05	\$16.79
2044	\$50.00	\$5.00	\$5.00	\$10.87	\$7.25	\$28.11	\$19.98	\$26.62	\$46.60	\$18.49
2045	\$45.00	\$5.00	\$4.50	\$11.09	\$7.39	\$27.98	\$21.07	\$27.15	\$48.22	\$20.24
2046	\$40.00	\$5.00	\$4.00	\$11.31	\$7.54	\$27.85	\$22.21	\$27.70	\$49.91	\$22.07
2047	\$35.00	\$5.00	\$3.50	\$11.53	\$7.69	\$27.72	\$23.42	\$28.25	\$51.67	\$23.95
2048	\$30.00	\$5.00	\$3.00	\$11.76	\$7.84	\$27.61	\$24.70	\$28.82	\$53.51	\$25.91
2049	\$25.00	\$5.00	\$2.50	\$12.00	\$8.00	\$27.50	\$26.03	\$29.39	\$55.44	\$27.94
2050	\$20.00	\$5.00	\$2.00	\$12.24	\$8.16	\$27.40	\$27.46	\$29.98	\$57.54	\$30.04
2051	\$15.00	\$5.00	\$1.50	\$12.48	\$8.32	\$27.31	\$28.96	\$30.58	\$59.54	\$32.23
2052	\$10.00	\$5.00	\$1.00	\$12.73	\$8.49	\$27.22	\$30.53	\$31.19	\$61.73	\$34.50
2053	\$5.00	\$5.00	\$0.50	\$12.99	\$8.66	\$27.15	\$32.20	\$31.82	\$64.01	\$36.86
2054	\$0.00	\$5.00	\$0.00	\$13.25	\$8.83	\$27.08	\$33.95	\$32.45	\$66.40	\$39.32

Net Present
Value

\$319.45 \$84.22 \$175.40 \$259.62 (\$59.82)