New York Independent System Operator

COST ALLOCATION OF NEW INTERCONNECTION FACILITIES TO THE NEW YORK STATE TRANSMISSION SYSTEM

FOR THE CLASS YEAR 2001

ANNUAL TRANSMISSION
BASELINE ASSESSMENT
AND
ANNUAL TRANSMISSION
RELIABILITY ASSESSMENT

Prepared by the

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ANNUAL TRANSMISSION BASELINE ASSESSMENT AND ANNUAL TRANSMISSION RELIABILITY ASSESSMENT OF THE NEW YORK STATE TRANSMISSION SYSTEM

1. INTRODUCTION

1.1 BACKGROUND

This report, prepared by the New York Independent System Operator (NYISO), presents the results of the Annual Transmission Baseline Assessment (ATBA), the Annual Transmission Reliability Assessment (ATRA) and the Project Cost Allocation for the Class Year 2001. The NYISO is required to conduct these two annual assessments to determine the allocation of cost responsibility for the facilities required for the reliable interconnection of the Class Year 2001 generation and merchant transmission projects. The NYISO and its staff directed and controlled this cost allocation study process (as much as possible since the rules were being developed during the execution of the study work) according to the rules set forth in Attachment S of the NYISO Open Access Transmission Tariff (OATT), Rules to Allocate Responsibility For The Cost of New Interconnection Facilities (Allocation Rules). These Allocation Rules require that the ATBA and ATRA be conducted under the requirements to maintain the reliability of the bulk power system within New York State(NYBPS), in compliance with established Northeast Power Coordinating Council (NPCC), New York State Reliability Council (NYSRC), NYISO, and local Transmission Owner (TO) criteria, rules, and procedures in effect when the ATBA was commenced on May 1,2001, (collectively, the Applicable Reliability Requirements). The ATBA was performed without the Class Year 2001 units to identify baseline generic units and System Upgrade Facilities required for the NYBPS to meet the Applicable Reliability Requirements

NPCC, a regional council of the North American Electric Reliability Council (NERC), has established criteria for the design and operation of interconnected power systems (NPCC Criteria) [7]. As part of its ongoing reliability compliance and enforcement program, NPCC requires each of the five NPCC Areas (New York, New England, Ontario, Quebec, and Maritimes) to conduct and present an annual Area Transmission Review, which is an assessment of the reliability of the planned bulk power transmission system within the Area in a future year. The process and requirements for this assessment are outlined in the Guidelines for NPCC Area Transmission Reviews [8]. The current Guidelines for NPCC Area Transmission Reviews require each Area to conduct a Comprehensive Review at least every five years, and an Intermediate Review when appropriate in intervening years between comprehensive reviews.

In addition to the NPCC Criteria, the New York State Reliability Council (NYSRC) have established rules for planning and operating the New York State Power System (NYSRC Reliability Rules) [1]. The NYSRC Reliability Rules are consistent with, but in certain cases more specific or stringent than, the NPCC Criteria. The NYSRC also has a compliance monitoring program, and the NYISO provides its annual transmission reliability assessment to the NYSRC in accordance with that program.

The most recent comprehensive review of the New York State Bulk Power System was presented by New York Independent System Operator (NYISO) staff in July 2000 and covered the year 2006[2]. The results from this review will constitute the basis for most of the analysis required to conduct the ATBA, as the system representation closely resembles the pre Class 2001 system. The most recent intermediate review, the 2001 Area Transmission Review of the New York State Bulk Power Transmission System in the Year 2006 [14], also focused on year 2006, but with an updated forecast of system conditions, including the Class Year 2001 projects. This intermediate review will constitute the basis for most of the analysis required for the ATRA. The Allocation Rules require that resource adequacy and short circuit assessments be made as part of the cost allocation process. These two reviews did not perform these two assessments. Initially, short circuit work was performed by the appropriate Transmission Owner under the direction of the NYISO. The NYISO then took control of the analysis and the work was reviewed by NYISO staff and an independent contractor, General Electric International, Inc.(GE). The consultant provided a report to the NYISO[17] summarizing their assessment of the Class 2001 Cost Allocation. The NYISO performed short circuit work in conjunction with the independent contractor, and with input and results form all three parties, the NYISO developed the identification of System Upgrade Facilities (SUFs) to reliably interconnect the Class 2001 Projects. To complete the resource adequacy assessment, Resource Reliability Analysis (MARS analysis) was performed by the NYISO to confirm the resource adequacy of the baseline generation and transmission facilities. Details of these two assessments will be provided in this report, while the appropriate results of the two referenced area transmission reviews will only be summarized and referenced in this report. Information and results from the Class 2001 System Reliability Impact Studies (SRIS) were utilized to determine the Attachment Facilities and System Upgrade Facilities that are needed for reliable connection to the New York State Transmission System that meets the NYISO Minimum Interconnection Standard.

The Con Edison Fault Current Management Plan (FCMP) [16], which was reviewed by the NYISO and the independent contractor provided information regarding Attachment Facilities and System Upgrade Facilities that was used for the cost estimates and identification process.

1.2 FACILITIES INCLUDED IN THE ATRA AND ATBA

The NYCA bulk power transmission system primarily consists of 4,039 miles of 765, 345 and 230 kV transmission and is supplemented by about 6,750 miles of 138 and 115 kV transmission, a small portion of which is considered to be bulk power transmission. Also included in the bulk power system are a number of large generating units that are generally, but not necessarily, 300 MW or larger. A 500 kV tie-line connects the Branchburg station in the Pennsylvania-New Jersey-Maryland Interconnection (PJM) to the Ramapo station in southeastern New York. A list of the NYCA existing bulk power generation and transmission lines and one-line diagrams depicting their layout are presented in Appendix B of the two area transmission reviews.

This Project Cost Allocation includes the proposed transmission and generation projects throughout the period of the review that have met two "milestone" requirements. The first milestone is the approval by the NYISO Operating Committee of a System Reliability Impact Study (SRIS). The second milestone is demonstration of satisfactory progress in the regulatory process. For large generation projects, this milestone is achieved by obtaining acceptance of the Article X application. For transmission projects, the appropriate regulatory milestone is that a hearing has been scheduled in the Article VII process. Details of proposed projects are presented in Table 1.2.1 and discussed below. Projects that have met these two milestones by May 1, 2001, and were not considered in the previous comprehensive review, are referred to as the Class 2001 Projects.

Proposed transmission improvements through the year 2006 consist of two 345 kV transmission modifications, one DC tie between Connecticut and Long Island, and plans to add about 30 additional miles of 115 and 138 kV transmission. The 345 kV proposed modifications are (1) connection of the Bowline Point 3 generation project located near the existing Bowline Point 1&2 units to the Ladentown substation, and (2) a new substation at Middletown tapping one of the Cooper Corners to Rock Tavern lines.

Eleven major generation projects are proposed. Two of these projects (Athens and Bethlehem) were included in the last comprehensive review, and will be considered baseline units for inclusion in the ATBA. The additional generic baseline units were not included in the previous comprehensive review, but their omission would not materially affect the results and conclusions from that review regarding the New York State Bulk Power Transmission System. The other nine generation projects in the Class 2001 Projects are summarized below. Although there are many more proposed projects in NYCA, these are the only ones that completed the milestones mentioned above.

The proposed DC tie project, referred to as the Cross Sound Cable, is a 330 MW link between the Shoreham 138 kV station and the East Shore 345 kV station near New Haven, Connecticut. The technology for the project is a form of FACTS device known as "HVDC Light" and uses two Voltage Sourced Converters (VSC) at each end. Unlike conventional HVDC technology, HVDC Light does not drain reactive power from the AC system; in fact, it is capable of supplying VARs to maintain AC voltages. This project has an anticipated in-service date in the year 2002.

The proposed Class 2001 projects which are included in this review are listed in Table 1.2, at the end of this section. Of these, all but three (Sithe Heritage, Athens, and Bethlehem) are to interconnect to the Con Edison system. The 800 MW Sithe Heritage project is located next to the Sithe Independence plant in the Oswego Complex area and will connect to the Independence 345 kV bus. The ANP Ramapo 1100 MW project is located at the Ramapo 345 kV station, and the 750 MW Bowline 3 project will connect to the Ladentown 345 kV station. The remaining new projects in this review are located in New York City. KeySpan Ravenswood will connect to the Rainey 345 kV station, the Con Edison East River project will connect to the East River 138 kV and 69 kV stations, and the SCS Astoria and NYPA Poletti expansion projects will connect to the 138 kV Astoria station. Note that NYPA proposes to interconnect at both the Astoria East and West buses, while SCS proposes to connect only to the Astoria East bus. The NYPA GTs will connect to six 138 kv buses in the Con Edison In City System and one 69 kv bus in the LIPA system. The Orion Astoria 2 restart is connecting at the Astoria East station in the Con Edison In City System.

1.3 Load and Capacity

Load and Capacity data for both the ATRA and ATBA was derived primarily from the 2001 "Load and Capacity Data" Report (Gold Book) prepared by the NYISO [3]. Table 1.3.1 below shows the load forecast from Table 1-1 from the Gold Book supplemented to include the In City and Long Island forecast.

The 2001 load forecast for the 2006 New York Control Area summer peak load is 32,500 MW. The 2001 “Load and Capacity Data” Report shows a total installed capability of 42,309 MW. This is an increase of almost 5,000 MW, primarily caused by the addition of the Class 2001 generating units. Based on this, the resultant installed reserve margin for NYCA increases to just over 30%. From this high installed reserve margin, and transfer limit analysis results form the Intermediate Area Review, NYISO staff has determined that there are sufficient resources to meet the Applicable Reliability Requirements for the ATRA. The initial baseline conditions for the ATBA were developed from the 2001 Gold Book. The 2001 Gold Book reports two retirements and twenty additions during the years 2001 to 2006 time period. The generator retirement shown for the Capital Load Zone was removed from the capacity model when the Bethlehem Generation addition was installed. The generator retirement shown for the NYC Load Zone (Waterside) was not removed from the capacity model because the East River Repowering (a Class 2001 unit) was removed from the capacity model and these two projects are associated. Additionally, the NYISO staff believes that this generator retirement could be replaced by a generic generator connecting in an electrically equivalent manner and the impacts would be identical. Eighteen of the generator additions identified are included in the Class 2001 and are treated accordingly, even if they were installed before 2002. Units that were actually installed to the system that were either not listed in the Gold Book or listed as having zero capacity were not included in the analysis unless they were included as a baseline unit. An example of this is the Hudson Avenue 10 unit that was not listed in the Gold Book but was restored in the year 2001. This unit was not identified as a new interconnection and thus it was not included in the capacity model or the short circuit model. The repair of Gowanus 7&8 was included in both models as these were used as baseline units. The Class 2001 units in the Gold Book were then removed from the capacity model and any deficiencies in the NYCA Installed Reserve Requirement of 18%, In City Requirement of 80%, Local in City Load pocket requirements, and Long Island requirement of 98% were identified. These deficiencies were corrected by the addition of generic generation to restore the installed reserve margins to their respective required levels. The initial generic baseline units are summarized with the Class 2001 units in Table 1.2. The load and capacity model with the Class 2001 units subtracted out is summarized in Table 1.4. This initial capacity model, including the identified LIPA tie, was then tested in a MARS analysis that is discussed in a later section of this report. Modifications to the initial capacity model and generic baseline units are reported there. These modifications were made because the MARS included additional capacity from both new units and increased total DMNC ratings of the existing units.

Table 1.1

Expected Peak Loads - Forecast Before DSM Adjustments Less DSM Adjustments

Year	Central Hudson	Con Ed	LIPA (1)	NYPA Retail	NYPA Muni	NYSEG(2)	NMPC	O&R	RG&E	Expected NYCA Peak(3)	In-City (~88%)	Long Island
2001	975	12,025	4519	675	706	2,351	6,456	1,345	1,465	**30,620**	10,535	4,722
2002	990	12,165	4568	675	711	2,358	6,478	1,360	1,502	**31,240**	10,675	4,771
2003	1,010	12,295	4707	683	716	2,364	6,503	1,375	1,520	**31,620**	10,791	4,911
2004	1,020	12,420	4805	688	721	2,370	6,526	1,390	1,523	**31,910**	10,901	5,009
2005	1,030	12,545	4,924	696	726	2,376	6,545	1,410	1,509	**32,220**	11,011	5,129
2006	1,071	12,645	4,998	704	728	2,382	6,561	1,425	1,534	**32,500**	11,099	5,204
2007	1,092	12,745	5,069	711	731	2,388	6,577	1,440	1,567	**32,780**	11,186	5,275
2008	1,111	12,845	5,139	717	735	2,394	6,600	1,455	1,613	**33,070**	11,274	5,346
2009	1,130	12,945	5,219	723	739	2,400	6,619	1,470	1,640	**33,350**	11,362	5,426
2010	1,148	13,045	5,313	731	743	2,406	6,655	1,490	1,666	**33,670**	11,450	5,521
2011	1,169	13,145	5,412	739	747	2,412	6,692	1,505	1,696	**33,990**	11,537	5,620
2012	1,189	13,245	5,514	747	749	2,418	6,717	1,520	1,713	**34,290**	11,625	5,722
2013	1,207	13,345	5,617	755	751	2,424	6,739	1,535	1,769	**34,630**	11,713	5,825
2014	1,226	13,445	5,717	764	753	2,430	6,763	1,550	1,799	**34,940**	11,801	5,925
2015	1,245	13,545	5,816	774	755	2,436	6,790	1,565	1,821	**35,240**	11,888	6,024
2016	1,264	13,645	5,919	785	757	2,442	6,817	1,580	1,840	**35,550**	11,976	6,127
2017	1,283	13,745	6,023	785	759	2,448	6,844	1,595	1,864	**35,850**	12,064	6,231
2018	1,303	13,845	6,129	785	759	2,454	6,871	1,610	1,892	**36,150**	12,152	6,337
2019	1,323	13,945	6,228	785	759	2,460	6,898	1,625	1,920	**36,450**	12,240	6,436
2020	1,343	14,045	6,333	785	759	2,466	6,926	1,640	1,949	**36,770**	12,327	6,541

Year	Con Ed	In-City	East River	East 13th St.	West 49 Street	Astoria Pocket
2001	12,025	10,535	461	1,491	2,583	3,258
2002	12,165	10,675	467	1,511	2,617	3,301
2003	12,295	10,791	473	1,528	2,646	3,337
2004	12,420	10,901	477	1,543	2,673	3,371
2005	12,545	11,011	482	1,559	2,699	3,405
2006	12,645	11,099	486	1,571	2,721	3,432

Table 1.2

Planned Projects Included in the NYISO ATRA and ATBA

Developer / roject	SRIS Approved	Regulatory Milestone Met (1)	BASE CASE STATUS	In Service Date	MWs	Interconnection Points			Data Provided	
						Name	Area	Bus Number	Bus #'s Used	Plant Configuration
PG Athens *	Yes	Yes	B	2003	1080	Leeds 345	F	78701	78705-78711	GENROU,EXST1
PSE&G Bethlehem *	Yes	Yes	B	2003	350	Albany 115	F	78733 Remove	78961-78964 78966-78969	GENROU,PSS2A,EXPIC1,IEEEG1
TEUS CT-LI DC Tie-line	Yes	Yes	T	2002	330	Shoreham	K	75062	75078	CHVDCL,PWRHL2
ANP Ramapo Energy	Yes	Yes	T	2003	1100	Ramapo	G	74347	74860-74864	GENROU,EXST1,PSS2A
KeySpan Ravenswood	Yes	Yes	T	2003	270	Rainey 345	J	74345	74390,74391	GENROU,URST4B
Orion Astoria 2 Restoration	Yes	Yes	T	2001	175	Astoria E	J	74402	74429	GENROU,IEEET1, IEEEG1
ConEd East River Repowering	Yes	Yes	T	2002	288	E13th,ER69	J	74632, 74434	74518,74519	GENROU,PSS2A,URST4B
SEI Bowline Point 3	Yes	Yes	T	2003	750	Ladentown	G	74340	74399,79395- 79398	GENROU,GAST2A,URST4B
Sithe Heritage Station	Yes	Yes	T	2003	800	Independence	C	77408	77971,77972	GENROU,PSS2A,EXPIC1,IEEEG1
NYPA 2001 NYC GTs	Yes	Yes	T	2001	452	FoxHills(Pouch) GowGrn(G5&6) Hell Gt 1(Annex) HellGt4(HRrYd) Ver-Grn(Nth 1st) Vernon 138 Brentwood 69	J J J J J J K	74466 74476 74492 74495 74504 74556 75146	79560 79561,79562 79565,79566 79563,79564 79567 79568,79569 79570	GENROU,IEEET2,IEESGO
NYPA Poletti Project	Yes	Yes	T	2004	500	Astoria E&W	J	74402, 74403	79538,79539 79540	GENROU,PSS2A,EXPIC1,IEEEG1
SCS Astoria Energy	Yes	Yes	T	2003	1000	Astoria E	J	74402	74722,74723 74717-74719 74742 74760,74761	GENROU,ESST3A,GAST2A
Generic #1	Gowanus		P	2002,4	370	Gowbarg	J	74306	74392-74394	CC, 2x185 MW GT, 150 MW ST
Generic #2	East Cost Power		P	2002	46	Gothls S	J	74335		Upgrade to existing facility
Generic #3	Astoria No. 2		P,T	2001	175	Astoria E	J	74402	74429	Reactivation, see similar Astoria
Generic #4	Gowanus 7&8		P	2001	36		J			Simple cycle GT
Generic #5	East River Repowering		P,T	2002	144	East River 69	J	74632		Simple cycle GT
Generic #6	NYPA GT		P,T	2001	44 80	Fox Hills Gow-Green	J J	74466		Aero derivative Aero derivative
Far Rockaway			P	2002	44	Far Rock 69	K	75157		Aero derivative
Glenwood			P	2002	79.9	Glenwood 69	K			Aero derivative
Shoreham			P	2002	79.9	Shorham 69	K			Aero derivative
Ruland Rd			P	2004	93.2	Ruland R 138	K			Aero derivative
TEUS CT-LI DC Tie-line			P,T	2002	330	Shoreham 138	K	75062		DC Tie Line

- * - Included in the 2000 Comprehensive Review
- B - Class 2000 Project,
- T - Class 2001 ATRA Project
- P - Generic Baseline Project

TABLE 1.3

TABLE IV-1

As of January 1, 2001

ADDITIONS *

Owner / Operator	Station Unit	DATE	CAPABILITY (kW) SUMMER	WINTER	UNIT TYPE	Annual Total
NYC - Load Zone	Generator Reactivation	5/1/2001	175100	175100	Steam Turbine	
NYC - Load Zone	Generator Addition	7/1/2001	39950	39950	Gas Turbine	
NYC - Load Zone	Generator Addition	7/1/2001	39950	39950	Gas Turbine	
NYC - Load Zone	Generator Addition	7/1/2001	47000	47000	Gas Turbine	
NYC - Load Zone	Generator Addition	7/1/2001	39950	39950	Gas Turbine	
NYC - Load Zone	Generator Addition	7/1/2001	39950	39950	Gas Turbine	
NYC - Load Zone	Generator Addition	7/1/2001	39950	39950	Gas Turbine	
NYC - Load Zone	Generator Addition	7/1/2001	39950	39950	Gas Turbine	
NYC - Load Zone	Generator Addition	7/1/2001	47000	47000	Gas Turbine	
NYC - Load Zone	Generator Addition	7/1/2001	39950	39950	Gas Turbine	
NYC - Load Zone	Generator Addition	7/1/2001	39950	39950	Gas Turbine	588700
Consolidated Edison of NY, Ir	East River Repowering *	9/1/2002	360000	360000	Combined Cycle	360000
Athens Generation Company	Athens Generation **	7/1/2003	1080000	1080000	Combined Cycle	
KeySpan	Ravenswood Cogen Project *	7/1/2003	250000	250000	Combined Cycle	1330000
Sithe Energies	Heritage Station **	1/1/2004	800000	800000	Combined Cycle	
Mirant Corporation	Bowline Unit 3 *	4/1/2004	750000	750000	Combined Cycle	
Ramapo Energy	Ramapo Energy Project *	4/1/2004	1100000	1100000	Combined Cycle	
SCS Energy	Astoria Energy *	7/1/2004	1000000	1000000	Combined Cycle	
Public Service Enterprise Grc	Bethlehem Energy Center *	7/1/2004	750000	750000	Combined Cycle	
New York Power Authority	Poletti Station Expansion *	7/1/2004	500000	500000	Combined Cycle	4900000
			7178700	7178700		7178700

* Project has approved Article X Application on file with the NYS Public Service Commission.
** Project has been approved by the NYS Public Service Commission.

TABLE IV-2

RERATINGS

Owner / Operator	Station Unit	DATE	CAPABILITY (kW) SUMMER	WINTER	REASON FOR RERATING
Long Island - Load Zone	Various GT Units	1/1/2001	60000	60000	Improved Cooling
			60000	60000	

TABLE IV-3

RETIREMENTS

Owner / Operator	Station Unit	DATE	CAPABILITY (kW) SUMMER	WINTER	REASON FOR RETIREMENT
NYC - Load Zone	Generator Retirement	9/1/2002	164000	164900	Station Repowering
Capital - Load Zone	Generator Retirement	7/1/2004	363600	375500	Station Repowering
Niagara Mohawk Power Corp	Nine Mile Point 1	8/1/2009	618200	622500	Operating License Expires
Rochester Gas and Electric C	Ginna 1	10/1/2009	498000	497200	Operating License Expires
Consolidated Edison Compan	Indian Point 2	9/1/2013	953000	970000	Operating License Expires
Entergy Nuclear	Fitzpatrick	10/1/2014	826000	843000	Operating License Expires
Entergy Nuclear	Indian Point 3	12/1/2015	982000	990000	Operating License Expires
			4404800	4463100	

Table 1.4

LOAD AND CAPACITY SCHEDULE FOR BASELINE (ATBA)

NEW YORK CONTROL AREA

					KILOWATTS	
SUMMER CAPABILITY	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Steam Turbine (Oil)	2022800	2022800	2022800	2022800	2022800	2022800
Steam Turbine (Oil & Gas)	10440700	10615800	10451800	10451800	10088200	10088200
Steam Turbine (Gas)	561100	561100	561100	561100	561100	561100
Steam Turbine (Coal)	4002930	4002930	4002930	4002930	4002930	4002930
Steam Turbine (Wood)	38500	38500	38500	38500	38500	38500
Steam Turbine (Refuse)	263780	263780	263780	263780	263780	263780
Steam (PWR Nuclear)	2433000	2433000	2433000	2433000	2433000	2433000
Steam (BWR Nuclear)	2593800	2593800	2593800	2593800	2593800	2593800
Pumped Storage Hydro	1057000	1057000	1057000	1057000	1057000	1057000
Internal Combustion	135391	135391	135391	135391	135391	135391
Conventional Hydro	4442670	4442670	4442670	4442670	4442670	4442670
Combined Cycle	3134060	3134060	3494060	4824060	9724060	9724060
Jet Engine (Oil)	526900	526900	526900	526900	526900	526900
Jet Engine (Gas & Oil)	164000	164000	164000	164000	164000	164000
Combustion Turbine (Oil)	1348700	1348700	1348700	1348700	1348700	1348700
Combustion Turbine (Oil & Gas)	1835500	1835500	1835500	1835500	1835500	1835500
Combustion Turbine (Gas)	585480	1059080	1059080	1059080	1059080	1059080
Wind	11214	11214	11214	11214	11214	11214
Other	680	680	680	680	680	680
Special Case Resources - SCR (3)	392000	0	0	0	0	0
Additions	588700	360000	1330000	4900000	0	0
Reratings	60000	0	0	0	0	0
Retirements	0	-164000	0	-363600	0	0
ADJUSTMENTS TO BASELINE						
NYPA GT's & Ast 2 Rest.	-588700	-588700	-588700	-588700		
East River w/o retire		-196000	-196000	-196000		
Keyspan Ravenswood			-250000	-250000		
Her,BP3,RAM,SCS,Pol				-4150000		
ALL Class of 2001 Units					-5184700	-5184700
NYCA CAPABILITY(4)	36050205	35658205	36738205	37124605	37124605	37124605
Purchases(1)	450	450	450	50	50	50
Sales(1)	-303	-303	-304	-298	-298	-298
TOTAL CAPABILITY	36050352	35658352	36738351	37124357	37124357	37124357
BASE FORECAST						
Non-DSM Peak Load	30860000	31530000	31880000	32190000	32470000	32770000
DSM	240000	290000	260000	280000	250000	270000
Net Load after DSM	30620000	31240000	31620000	31910000	32220000	32500000
Agreement Capability	36050352	35658352	36738351	37124357	37124357	37124357
Required Capability	36131600	36863200	37311600	37653800	38019600	38350000
Actual Reserve KW	5430352	4418352	5118351	5214357	4904357	4624357
Reserve Requirement	5511600	5623200	5691600	5743800	5799600	5850000
Reserve Margin %	17.73	14.14	16.19	16.34	15.22	14.23
Additional Purchases(2)	81248	1204848	573249	529443	895243	1225643
Req. Reserve Margin (18%)	18.00	18.00	18.00	18.00	18.00	18.00

(1) - Purchases & Sales are with neighboring Control Areas.

(2) - Sufficient Capacity will be purchased by market participants to meet the New York Control Area installed Reserve requirement from Capacity resources located within the New York Control Area, including Merchant plants desiring to locate in New York, and capacity resources located external to the New York Control Area. The blue shaded columns in the row titled Additional Purchases show baseline requirements to be met with additional purchases or generic units.

(3) - Special Case Resources (SCR) are loads capable of being interrupted upon demand and distributed generators that are not visible to the ISO's Market Information System and that are subject to special rules in order to participate as Installed Capacity suppliers.

(4) Hudson Avenue not included

TABLE 1.5

LOAD AND CAPACITY SCHEDULE FOR CLASS 2001 ATRA

NEW YORK CONTROL AREA

KILOWATTS

SUMMER CAPABILITY	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Steam Turbine (Oil)	2022800	2022800	2022800	2022800	2022800	2022800
Steam Turbine (Oil & Gas)	10440700	10615800	10451800	10451800	10088200	10088200
Steam Turbine (Gas)	561100	561100	561100	561100	561100	561100
Steam Turbine (Coal)	4002930	4002930	4002930	4002930	4002930	4002930
Steam Turbine (Wood)	38500	38500	38500	38500	38500	38500
Steam Turbine (Refuse)	263780	263780	263780	263780	263780	263780
Steam (PWR Nuclear)	2433000	2433000	2433000	2433000	2433000	2433000
Steam (BWR Nuclear)	2593800	2593800	2593800	2593800	2593800	2593800
Pumped Storage Hydro	1057000	1057000	1057000	1057000	1057000	1057000
Internal Combustion	135391	135391	135391	135391	135391	135391
Conventional Hydro	4442670	4442670	4442670	4442670	4442670	4442670
Combined Cycle	3134060	3134060	3494060	4824060	9724060	9724060
Jet Engine (Oil)	526900	526900	526900	526900	526900	526900
Jet Engine (Gas & Oil)	164000	164000	164000	164000	164000	164000
Combustion Turbine (Oil)	1348700	1348700	1348700	1348700	1348700	1348700
Combustion Turbine (Oil & Gas)	1835500	1835500	1835500	1835500	1835500	1835500
Combustion Turbine (Gas)	585480	1059080	1059080	1059080	1059080	1059080
Wind	11214	11214	11214	11214	11214	11214
Other	680	680	680	680	680	680
Special Case Resources - SCR (3)	392000	0	0	0	0	0
Additions	588700	360000	1330000	4900000	0	0
Reratings	60000	0	0	0	0	0
Retirements	0	-164000	0	-363600	0	0
NYCA CAPABILITY	36638905	36442905	37772905	42309305	42309305	42309305
Purchases(1)	450	450	450	50	50	50
Sales(1)	-303	-303	-304	-298	-298	-298
TOTAL CAPABILITY	36639052	36443052	37773051	42309057	42309057	42309057
BASE FORECAST						
Non-DSM Peak Load	30860000	31530000	31880000	32190000	32470000	32770000
DSM	240000	290000	260000	280000	250000	270000
Net Load after DSM	30620000	31240000	31620000	31910000	32220000	32500000
Agreement Capability	36639052	36443052	37773051	42309057	42309057	42309057
Required Capability	36131600	36863200	37311600	37653800	38019600	38350000
Actual Reserve KW	6019052	5203052	6153051	10399057	10089057	9809057
Reserve Requirement	5511600	5623200	5691600	5743800	5799600	5850000
Reserve Margin %	19.66	16.66	19.46	32.59	31.31	30.18
Additional Purchases(2)	0	420148	0	0	0	0
Req. Reserve Margin (18%)	19.66	18.00	19.46	32.59	31.31	30.18

(1) - Purchases & Sales are with neighboring Control Areas.

(2) - Sufficient Capacity will be purchased by market participants to meet the New York Control Area installed Reserve requirement from Capacity resources located within the New York Control Area, including Merchant plants desiring to locate in New York, and capacity resources located external to the New York Control Area.

TABLE 1.6

As of January 1, 2001

Generator Type	ZONE			ZONE			ZONE			ZONE		
	A	B	C	D	E	F	G	H	I	J	K	NYCA
	Summer Capability Period (KW)								Summer Capability Period (KW)			
Steam Turbine (Oil)	0	0	2E+06	0	0	0	0	0	0	0	381000	2022800
Steam Turbine (Oil & Gas)	65500	0	360000	0	0	362900	2632500	0	0	4971800	2048000	10440700
Steam Turbine (Gas)	500	0	0	0	0	39600	0	0	0	295000	226000	561100
Steam Turbine (Coal)	2E+06	2E+05	829630	0	52800	0	715700	0	0	0	0	4002930
Steam Turbine (Wood)	0	0	0	17900	20100	500	0	0	0	0	0	38500
Steam Turbine (Refuse)	39900	0	33520	0	0	12200	8000	54000	0	0	116160	263780
Steam (PWR Nuclear)	0	5E+05	0	0	0	0	0	1935000	0	0	0	2433000
Steam (BWR Nuclear)	0	0	3E+06	0	0	0	0	0	0	0	0	2593800
Pumped Storage Hydro	0	0	0	0	0	1057000	0	0	0	0	0	1057000
Internal Combustion	5250	0	22240	1800	1080	2600	13600	0	0	2685	86136	135391
Conventional Hydro	3E+06	52640	142510	834590	411260	334560	108800	0	2600	0	0	4442670
Combined Cycle	329680	1E+05	850310	319000	336720	621400	19000	0	0	293000	249250	3134060
Jet Engine (Oil)	0	0	0	0	0	0	0	0	0	0	526900	526900
Jet Engine (Gas & Oil)	0	0	0	0	0	0	0	0	0	0	164000	164000
Combustion Turbine (Oil)	0	14000	0	0	0	0	18600	46500	0	722600	547000	1348700
Combustion Turbine (Oil & Gas)	121500	0	300000	0	0	0	91000	0	0	1199000	124000	1835500
Combustion Turbine (Gas)	2800	14000	0	0	0	39600	0	0	0	510900	18180	585480
Wind	16	100	26	0	11064	8	0	0	0	0	0	11214
Other	0	0	0	0	0	0	0	0	680	0	0	680
Totals	5E+06	9E+05	7E+06	1E+06	833024	2470368	3607200	2035500	3280	7994985	4486626	35598205
Pre - Baseline Additions to					PG&E Ather	1080000					60000	
2001 Load and Capacity					PSE&G Betl	386000						
Total Pre Baseline Capacity						3936368			24582594	7994985	4546626	37124205
2006 Load									16197000	11099000	5204000	32500000
Total Installed Requirement									19112460	8879200	5099920	38350000
Surplus/(Deficiency)									59892054	-884215	-553294	-1225795

2. STUDY RESULTS DEMONSTRATING CONFORMANCE WITH RELIABILITY REQUIREMENTS

2.1 STUDY METHODOLOGY

As described earlier, the required analysis relied on the previous Area Transmission Reviews to develop the normal and emergency transfer capabilities of the planned transmission system and to determine whether the planned transmission system meets the Applicable Reliability Standards. The analysis conducted for the area reviews was conducted in accordance with the NYSRC Reliability Rules [1]. Specific guidelines for voltage and stability analysis are found in NYISO Transmission Planning Guidelines #2-0 [5] and #3-0 [6] respectively. These two NYISO Guidelines are Attachments E and F of the NYISO Transmission Expansion and Interconnection Manual [13]. These Guidelines conform to the NPCC Basic Criteria [7] and Guidelines for NPCC Area Transmission Reviews [8]. The NYISO Guidelines provide additional details regarding NYISO's methodology for evaluating the performance of the bulk power transmission system.

The procedure used to evaluate the performance of the bulk power transmission system consists of the following basic steps: (1) develop a mathematical model (or representation) of the New York State and external electrical systems for the period of study (in this case, the year 2006), (2) develop various load flow base cases to model the system conditions (load and power transfer levels, commitment and dispatch of generation and reactive power devices) to be tested, and (3) conduct load flow and stability analysis to determine whether or not the transmission system meets NYSRC and NPCC criteria for thermal, voltage and stability performance. In actual practice, steps (2) and (3) are interwoven during the conduct of a study, and the detailed procedures differ for the various types of analyses conducted. The details regarding the representation, base cases, analysis procedures, and results are discussed in the appropriate sections of the two area reviews.

2.2 TRANSMISSION ADEQUACY

The transfer limits that were developed as per Attachment S are summarized in the table below. Details of their development can be found in the appropriate review reports. Based on the findings of the two reviews, the NYISO determined that no System Upgrade Facilities are required to mitigate any adverse reliability impacts regarding transfer limits.

TABLE 2.1

NYCA BULK POWER TRANSFER LIMITS

Interface	2000 Comprehensive Review Transfer Limit (Study Year 2006)		2001 Intermediate Review Transfer Limit (Study Year 2006)	
	Normal	Emergency	Normal	Emergency
Dysinger East (closed)	3700	3800	**	**
Dysinger East (open)	2400	2475	**	**
West Central (closed)	2400	2525	**	**
West Central (open)	1100	1175	**	**
Volney East (closed)	5050	5175	**	**
Volney East (open)	4325	4400	**	**
Moses South (closed)	1450	1875	**	**
Moses South (open)	1300	1700	**	**
Total East	5325	5325	5025	5025
Central East	2725	2850	2725	2775
UPNY/SENY (closed)	4750	5400	4300	4950
UPNY/SENY (open)	4600	5250	4175	4825
UPNY/CONED (closed)	6525	6925	7475	8050
UPNY/CONED (open)	5425	5750	6275	6825
Millwood South (closed)	8025	11150	**	**
Dunwoodie South (closed)	6075	6075	6225	6325
Dunwoodie South (open)	4950	4950	5025	5125
Long Island Import (1)	1200	1850	1500	2175

(1) The emergency limit for the Long Island Import is dependent on the phase angle regulator control settings in the LIPA area. The limit shown is for the base case conditions. For comparison purposes, the emergency limit with phase shifters optimized of 1850 from the previous comprehensive review is used

** Not evaluated in this review

2.3 Resource Adequacy

The NYISO staff conducted a reliability analysis of the year 2006 using Multi-Area Reliability Simulation (MARS) software. This analysis started with the Installed Reserve Margin (IRM)[1] study database. The basis for that study's assumptions along with those for this analysis are presented in the below table.

BASE CASE ASSUMPTION	2002 REPORT	2006 ANALYSIS
NYCA Capacity	All Capacity in the NYCA	Updated to class of 01
NYCA Unit Ratings	Based on 2001 Gold Book	No Change- new unit ratings as provided by developer
Planned Capacity	IRM study see Page 15	Updated to time of study
Unit Availability	NERC-GADS 1991-2000	No Change, NERC class average for proposed units
Unit Maintenance Schedule	Historical adjusted for forecasted time of year	No Change
Neighboring Control areas – all except PJM	NPCC CP-8 Study	No Change
Neighboring Control area – PJM	Used model developed for 2000 Report.	No Change
Load Model	1995 NYCA shape	No Change
Peak Load Forecast	ISO staff forecast of 30,650 MW (adjusted for loss of Rockland load.)	Based on forecast in 2001 Gold Book
Load Model Uncertainty	Includes updated load growth uncertainty model	No Change
External ICAP	Grandfathered plus 300 MW from ISO-NE and 800 MW HQ	No Change
Emergency Operating Procedures	1056 MW load relief	No Change
Special Case Resources	515 MW	No Change
Locational Capacity Requirements	Used results from 2001 NYISO Locational Requirements Study	No Change
Transfer Limits	Same as 2001 except for the reduction of LIPA import by 50 MW.	Added 330 MW HVDC tie from NE to Area –K Sensitivity run for reduced UPNY-SENY
Inter-control Area reserve sharing priority	Updated	No Change

[1] "New York Control Area Installed Capacity Requirements for the Period May 2002 through April 2003", New York State Reliability Council, L.L.C., Executive Committee Resolution and Technical Study Report, December 14, 2001.

Changes to assumptions from 2002 IRM study

Changes were made in the areas of peak load, capacity, and transfer limits. A NYCA peak load of 32,500 MW was derived from the 2001 Gold Book by subtracting the Rockland Electric Load, which is leaving the NYISO system. Areas J and K were forecast to be 11,099 MW and 5,206 MW respectively. The 330 MW HVDC tie between New England and Area K was assumed to be in service. Changes to capacity from the Gold book are shown in two pieces below. First a reproduction of page 16 of the IRM study showing the changes from the Gold book to the IRM study. Next comes a table showing the capacity changes from the IRM study to this analysis.

From the IRM study:
The unit ratings were obtained from the NYISO "2001 Load & Capacity Data" (Gold Book). The following changes that were announced after the Gold Book was published are modeled in this study:

- **Retirements:**
  Jennison 1 and 2 and Hickling 1&2 for a total of -155 MW, Upstate
- **New Units: (Units installed during 2001)**
  Gowanus 5&6 79.9 – MW, NYC
  Binghamton Cogen - 40 MW, Zone C
  NYPA Brentwood - 47 MW, Long Island
  Harlem River 1 & 2 - 79.9 MW, NYC
  Hellgate 1&2 - 79.9 MW, NYC
  Hudson Ave. - 60 MW, NYC
  North 1st - 47 MW, NYC
  Pouch GT - 44 MW, NYC
  Vernon GT 2&3 79.9 MW, NYC
- **Planned Units for 2002:**
  SEF - 79.9 MW, NYC
  Fortistar 1&2 - 2 units at 79.9 MW each, NYC
  FP&L Far Rockaway - 44 MW, Long Island
  KeySpan Glenwood – 79.9 MW, Long Island
  Gotham – 79.9 MW, NYC
  PP&L Shoreham - 79.9 MW, Long Island
  JFK expansion - 45 MW, NYC
  East Coast Power Cogen upgrade - 15 MW, (Total of 726 MW), NYC

The following table shows the changes from the IRM Study to this analysis. Several units that were modeled in the IRM study had to be removed for this analysis. These units are represented with negative MW values below. In addition, there was removal of several Albany steam units.

		TOTAL	AREA-J	AREA-K
IRM Study		**37306**	**9191**	**4745**
	Area	**MW**		
GOWANUS (36 to 30)	J	-6	-6	
SEF GOWANUS	J	330	330	
EAST RIVER	J	144	144	
GOWANUS 5	J	-40	-40	
GOWANUS 6	J	-40	-40	
HARLEM 1	J	-40	-40	
HARLEM 2	J	-40	-40	
HELLGAT1	J	-40	-40	
HELLGAT2	J	-40	-40	
NORTH1ST	J	-47	-47	
HUDS.AVE	J	-60	-60	
GOTHAM	J	-80	-80	
SEF	J	-80	-80	
FORTISTR1	J	-80	-80	
FORTISTR1	J	-80	-80	
JFK expansion	J	-45	-45	
ATHENS	F	1080		
BETHLEHEM	F	750		
ALBANY STEAM	F	-374		
RULAND	K	93		93
BRENTWOD	K	-44		-44
Sub-Total		1261	-244	49
Grand Total		**38,567**	**8,947**	**4,794**

Methodology

The analysis was conducted by making the above changes to the IRM study base case MARS database. Since the resultant Loss of Load Expectation (LOLE) was lower than the NPCC criteria of 0.1 days per year, load was increased upstate until the LOLE was established at the NPCC threshold. This occurred at a load level of approximately 32,700 MW. A sensitivity was run with a lower UPNY/SENY interface limit to assess the impact of the Athens unit when it is dispatched to full. This was identified in the SRIS for this plant as well as the Annual Transmission Review. This was the only identified limit sensitivity that was run.

Results

Results of the analysis showed that, for the ATBA system with the 2006 peak load forecast, new capacity, and new transfer limit, the LOLE of the state was reduced to 0.035 days per year. Load was then increased in the upstate areas (Area-A through Area-I) until the LOLE approached the 0.1 days per year NPCC criteria. At this point the ratio of capacity to load in Area-J was approximately 80% and the ratio in Long Island (Area K) was approximately 93%. The resultant 93% requirement for Long Island includes the Cross Sound DC line and therefore its capacity was removed from the initial baseline capacity table and the remaining capacity additions was verified to meet the new 93% requirement. The final in city capacity requirement after these adjustments was approximately 8879 MW. The requirement was rounded to 80 percent, which represents no change from the previous requirement.

2.4 Conclusions

Based on the results above, the NYISO staff has determined that the ATBA and ATRA meet all Applicable Reliability Requirements.

3. SHORT CIRCUIT ASSESSMENT

As per Attachment S, the procedure for conducting the ATRA and ATBA will use the Applicable Reliability Requirements in effect when the assessments are commenced. For 2001, the commencement date was May 1, 2001.
The Applicable Reliability Requirements regarding short circuit analysis in effect when the ATBA and ATRA commenced were those of the local Transmission Owners. The predominant methodology employed by the New York Transmission Owners is what is referred to as the "Classical Method", which is summarized below. This describes the methodology employed by Con Edison. NYISO staff has relied upon results from its independent consultant, its own studies, and results from Transmission Owner studies for its short circuit assessment. The first part of the short circuit assessment was a review of the individual Transmission Owner plans. This was done under the control of the NYISO in conjunction with its consultant. After this review, the NYISO conducted its own statewide assessment in accordance with Attachment S and to take into account its own concerns and those raised by market participants.

3.1 Methodology

"Classical Method" was used to evaluate the fault currents and circuit breaker adequacy for this study. This is a very common method widely used among electric utilities and consultants performing Short Circuit studies. The method provides conservative results, and requires the following system assumptions:

- All generating units in service.
- All transmission feeders in service.
- All series reactors in service.
- Loads, shunts and line capacitance not represented.
- Pre-fault flat start system representation (e.g., unity operating voltages, unity transformer tap ratios, etc.).
- Generators are represented by their *direct axis sub-transient reactance at rated voltage (X"dv)* which ensures that breaker fault duty levels are determined immediately after the occurrence of the fault, when a generator current contribution into the fault is at its maximum level.

The short circuit analysis is performed for the above system conditions at each substation and for the following faults.

a. Three phase to Ground faults

b. Double phase to Ground faults

c. Single phase to Ground faults

In comparing the calculated fault duties to the breaker ratings, only the highest of the three currents need to be evaluated.

If the fault duty at any substation exceeds the nameplate rating of the lowest rated circuit breaker at that substation, then an individual circuit breaker analysis is performed to determine whether that circuit breaker is actually overdutied or not. The following guidelines will be used to perform an individual circuit breaker analysis:

- No intentional impedance (such as arc resistance) will be added between the faulted element and the circuit breaker.
- The circuit breaker to be evaluated always interrupts <u>*after*</u> every other breaker with an equal voltage rating, but always <u>*before*</u> any other breaker with a lower voltage rating.

3.2 Baseline (ATBA)

The Annual Transmission Baseline Assessment is focused on Con Edison and LIPA systems only because the TOs representing the rest of the NYCA system have reported that no system upgrades requiring cost allocation are needed in their systems. NYISO staff have reviewed the TOs study results and concur with their findings. While reviewing the short circuit database provided by Con Edison, it was found that the resistance values of numerous transformers and generators were shown as zero. NYISO staff directed its consultant to change the zero resistance values of transformers and generators to typical values obtained from IEEE and ANSI standards (IEEE std. 141-1986 and ANSI/IEEE std. C37.010, 1999). NYISO staff conducted its own studies with the database not updated with resistance values. Con Edison maintained that the database was constructed for the classical method of analysis and it has been kept that way to obtain conservative results. Con Edison had serious concerns regarding the application of X/R ratios from this database (because those are not the X/R ratios that would be determined from a more detailed system representation) to determine “momentary duty” and “total interrupting current” for each circuit breaker. Con Edison, like many other electric utililties that employ the “Classical Method” , uses only symmetrical fault currents to compare against the circuit breaker ratings. NYISO determined that for its own analysis, the more conservative approach was to use the Con Edison database without the zero resistance changes and to complete its short circuit assessment accordingly.

Con Ed System (ATBA)

For this study, NYISO staff used 4 cycle and 6 cycle breaker opening time for 345 kV and 138 kV breakers respectively. This information was obtained from Con Edison's report on Fault Current Management Plan (page 13).

Since the NYISO calculated fault duties were practically identical to the Con Ed and GE calculated symmetrical fault currents, the results are only reported for the Con Ed and GE calculations in the tables on the next few pages. Any circuit breaker that has been identified as *overdutied* is due to symmetrical fault duty exceeding the symmetrical rating of that circuit breaker.

Table 3.1 below shows the fault currents at Con Edison's 345 kV, 138 kV and 69 kV substations for the Con Edison ATBA. Athens and Bethlehem projects were included in the baseline system as they are pre Class 2001 projects. Substations with excessive fault currents have been highlighted in Table 3.1. Individual circuit breaker analysis was then performed to determine if any of the circuit breakers at those substations were actually overdutied. In making that determination, NYISO staff referred to the circuit breaker diagrams supplied by Con Edison, and occasional consultation with Con Edison staff regarding the circuit breaker operating schemes. Table 3.2 summarizes all such overdutied circuit breakers that need to be replaced or mitigated. Tables 3.3 through 3.7 show the results where the circuit breakers have been found adequate, even though in some cases, extremely close to the ratings. Table 3.8 shows that one circuit breaker at Sherman Creek substation (breaker 3W) is slightly overdutied. Con Edison had also identified this circuit breaker as overdutied but missed accounting for it.

NYISO staff spent a considerable amount of time checking and re-checking the results of individual breaker analysis at Ramapo and Sprainbrook substations (Tables 3.4 and 3.5) due to fault currents being short by just 20 amperes and 30 amperes of the circuit breaker ratings respectively. Even using different programs (PTI, GE and Aspen) did not change the results. Therefore, adhering to the study methodology defined under section 3.1, and subject to the statewide assessment, NYISO staff is satisfied that the circuit breakers at Ramapo and Sprainbrook substations are within their ratings for the conditions studied. NYISO staff, however, makes the following observations:

- The series reactor in the Sprainbrook-E. Garden City circuit is assumed to be in service as part of the classical methodology. NYISO staff understands that an operating agreement exists governing the operation of this device.
- If either one of the transformers N7 or S6 at the Sprainbrook substation is out of service, especially in the summer time when maximum generation is on line in Con Edison system, the individual breaker analysis indicates that at least five circuit breakers at the Sprainbrook substation may get overdutied by about 400 amperes for a 3 phase fault. NYISO staff recommends that the above transformer outages should be properly coordinated to minimize risk of over-duty conditions at the Sprainbrook substation.

TABLE 3.1
Con Edison Service Area
Year 2001 Annual Transmission Baseline Assessment
Fault Currents with Generic Units in Service
(Study Year 2006)

Substation Name	Lowest Breaker Rating	Fault Type causing Maximum Fault Current	Symmetrical Fault Current Calculated By GE	Fault Current calculated by Con Edison
345kV	**(kA)**		**(kA)**	**(kA)**
Buchanan North	40	3-Ph	30.10	30.11
Buchanan South	40(1)	3-Ph	41.07	41.08
Dunwoodie	63	3-Ph	62.70	62.74
East Fishkill	63	3-Ph	39.23	39.23
Farragut	63	LLG	62.71	62.70
Fresh Kills	63	LLG	24.75	24.72
Goethals North	40	LLG	23.96	23.92
Goethals South	63	L-G	24.35	24.35
Gowanus North	40	LLG	19.55	19.53
Gowanus South	40	LLG	19.67	19.65
Ladentown	63	3-Ph	40.84	40.84
Millwood	63	3-Ph	48.88	48.89
Pleasant Valley	63	3-Ph	40.06	40.06
Poletti	63	LLG	47.17	47.16
Rainey	63	LLG	61.60	61.60
Ramapo	40(1)	3-Ph	43.90	43.92
Sprain Brook	63(1)	3-Ph	63.58	63.60
West 49 Street	63	LLG	57.52	57.52
138kV				
Astoria-East	45(2)	L-G	51.24	51.26
Astoria-West	45	LLG	41.21	41.24
Buchanan	40	3-Ph	15.67	15.67
Corona	45(1)	LLG	49.97	50.04
Dunwoodie N.	40	LLG	33.35	33.56
Dunwoodie S.	40	LLG	31.56	31.57
E. 13 Street	40(2)	LLG	44.60	44.54
E. 179 Street	63	LLG	47.53	47.58
Fox Hills	40	LLG	35.11	35.59
Fresh Kills	40	LLG	37.77	37.77
Greenwood	45(2)	LLG	57.74	57.70
Hell Gate 6	63	LLG	42.24	42.23
Hudson Ave. East	40	3-Ph	37.82	37.82
Jamaica	40(1)	LLG	46.47	46.47

Millwood	20	3-Ph	19.23	19.23
Queensbridge	45	LLG	40.35	40.36
Sherman Creek	40(2)	LLG	42.74	42.79
Vernon East	40	LLG	32.37	32.33
Vernon West	40	LLG	30.59	30.63
69kV				
East River	42(2)	L-G	50.62	50.10

(1) Individual Breaker analysis performed by Con Ed and verified by NYISO shows that no breaker is overdutied.
(2) Breakers at this substation need to be replaced

TABLE 3.2
Con Edison Service Area
Year 2001 Annual Transmission Baseline Assessment
Required System Upgrade Facilities (SUFs)

Substation	Replace the following Circuit Breakers
Astoria E 138 kV	1E, 7E, 2W, B1, all to 63 kA
E. 13 th Street 138 kV	All 4 breakers to 63 kA
Greenwood 138 kV	BT, 4S to 63 kA
East River 69 kV	12 breakers to 50 kA
Sherman Creek 138 kV	3W to 45 kA

TABLE 3.3
BUCHANAN S 345 kV
Individual Breaker Analysis
Year 2001 Annual Transmission Baseline Assessment

Breaker	Rating (kA)	Fault Type Resulting in Maximum Fault Current	Fault (kA)	% of Rating
1	40	3-Ph	36.88	92
3	40	3-Ph	36.88	92
5	40	3-Ph	35.71	89
6	40	3-Ph	35.71	89

TABLE 3.4
RAMAPO 345 kV
Individual Breaker Analysis
Year 2001 Annual Transmission Baseline Assessment

Breaker	Rating (kA)	Fault Type Resulting in Maximum Fault Current	Fault (kA)	% of Rating
T-1500-W72-2	40	3-Ph	39.98	100
T-77-94-2	40	3-Ph	38.68	97

TABLE 3.5
SPRAINBROOK 345 kV
Individual Breaker Analysis
Year 2001 Annual Transmission Baseline Assessment

Breaker	Rating (kA)	Breaker Resulting in Maximum Fault Current	Fault (kA)	% of Rating
RN2	63	3-Ph	62.97	100
RN3	63	3-Ph	62.97	100
RN4	63	3-Ph	62.97	100
RN5	63	3-Ph	62.97	100
RN6	63	3-Ph	62.97	100
RS3	63	3-Ph	62.89	100
RS4	63	3-Ph	62.89	100
RS5	63	3-Ph	62.89	100
RS6	63	3-Ph	62.89	100
RNS2	63	3-Ph	62.89	100
RNS6	63	3-Ph	62.07	99
RNS4	63	3-Ph	62.28	99
RNS3	63	3-Ph	62.27	99
RNS5	63	3-Ph	62.19	99

TABLE 3.6
CORONA 138 kV
Individual Breaker Analysis
Year 2001 Annual Transmission Baseline Assessment

Breaker	Rating (kA)	Fault Type Resulting in Maximum Fault Current	Fault (kA)	% of Rating
BT	45	LLG	44.93	100

TABLE 3.7
JAMAICA 138 kV
Individual Breaker Analysis
Year 2001 Annual Transmission Baseline Assessment

Breaker	Rating (kA)	Fault Type Resulting in Maximum Fault Current	Fault (kA)	% of Rating
1	45	LLG	38.93	86
3	45	LLG	41.34	92
4	45	LLG	39.13	87
6	45	LLG	41.45	92
7	45	LLG	33.69	75
8	40	LLG	36.18	90
13	40	LLG	31.11	78
14	40	LLG	31.11	78

TABLE 3.8
SHERMAN CREEK 138 kV
Individual Breaker Analysis
Year 2001 Annual Transmission Baseline Assessment

Breaker	Rating (kA)	Fault Type Resulting in Maximum Fault Current	Fault (kA)	% of Rating
3W	40	LLG	40.04	100
4E	40	LLG	38.98	97
5E	40	LLG	39.98	100

LIPA System (ATBA)

LIPA has added 297 MW of generic on-island generation and 330 MW of DC Tie-line with Connecticut, to meet its 2006 load and reserve requirements. LIPA has provided its ATBA/ATRA report along with short circuit representation of its system data to NYISO for review and analysis.

While reviewing the LIPA report and system data, NYISO staff finds that LIPA has not inserted the series reactor in Sprainbrook to East Garden in their methodology to develop fault duties at LIPA substations.

The fault duties are significantly higher without the reactor than with. NYISO calculations indicate that fault levels at East Garden City will decrease by about 5700 amperes, at Pilgrim by about 600 amperes and at Valley stream by about 1800 amperes. These reductions may bring the fault duties to well within the circuit breaker ratings. Consequently, some of the circuit breakers shown overdutied are actually not overdutied with the reactor in service.

Table 3.9 shows the circuit breakers identified by LIPA that are overdutied without the series reactor in service.

Table 3.9

Substation	Overdutied circuit breakers	Fault type causing maximum current	% loading
East Garden City	1310, 1350, 1380	LLG	102.76, 102.37, 102.76
Pilgrim	1310, 1320	LLG	106.17, 106.05
Valley Stream	1350	LLG	103.62

Although NYISO staff did not review the LIPA ATBA and ATRA to the same level of detail as Con Edison’s, NYISO staff is satisfied with the plan and methodology.

NYISO Statewide Assessment

After the development and review of the individual Transmission Owner ATBAs, NYISO staff, in response to its and market participant concerns, reassessed the plans on an independent and statewide basis in accordance with Attachment S. Since the NYISO statewide short circuit database is not available at this time, NYISO staff developed a proxy database by replacing the Long Island system representation in the Con Edison database with the LIPA provided Long Island representation. This combined proxy database was updated to address further concerns of the NYISO. Short circuit analysis was performed with this database and additional overdutied conditions were determined to exist, most notably at Sprainbrook. These additional overdutied conditions were mitigated by the inclusion of two of the mitigation actions identified in the Fault Current Management Plan(series reactor in Feeder 15055 with the associated relocation of Hell Gate transformer connections). In addition, this mitigation action allowed for the relocation of Astoria Unit 4 to the Astoria West bus without creating additional overdutied conditions. The results from this statewide database are compared with those from the Con Edison database for the appropriate Substations in Table 3.10. As can be seen from the table, the breakers at Astoria East do not need to be replaced after the insertion of the series reactor in feeder 15055. In addition, a more desirable overduty margin is created at the significant substations. NYISO believes that this extra margin satisfies its concerns at this time without any additional analysis. NYISO concludes that the identification of system upgrade facilities in Table 3.11 is the least costly configuration of system upgrade facilities required to maintain system reliability as set forth in the Applicable Reliability Requirements for the ATBA.

TABLE 3.10
NYISO Assessment
AND
Impact of System Upgrade Facilities

Substation Name	With Con Edison Database			With Statewide Database & Mitigation			
	Lowest Breaker Rating (kA)	Fault Type causing Maximum Fault Current	Symmetrical Fault Current (kA)	Lowest Breaker Rating (kA)	Fault Type Resulting in Maximum Fault Current	Symmetrical Fault Current (kA)	
						Before	After
345kV							
Buchanan North	40	3-Ph	30.11	40	3-Ph		
Buchanan South	40	3-Ph	41.08	40	3-Ph	41.10	40.99
Dunwoodie	63	3-Ph	62.74	63	3-Ph	62.91	62.30
East Fishkill	63	3-Ph	39.23	63	3-Ph		
Farragut	63	LLG	62.70	63	LLG	62.85	62.60
Fresh Kills	63	LLG	24.72	63	LLG		
Goethals North	40	LLG	23.92	40	LLG		
Goethals South	63	L-G	24.35	63	L-G		
Gowanus North	40	LLG	19.53	40	LLG		
Gowanus South	40	LLG	19.65	40	LLG		
Ladentown	63	3-Ph	40.84	63	3-Ph		
Millwood	63	3-Ph	48.89	63	3-Ph		
Pleasant Valley	63	3-Ph	40.06	63	3-Ph		
Poletti	63	LLG	47.16	63	LLG		
Rainey	63	LLG	61.60	63	LLG	61.75	61.56
Ramapo	40	3-Ph	43.92	63	3-Ph	43.93	43.87
Sprain Brook (1)	63	3-Ph	63.60	63	3-Ph	63.75	63.10
West 49 Street	63	LLG	57.52	63	LLG		
138kV							
Astoria-East	45	L-G	51.26	63	LG	51.36	42.96
Astoria-West	45	LLG	41.24	45	LG	41.25	32.63
Buchanan	40	3-Ph	15.67	40	3-Ph		
Corona	45	LLG	50.04	45	LLG	50.56	42.69
Dunwoodie N.	40	LLG	33.56	40	3-Ph		
Dunwoodie S.	40	LLG	31.57	40	LLG		
E. 13 Street	40	LLG	44.54	63	LG	44.57	44.52
E. 179 Street	63	LLG	47.58	63	LLG	47.60	37.71
Fox Hills	40	LLG	35.59	40	LLG		
Fresh Kills	40	LLG	37.77	40	LLG		
Greenwood	45	LLG	57.70	63	LLG	57.70	57.69
Hell Gate 6	63	LLG	42.23	63	LLG		
Hudson Ave. East	40	3-Ph	37.82	40	3-Ph		

Jamaica	40	LLG	46.47	40	LLG		
Millwood	20	3-Ph	19.23	20	3-Ph		
Queensbridge	45	LLG	40.36	45	LLG	40.37	32.84
Sherman Creek	40	LLG	42.79	63	LLG	42.81	35.18
Vernon East	40	LLG	32.33	40	LG		
Vernon West	40	LLG	30.63	40	LG		
69kV							
East River	42	L-G	51.26	50	LG		

1) Sprainbrook is overdutied after individual breaker analysis before the mitigation, is OK after mitigation.

TABLE 3.11
NYISO Assessment ATBA
System Upgrade Facilities

Substation	SUFs Required and Breaker Replacement
All	Install Series Reactor in Fdr 15055
All	Reconnect two Hell Gate Transformers
E. 13 th Street 138 kV	All 4 breakers to 63 kA
Greenwood 138 kV	4S, BT to 63 kA
East River 69 kV	12 breakers to 50 kA
Pilgrim 138 kV	Replace 1310, 1320 Breakers

3.3 Class 2001 (ATRA)

Con Ed System (ATRA)

The generic units used for ATBA were removed from the base case and the Class 2001 proposed projects were added into the system. This base case was supplied to NYISO staff by Con Edison. NYISO staff reviewed the data and the modeling in the case, and except for few minor adjustments, the case was found adequate for Short circuit study. The adjustment was done in the interconnection of Bowline unit #3, moving it from the W. Haverstraw substation to the Ladentown Substation.

Con Edison also provided to NYISO staff another base case that included the above class 2001 projects and Con Edison's Fault Current Management plan (Plan) that was developed to mitigate overdutied circuit breakers. This base case was used by NYISO staff to verify the adequacy of the plan.

The results of the two base cases (without and with plan) have been summarized under Table 3.12. The results presented below are a combination of GE, NYISO, and Con Edison results. The major change from the results provided by Con Edison is the inclusion of the Buchanan South substation in the cost allocation.

The highlighted numbers in TABLE 3.12 show that one or more circuit breakers at these substations are overdutied, and should either be replaced or mitigated through the Fault Management Plan (Plan). All 63 kA circuit breakers that are overdutied will not be replaced but instead, will rely on the Plan to reduce fault levels to within the circuit breaker ratings. Some lower rated circuit breakers such as Buchanan South (40 kA) can also benefit from the Plan in reducing the fault levels to below 40 kA, and therefore do not need to be replaced. The Plan, however, does not benefit some heavily overdutied circuit breakers that must be replaced with appropriate higher rating circuit breakers.

Table 3.13 shows all those identified circuit breakers that must be replaced, as well as the required non breaker SUF's in the Plan. This information is taken from Con Edison's ATBA/ATRA report, Table V and verified by the NYISO and its consultant as being adequate.

TABLE 3.12
Con Edison Service Area
Class Year 2001 Projects [1]
AND
Impact of Fault Current Management Facilities

Substation Name	With Class Year 2001 Projects			With Fault Current Management Facilities		
	Lowest Breaker Rating (kA)	Fault Type causing Maximum Fault Current	Symmetrical Fault Current (kA)	Lowest Breaker Rating (kA)	Fault Type Resulting in Maximum Fault Current	Symmetrical Fault Current (kA)
345kV						
Buchanan North	40	3-Ph	32.16	40	3-Ph	31.22
Buchanan South	40	3-Ph	44.67	40	3-Ph	42.17 [2]
Dunwoodie	63	3-Ph	67.50	63	3-Ph	53.11
East Fishkill	63	3-Ph	40.22	63	3-Ph	38.67
Farragut	63	LLG	67.57	63	LLG	55.73
Fresh Kills	63	LLG	24.58	63	LLG	24.31
Goethals North	40	LLG	23.81	40	LLG	23.55
Goethals South	63	L-G	24.21	63	L-G	23.98
Gowanus North	40	LLG	19.46	40	LLG	19.23
Gowanus South	40	LLG	19.58	40	LLG	19.35
Ladentown	63	3-Ph	50.14	63	3-Ph	48.94
Millwood	63	3-Ph	52.36	63	3-Ph	47.25
Pleasant Valley	63	3-Ph	41.02	63	3-Ph	39.59
Poletti	63	LLG	49.74	63	LLG	43.36
Rainey	63	LLG	66.52	63	LLG	53.97
Ramapo	40	3-Ph	54.97	63	3-Ph	53.89
Sprain Brook	63	3-Ph	68.62	63	3-Ph	54.33
West 49 Street	63	LLG	61.56	63	LLG	48.59
138kV						
Astoria-East (W)	45	L-G	78.36	63	LG	51.41
Astoria-East (E)	45			63	LG	52.75
Astoria-West	45	LLG	46.93	45	LG	29.90
Buchanan	40	3-Ph	15.81	40	3-Ph	15.68
Corona (N)	45	LLG	71.89	45	LLG	47.34 [2]
Corona (S)	45			63	LLG	48.29
Dunwoodie N.	40	LLG	34.42	40	3-Ph	32.11
Dunwoodie S.	40	LLG	32.42	40	LLG	30.44
E. 13 Street	40	LLG	48.99	63	LG	46.74
E. 179 Street	63	LLG	54.98	63	LLG	42.55
Fox Hills	40	LLG	32.83	40	LLG	32.71
Fresh Kills	40	LLG	35.90	40	LLG	35.77
Greenwood	45	LLG	49.28	63	LLG	48.98

Hell Gate 6	63	LLG	48.27	63	LLG	28.85
Hudson Ave. East	40	3-Ph	39.07	40	3-Ph	38.95
Jamaica	40	LLG	49.10	40	LLG	48.99 (2)
Millwood	20	3-Ph	19.44	20	3-Ph	19.20
Queensbridge	45	LLG	45.82	45	LLG	29.53
Sherman Creek	40	LLG	48.12	63	LLG	38.87
Vernon East	40	LLG	31.07	40	LG	29.98
Vernon West	40	LLG	32.14	40	LG	31.17
69kV						
East River	42	L-G	51.13	50	LG	50.66 (2)

(1) Athens and Bethlehem projects are included in the base system
(2) Individual breaker analysis at this station shows that the breakers are not overdutied

TABLE 3.13
Class Year 2001 Projects
Required System Upgrade Facilities

Substation	Identified Circuit Breakers and Other SUFs
Ramapo	T-1500-W72-2 and T-77-94-2 to 63 kA each
Astoria E 138 kV	1E, 7E, 2W, B1, all to 63 kA
E. 13th Street 138 kV	All 4 breakers to 63 kA
Greenwood 138 kV	4S to 63 kA
East River 69 kV	12 breakers to 50 kA
Sherman Creek 138 kV	3 circuit breakers, already been replaced by NYPA, not needed after mitigation
All	345 kV Series Reactors in Feeders M51 & M52, @ Sprainbrook
All	345 kV Series Reactors in Feeders M71 & M72, @ Dunwoodie
All	PAR to split Astoria East 138 kV
All	Series Reactor to split Corona 138 kv
All	Series Reactor in Fdr 15055 @ E179th St. 138 kV Substation
All	Reconnect two Hellgate Transformers

LIPA System (ATRA)

LIPA has reported that class 2001 projects would result in two additional circuit breakers at East Garden City substation to be replaced. These are circuit beakers #1330 and #1360. The duty on these breakers is reported to be 100.12% each.

These circuit breakers will be well under their ratings because the insertion of the 345 kV series reactor in the Sprainbrook-E. Garden City circuit would reduce the fault current at E. Garden City 138 kV substation by about 5600 amperes (~10% reduction).

As a sensitivity, NYISO staff checked the impact of the Plan on the fault currents at E. Garden City. The plan will reduce the fault currents by about 700 amperes using LIPA methodology.

NYISO Statewide Assessment (ATRA)

After review of the individual TO analysis and its own independent analysis, the NYISO concluded that the ATRA did not have to be done with the statewide database as the margins created by the identified System Upgrade Facilities is great enough to accommodate the increase in fault duties. NYISO concludes that the identification of system upgrade facilities in Table 3.13 is the least costly configuration of system upgrade facilities required to maintain system reliability as set forth in the Applicable Reliability Requirements for the ATRA.

4. IDENTIFICATION OF SYSTEM UPGRADE FACILITIES

4.1 System Upgrade Facility Cost Estimates

Cost estimates for the system upgrade facilities were provided by Con Edison in their Fault Current Management Plan Report[16]. Additional breakdown of these costs between labor and material were provided by Con Edison during this assessment. These cost estimates are not detailed engineering estimates. As per Attachment S, responsibility for cost sharing is only for the actual cost figure for the facility. The cost estimates are provided in the table below.

CLASS 2001 - FAULT MITIGATION PLAN
BREAKDOWN OF COST ESTIMATES

(The cost are year 2000 unescalated costs)

FAULT CURRENT MITIGATION PROGRAM	LABOR COST ($1,000)	MATERIAL COST ($1,000)	TOTAL COST ($1,000)
Series Reactors in Feeders M51 & M52 at Sprain Brook	$ 15,340	$ 8,660	$ 24,000
Series Reactors in Feeders 71 & 72 at Dunwoodie	$ 9,170	$ 7,840	$ 17,010
Series Reactors in Feeder 15055 at East 179th Street	$ 1,700	$ 900	$ 2,600
Series Reactors at Corona	$ 1,300	$ 900	$ 2,200
Phase Angle Regulator at Astoria East	$ 3,000	$ 6,300	$ 9,300
Reconnect Transformers 1 & 4 at Hell Gate	$ 1,470	$ 530	$ 2,000
Replace 138kV Circuit Breakers (cost/breaker)	$ 200	$ 300	$ 500
Replace 69 kV Circuit Breakers (cost/breaker)	$ 200	$ 200	$ 400
Replace 345 kV Circuit Breakers (cost/breaker)	$ 200	$ 550	$ 750

The schedule and cost escalation for the system upgrade facilities is below:

Cash Flow and Schedule
Of The Escalated Capital Cost Associated With The Plan ($Million)
(From Con Edison Fault Current Management Plan,with modifications)

Description	Year	2001	2002	2003	2004	Total Cost
Series Reactors In Feeders M51/52	2003	3.10	14.88	7.67	0.00	25.6
Series Reactors in Feeders 71/72	2003	3.10	11.69	3.29	0.00	18.1
Series Reactor in Feeder 15055	2004	0.00	0.00	1.10	1.81	2.9
Series Reactor At Corona	2004	0.00	0.00	0.60	1.92	2.5
Phase Angle Regulator at Astoria East	2004	0.00	1.06	6.36	2.83	10.2
Hell Gate - Reconnect Transformers 1 & 4	2004	0.00	0.00	0.66	1.58	2.2
Replace 4-138 kV Breakers at Astoria East	2001	2.10	0.00	0.00	0.00	2.1
Replace 1-138 kV Breaker at Greenwood	2001	0.52	0.00	0.00	0.00	0.5
Replace 16 Breakers at E 13 St & East River	2002	4.40	2.40	0.00	0.00	6.8
Replace 2- 345 kV Breakers at Ramapo	2004	0.00	0.00	0.00	1.70	1.7
	Total	13.21	30.02	19.68	9.84	72.7

4.2 ATBA Facilities

The system upgrade facilities(SUFs) associated with the ATBA are summarized in the following table.

Identification of System Upgrade Facilities (ATBA)
(Costs are Escalated Dollars)

		Total Cost M$s
138 kV Series Reactor At East 179th St. In Feeder 15055		**2.9**
Replace 2 Breakers at Greenwood (BT,4S)		**1.1**
Replace 4 Breakers at E. 13th Street		**2.0**
Replace 12 Breakers at East River		**4.8**
Reconnect Two Hell Gate 138/13 kV Transformers		**2.2**
	Con Edison Total	**13.0**
Replace 2 Breakers at Pilgrim (1310, 1320)		**1.0**
	LIPA Total	**1.0**
	O&R Total	**0.0**

4.3 ATRA Facilities

The system upgrade facilities(SUFs) associated with the ATRA are summarized in the following Table:

Identification of System Upgrade Facilities (ATRA)
(All costs are Escalated Dollars)

		Total Cost (M$s)	Attachment Cost (M$s)	Allocated Cost (M$s)	Elected Cost (M$s)
Required Fault Current Management Plan SUFs for Class 2001					
a)	345 kV Series Reactors In Feeders M51 and M52	**25.7**		**25.7**	
b)	345 kV Series Reactors In Feeders 71 and 72	**18.1**		**18.1**	
c)	138 kV Phase Angle Regulator At Astoria East Substation	**10.2**		**10.2**	
d)	138 kV Series Reactor At Corona Substation	**2.5**		**2.5**	
e)	138 kV Series Reactor At East 179th St. In Feeder 15055	**2.9**		**2.9**	
f)	Reconnect Two Hell Gate 138/13 kV Transformers	**2.2**		**2.2**	
g)	Replace 2 345 kV Circuit Breakers At Ramapo Substation	**1.7**		**1.7**	
h)	Replace 4 138 kV Circuit Breakers At Astoria East Substation	**2.1**		**2.1**	
I)	Replace 1 138 kV Circuit Breaker At Greenwood Substation(4S)	**0.5**		**0.5**	
j)	Replace 3 138 kV Circuit Breakers At Sherman Creek Substation	**1.6**	(for headroom tracking)		**1.6**
k)	Replace 4 138 kV Circuit Breakers At East 13th Street Substation	**2.0**		**2**	
l)	Replace 12 69 kV Breakers At East River Substation	**4.8**		**4.8**	
	Total	**74.3**		**72.7**	

5 PROJECT COST ALLOCATION

5.1 Methodology

The details of the methodology employed is defined in Appendix A. The details of the cost allocation process are contained in Appendix C. The system upgrade facilities identified for the ATBA are a subset of the system upgrade facilities in the ATRA, and therefore have the same schedule and escalation.

5.2 Results

NYISO staff, as per Attachment S, provides to each Class 2001 project developer, its share of the cost of the System Upgrade Facility identified and the plan and schedule for implementation of the System Upgrade Facility. A summary of the allocation is provided in the table below.

Developer Allocation Summmary

(Costs in Current Yr Dollars)

Project Developer	Cost M$s
ANP Ramapo	$6.973
East River	$13.569
Keyspan Ravenswood	$11.440
Mirant Bowline 3	$5.046
NYPA Poletti Project	$7.989
NYPA GT's	$4.959
Orion Astoria 2 Rest.	$1.699
SCS Astoria Energy	$8.025
Total Allocation	$59.700
ATBA Cost	$13.00
Total ATRA Cost	$72.700

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