

Updating and Extending the 2017 CARIS Database for Specific Project Evaluation

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Business Issues Committee

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Agenda

- Background/Schedule
- Phase 2 Input Assumption Updates
- Next Steps

2018 CARIS Phase 2 Background & Schedule

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2018 CARIS Phase 2

- **NYISO must update and extend the CARIS Phase 1 database for Phase 2 studies**
 - Economic Planning Process Manual, Section 3.1
 - CARIS Phase 1 Base Case (2017-2026)
 - CARIS Phase 2 updates and extends through 2036 for a total of 20-year study period
- **CARIS Phase 2 Base Case to be utilized in evaluation of specific Regulated Economic Transmission projects**
 - Also available for use in optional Additional CARIS Studies

2018 CARIS Phase 2 Schedule

- August 8th ESPWG
 - Base Case Assumptions and Preliminary results
- August 22th ESPWG
 - Preliminary Base Case comments follow-up
 - Final Base Case results
- September 6th ESPWG
 - Updated Base Case and comments follow-up
- **September BIC**
 - Review and comment of Final Base Case

2018 CARIS Phase 2 Base Case Input Assumption Updates

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NYCA Generation Updates

■ Added for CARIS Phase 2

- Arthur Kill Cogen, Zone J, 11.1MW (04/01/2018)

■ Modified In service date for CARIS Phase 2

- Ogdensburg, Zone E, 79.0MW (05/01/2018, was 05/01/2017)
- Arkwright Summit, Zone A, 78.4MW (10/01/2018, was 10/01/2017)
- Cricket Valley Energy Center II, Zone G, 1020.0MW (01/01/2020, was 08/01/2019)
- Taylor Biomass, Zone G, 19.0MW (04/01/2021, was 04/01/2018)

NYCA Generation Updates

■ Removed for CARIS Phase 2

Unit name	Zone	SUM. Capacity(MW)	Removal Date
Binghamton	C	43.7	1/9/2018
Indian Point 2	H	1018.5	4/30/2020
Indian Point 3	H	1037.8	4/30/2021
Selkirk 1&2	F	360.2	5/15/2018
Lyonsdale(Burrows)	E	20.1	4/1/2018
Ravenswood 09	J	16.3	11/1/2017
Ravenswood GT 2-1, 2-2, 2-3, 2-4, 3-1, 3-2&3-4	J	213.4	4/1/2018
Cayuga 2	C	150.2	7/1/2018
Eight Point Wind Energy Center	B	101.2	N/A

■ Retained for CARIS Phase 2

- Pilgrim GT1, GT2(reliability need identified, solution under solicitation)

NYCA Transmission Updates

- Zero OBF effective date change (2019)
- Erie – South Ripley series reactor (2019)
- Leeds Hurley SDU (2020)
- UPNY-ConEd limit increase to 6,250 MW (May 2021)
- Empire State Line Project/Western PP Selected project (2022)
- Representative AC PP Transmission project (2023)
 - Central East voltage limit assumes 825 MW increase

20-Year Representative System

- No need to add generic capacity to maintain NYCA Target Reserve Proxy
- Model assumptions consistent with 2018 RNA (with NYCA load forecast extended out to 2036) except for inclusion of Pilgrim GT and deactivation of Cayuga 2

2018 CARIS Phase 2 Next Steps

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Next Steps

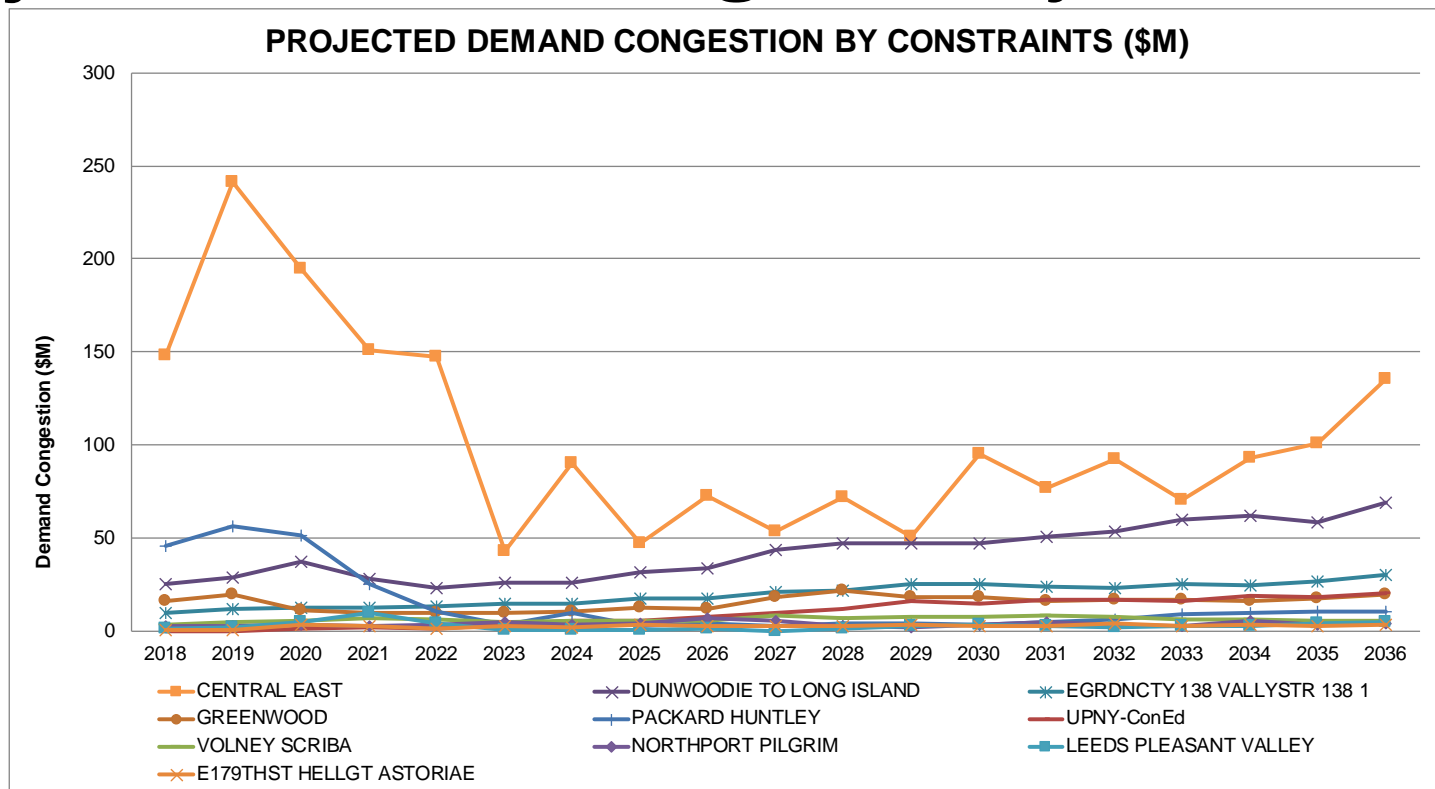
- **NYISO reviewed with ESPWG CARIS 2 model assumptions and updates from CARIS 1**
 - Minor comments received and addressed
- **CARIS procedures require BIC's review and comment on updated and extended CARIS 2 database**
 - Ensures potential project beneficiaries have timely access to Base Case assumptions and model results
 - Any subsequent updates to CARIS 2 Base Case would necessitate further discussion at ESPWG and an additional review at BIC
- **No governance action is required by BIC**

Appendix: 2018 CARIS Phase 2 Final Base Case Results

Projected Demand Congestion by Constraints

Demand Congestion (\$M)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
CENTRAL EAST	148	241	194	151	147	43	90	47	72	53	72	51	95	76	92	71	93	100	135
DUNWOODIE TO LONG ISLAND	25	29	37	28	23	26	26	32	34	44	47	47	47	51	54	60	62	58	69
EGRDNCTY138 VALLYSTR 138 1	10	12	13	12	13	15	15	17	17	21	22	26	26	24	23	25	25	27	30
GREENWOOD	16	20	11	10	10	9	10	12	12	18	22	19	18	16	17	17	16	17	20
PACKARD HUNTLEY	46	56	51	25	11	4	10	2	4	3	4	4	4	5	6	9	10	11	11
UPNY-ConEd	0	0	2	2	1	4	6	5	7	10	12	16	15	16	17	16	19	18	20
VOLNEYSCRIBA	4	5	6	7	6	5	5	5	6	8	7	8	8	8	8	6	6	5	5
NORTHPORT PILGRIM	3	3	3	3	3	4	4	4	7	6	3	2	3	5	3	3	6	4	4
LEEDS PLEASANT VALLEY	1	2	5	10	4	0	1	1	1	0	1	3	4	2	2	2	2	4	5
E179THST HELLGT ASTORIAE	0	1	3	3	2	2	2	4	3	3	3	3	2	2	4	3	3	3	3

Projected Demand Congestion by Constraints



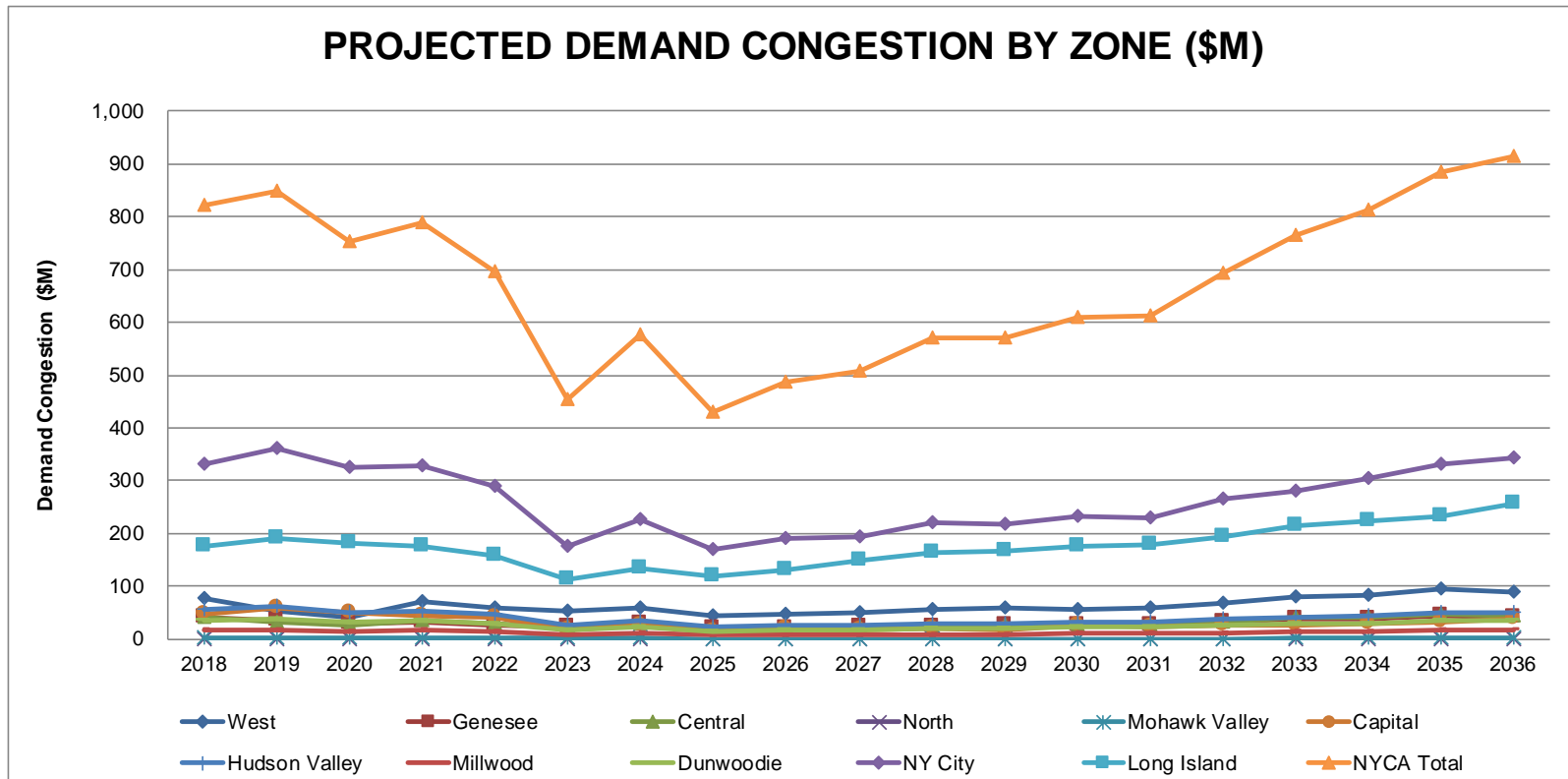
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Projected Demand Congestion by Zone

Demand Congestion (\$M)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
West	76	52	42	70	60	52	60	44	47	51	55	58	57	60	69	81	83	95	88
Genesee	40	34	29	32	28	23	28	19	21	22	24	26	25	27	31	37	38	44	41
Central	41	33	26	34	28	25	30	20	22	22	24	26	25	27	31	40	41	47	44
North	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Mohawk Valley	1	2	1	1	1	1	1	1	1	0	0	1	1	1	1	2	1	2	1
Capital	48	60	49	44	40	16	27	15	20	17	21	18	25	23	27	26	30	33	37
Hudson Valley	57	61	51	53	48	25	35	23	27	26	30	29	33	33	38	41	45	50	52
Millwood	17	18	15	16	14	8	11	7	8	8	10	9	11	11	12	13	14	16	17
Dunwoodie	36	38	32	34	30	17	23	15	18	18	20	20	23	23	26	28	30	34	35
NY City	332	360	324	329	288	176	227	168	191	194	221	217	233	230	265	281	304	331	342
Long Island	175	190	183	175	157	112	135	117	132	149	164	167	176	180	195	213	225	234	256
NYCA Total	823	848	753	788	695	455	577	429	488	508	570	571	608	613	695	764	811	885	914

Projected Demand Congestion by Zone



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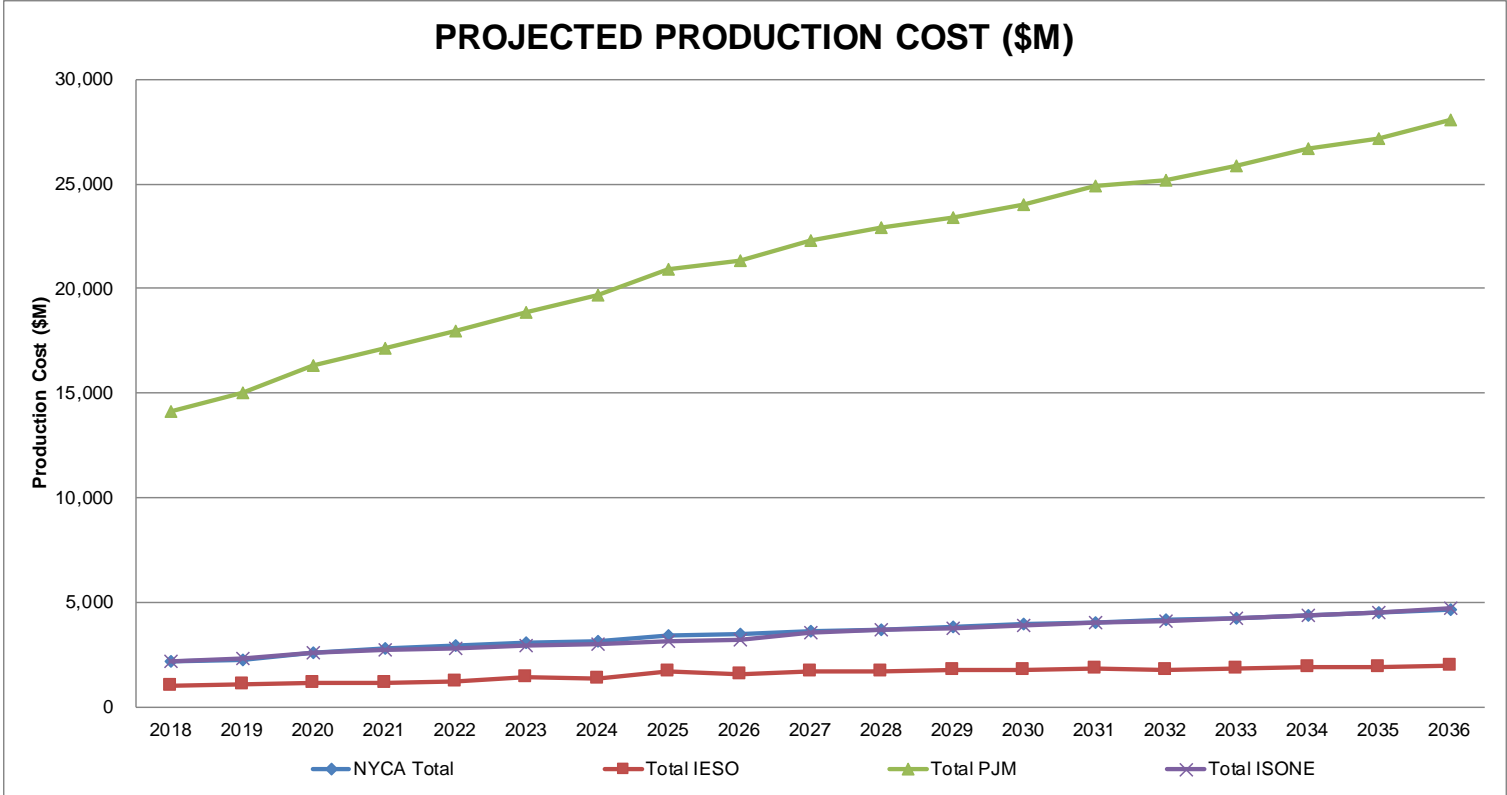
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NEW YORK
INDEPENDENT
SYSTEM OPERATOR

Projected Production Cost (\$M)

Production Cost (\$M)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
West	12	17	25	25	32	57	47	83	77	46	43	46	46	46	43	35	39	34	36
Genesee	38	36	38	42	40	43	46	45	46	51	47	48	53	50	52	57	54	55	61
Central	260	281	321	354	379	442	440	490	490	518	509	536	537	563	564	584	586	600	624
North	4	5	7	8	9	16	12	19	17	12	14	13	13	14	14	12	13	11	11
Mohawk Valley	3	3	3	4	4	7	6	8	7	7	6	7	7	7	7	6	8	6	6
Capital	392	396	445	521	572	592	604	648	653	670	690	715	734	750	769	759	787	802	839
Hudson Valley	215	217	398	489	506	501	505	546	556	555	574	582	600	609	621	631	660	668	678
Millwood	128	132	91	23	6	7	7	7	7	7	7	7	7	7	8	8	8	8	8
Dunwoodie	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NY City	840	860	952	1,053	1,083	1,113	1,152	1,220	1,244	1,382	1,414	1,481	1,518	1,574	1,635	1,675	1,754	1,815	1,881
Long Island	282	279	301	312	319	328	342	357	366	390	402	419	435	445	458	472	490	505	530
NYCA Total	2,174	2,227	2,582	2,832	2,952	3,105	3,161	3,423	3,464	3,637	3,707	3,854	3,950	4,065	4,170	4,240	4,399	4,504	4,674
NYCA Imports	595	671	819	902	979	1,042	1,138	1,155	1,247	1,522	1,638	1,675	1,746	1,787	1,896	1,934	2,044	2,084	2,246
NYCA Exports	244	240	282	228	201	211	225	237	219	264	249	280	276	289	300	321	318	350	376
NYCA + Imports - Exports	2,525	2,658	3,119	3,507	3,730	3,937	4,073	4,341	4,493	4,895	5,095	5,249	5,420	5,564	5,767	5,852	6,125	6,238	6,544
Total IESO	1,019	1,063	1,140	1,177	1,231	1,442	1,350	1,674	1,583	1,704	1,707	1,745	1,798	1,856	1,794	1,825	1,876	1,920	1,973
Total PJM	14,156	15,031	16,306	17,176	17,963	18,832	19,657	20,943	21,311	22,309	22,908	23,421	24,003	24,906	25,157	25,859	26,692	27,163	28,087
Total ISONE	2,158	2,324	2,585	2,744	2,816	2,915	3,020	3,151	3,220	3,556	3,660	3,773	3,913	4,013	4,119	4,253	4,397	4,502	4,733
Total System	19,507	20,645	22,612	23,928	24,962	26,295	27,188	29,192	29,578	31,205	31,982	32,794	33,665	34,840	35,239	36,177	37,364	38,090	39,466

Projected Production Cost (\$M)



Projected NYCA Generation (GWh)

Generation (GWh)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
West	14,579	14,922	15,434	15,418	15,649	16,254	15,925	16,746	16,553	15,749	15,697	15,763	15,739	15,713	15,666	15,498	15,551	15,486	15,524
Genesee	5,260	4,888	4,965	5,390	4,996	5,046	5,462	5,068	5,079	5,483	5,074	5,058	5,484	5,080	5,103	5,507	5,099	5,087	5,527
Central	28,170	29,556	29,553	31,181	30,789	33,278	31,714	33,695	32,337	32,830	31,338	32,525	31,229	32,449	31,198	32,194	30,886	31,841	30,903
North	8,750	8,772	8,820	8,832	8,848	9,009	8,934	9,057	9,013	8,840	8,865	8,866	8,859	8,853	8,857	8,804	8,815	8,816	8,796
Mohawk Valley	2,923	3,080	3,123	3,151	3,180	3,240	3,261	3,293	3,287	3,274	3,275	3,308	3,312	3,305	3,312	3,305	3,323	3,323	3,325
Capital	16,190	15,499	15,487	17,134	17,928	17,897	17,520	17,825	17,413	15,878	15,778	15,732	15,756	15,632	15,399	14,841	14,823	14,731	14,660
Hudson Valley	7,464	7,095	12,194	13,997	14,116	13,560	13,286	13,508	13,450	11,897	11,935	11,777	11,870	11,622	11,495	11,282	11,270	11,245	10,958
Millwood	17,123	17,121	11,370	2,558	435	438	443	443	445	446	449	450	451	454	455	456	458	459	462
Dunwoodie	47	58	68	74	81	85	89	93	96	99	102	105	108	111	113	114	116	118	121
NY City	26,542	25,403	24,794	26,214	26,128	25,485	25,140	25,315	25,084	25,079	24,887	25,055	24,993	25,236	25,320	25,287	25,655	25,840	25,530
Long Island	9,031	8,556	8,277	8,348	8,286	8,120	8,002	8,077	8,040	7,623	7,626	7,560	7,651	7,617	7,641	7,706	7,729	7,656	7,731
NYCA Total	136,078	134,950	134,086	132,298	130,438	132,412	129,777	133,121	130,798	127,198	125,027	126,198	125,452	126,070	124,560	124,993	123,724	124,602	123,537
Total IESO	154,672	155,902	154,141	149,276	148,845	138,777	146,630	134,438	139,341	136,960	140,412	138,153	139,832	138,339	141,337	141,868	142,917	142,738	142,856
Total PJM	799,689	803,686	805,438	808,923	813,702	825,013	826,426	835,405	837,901	845,335	844,030	845,938	845,126	846,230	845,374	844,852	844,711	845,190	845,979
Total ISONE	108,522	106,824	104,038	104,843	104,457	103,589	102,506	102,502	101,938	100,935	101,242	100,874	101,047	101,062	100,842	100,742	101,146	100,666	100,648
Total HQ *	22,390	22,397	22,481	22,430	22,423	22,421	22,460	22,411	22,432	22,430	22,487	22,390	22,397	22,411	22,494	22,423	22,421	22,390	22,473
Total System	1,221,351	1,223,760	1,220,185	1,217,770	1,219,864	1,222,213	1,227,799	1,227,877	1,232,409	1,232,857	1,233,199	1,233,554	1,233,855	1,234,112	1,234,606	1,234,877	1,234,919	1,235,586	1,235,493

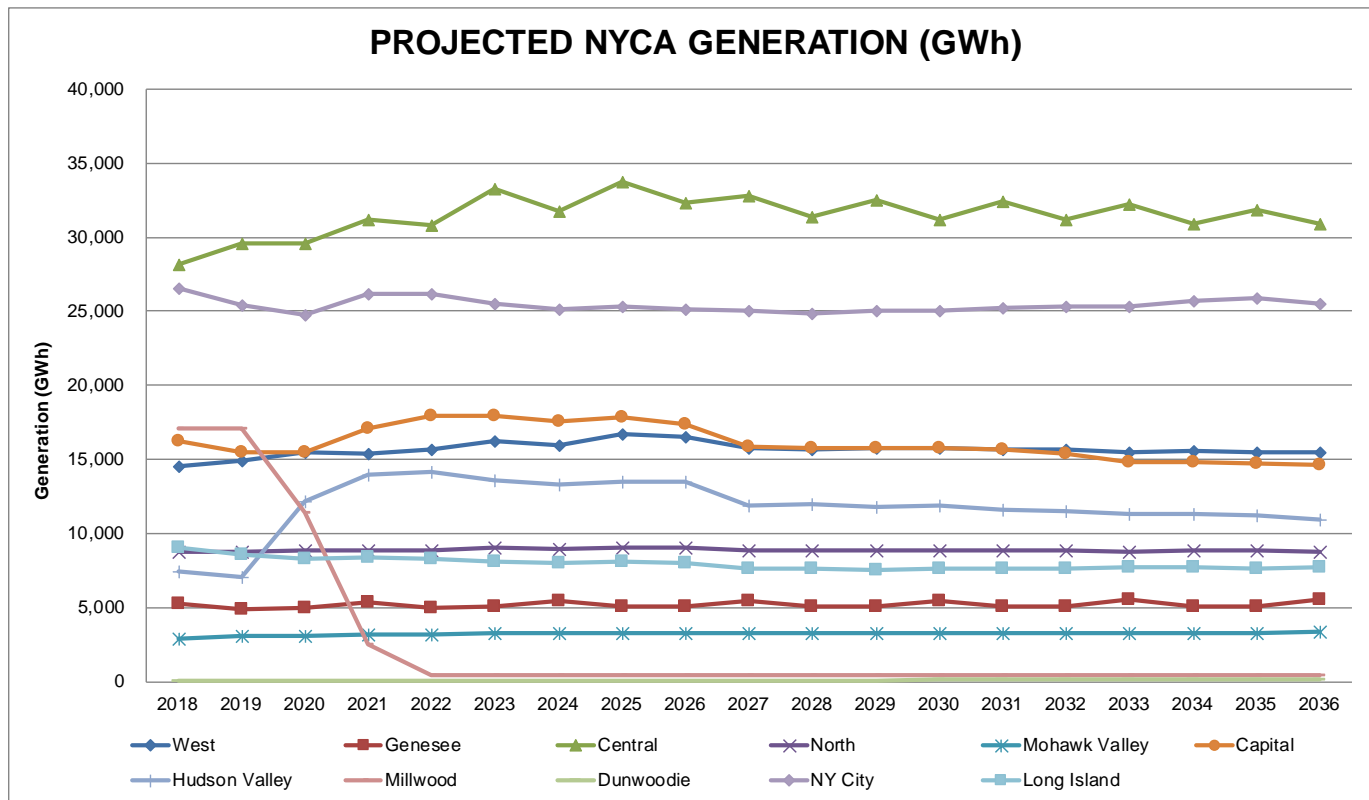
*Only interchange flow is modeled



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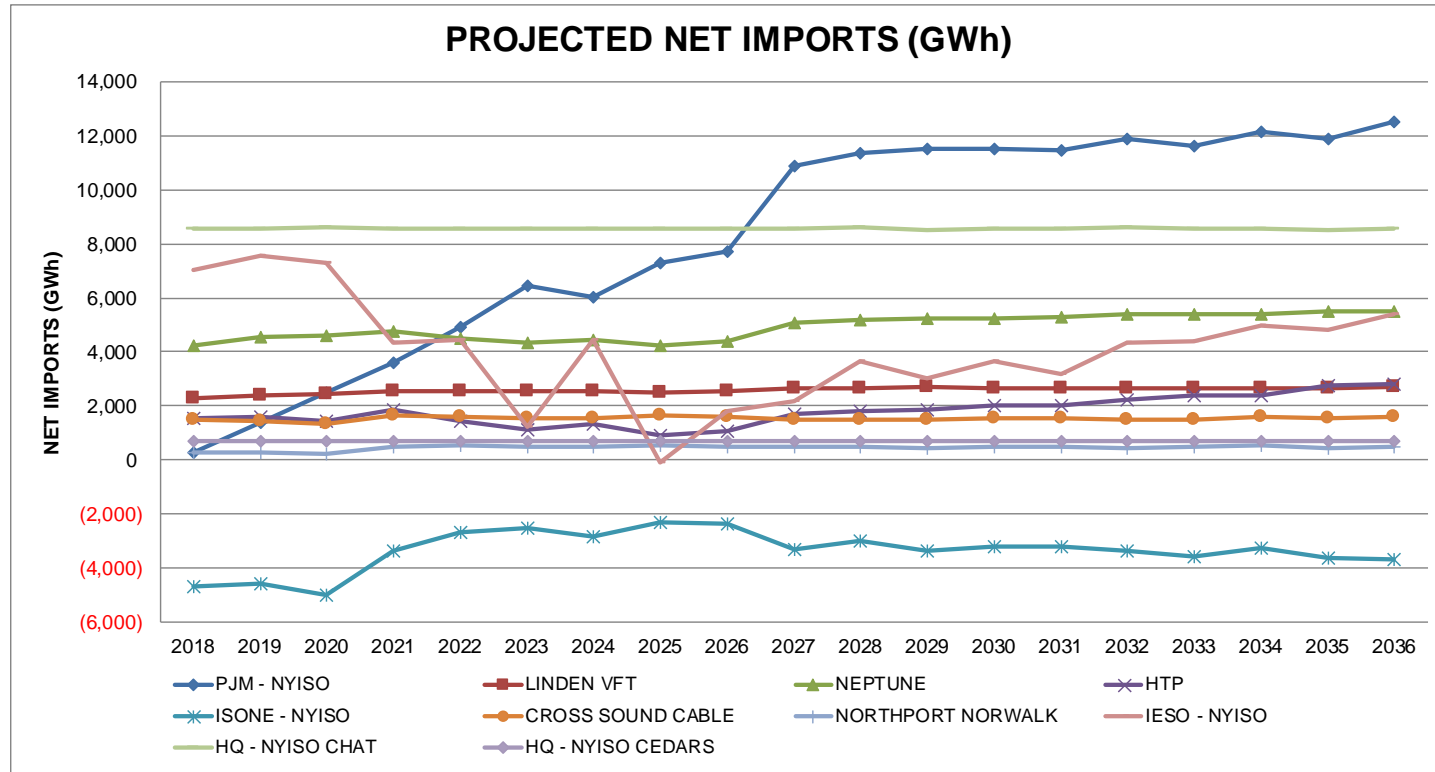
Projected NYCA Generation (GWh)



Projected NYCA Net Imports(GWh)

NET IMPORTS (GWh)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
PJM - NYISO	287	1,362	2,500	3,623	4,920	6,469	6,050	7,295	7,717	10,867	11,366	11,518	11,517	11,482	11,867	11,611	12,161	11,868	12,528
LINDEN VFT	2,258	2,399	2,463	2,555	2,542	2,530	2,566	2,510	2,560	2,649	2,665	2,681	2,674	2,652	2,654	2,654	2,655	2,669	2,680
NEPTUNE	4,219	4,545	4,592	4,764	4,498	4,343	4,453	4,218	4,377	5,069	5,181	5,231	5,256	5,297	5,381	5,404	5,416	5,508	5,524
HTP	1,516	1,587	1,413	1,840	1,426	1,136	1,308	929	1,068	1,717	1,794	1,855	1,999	2,028	2,238	2,387	2,372	2,731	2,827
ISONE - NYISO	(4,662)	(4,589)	(5,023)	(3,351)	(2,665)	(2,546)	(2,828)	(2,292)	(2,387)	(3,288)	(2,982)	(3,347)	(3,209)	(3,231)	(3,363)	(3,558)	(3,272)	(3,619)	(3,681)
CROSS SOUND CABLE	1,473	1,445	1,314	1,622	1,620	1,553	1,561	1,629	1,588	1,500	1,494	1,494	1,527	1,533	1,507	1,512	1,578	1,531	1,578
NORTHPORT NORWALK	285	271	238	506	541	500	471	542	506	470	494	460	463	500	454	481	529	447	476
IESO - NYISO	7,015	7,583	7,282	4,342	4,467	1,225	4,432	(108)	1,792	2,178	3,665	3,020	3,645	3,162	4,350	4,416	4,983	4,803	5,396
HQ - NYISO CHAT	8,536	8,546	8,592	8,583	8,585	8,575	8,552	8,548	8,569	8,572	8,598	8,524	8,534	8,548	8,594	8,572	8,575	8,524	8,567
HQ - NYISO CEDARS	719	717	717	715	713	713	720	716	715	715	714	719	717	716	716	713	713	719	718
TOTAL	21,646	23,866	24,087	25,199	26,647	24,497	27,285	23,987	26,506	30,449	32,989	32,155	33,124	32,686	34,398	34,191	35,710	35,183	36,615

Projected NYCA Net Imports (GWh)



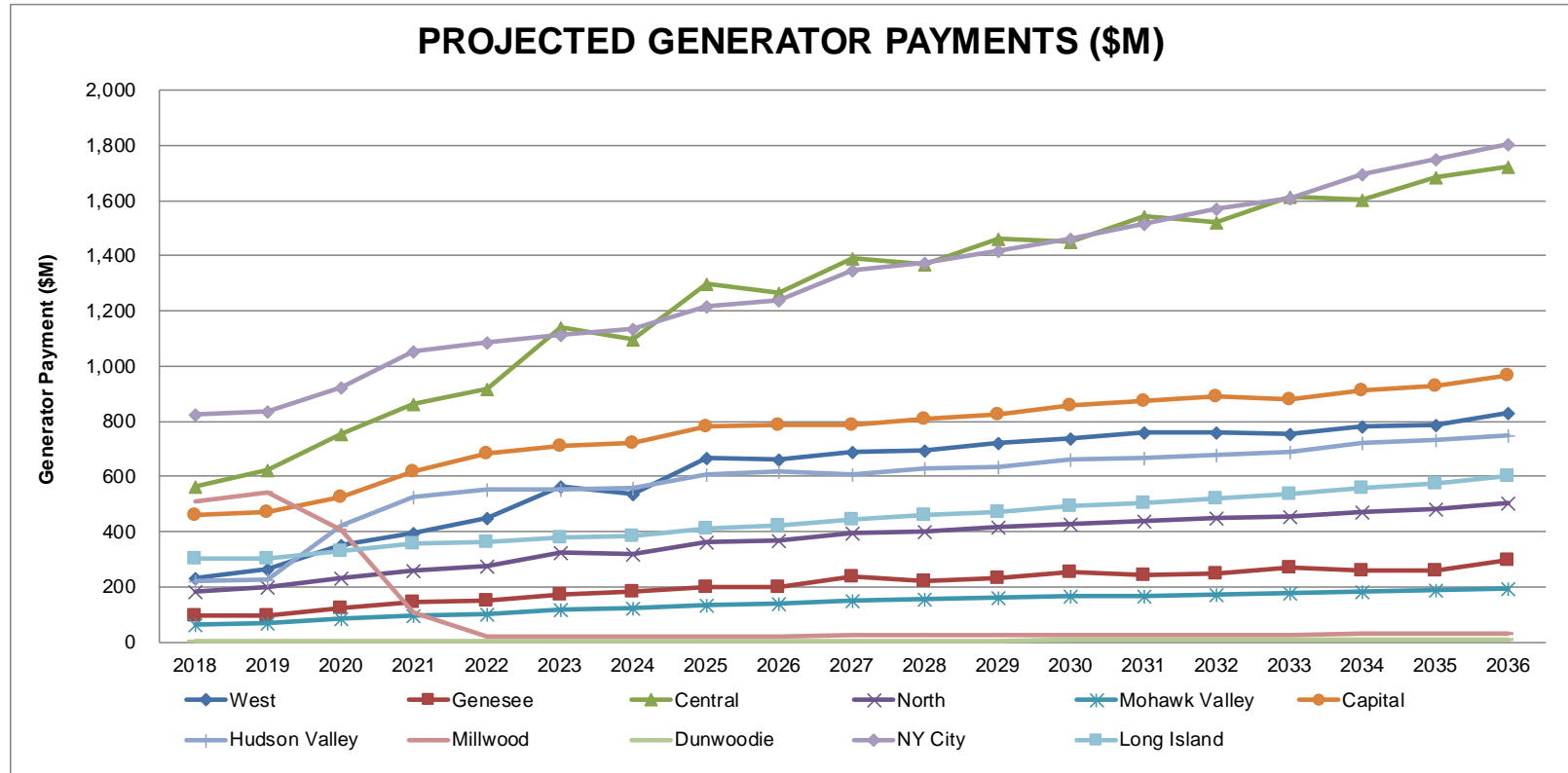
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Projected Generator Payments(\$M)

Generator Payment (\$M)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
West	230	265	354	395	452	563	535	670	660	691	697	720	741	760	762	754	782	785	831
Genesee	95	98	121	145	148	175	185	199	200	235	223	230	255	244	247	270	260	262	299
Central	566	626	753	864	919	1,143	1,095	1,298	1,267	1,393	1,368	1,461	1,451	1,546	1,523	1,612	1,605	1,686	1,723
North	185	197	235	259	277	323	322	364	366	394	403	417	428	441	448	455	471	481	502
Mohawk Valley	64	70	85	94	102	120	121	136	138	151	154	160	165	169	172	176	183	187	195
Capital	459	471	525	620	684	713	720	784	788	787	809	827	856	873	890	877	913	930	967
Hudson Valley	223	225	424	528	554	555	560	608	620	609	629	637	661	668	679	692	720	735	748
Millwood	512	542	404	106	17	18	19	20	21	23	24	25	25	26	27	28	29	30	32
Dunwoodie	2	2	3	3	3	4	4	5	5	5	6	6	6	7	7	7	8	8	9
NY City	823	836	921	1,056	1,088	1,114	1,136	1,216	1,241	1,345	1,377	1,421	1,464	1,515	1,573	1,607	1,694	1,752	1,806
Long Island	302	304	331	356	365	377	385	413	422	443	462	472	491	503	518	536	558	573	604
NYCA Total	3,461	3,636	4,156	4,426	4,610	5,106	5,082	5,713	5,727	6,076	6,152	6,376	6,545	6,751	6,847	7,014	7,224	7,428	7,715

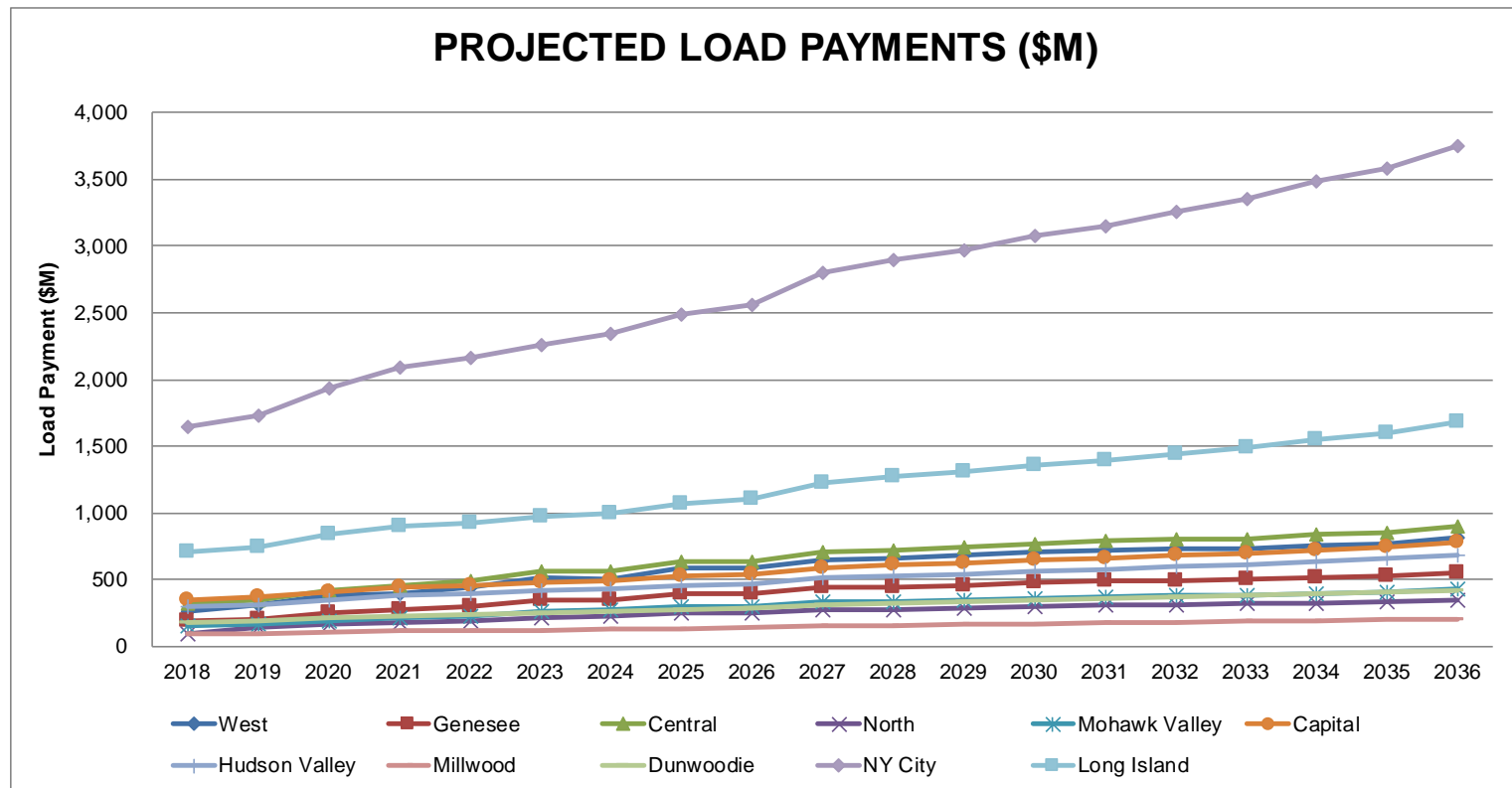
Projected Generator Payments(\$M)



Projected Load Payments(\$M)

Load Payment (\$M)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
West	267	309	383	399	438	515	504	590	591	649	660	681	702	723	729	733	759	768	812
Genesee	183	201	248	271	296	346	340	393	396	436	445	459	474	488	495	499	519	527	555
Central	318	343	418	451	489	560	559	631	640	703	719	741	765	785	800	808	838	852	897
North	94	136	163	179	191	219	219	245	247	272	278	287	295	304	310	316	326	334	349
Mohawk Valley	156	165	195	211	225	265	268	296	301	330	338	349	359	370	378	385	398	407	427
Capital	341	368	411	438	457	475	491	525	539	587	605	622	645	661	680	694	721	741	777
Hudson Valley	294	311	347	378	393	412	427	454	468	509	526	541	561	576	596	612	636	656	686
Millwood	87	92	102	111	116	121	126	134	138	151	156	161	167	172	178	183	190	196	205
Dunwoodie	180	189	211	230	239	250	259	276	285	311	322	332	344	354	366	377	392	404	423
NY City	1,642	1,732	1,935	2,093	2,158	2,264	2,343	2,492	2,564	2,797	2,893	2,974	3,073	3,155	3,263	3,352	3,483	3,588	3,752
Long Island	704	747	838	895	920	967	1,001	1,072	1,109	1,225	1,271	1,310	1,355	1,396	1,443	1,493	1,551	1,593	1,680
NYCA Total	4,266	4,592	5,251	5,658	5,922	6,395	6,537	7,107	7,277	7,970	8,214	8,457	8,740	8,984	9,236	9,452	9,814	10,066	10,564

Projected Load Payments(\$M)



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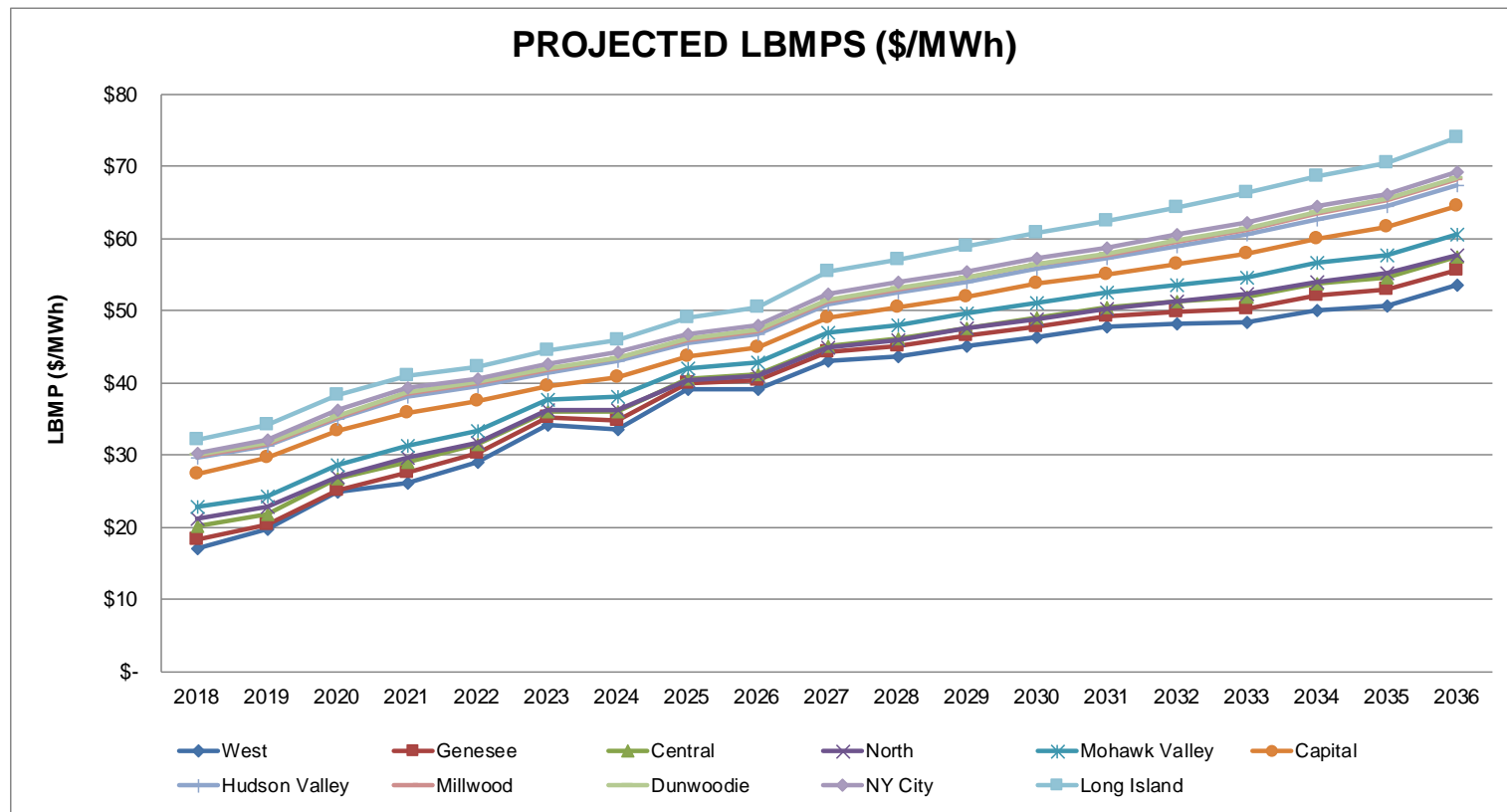
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NEW YORK
DEPENDENT
SYSTEM OPERATOR

Projected LBMP (\$/MWh)

LBMP (\$/MWh)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
West	16.94	19.82	24.81	26.19	28.90	34.19	33.51	39.12	39.18	43.02	43.59	45.15	46.42	47.87	48.11	48.48	50.14	50.65	53.47
Genesee	18.34	20.27	25.09	27.57	30.19	35.29	34.78	40.02	40.29	44.21	45.03	46.57	47.87	49.32	49.86	50.32	52.15	52.86	55.59
Central	20.03	21.84	26.66	28.95	31.42	36.06	36.05	40.61	41.16	45.17	46.13	47.64	49.09	50.42	51.23	51.86	53.72	54.52	57.39
North	21.25	22.74	27.01	29.70	31.68	36.17	36.33	40.45	40.91	44.96	45.91	47.51	48.81	50.25	51.19	52.30	54.02	55.20	57.76
Mohawk Valley	22.77	24.23	28.69	31.34	33.44	37.76	38.14	42.11	42.82	46.94	48.05	49.62	51.09	52.50	53.60	54.66	56.55	57.72	60.49
Capital	27.41	29.71	33.42	35.83	37.54	39.54	40.87	43.71	44.84	48.96	50.39	51.82	53.77	55.01	56.53	57.81	59.97	61.53	64.57
Hudson Valley	29.65	31.30	34.92	38.07	39.57	41.48	42.95	45.51	46.76	50.90	52.43	53.95	55.80	57.18	58.91	60.57	62.73	64.57	67.43
Millwood	29.88	31.55	35.24	38.46	39.95	41.83	43.35	45.89	47.18	51.37	52.93	54.49	56.36	57.76	59.51	61.19	63.38	65.23	68.12
Dunwoodie	30.04	31.70	35.42	38.65	40.11	41.99	43.54	46.04	47.35	51.53	53.10	54.67	56.53	57.93	59.70	61.40	63.59	65.46	68.34
NY City	30.32	32.15	36.20	39.29	40.61	42.67	44.19	46.84	48.09	52.30	53.95	55.50	57.28	58.66	60.55	62.20	64.42	66.24	69.18
Long Island	32.07	34.10	38.37	41.08	42.31	44.47	46.02	49.00	50.44	55.40	57.15	58.88	60.78	62.37	64.26	66.41	68.70	70.43	74.05

Projected LBMP (\$/MWh)



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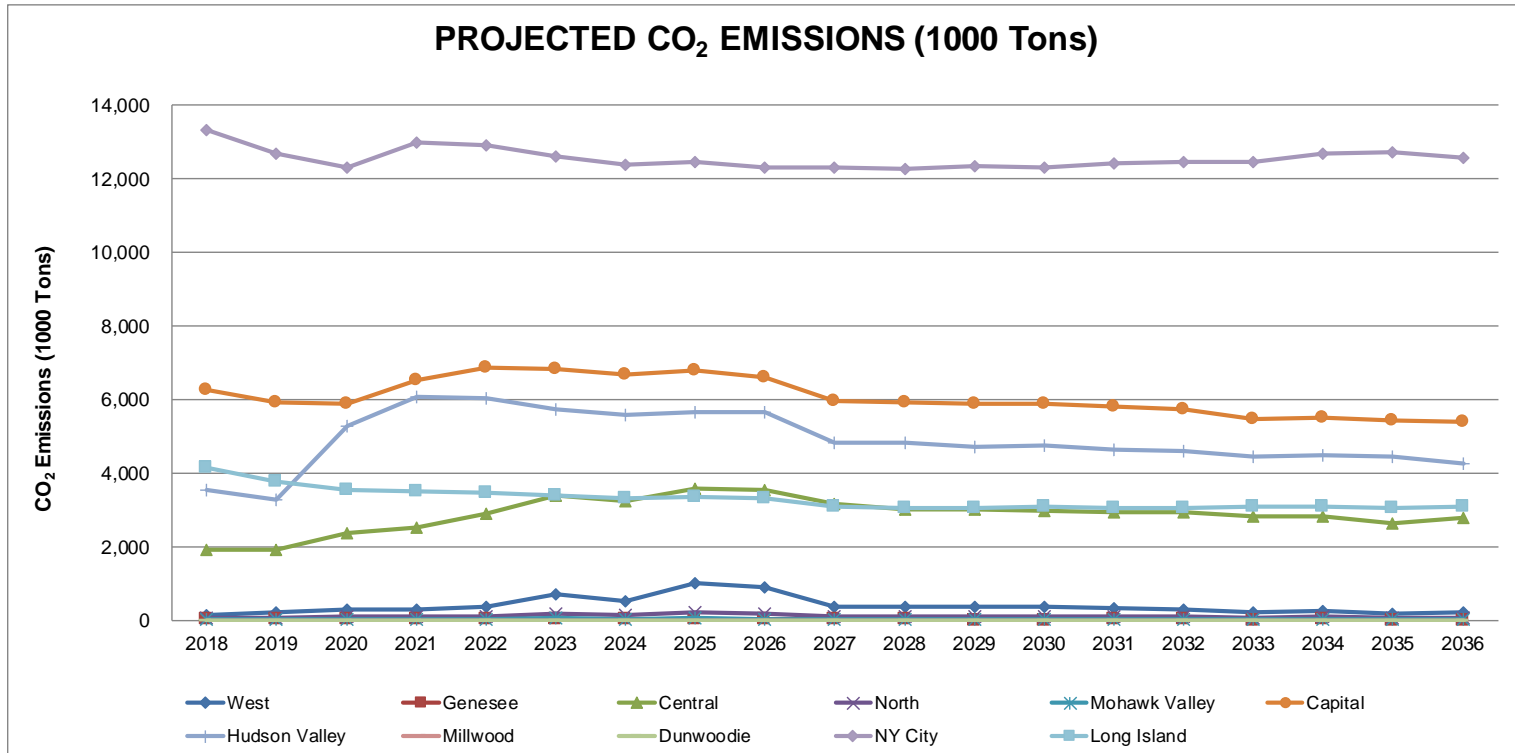
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NEW YORK
INDEPENDENT
SYSTEM OPERATOR

Projected CO₂ Emissions (1000 Tons)

CO ₂ Emissions (1000 Tons)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
West	158	219	302	292	379	731	540	1,029	921	392	357	368	360	342	308	225	250	203	207
Genesee	17	16	23	20	20	34	21	34	35	23	18	13	12	17	17	15	17	9	9
Central	1,908	1,916	2,382	2,531	2,899	3,413	3,257	3,576	3,554	3,155	3,029	3,003	2,995	2,952	2,934	2,827	2,819	2,657	2,775
North	69	83	103	113	121	201	146	213	192	108	121	107	108	106	107	88	93	78	72
Mohawk Valley	30	33	31	34	36	56	47	61	53	43	38	44	41	35	34	33	38	27	25
Capital	6,257	5,931	5,882	6,543	6,874	6,838	6,678	6,802	6,614	5,947	5,915	5,875	5,890	5,824	5,738	5,489	5,498	5,441	5,415
Hudson Valley	3,538	3,284	5,295	6,075	6,034	5,733	5,582	5,680	5,645	4,824	4,836	4,710	4,756	4,629	4,587	4,468	4,481	4,439	4,284
Millwood	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dunwoodie	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NY City	13,332	12,693	12,313	12,996	12,908	12,607	12,402	12,472	12,323	12,329	12,255	12,336	12,306	12,412	12,456	12,471	12,696	12,733	12,588
Long Island	4,139	3,769	3,539	3,527	3,475	3,382	3,315	3,342	3,315	3,086	3,074	3,045	3,086	3,069	3,071	3,091	3,107	3,068	3,093
NYCA Total	29,448	27,946	29,869	32,131	32,744	32,994	31,987	33,208	32,653	29,907	29,643	29,500	29,554	29,385	29,252	28,705	28,999	28,655	28,468

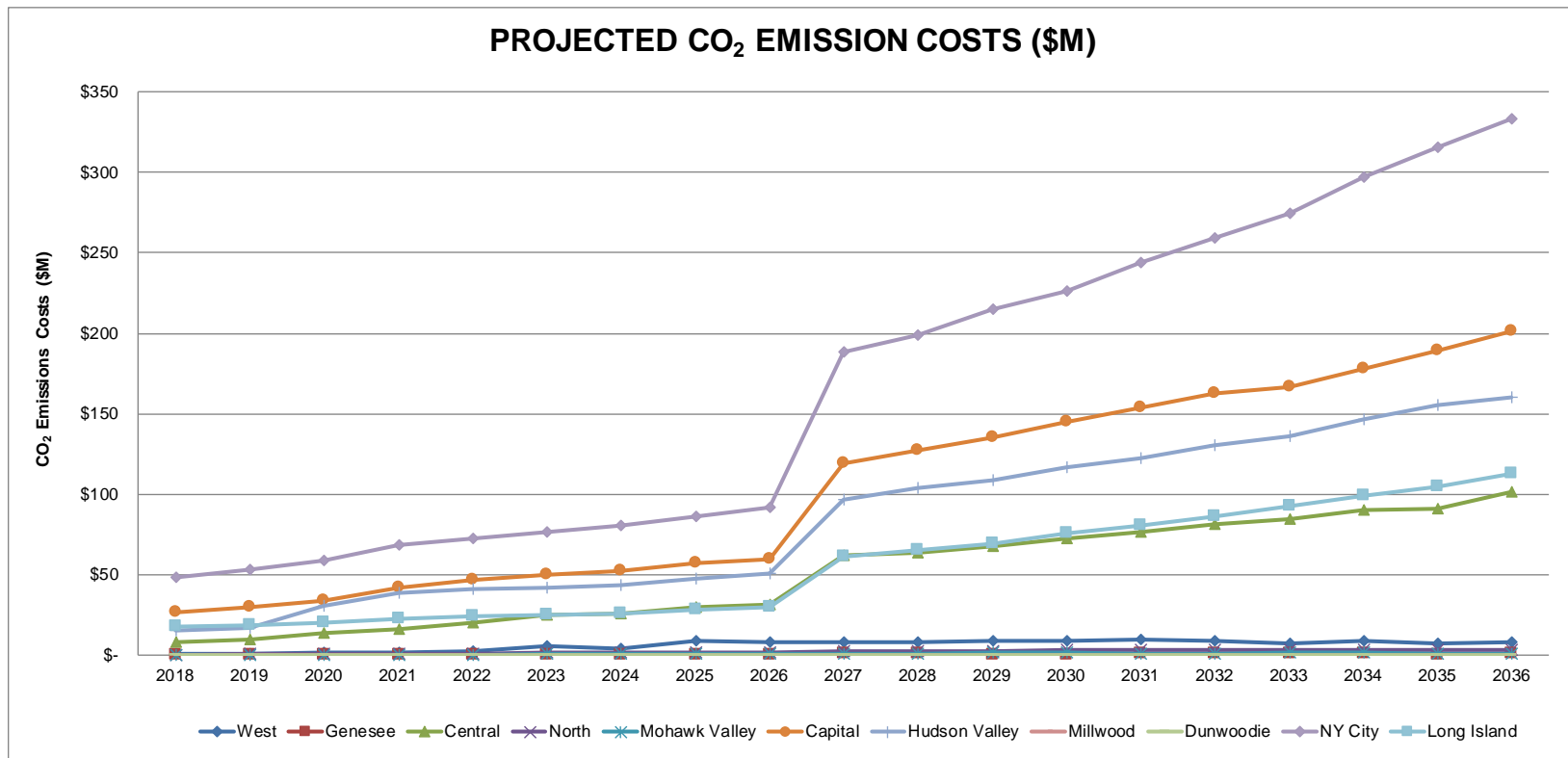
Projected CO₂ Emissions (1000 Tons)



Projected CO₂ Emission Costs (\$M)

CO ₂ Emissions Costs (\$M)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
West	1	1	2	2	3	5	4	9	8	8	8	9	9	9	9	7	9	7	8
Genesee	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	1	0	0
Central	8	10	14	16	20	25	25	30	32	62	64	68	72	77	81	84	90	91	102
North	0	0	1	1	1	2	1	2	2	2	3	3	3	3	3	3	3	3	3
Mohawk Valley	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	1	2	1	1
Capital	27	30	34	42	47	50	52	57	60	119	127	135	145	154	162	166	178	189	202
Hudson Valley	15	17	30	39	41	42	44	48	51	97	104	108	117	123	130	136	146	155	161
Millwood	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dunwoodie	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NY City	48	53	59	68	73	76	81	86	91	188	199	215	226	244	259	274	297	316	333
Long Island	18	19	20	23	24	25	26	28	30	61	65	70	75	80	86	92	99	105	113
NYCA Total	118	130	160	191	209	226	235	260	274	540	572	609	649	691	733	765	825	867	922

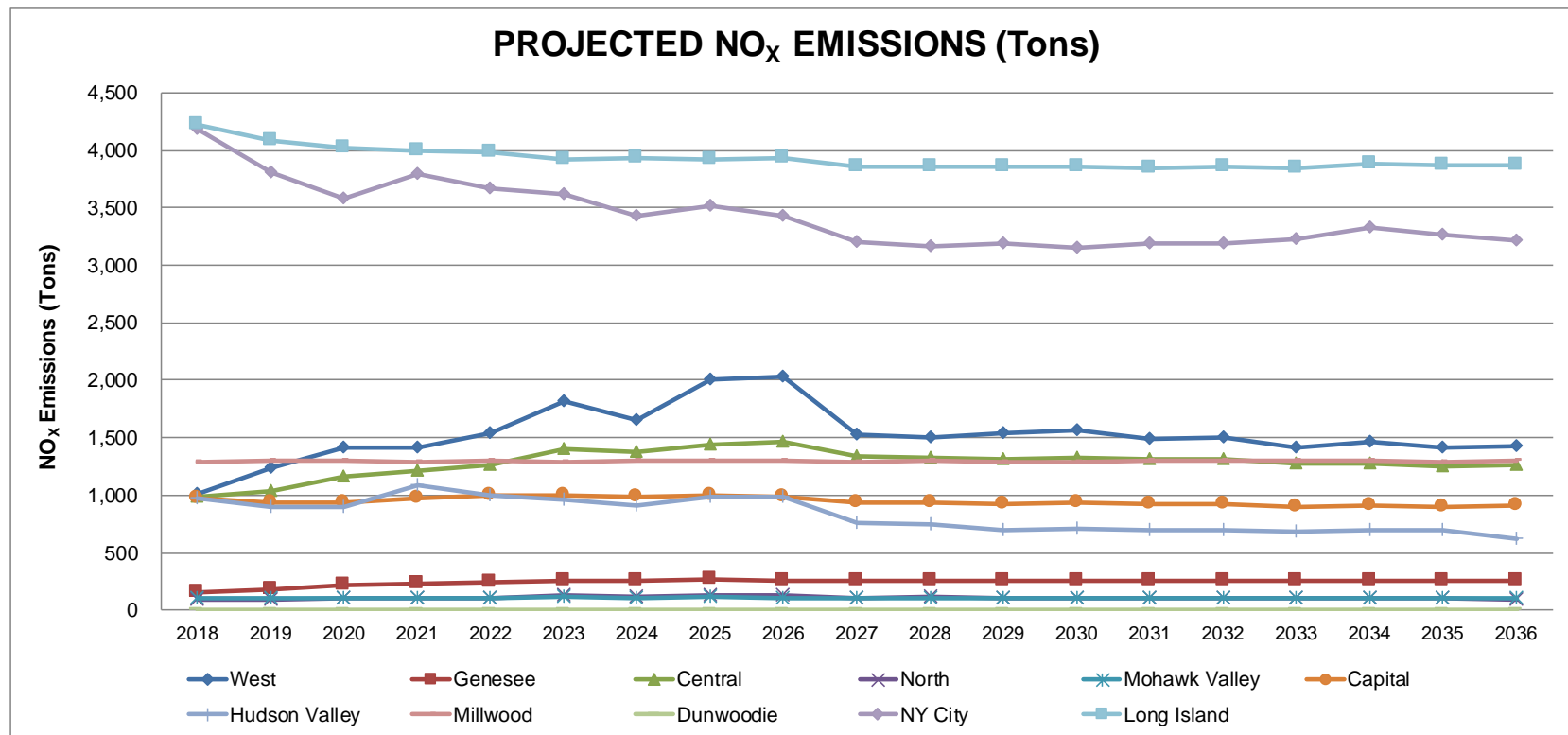
Projected CO₂ Emission Costs (\$M)



Projected NO_x Emissions (Tons)

NO _x Emissions (Tons)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
West	1,006	1,236	1,419	1,415	1,537	1,821	1,648	2,004	2,025	1,532	1,508	1,545	1,559	1,487	1,508	1,412	1,462	1,415	1,427
Genesee	149	181	220	227	240	260	250	263	261	259	258	256	255	256	257	255	257	254	255
Central	986	1,042	1,163	1,212	1,267	1,400	1,377	1,437	1,464	1,339	1,322	1,315	1,332	1,309	1,310	1,280	1,280	1,254	1,266
North	95	97	105	107	110	131	117	134	129	107	111	107	108	106	107	102	105	98	98
Mohawk Valley	105	102	102	103	104	111	108	114	110	106	106	106	106	104	103	103	105	101	101
Capital	978	933	932	976	997	997	986	994	984	932	933	927	930	926	923	902	907	903	904
Hudson Valley	974	899	904	1,085	998	963	911	982	988	763	751	691	714	692	693	680	693	691	624
Millwood	1,294	1,298	1,299	1,293	1,297	1,294	1,302	1,297	1,297	1,294	1,298	1,294	1,293	1,297	1,299	1,296	1,296	1,294	1,300
Dunwoodie	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NY City	4,185	3,806	3,573	3,799	3,672	3,622	3,431	3,520	3,430	3,205	3,169	3,185	3,145	3,184	3,184	3,232	3,326	3,262	3,209
Long Island	4,227	4,080	4,018	3,993	3,977	3,925	3,932	3,920	3,928	3,854	3,855	3,858	3,855	3,840	3,859	3,841	3,876	3,863	3,869
NYCA Total	13,999	13,674	13,736	14,210	14,200	14,525	14,062	14,666	14,616	13,390	13,310	13,283	13,295	13,200	13,243	13,102	13,306	13,134	13,054

Projected NO_x Emissions (Tons)



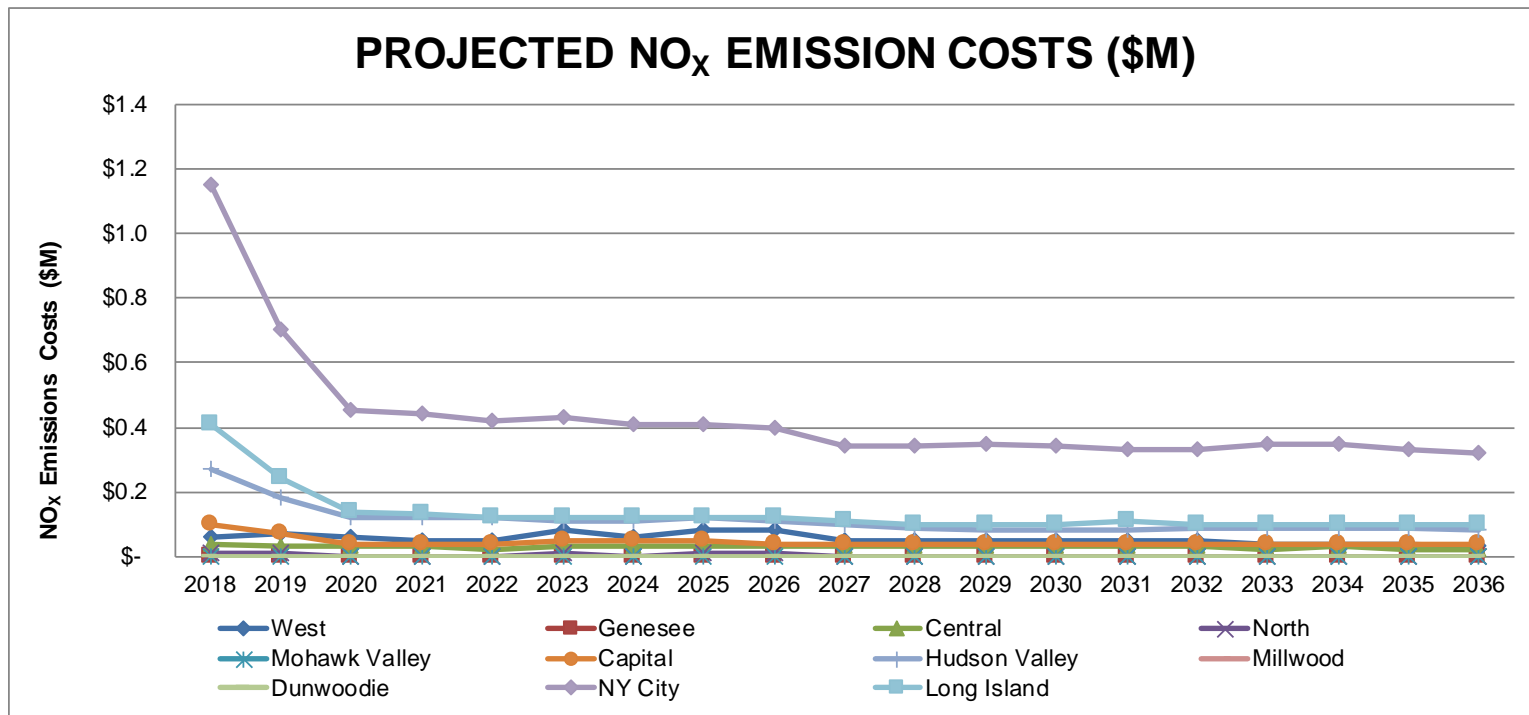
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Projected NO_x Emission Costs (\$M)

NO _x Emissions Costs (\$M)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
West	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0
Genesee	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Central	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
North	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mohawk Valley	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Capital	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hudson Valley	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Millwood	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dunwoodie	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NY City	1.1	0.7	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Long Island	0.4	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
NYCA Total	2.0	1.3	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6

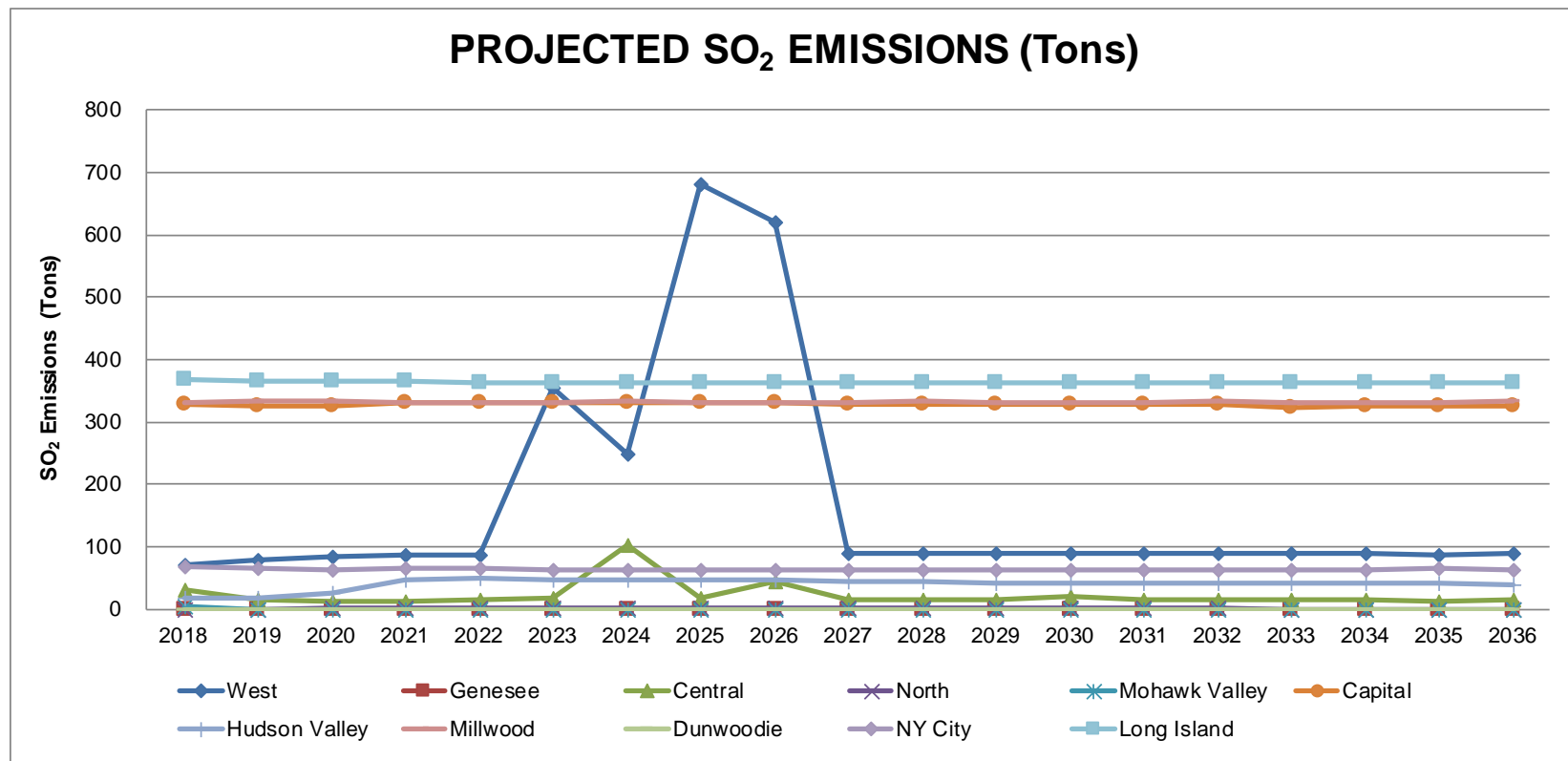
Projected NO_x Emission Costs (\$M)



Projected SO₂ Emissions (Tons)

SO ₂ Emissions (Tons)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
West	71	80	84	87	87	354	248	682	621	89	89	89	89	89	89	88	88	88	88
Genesee	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Central	31	15	12	13	14	17	103	18	46	16	15	15	20	15	15	14	14	13	14
North	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0
Mohawk Valley	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capital	328	326	327	330	331	331	332	332	331	328	329	327	328	328	327	324	325	324	325
Hudson Valley	18	17	27	46	50	48	47	48	48	44	44	42	43	42	42	41	41	41	40
Millwood	331	332	332	331	332	331	333	332	332	331	332	331	331	332	333	332	332	331	333
Dunwoodie	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NY City	69	67	62	66	66	64	63	63	63	63	62	62	62	63	63	63	64	64	64
Long Island	367	365	365	365	364	363	364	363	363	362	363	361	362	362	363	362	362	362	363
NYCA Total	1,221	1,202	1,210	1,237	1,245	1,510	1,490	1,840	1,805	1,233	1,236	1,230	1,235	1,231	1,231	1,224	1,227	1,224	1,227

Projected SO₂ Emissions (Tons)



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The Mission of the New York Independent System Operator, in collaboration with its stakeholders, is to serve the public interest and provide benefits to consumers by:

- Maintaining and enhancing regional reliability
- Operating open, fair and competitive wholesale electricity markets
- Planning the power system for the future
- Providing factual information to policy makers, stakeholders and investors in the power system



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