New York ISO
Independent System Operator

Appendix []: Renewable Generation Pockets

2023-2042 System & Resource Outlook

A Report from the New York Independent System Operator

DRAFT for May 14, 2024, ESPWG

Appendix []: Renewable Generation Pockets

This appendix discusses the congested hours for transmission constraints and deliverability of energy from renewable resources within the renewable generation pockets identified in the Contract and Policy Cases for simulation years 2030 and 2035. Previous pocket analysis performed for the 2021-2040 System and Resource Outlook (prior Outlook) focused on the 2030 year for the Contract Case and the years 2030 and 2035 for the Policy Case scenarios. The renewable generation pockets analysis aims to examine the effects of increased renewable penetration connecting to the transmission network on specific areas within the system. This analysis shows likely locations of new renewable resource additions, likely congestion on the transmission network, and possible curtailment of resources due to congestion, competition, and other factors. This appendix also highlights how increasing transmission capability by upgrading transmission paths may help to alleviate congestion and provide increased energy deliverability of resources from constrained pockets.

Renewable Generation Pocket Overview

Consistent with the renewable generation pockets identified in the 70 x 30 Scenario 2019 from the CARIS Phase 1 and further evaluated in the 2021-2040 System & Resource Outlook, the renewable generation pockets are defined below. Each pocket (W, X, Y and Z), along with corresponding sub-pockets (W1, X2, Y1, etc.), depicts a geographic grouping of renewable generation and the transmission constraints in a local area.

- **Western NY (Pocket W)**: Western NY constraints, mainly 115 kV in Buffalo and Rochester areas:
  1) **W1**: Orleans-Rochester Wind (115 kV)
  2) **W2**: Buffalo Erie region Wind & Solar (115 kV)
  3) **W3**: Chautauqua Wind & Solar (115 kV)
- **North Country (Pocket X)**: Northern NY constraints, including the 230 kV and 115 kV facilities in the North Country:
  1) **X1:** North Area Wind (mainly 230 kV in Clinton County)
  2) **X2**: Tug Hill Plateau Wind & Solar (mainly 115 kV in Lewis County)
  3) **X3**: Watertown Wind & Solar (115 kV in Jefferson & Oswego Counties)
- **Capital Region (Pocket Y)**: Eastern NY constraints, mainly the 115 kV facilities in the Capital Region:

1) **Y1**: Capital Region Solar Generation (115 kV in Montgomery County)
2) **Y2**: Hudson Valley Corridor (115 kV)

- **Southern Tier (Pocket Z)**: Southern Tier constraints, mainly the 115 kV constraints in the Finger Lakes area:
  1) **Z1**: Finger Lakes Region Wind & Solar (115 kV)
  2) **Z2**: Southern Tier Transmission Corridor (115 kV)
  3) **Z3**: Central and Mohawk Area Wind and Solar (115 kV)

The renewable generation pocket analysis performed using the aforementioned pocket definitions is based on the grouping of congested lines and generators that are likely to be curtailed within a localized area. The pocket definitions and locations are consistent between the Contract and Policy Cases. With the addition of new resources in the Policy Case (as informed by capacity expansion simulations for the Lower Demand Policy Case, Higher Demand Policy Case, and the State Scenarios), significantly more renewable energy resources are added to the system in the Policy Case scenarios as compared to the Base and Contract Cases.

[placeholder for renewable generation pocket map]

Contract Case (2030)

The Contract Case for the 2023-2042 System and Resource Outlook (Outlook) considers additional resources, incremental to the Base Case resources from NYSERDA's Large Scale Renewables database that were awarded certificates from the Tier 1 and OREC solicitations. The Contract Case also includes additional transmission capability, such as the Clean Path NY HVDC line and approved Phase 1 and 2 transmission upgrades from various Transmission Owners. These transmission upgrades significantly increase the transmission capability of lines that the NYISO identified as congested in the prior pocket analysis studies. While curtailment of resources is not completely eliminated, the upgraded paths do provide additional transmission capability for resources to be connected to the bulk transmission system. Congestion on the bulk system and competition between similar resources may cause resources to be curtailed.

Since the Contract Case in the Outlook considers more renewable resource additions compared to the prior Outlook, increased competition between resources located in the same area could also contribute to some resources being curtailed. Apart from transmission constraints, generator specific constraints such as Must Run, Minimum Down Time, Minimum Run Time, Local Reliability

Rules, etc., which introduce inflexibility in operation of existing fossil resources to accommodate intermittent resources like wind and solar, can also cause curtailment.

The pocket analysis sections below show the renewable generation pockets for this Outlook's Contract Case and compares the pocket metrics (congested hours and energy deliverability) with the prior Outlook to highlight differences in assumptions and its effect on the pocket metrics.

Western New York (Pocket W)

The Western New York pocket contains large existing hydro units, as well as a mix of new utility-scale solar (UPV) and Land Based Wind (LBW) units. UPV units, mostly derived from the Contract Case, are located primarily in sub-pocket W1. With upgrades in transmission paths throughout the region, this pocket shows less congestion than observed in previous studies.

As part of National Grid's Phase 1 and 2 transmission upgrades, several transmission paths in the Western New York pocket are upgraded in the Contract and Policy Cases. These lines appear as "Green" highlighted paths in the pocket diagrams in the following sections.

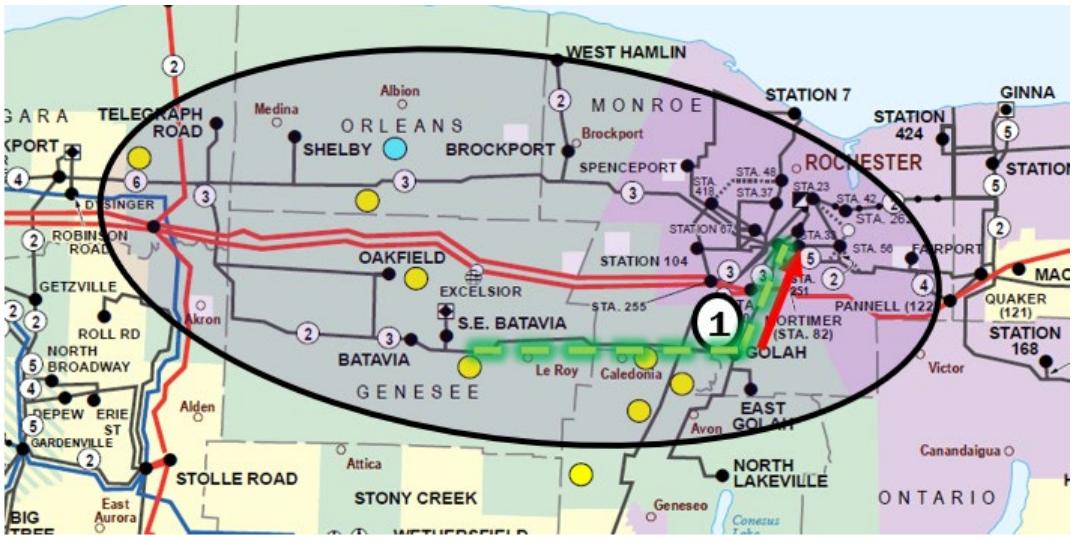
Pocket W1

W1 – 2030 Pocket Analysis

Pocket W1 is located in the Niagara-Orleans-Rochester area. The UPV units in this sub-pocket experience 4% more curtailment compared to the Contract Case in the prior Outlook. The LBW unit in the pocket experiences no curtailment. Addition of UPV resources in the sub-pocket and congestion outside the boundaries of the pocket or in the bulk system can cause decreased deliverability of the resource.

There are no congested elements in this pocket meeting a threshold of greater than 100 congested hours. In the Contract Case for the prior Outlook, "Golah 115-Mortimer 115," which is a 115 kV line feeding power into the Rochester area, was congested for 845 hours. With transmission upgrades, the element now experiences 0 hours of congestion in the Contract Case. These transmission upgrades are indicated by dashed green lines in Figure XX.

Figure XX: Pocket W1 Congestion and Energy Deliverability Summary (2030)



ID	Constraint	Number of Limiting Hours	
		2023 Outlook Contract Case	2021 Outlook Contract Case
1	GOLAH115-MORTIMER 115	0	845

Type	Capacity (MW)		Energy Deliverability (%)	
	2023 Outlook Contract Case	2021 Outlook Contract Case	2023 Outlook Contract Case	2021 Outlook Contract Case
Wind	147	200	100%	100%
Solar	2,030	1,130	96%	99%

Pocket W2

W2 – 2030 Pocket Analysis

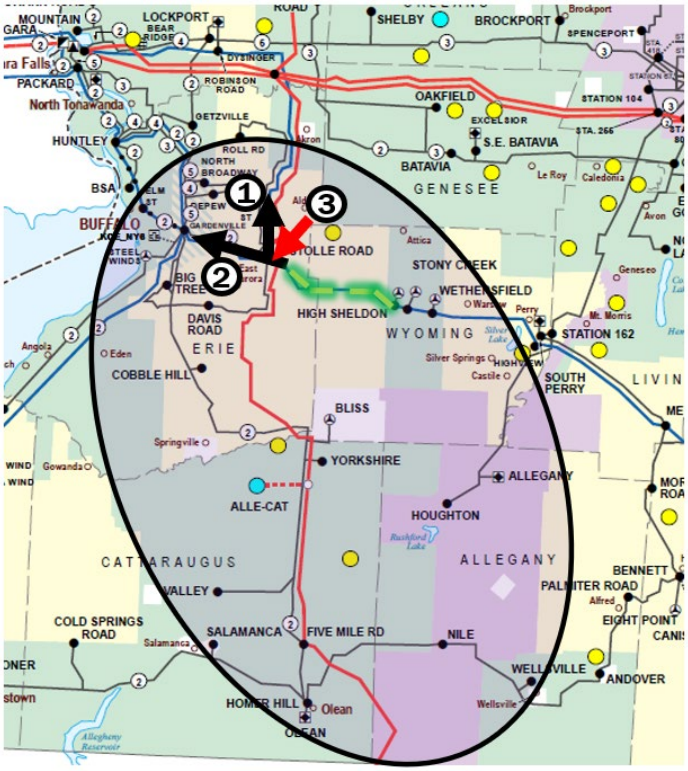
Pocket W2 is located in the Buffalo-Erie area. The binding constraints in this sub-pocket are on the 115 kV level in the Buffalo area. This pocket is west of pockets W1 and Z1 and north of pocket W3. Resources in adjacent pockets feed power to load center in this pocket leading to increased congestion on the lower kV system in this pocket.

Lines constrained in the prior Outlook Contract Case experience 0 hours of congestion in the current study with the transmission upgrades at the Stolle 345 kV substation. A newly limited line appears downstream of the upgraded path on Erie 115–Pavement Rd 115 kV, which is congested for 1,455 hours, while the Stolle 115-Girdle Rd 115 kV saw significantly reduced number of

congested hours when compared to the prior Outlook.

Awarded LBW generators are curtailed slightly more than previous studies due to higher energy output from the units.[1]

Figure XX: Pocket W2 Congestion and Energy Deliverability Summary (2030)



ID	Constraint	Number of Limiting Hours	
		2023 Outlook Contract Case	2021 Outlook Contract Case
1	ERIE 115 115.00-PAVMT115 115.00	1,455	-
2	STOLLE115 115-GIRD115 155	132	3,816
3	STOLE115 115-STOLE345 345	-	2,040

[1] Renewable energy resources in the 2023-2042 Outlook utilized DNV shapes that have higher capacity factor compared to NREL or unit specific shapes used in the 2021-2040 Outlook.

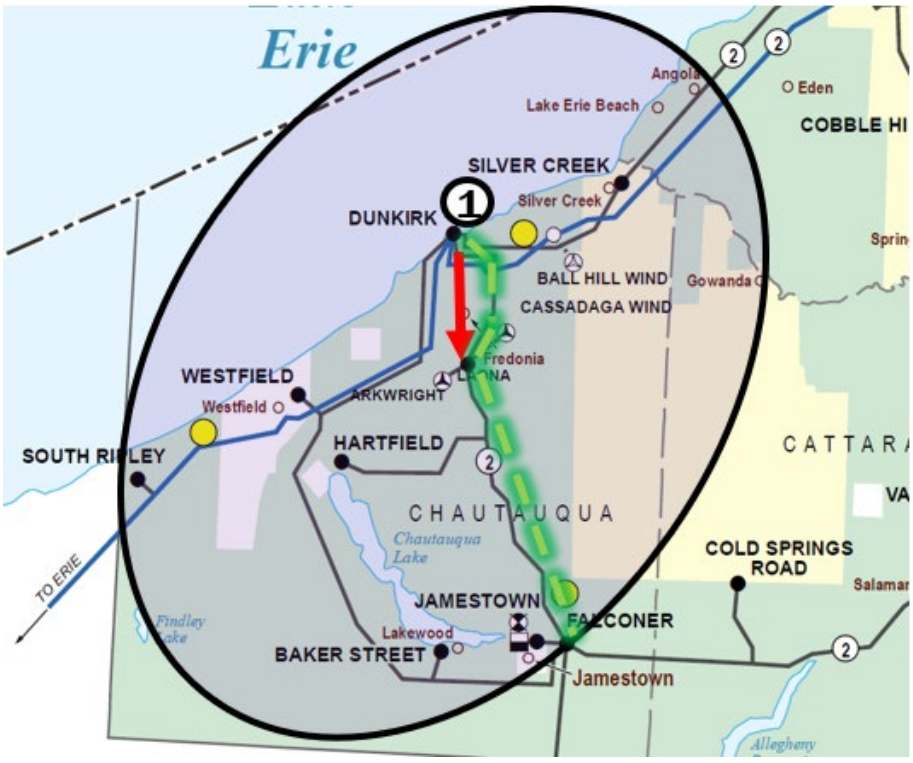
Type	Capacity (MW)		Energy Deliverability (%)	
	2023 Outlook Contract Case	2021 Outlook Contract Case	2023 Outlook Contract Case	2021 Outlook Contract Case
Wind	813	813	97%	100%
Solar	60	60	99%	100%

Pocket W3

W3 – 2030 Pocket Analysis

Pocket W3 is located in Chautauqua County along the 230 kV line from Silver Creek-Dunkirk-Ripley. This pocket contains UPV resources connected to the Dunkirk-South Ripley 230 kV path, Dunkirk – Silver Creek 115 kV line, and facilities around the Falconer 115 kV substation. This pocket experiences no curtailment of resources, and the congested element present in the prior study is no longer limiting.

Figure XX: Pocket W3 Congestion and Energy Deliverability Summary (2030)



ID	Constraint	Number of Limiting Hours	
		2023 Outlook Contract Case	2021 Outlook Contract Case
1	EDNK-161 115-ARKWRIGHT 115	0	297

Type	Capacity (MW)		Energy Deliverability (%)	
	2023 Outlook Contract Case	2021 Outlook Contract Case	2023 Outlook Contract Case	2021 Outlook Contract Case
Wind	305	305	100%	100%
Solar	480	290	100%	100%

Pocket X – Northern New York

The Northern New York pockets are located in Zone D (North) and Zone E (Mohawk Valley) consists of existing large-scale LBW, Hydro, and UPV units with the addition of mostly UPV units and few LBW units in the Contract Case. As part of the Northern New York Transmission Project (Smart Path Connect), transmission upgrades have been built throughout all three sub-pockets to greatly reduce congestion on previously constraining paths.

Northern New York Pocket X1 contains points of interconnection for two lines from Hydro Quebec (*i.e.*, HQ Chateauguay and HQ Cedars). The flows on these lines are modeled as fixed net imports from Quebec to New York. The flows are based on levels as observed for a historical year. The imports do not have any negative bids modeled. Compared to other resources that receive Renewable Energy Certificates (REC), the imports from HQ will be higher in curtailment order in the production cost simulations.

Pocket X1

X1 – 2030 Pocket Analysis

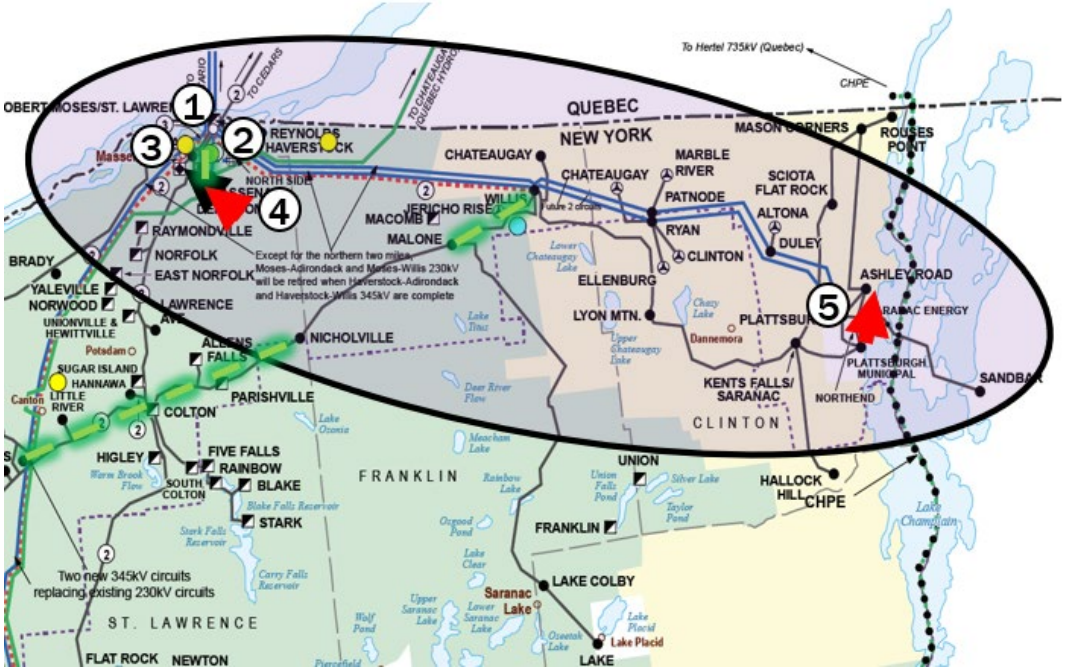
Pocket X1 is located in Zone D along the 230 kV path from Moses to Plattsburgh. This region consists of existing LBW units along the path and additional UPV units in the Contract Case. In the prior Outlook, this sub-pocket had four constraining elements. The North Tie IESO:NY (comprised of L33 and L34 PARs) connects New York to Ontario and is the largest constraining element being congested for 75% of the year—approximately 1,000 hours less than it was in the prior Outlook. The PARs that makeup the North Tie OH:NE are set to zero scheduled flow in the day-ahead market and allowed to move in real-time operations to direct flows between New York and Ontario. Three

of the constraining elements that the prior Outlook identified have reduced limiting hours below the threshold and, therefore, are no longer identified as constrained. With significant capacity buildout of UPV, energy deliverability in the pocket has decreased.

This pocket also contains the St. Lawrence hydro unit, which is modeled as a fixed hourly resource in the production cost model for this Outlook. In the prior Outlook, this unit utilized the pondage model in MAPS, which allows the software to optimize the unit's output. Based on stakeholder feedback, this unit has limited pondage capability and would spill water if there is congestion in the system that requires curtailment of the unit. This unit's limitation is, therefore, captured by modeling it as a fixed resource that utilizes an annual hourly shape based on historical averages. This approach takes away some of the flexibility in the unit's operation offered by the pondage model leading to slightly higher curtailment levels.

Pocket X1 also contains upgrades to the transmission system compared to the Contract Case in the prior Outlook. These include NYPA's Smart Path project on the bulk level (*i.e.*, 230 kV and above) and National Grid's Phase 1 and 2 upgrades on the 115 kV transmission system. With these upgrades, much of the congested elements identified for this pocket in the Contract Case for the prior Outlook are resolved.

Figure XX: Pocket X1 Congestion and Energy Deliverability Summary (2030)



ID	Constraint	Number of Limiting Hours	
		2023 Outlook Contract Case	2021 Outlook Contract Case
1	North Tie: IESO-NY	6,561	7,678
2	MOSES W 230.00-MNH3230 230.00	883	-
3	ALCOA-NM 115.00-ALCOA N 115.00	45	926
4	ALCOA-NM 115-DENNISON 115	22	782
5	NOEND115 115-PLAT 115 115	-	128

Type	Capacity (MW)		Energy Deliverability (%)	
	2023 Outlook Contract Case	2021 Outlook Contract Case	2023 Outlook Contract Case	2021 Outlook Contract Case
Hydro	1,149	1,049	98%	100%
HQ Imports	1,930	1,930	97%	100%
Wind	977	876	93%	100%
Solar	690	180	89%	100%

Pocket X2

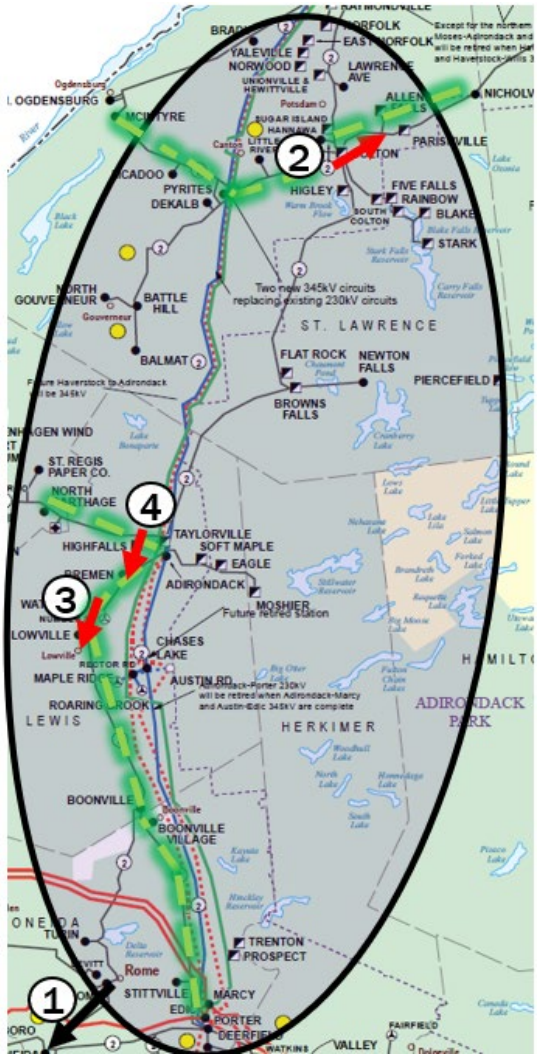
X2 – 2030 Pocket Analysis

Pocket X2 is located in Zones D and E along the Moses-Adirondack-Porter path that connects upstream of the Central East interface. This pocket contains primarily UPV resources. The only limiting element is the Turning Stone-Sterling 115 kV line flowing southwest outside of the pocket at 200 limiting hours. In the prior Outlook, this pocket had three constraining lines that now have zero limiting hours as they are located on the paths updated as part of National Grid's Phase 1 and 2 transmission upgrades. Energy deliverability has decreased slightly with the addition of UPV units located along paths adjacent to the transmission upgrades. Moreover, since this sub-pocket is upstream of Central East, congestion on that interface holds back some generation in this pocket that would have otherwise served load further downstate.

The addition of two Boonville PARs as part of the Phase 1 and 2 upgrades diverts power away from the Boonville – Turin – Rome circuits and towards the upgraded path along Boonville – Porter. This further increases congestion on Central East as the upgraded path is directly upstream of the

Central East interface.

Figure XX: Pocket X2 Congestion and Energy Deliverability Summary (2030)



ID	Constraint	Number of Limiting Hours	
		2023 Outlook Contract Case	2021 Outlook Contract Case
1	TRNG STN 115.00-STERLING 115.00	200	-
2	NICHOLVL 115-PARISHVL 115	-	515
3	LOWVILLE 115-Q531_POI 115	-	434
4	BREMEN 115-Q531_POI 115	-	182

Type	Capacity (MW)		Energy Deliverability (%)	
	2023 Outlook Contract Case	2021 Outlook Contract Case	2023 Outlook Contract Case	2021 Outlook Contract Case
Hydro	252	250	97%	100%
Wind	505	505	96%	100%
Solar	80	35	92%	96%

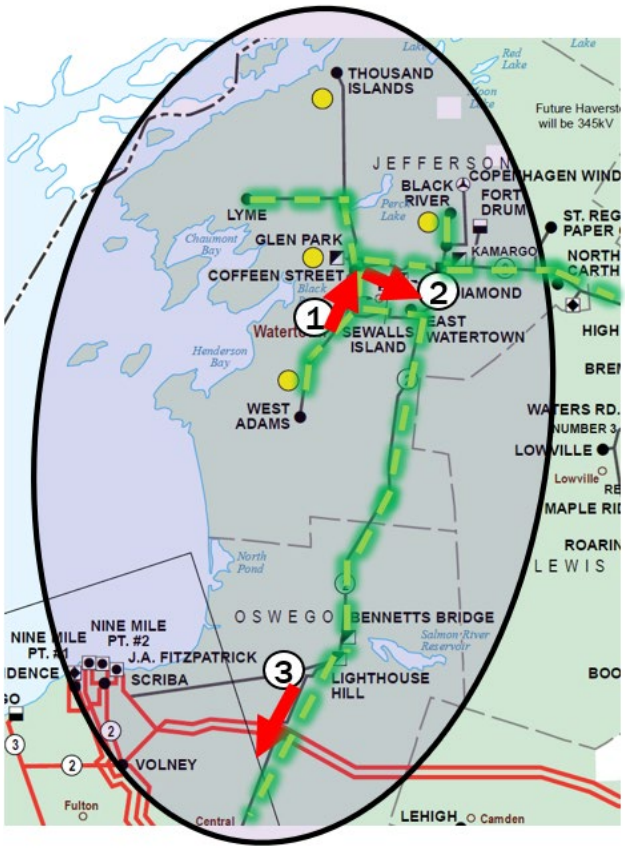
Pocket X3

X3 – 2030 Analysis

Pocket X3 encompasses the Jefferson and Oswego counties in Zone C (Central) and Zone E (Mohawk Valley). The pocket consists of a 115 kV system around Watertown with a 115 kV path from Watertown to the Lighthouse Hill 115 kV substation. Previously, this sub-pocket had three constraining lines—two along the Coffeen 115 kV path ranging from 700-1,000+ limiting hours and one path flowing out of the pocket from Lighthouse Hill to Mallory. Transmission upgrades have been proposed on almost all lower kV lines in this sub-pocket resulting in zero congested elements in the Contract Case. The energy deliverability improved greatly compared to the prior Outlook with solar deliverability reaching 99% (as compared to 90%) even with an increase in the assumed solar capacity. Hydro and LBW deliverability slightly decreased but continued to have high energy deliverability of 98%.

Pocket X3 was identified as a high-risk pocket in the prior Outlook due to the high likelihood of renewables being built in the area and insufficient transmission capacity on the existing 115 kV transmission system. With significant upgrades proposed, pocket X3 has high energy deliverability in the Contract Case for this Outlook. Some of the observed curtailment could also be a result of this pocket feeding into Pocket X2 and eventually being limited by the congestion on the Central East interface.

Figure XX: Pocket X3 Congestion and Energy Deliverability Summary (2030)



ID	Constraint	Number of Limiting Hours	
		2023 Outlook Contract Case	2021 Outlook Contract Case
1	COFFEEN 115-GLEN PRK 115	-	1,119
2	COFFEEN 115-E WTRTWN 115	-	748
3	HTHSE HL 115-MALLORY 115	-	591

Type	Capacity (MW)		Energy Deliverability (%)	
	2023 Outlook Contract Case	2021 Outlook Contract Case	2023 Outlook Contract Case	2021 Outlook Contract Case
Hydro	150	155	98%	99%
Wind	80	80	98%	100%
Solar	469	369	99%	90%

Pocket Y – Capital Region

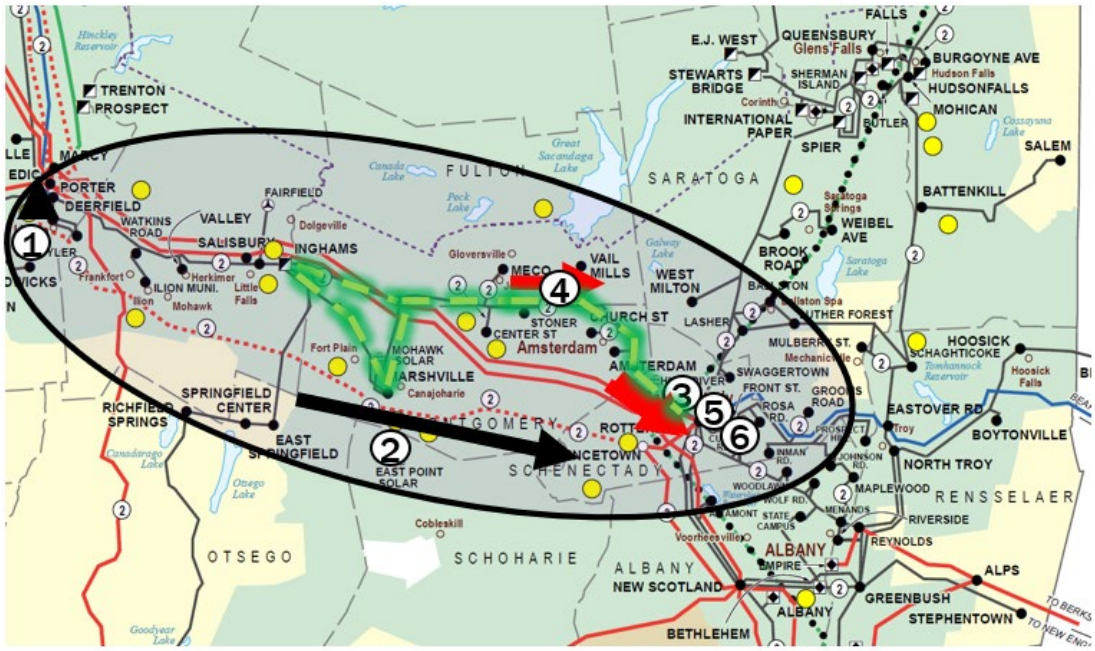
The Capital Region pockets are centered around the Albany metropolitan area and include areas in the Mohawk Valley and upper Hudson Valley regions. There is a large buildout of UPV units in this area mainly along the 115 kV path flowing across Herkimer and Montgomery counties, as well as generation northeast outside of the pocket in Washington County. Bulk level transmission constraints in the area include Central East and New Scotland-Knickerbocker—both paths are historically congested throughout the year. The addition of UPV units along with this pocket being downstream of major interfaces carrying power from upstate to downstate causes high levels of congestion.

Pocket Y1

Y1 – 2030 Pocket Analysis

Pocket Y1 contains a large amount of awarded UPV units increasing the capacity from 961 MW from the prior Outlook Contract Case to 1,700 MW. These resources are spread along the 345/115 kV path spanning Herkimer and Montgomery counties. In the prior Outlook's Contract Case this sub-pocket had four elements meeting the congestion threshold. These lines have all reduced congestion under the threshold consistent with the transmission upgrades highlighted in the pocket. The constrained element in the current study is the 115 kV line from Deerfield to Porter at 904 limiting hours. Central East has become more limited with 2,020 hours as compared to 234 hours in the prior Outlook's Contract Case. With the addition of many UPV units and being located downstream of resources and constrained elements from Pocket X, sub-pocket Y1 faces slightly lower energy deliverability of UPV and Hydro units than the prior Outlook. Phase 1 and 2 transmission upgrades within this pocket include upgrades to the Inghams PAR and transmission line upgrades to the 115 kV circuits east of Inghams as shown in the figure below. Since the PAR is proposed to operate in a way to direct flow west to east, it further increases flow and hence congestion on the Central East interface. UPV units connected west of the upgraded path show increased curtailment.

Figure XX: Pocket Y1 Congestion and Energy Deliverability Summary (2030)



ID	Constraint	Number of Limiting Hours	
		2023 Outlook Contract Case	2021 Outlook Contract Case
1	DEERFD-H 115.00-PORTER 1 115.00	904	-
2	Central East	2020	234
3	RTRDM1 115-Q638POI 115	-	1,200
4	STONER 115-VAIL TAP 115	-	882
5	AMST 115 115-Q638POI 115	-	302
6	Q638POI 115-AMST 115 115	-	293

Type	Capacity (MW)		Energy Deliverability (%)	
	2023 Outlook Contract Case	2021 Outlook Contract Case	2023 Outlook Contract Case	2021 Outlook Contract Case
Hydro	32	32	94%	100%
Wind	74	74	99%	97%
Solar	1,700	961	94%	96%

Pocket Y2

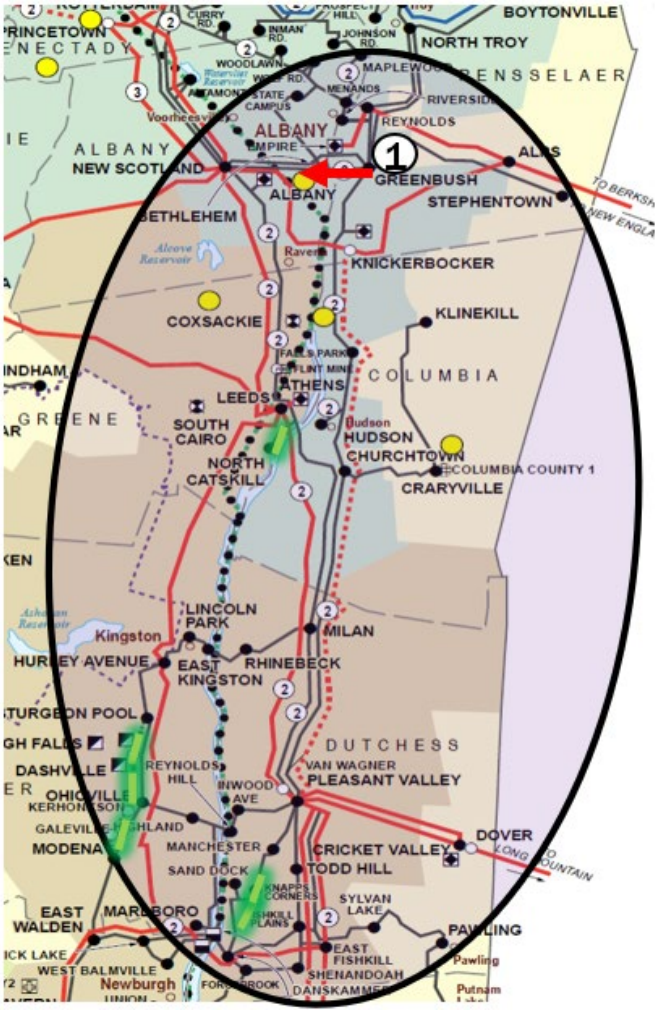
Y2 – 2030 Pocket Analysis

Pocket Y2 is located south of the Albany metro area in the upper Hudson Valley. This pocket consists mainly of higher level 345 kV lines carrying power from the Capital Region into Hudson Valley and down to load centers in New York City and Long Island. This sub-pocket has no constraining elements. The transmission upgrades made throughout the pocket, which are downstream of the congested constraint present in the prior Outlook Contract Case, have reduced those previously identified constraints to zero limiting hours.

The energy deliverability for solar in the pocket has decreased slightly from 100% to 98% with the addition of UPV units. Of note, sub-pocket Y2 is located downstream of sub-pocket Y1 , and additional UPV generation is located outside of this pocket (i.e., north of Albany); these factors lead to a reduction in energy deliverability in this pocket.

Hydro curtailment increases due to the fixed hourly modeling compared to pondage model in the prior Outlook and leads to 94% energy deliverability.

Figure XX: Pocket Y2 Congestion and Energy Deliverability Summary (2030)



ID	Constraint	Number of Limiting Hours	
		2023 Outlook Contract Case	2021 Outlook Contract Case
1	JMC2+9TP 115-PC W +MG 115	0	702

Type	Capacity (MW)		Energy Deliverability (%)	
	2023 Outlook Contract Case	2021 Outlook Contract Case	2023 Outlook Contract Case	2021 Outlook Contract Case
Hydro	25	25	94%	100%
Solar	290	250	98%	100%

Pocket Z – Southern Tier

Pocket Z is located along the southern border of New York State in Zone C (Central) and Zone E

(Mohawk Valley). Large buildouts of UPV resources are located in this area. This pocket contains significant bulk level and lower kV transmission networks that connect resources in Western New York and the Finger Lakes to bulk transmission leading to major interfaces, such as Central East and Marcy-South, delivering power to the rest of the state. The lower kV transmission networks across all three sub-pockets have undergone upgrades as part of the Phase 1 and 2 transmission upgrades.

Pocket Z1

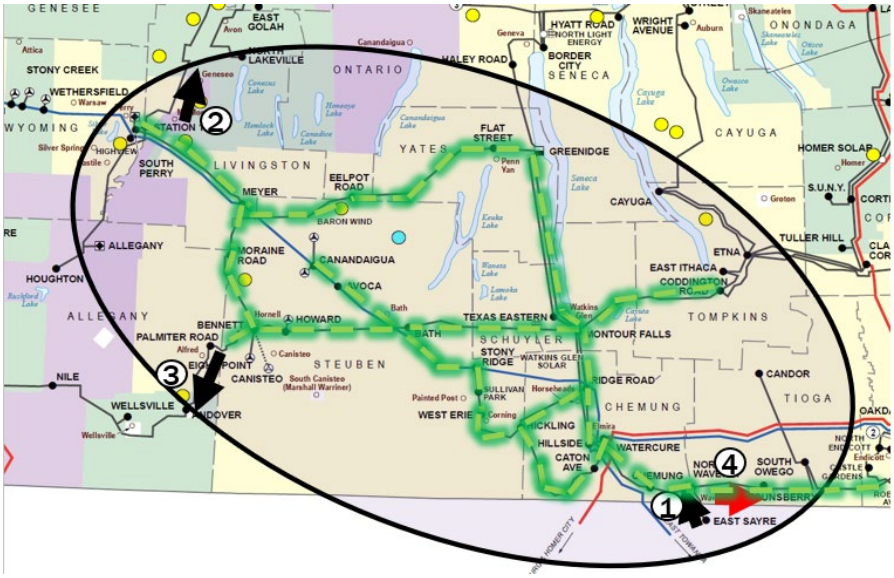
Z1 – 2030 Pocket Analysis

Pocket Z1 is located along the 230 kV path from South Perry to Hillside, the 115 kV circuits around Bennett substation, the 115 kV circuit from Hillside to North Waverly, and the Watercure 345 kV bus. This large sub-pocket spans multiple counties and includes a variety of transmission paths for resources to interconnect. In the Contract Case from the prior Outlook, the North Wavery 115 to East Sayre and Louns 115 to Stagecoach 115 met the congestion threshold of over 100 limiting hours at 3,225 and 170 hours, respectively.

In this Contract Case, three constraining elements are present. The 115 kV North Waverly to East Sayre[2] has increased limiting hours to 4,247 hours, while Louns to Stagecoach is no longer congested. Newly constrained lines include the South Perry to Station 158 115 kV line is limiting 1,032 hours of the year and Palmiter Road 115 kV line to Andover at 251 hours. These lines are just outside of the transmission upgrades built in the pocket. UPV buildout has increased greatly in this pocket and increased capacity by 522 MW. Wind capacity in this pocket, however, is lower than what was assumed in the prior Outlook. Energy deliverability remains high at 99% for solar and 100% for wind.

Figure XX: Pocket Z1 Congestion and Energy Deliverability Summary (2030)

[2] North Waverly to East Sayre 115 kV line is an inter-pool tie line that has its own operational protocol. Congestion on this line is reported in this study for informational purposes only.



ID	Constraint	Number of Limiting Hours	
		2023 Outlook Contract Case	2021 Outlook Contract Case
1	N.WAV115 115.00-26E.SAYR 115.00	4,247	3,225
2	S.PER115 115.00-STA 158S 115.00	1,032	-
3	PALMT115 115.00-ANDOVER1 115.00	251	-
4	LOUNS115 115-STAGECOA 115	-	170

Type	Capacity (MW)		Energy Deliverability (%)	
	2023 Outlook Contract Case	2021 Outlook Contract Case	2023 Outlook Contract Case	2021 Outlook Contract Case
Wind	691	720	100%	100%
Solar	927	405	99%	100%

Pocket Z2

Z2 – 2030 Pocket Analysis

Pocket Z2 is located along the 345/115 kV corridor from Oakdale to the Fraser substation and contains the 115 kV section from East Norwich to Jennison. In the 2021-2040 Outlook Contract Case, this sub-pocket had one constraining element—Jennison 115 to Sidney with 542 limiting hours. This line is located along the path that underwent transmission upgrades and now experiences zero limiting hours. The only constraining element is the Fraser to Oakdale 345 kV line

at 150 hours that extends across the whole sub-pocket. The capacity of solar has increased greatly with 205 MW compared the 60 MW in the prior Outlook. F Due to the large solar capacity buildout as compared to the prior Outlook, energy deliverability has lowered slightly to 97% for solar, while wind has increased to 100% deliverability.

Figure XX: Pocket Z2 Congestion and Energy Deliverability Summary (2030)

ID	Constraint	Number of Limiting Hours	
		2023 Outlook Contract Case	2021 Outlook Contract Case
1	FRASR345 345.00-OAKDL345 345.00	150	-
2	JENN 115 115-SIDNT115 115	-	542

Type	Capacity (MW)		Energy Deliverability (%)	
	2023 Outlook Contract Case	2021 Outlook Contract Case	2023 Outlook Contract Case	2021 Outlook Contract Case
Wind	213	213	100%	99%
Solar	205	60	97%	100%

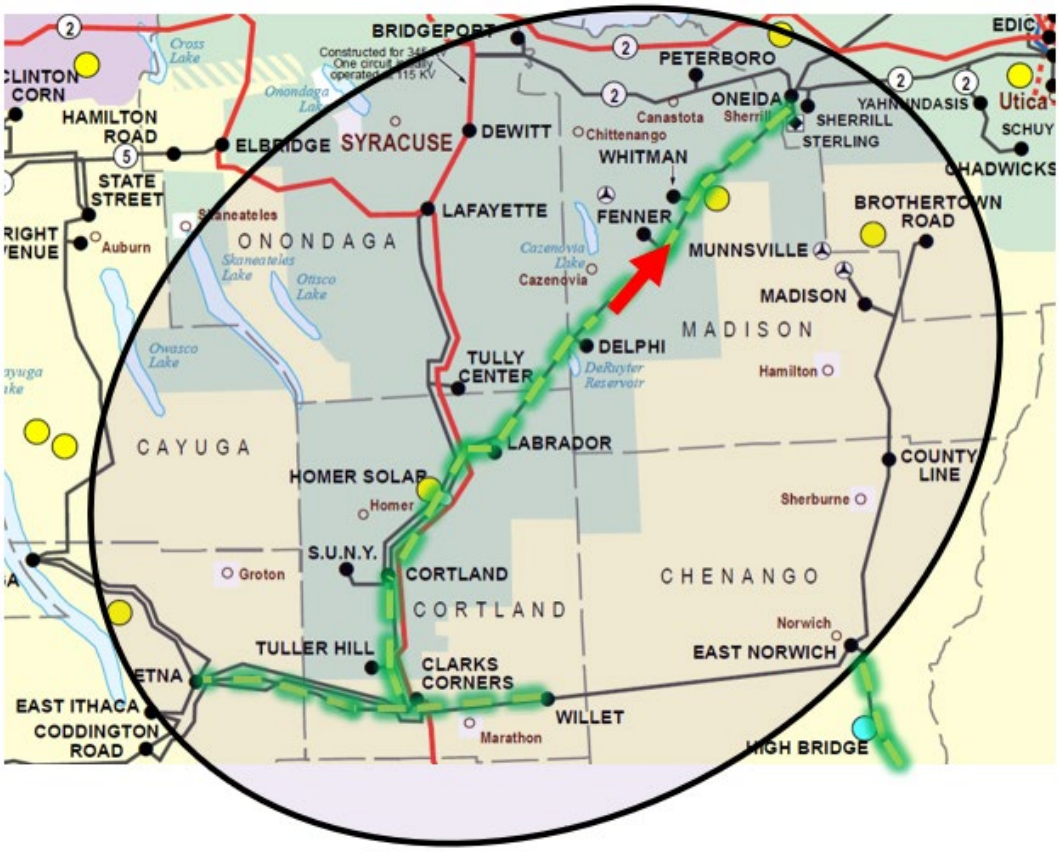
Pocket Z3

Z3 – 2030 Pocket Analysis

Pocket Z3 is located along the 345/115 kV corridor from Lafayette-Clarks Corners substation and the 115 kV circuit from Clarks Corners to Oneida substation. Consistent with the prior Outlook

Contract Case, there are no constraining elements. The UPV capacity has nearly doubled in this sub-pocket from 150 MW to 290 MW. The energy deliverability follows the buildout of resources, slightly lowering from 100% deliverability to 99% for solar and 98% for wind deliverability.

Figure XX: Pocket Z3 Congestion and Energy Deliverability Summary (2030)



ID	Constraint	Number of Limiting Hours		
		2023 Outlook Contract Case	2021 Outlook Contract Case	2021 Outlook Policy S1
1	WHITMAN 115-FEN-WIND 115	0	-	128

Type	Capacity (MW)		Energy Deliverability (%)	
	2023 Outlook Contract Case	2021 Outlook Contract Case	2023 Outlook Contract Case	2021 Outlook Contract Case
Wind	76	76	98%	100%
Solar	290	150	99%	100%

Summary Pocket Metrics (2030)

Contract Case (2030)					
Pocket	Type	Capacity (MW)	Scheduled Energy (GWh)	Curtailment (GWh)	Energy Deliverability (%)
W1	Wind	147	392	0	100%
	Solar	2,030	4,016	181	96%
W2	Wind	813	2,271	61	97%
	Solar	60	95	1	99%
W3	Wind	305	843	1	100%
	Solar	480	799	4	100%
X1	Hydro	1,155	7,401	181	98%
	HQ Imports	1,930	10,798	340	97%
	Wind	977	2,613	186	93%
	Solar	690	1,336	145	89%
X2	Hydro	252	1,238	39	97%
	Wind	505	1,386	55	96%
	Solar	80	128	10	92%
X3	Hydro	224	658	14	98%
	Wind	80	217	4	98%
	Solar	469	879	12	99%
Y1	Hydro	32	100	5	94%
	Wind	74	182	3	99%
	Solar	1,700	3,305	189	94%
Y2	Hydro	39	101	7	94%
	Wind	-	-	-	-
	Solar	290	512	11	98%
Z1	Wind	691	1,890	4	100%
	Solar	927	1,707	15	99%
Z2	Wind	213	701	0	100%
	Solar	205	389	14	97%
Z3	Wind	76	189	2	98%
	Solar	290	539	8	99%

Policy Case (2035)

[This draft includes results and analyses for the Lower and Higher Demand Policy Case scenarios. Results for the State Scenario Policy Case will be filled out in future versions of this draft.]

Three scenarios were evaluated in the Policy Case for this Outlook to assess various potential resource mixes to satisfy policy achievement for the 20-year study horizon. Additional detail on these scenarios and resulting resource mixes are included in Appendix []. The renewable generation pocket analysis for the Policy Case is performed for year 2035 to highlight potential progression of the impacts of increased resource buildout without additional transmission upgrades beyond year 2030.

Resources studied in the Contract Case are included as firm generators in each Policy Case

scenario. Between 2030 and 2035, renewable capacity increases by approximately 4 GW in the Lower Demand Policy Scenario and 12 GW in the Higher Demand Policy Scenario. This buildout is a mix of LBW units located mainly in Pockets W and Y and UPV units in Pocket X. Placement of generic resources in the Policy Case scenarios leverages the NYISO's Interconnection Queue[3] for LBW and UPV , as well as NYSERDA's LSR Supply Curve analysis.[4] Congestion on transmission constraints within the pockets remains low as a result of NYPA's Smart Path project and the Phase 1 and 2 transmission upgrades assumed to be included on the lower kV system.

Pocket W – Western New York

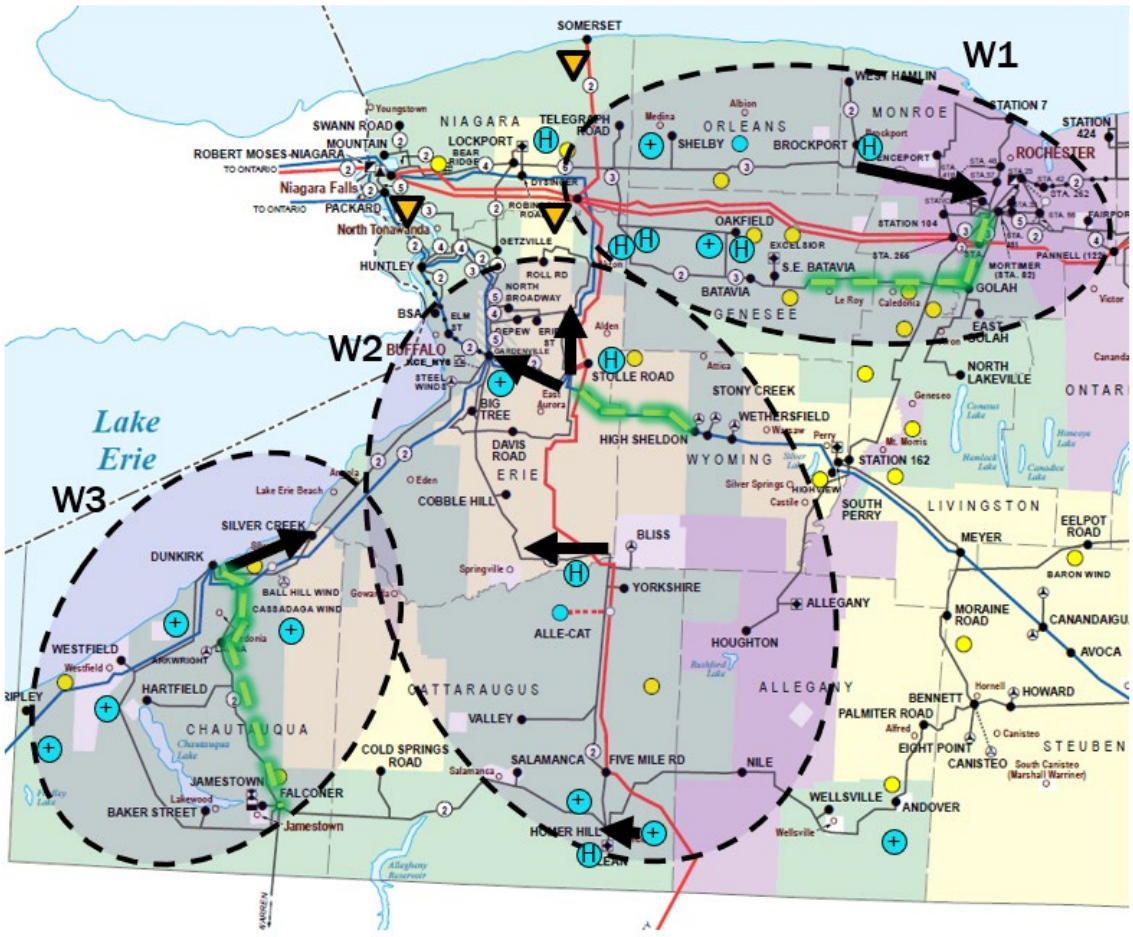
Pocket W includes three large loads indicated in Figure X below with orange triangles. While located outside of designated sub-pockets W1, W2, and W3, the large loads are served by transmission lines within the sub-pockets and impact energy deliverability and curtailment. The blank yellow and blue circles on the map represent wind and solar awarded resources added in the Contract Case included as of the lockdown date of the study.[5] Circles with an L or H in the middle represent resources added in only the Lower Demand Policy Scenario and Higher Demand Policy Scenario, respectively. Circles with a plus sign ("+") indicate resources that were added in both Policy Case scenarios.

Figure XX: Pocket W Summary Map and Key (2035)

[3] NYISO's Interconnection Queue (last updated January 31, 2024): https://www.nyiso.com/documents/20142/1394430/NYISO-Interconnection-Queue-1-31-24.xlsx

[4] Supply curve analysis undertaken by NYSERDA and consultants in 2023.

[5] Lockdown date for the Contract Case was October 30, 2023.

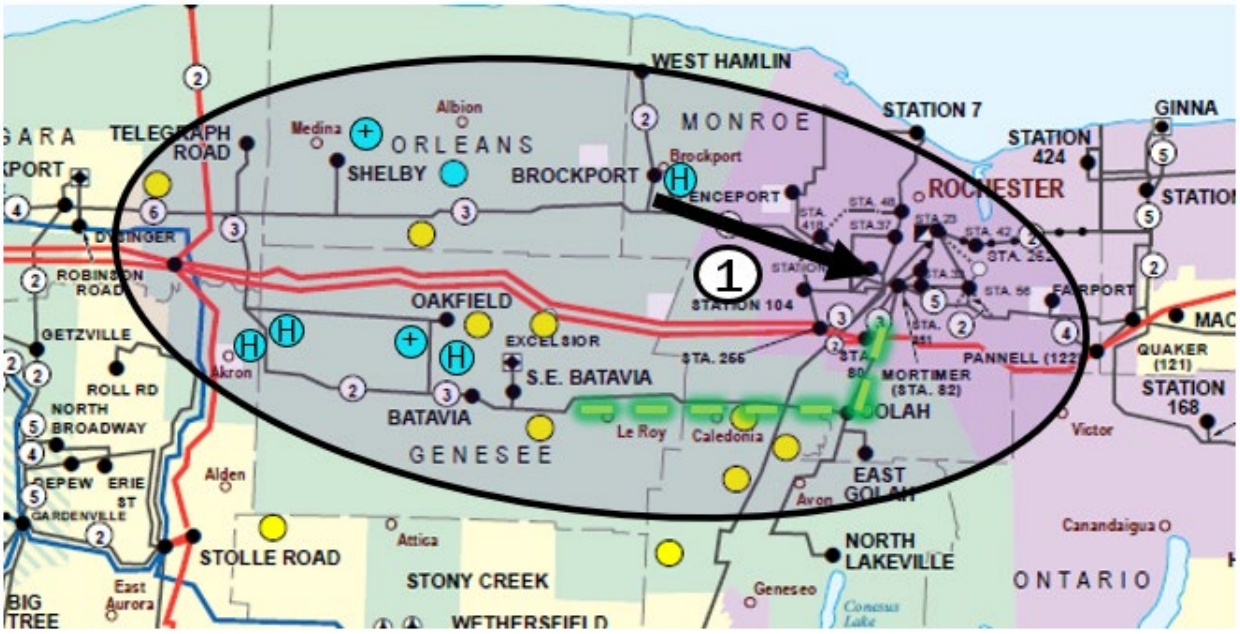


Key	Awarded Resource*	Lower	Higher	Lower + Higher
Wind	●	L	H	+
Solar	●	L	H	+

Pocket W1

Pocket W1 contains incremental LBW capacity in both scenarios with significantly more included in the Higher Demand Policy Scenario. The UPV capacity is consistent with the Contract Case. A new transmission constraint appears in Pocket W1 in the Policy Case. The number of congested hours on this line increases significantly between Lower and Higher Demand from 200 to 3,377 as it is downstream of added LBW units connecting along the path. The energy deliverability in the pocket follows congestion with deliverability of wind ranging from 100% in the Contract Case to 84% in the Higher Demand Policy Scenario. Though solar capacity does not increase between cases, deliverability reduces to 90% in the Lower Demand Policy Scenario and improves slightly in the Higher Demand Policy Scenario likely due to increased load demand.

Figure XX: Pocket W1 Congestion and Energy Deliverability Summary (2035)



ID	Constraint	Number of Limiting Hours		
		Contract Case	Policy Case: Lower Demand	Policy Case: Higher Demand
1	MORTIMER 115.00-SWDN-113 115.00	-	200	3,377

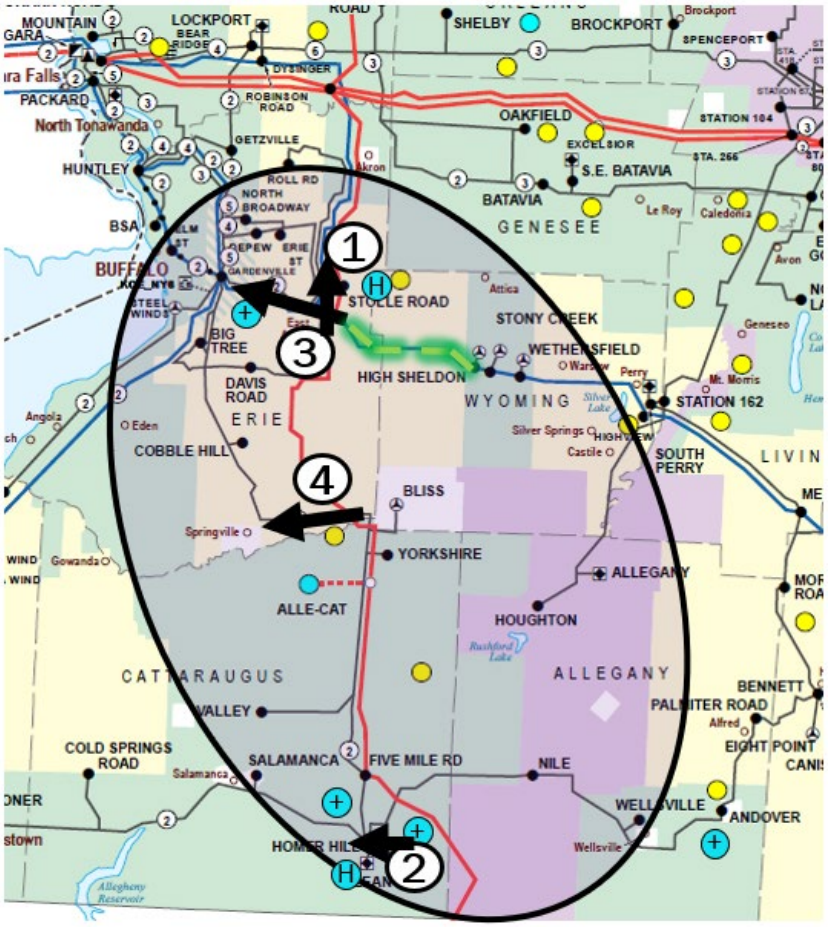
Type	Capacity (MW)			Energy Deliverability (%)		
	Contract Case	Policy Case: Lower Demand	Policy Case: Higher Demand	Contract Case	Policy Case: Lower Demand	Policy Case: Higher Demand
Wind	147	339	1,001	100%	100%	84%
Solar	2,030	2,030	2,030	96%	90%	92%

Pocket W2

Pocket W2 is south of Buffalo along the Stolle-Five Mile 345 kV corridor and includes portions of the eastern path out of Stolle 230 kV towards South Perry. The addition of LBW units incrementally increases between the Contract Case, Lower Demand Policy Scenario, and again with the Higher Demand Policy Scenario and causes congestion on constraints that were not present in the Contract Case. The two constraints previously binding—Erie to Pavement and Stolle to Girdle—

are upstream of transmission upgrades and experience similar congested hours in both the Contract Case and the Policy Case. Freedom to Bixby Hill becomes heavily congested in the Higher Demand Policy Scenario at 2,581 hours compared to only 6 hours in the Lower Demand Policy Scenario. Congestion in the pocket increases near load centers seen in Figure XX and on lines that feed into these load centers. Though the wind capacity and number of constraints increases, energy deliverability in the pocket remains high. The location of the wind units near each transmission line may work to reduce curtailment.

Figure XX: Pocket W2 Congestion and Energy Deliverability Summary (2035)



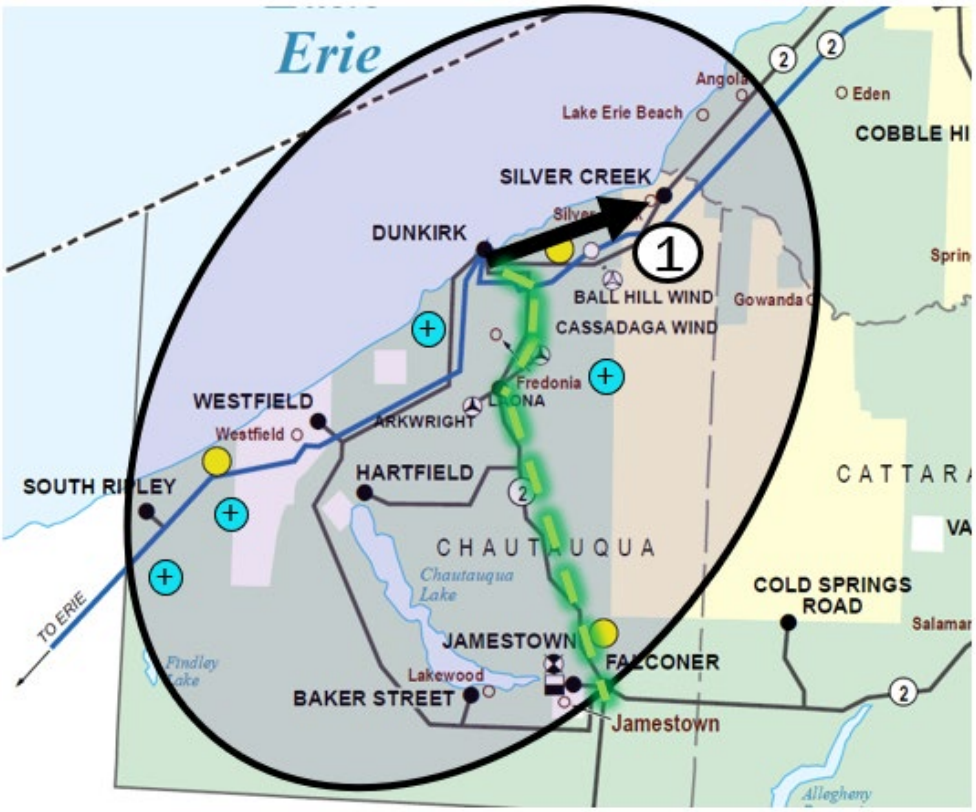
ID	Constraint	Number of Limiting Hours		
		Contract Case	Policy Case: Lower Demand	Policy Case: Higher Demand
1	ERIE 115 115.00-PAVMT115 115.00	1,455	2,177	2,491
2	DUGN-157 115.00-HOMERHIL 115.00	-	459	476
3	STOLLE115 115-GIRDLE RD 115	132	187	245
4	FREEDOM 115.00-BIXBY_HL 115.00	11	6	2,581

Type	Capacity (MW)			Energy Deliverability (%)		
	Contract Case	Policy Case: Lower Demand	Policy Case: Higher Demand	Contract Case	Policy Case: Lower Demand	Policy Case: Higher Demand
Wind	813	1,476	1,959	97%	97%	96%
Solar	60	60	60	99%	99%	97%

Pocket W3

Congestion in Pocket W3 increases in year 2035 with the addition of LBW units in both Policy Case scenarios. These LBW units increase congestion on the 115 kV path from Dunkirk to Silver Creek causing it to be constrained from zero hours in the Contract Case to 1,691 and 1,771 in the Lower and Higher Demand Policy Scenarios, respectively. This constraint is upstream of the LBW units and transmission upgrades in the pocket. As a result of large renewable capacity added in the area and limited transmission paths, energy deliverability is lowest for LBW and UPV in the Higher Demand Policy Scenario.

Figure XX: Pocket W3 Congestion and Energy Deliverability Summary (2035)



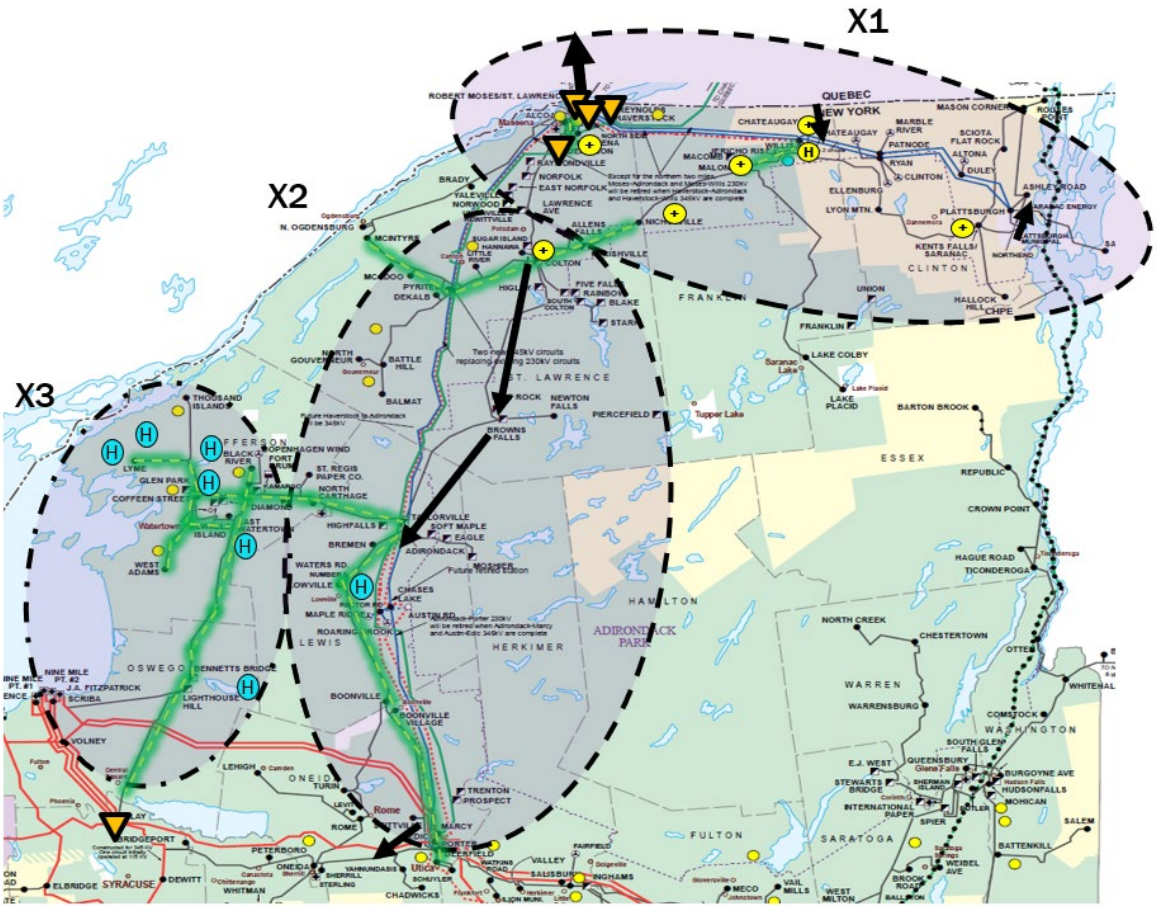
ID	Constraint	Number of Limiting Hours		
		Contract Case	Policy Case: Lower Demand	Policy Case: Higher Demand
1	SLVRC141 115.00-DUNKIRK1 115.00	-	1,691	1,771

Type	Capacity (MW)			Energy Deliverability (%)		
	Contract Case	Policy Case: Lower Demand	Policy Case: Higher Demand	Contract Case	Policy Case: Lower Demand	Policy Case: Higher Demand
Wind	305	894	917	100%	95%	94%
Solar	480	480	480	100%	94%	93%

Pocket X – Northern New York

In year 2035, Pocket X has significant increases in both LBW and UPV capacity. UPV units are largely located in sub-pocket X1, and LBW units are located in sub-pocket X3. Indicated by the orange triangles, large loads in the area are connected to Zones D and E in sub-pocket X1 and outside of sub-pocket X3. Extensive transmission upgrades indicated by green highlights in Figure XX, below, have been made throughout the region. These upgrades occur on constraints that flow across sub-pockets affecting energy deliverability not only in the sub-pocket that a constraint is located within but outside it as well.

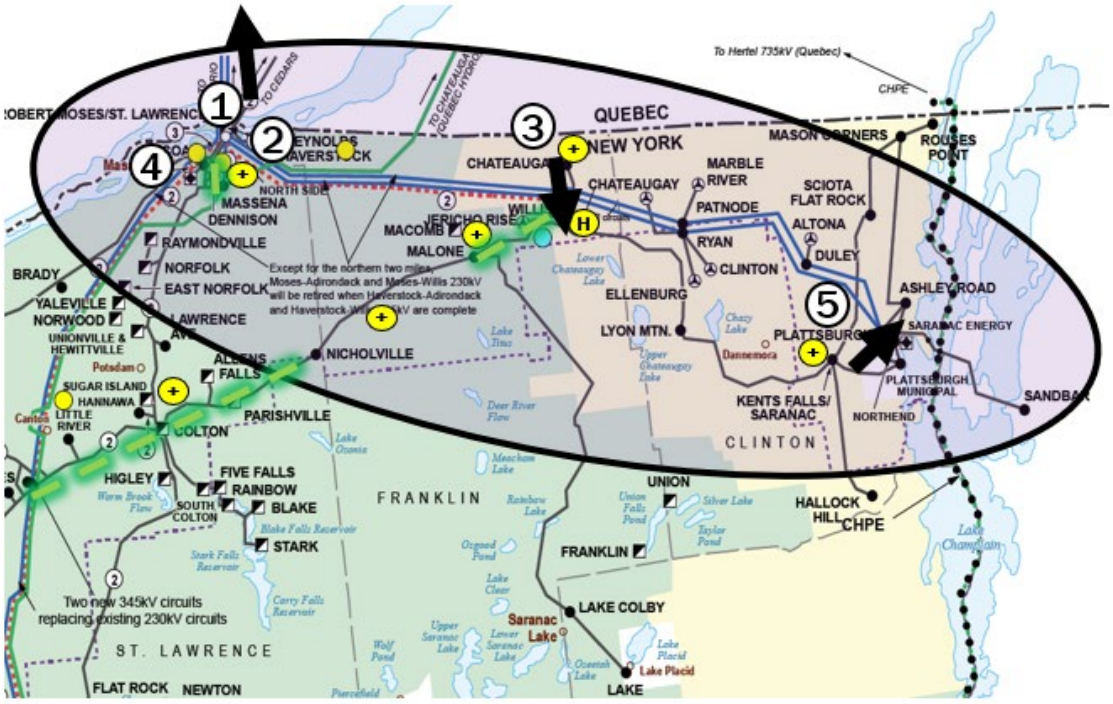
Figure XX: Pocket X Summary Map (2035)



Pocket X1

Pocket X1 UPV capacity in the Policy Case scenarios double as compared to the Contract Case. The majority of constraints and congested hours appear in the Lower Demand Policy Scenario with the initial introduction of additional UPV units. Energy deliverability reduces for hydro and wind resources, while solar increases from 89% to 91%. For instance, one UPV unit is added in the Higher Demand Policy Scenario and the number of congestion hours on all constraints reduce except for the 115 kV line from Alcoa NM to Alcoa N. Energy deliverability improves in the Higher Demand Policy Scenario with reduced congestion on the lines. The observed high deliverability is correlated with the high number of large loads in Zone D being located within this sub-pocket around Massena.

Figure XX: Pocket X1 Congestion and Energy Deliverability Summary (2035)



ID	Constraint	Number of Limiting Hours		
		Contract Case	Policy Case: Lower Demand	Policy Case: Higher Demand
1	North Tie: IESO-NY*	6,561	6,790	6,505
2	MOSES W 230.00-MNH3230 230.00	883	1,268	704
3	CHATG115 115.00-CHATP115 115.00	-	644	-
4	ALCOA-NM 115.00-ALCOA N 115.00	45	165	358
5	ASHLY115 115.00-PLAT 115 115.00	-	156	133

6

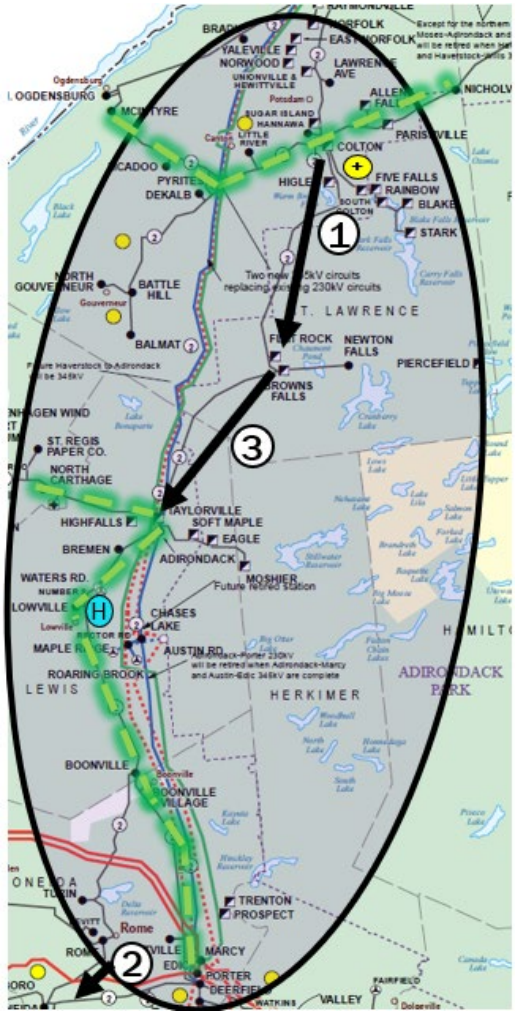
Type	Capacity (MW)			Energy Deliverability (%)		
	Contract Case	Policy Case: Lower Demand	Policy Case: Higher Demand	Contract Case	Policy Case: Lower Demand	Policy Case: Higher Demand
Hydro	1,149	1,149	1,149	98%	93%	97%
HQ Imports	1,930	1,930	1,930	97%	93%	96%
Wind	977	977	977	93%	90%	94%
Solar	690	1,308	1,396	89%	91%	95%

Pocket X2

[6] North Tie: IESO-NY congestion is reported for information only as operation protocols will dictate the operation of this line. The number of congested hours on this tie line remain consistent across the cases.

In Pocket X2, UPV capacity is added in both Policy Case scenarios and LBW capacity is added in the Higher Demand Policy Scenario by 2035. Two new constraints appear at the 115 kV level with Colton to Flat Rock and Browns Falls to Taylorville. These two constraints are between transmission upgrades that have been made north and south of the pocket. Downstream of the added UPV unit and resources in sub-pocket X1, energy deliverability greatly reduces in the Lower Demand Policy Scenario. Even with the addition of LBW capacity in the Higher Demand scenario, the energy deliverability of all resources improves and the number of congested hours on the new constraints reduces due to the higher loads assumed in this scenario.

Figure XX: Pocket X2 Congestion and Energy Deliverability Summary (2035)



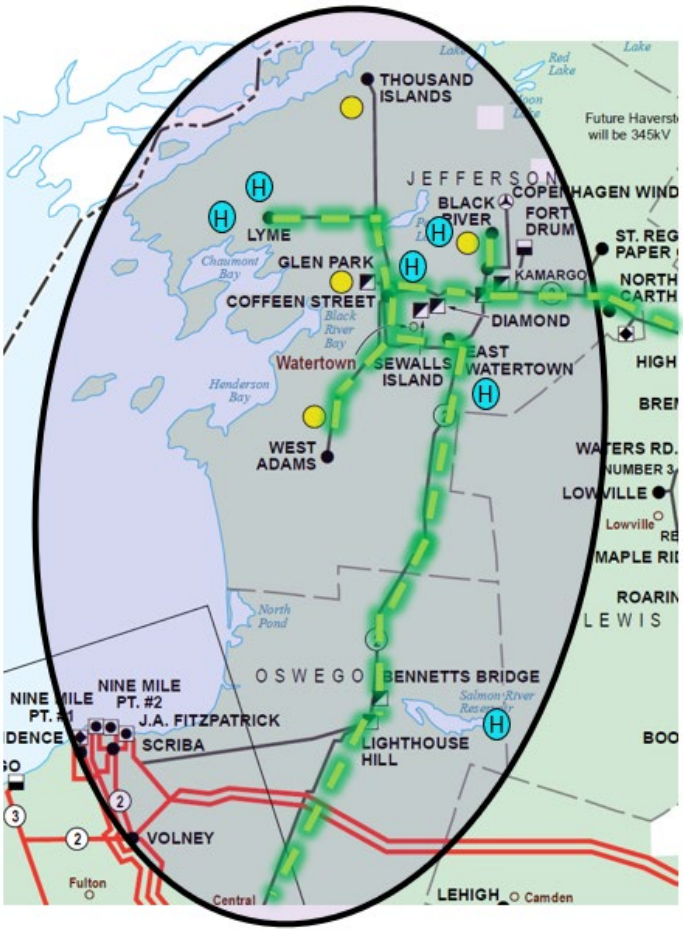
ID	Constraint	Number of Limiting Hours		
		Contract Case	Policy Case: Lower Demand	Policy Case: Higher Demand
1	COLTON 115.00-FLAT RCK 115.00	-	1,408	816
2	TRNG STN 115.00-STERLING 115.00	200	497	507
3	BRNS FLS 115.00-TAYLORVL 115.00	-	276	206

Type	Capacity (MW)			Energy Deliverability (%)		
	Contract Case	Policy Case: Lower Demand	Policy Case: Higher Demand	Contract Case	Policy Case: Lower Demand	Policy Case: Higher Demand
Hydro	252	252	252	97%	87%	93%
Wind	505	505	583	96%	92%	96%
Solar	80	244	250	92%	85%	92%

Pocket X3

Significant buildout of LBW capacity occurs in Pocket X3 for the Higher Demand Policy Scenario from 80 MW to 932 MW, while hydro and solar capacity remains the same. Extensive upgrades as part of the Phase 1 and 2 transmission projects have been made to this sub-pocket, which eliminate previously congested elements.. Results show that lines in the sub-pocket remain unconstrained at zero limiting hours across all scenarios. Although there are no congested elements within the sub-pocket, there is some curtailment of hydro and solar resources. . Pocket X3 has lines connected to Pockets X2 and Y1. As resources are added to these areas, lines may become congested and limit energy deliverability. The large load shown in Figure XX is also connected to the Clay bus located directly downstream of the pocket. At the bulk level, the Central East interface is a limiting element for resources in Pocket X and Pocket Y. Resources in Pockets X2 and X3 have an effect on the Central East flow that may cause an increase of limiting hours that, in turn, could restrict deliverability of generation across pockets.

Figure XX: Pocket X3 Congestion and Energy Deliverability Summary (2035)



ID	Constraint	Number of Limiting Hours		
		Contract Case	Policy Case: Lower Demand	Policy Case: Higher Demand
	-	-	-	-

Type	Capacity (MW)			Energy Deliverability (%)		
	Contract Case	Policy Case: Lower Demand	Policy Case: Higher Demand	Contract Case	Policy Case: Lower Demand	Policy Case: Higher Demand
Hydro	150	150	150	98%	94%	97%
Wind	80	80	932	98%	93%	100%
Solar	469	469	469	99%	97%	97%

Pocket Y – Capital Region

Pocket Y in the Capital region is downstream of added resources and large loads in Pocket X. The Higher Demand Policy Scenario has additional buildout of LBW units in both sub-pockets. The Lower Demand Policy Case is similar to the Contract Case as there is no change in renewable generator buildout but there is a difference in energy deliverability.

Figure XX: Pocket Y Summary Map (2035)

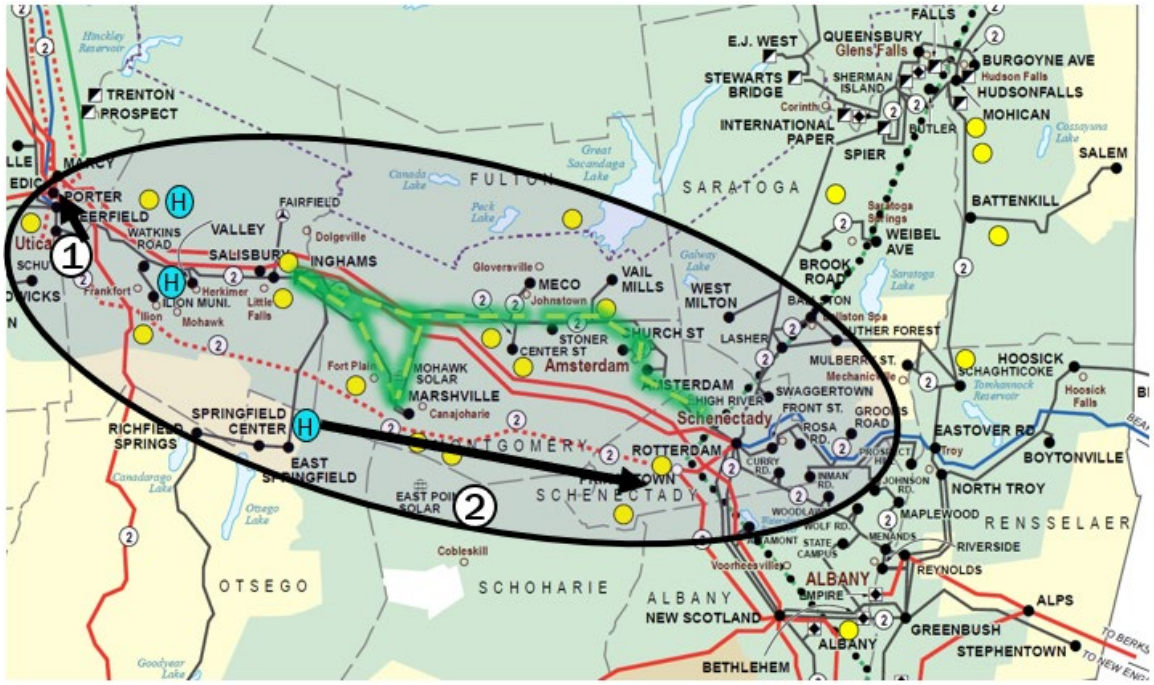
Pocket Y1

Pocket Y1 includes transmission lines comprising the Central East bulk-level interface, which is consistently congested but has a reduction of limiting hours across the scenarios in the Policy Case. LBW capacity increases in the Higher Demand Policy Scenario and is located upstream of

constraints and transmission upgrades in the pocket. Despite no incremental buildout in the Lower Demand Policy Scenario by 2035, the energy deliverability decreases for hydro, wind, and solar. This may be due to the pocket being downstream of Pocket X, which has significant buildout of solar in the Lower Demand Policy Scenario that constrains lines flowing into sub-pocket Y1. Central East congestion has a major impact on the curtailment of resources in the pocket leading to reduced deliverability. The Higher Demand Policy Scenario simulates a higher interface limit on Central East due to increased generator commitments in the Oswego area.[7] The higher interface limit on Central East leads to lower congestion and, therefore, increased deliverability of resources connected upstream of this interface.

Figure XX: Pocket Y1 Congestion and Energy Deliverability Summary (2035)

[7] Central East interface limit is dynamically calculated based on the commitment of groups of generators according to the Central East Voltage Collapse Limit Study (CEVC-24), which is available at: https://www.nyiso.com/documents/20142/3692791/Central-East-Voltage-Limit-Study-2024-FINAL.pdf



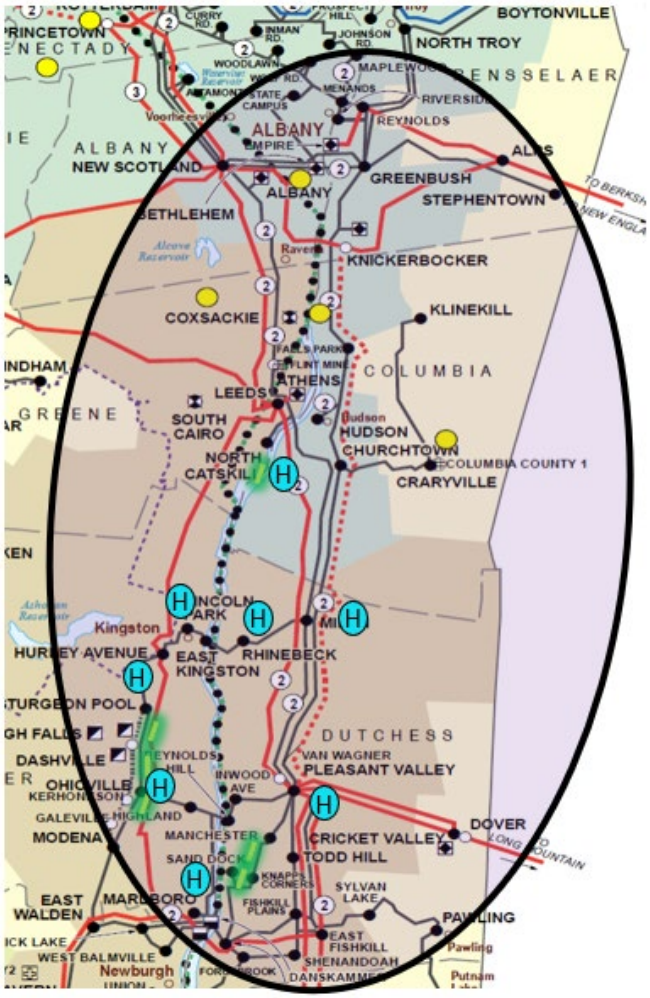
ID	Constraint	Number of Limiting Hours		
		Contract Case	Policy Case: Lower Demand	Policy Case: Higher Demand
1	DEERFD-H 115.00-PORTER 1 115.00	904	865	893
2	CENTRAL EAST	2,020	1,991	1,533

Type	Capacity (MW)			Energy Deliverability (%)		
	Contract Case	Policy Case: Lower Demand	Policy Case: Higher Demand	Contract Case	Policy Case: Lower Demand	Policy Case: Higher Demand
Hydro	32	32	32	94%	93%	96%
Wind	74	74	324	99%	96%	100%
Solar	1,700	1,700	1,700	94%	92%	93%

Pocket Y2

Pocket Y2 in the Higher Demand Policy Scenario includes increased LBW capacity compared to the Lower Demand Policy Scenario, the Contract Case, and previous Outlook cases that assessed renewable pockets. The LBW units are added throughout the southern portion of the sub-pocket along 345 kV lines near areas with transmission upgrades. Notably, zero curtailment of wind occurs in this pocket because these generators are connected to higher voltage lines and there are no new constrained elements appearing in this pocket in either Policy Case scenario. However, energy deliverability is reduced for hydro and solar resources.

Figure XX: Pocket Y2 Congestion and Energy Deliverability Summary (2035)



ID	Constraint	Number of Limiting Hours		
		Contract Case	Policy Case: Lower Demand	Policy Case: Higher Demand
	-	-	-	-

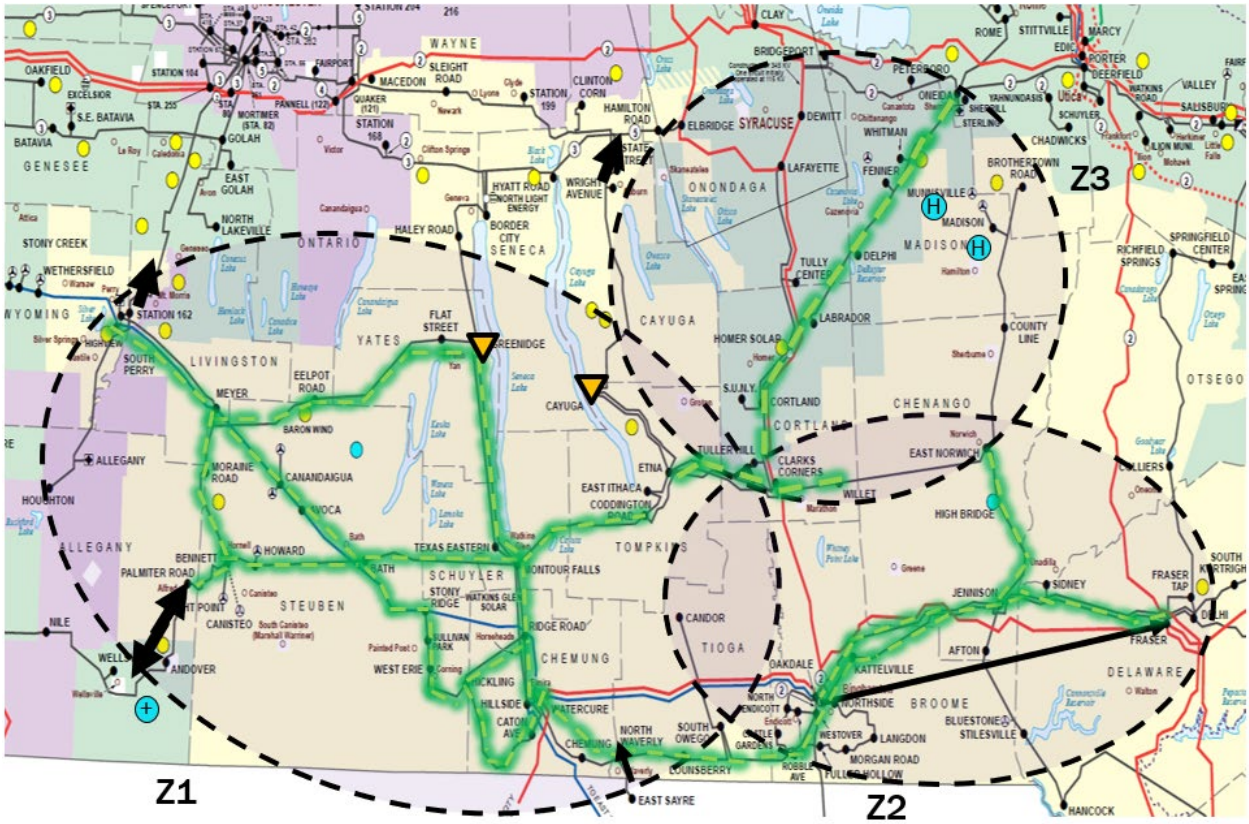
Type	Capacity (MW)			Energy Deliverability (%)		
	Contract Case	Policy Case: Lower Demand	Policy Case: Higher Demand	Contract Case	Policy Case: Lower Demand	Policy Case: Higher Demand
Hydro	25	25	25	94%	90%	93%
Wind	-	-	151	-	-	100%
Solar	290	290	290	98%	98%	97%

Pocket Z – Southern Tier

Pocket Z consists of the most extensive transmission upgrades out of all studied pockets due to the Phase 1 and 2 transmission projects (indicated by the green highlights on the figure below).

This pocket has the least amount of added renewable capacity out of all identified pockets with new renewable resource buildout occurring only in sub-pocket Z3.

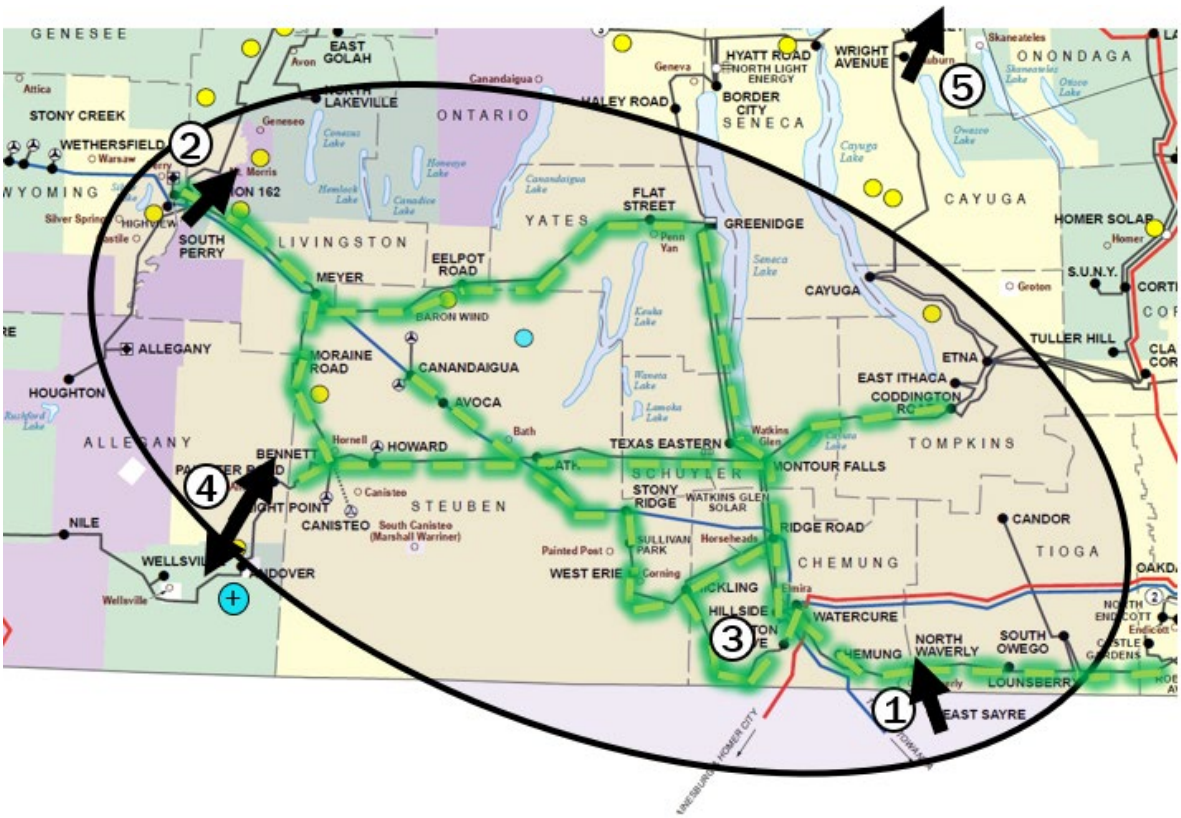
Figure XX: Pocket Z Summary Map (2035)



Pocket Z1

No renewable capacity is added in this sub-pocket for the Lower and Higher Demand Policy Scenarios between years 2030 and 2035. The 115 kV Palmiter Road to Andover line reduces congested hours below the threshold for both scenarios due to addition of a generic wind resource at the Andover 115 kV bus. After the addition of the generic LBW unit in the Policy Case scenarios, this line in 2035 flows in both directions, as indicated by the double headed arrow. Notably, the State Street to Wright Avenue 115 kV line is located outside of the pocket boundaries; however, it was included in this analysis as it is a congested element across multiple cases and is connected to the transmission affecting sub-pocket Z1. With transmission upgrades throughout the pocket and lack of capacity buildout, energy deliverability remains high throughout the Policy Case scenarios.

Figure XX: Pocket Z1 Congestion and Energy Deliverability Summary (2035)



[8]

ID	Constraint	Number of Limiting Hours		
		Contract Case	Policy Case: Lower Demand	Policy Case: Higher Demand
1	N.WAV115 115.00-26E.SAYR 115.00*	4,247	4,393	5,051
2	S.PER115 115.00-STA 158S 115.00	1,032	1,062	1,066
3	HILSD230 230.00-HILSD230 230.00	-	104	76
4	PALMT115 115.00-ANDOVER1 115.00	251	50	45
5	STATE ST. 115 – WRIGHT AVE. 115	551	463	539

Type	Capacity (MW)			Energy Deliverability (%)		
	Contract Case	Policy Case: Lower Demand	Policy Case: Higher Demand	Contract Case	Policy Case: Lower Demand	Policy Case: Higher Demand
Wind	691	691	691	100%	98%	99%
Solar	927	927	927	99%	98%	97%

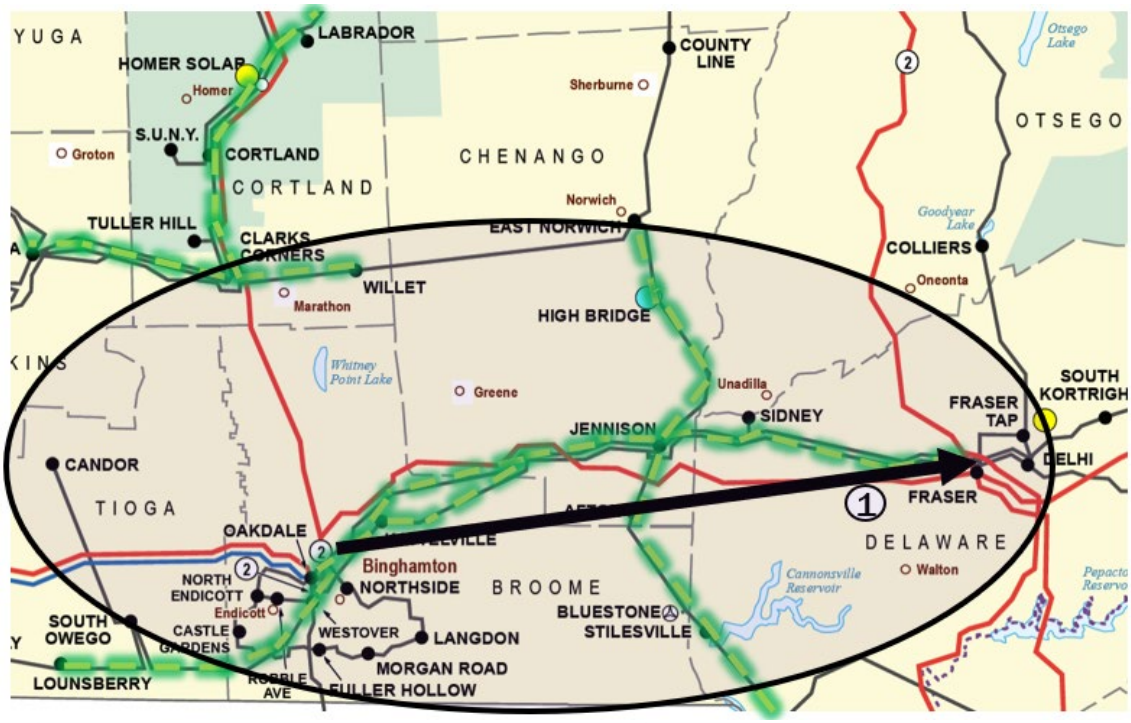
Pocket Z2

For year 2035, the 345 kV Fraser to Oakdale line remains the only congested element in the

[8] North Wavery to East Sayre remains consistently congested and is reported for information only as operations protocols would determine the operation of this line.

pocket with the number of limiting hours increasing in the Lower Demand Policy Scenario but decreasing to 136 hours in the Higher Demand Policy Scenario. Renewable capacity does not change within the pocket between the Contract and Policy Cases; however, solar deliverability reduces slightly in the Policy Case scenarios. Wind deliverability remains high at 100%.

Figure XX: Pocket Z2 Congestion and Energy Deliverability Summary (2035)



ID	Constraint	Number of Limiting Hours		
		Contract Case	Policy Case: Lower Demand	Policy Case: Higher Demand
1	FRASR345 345.00-OAKDL345 345.00	150	258	136

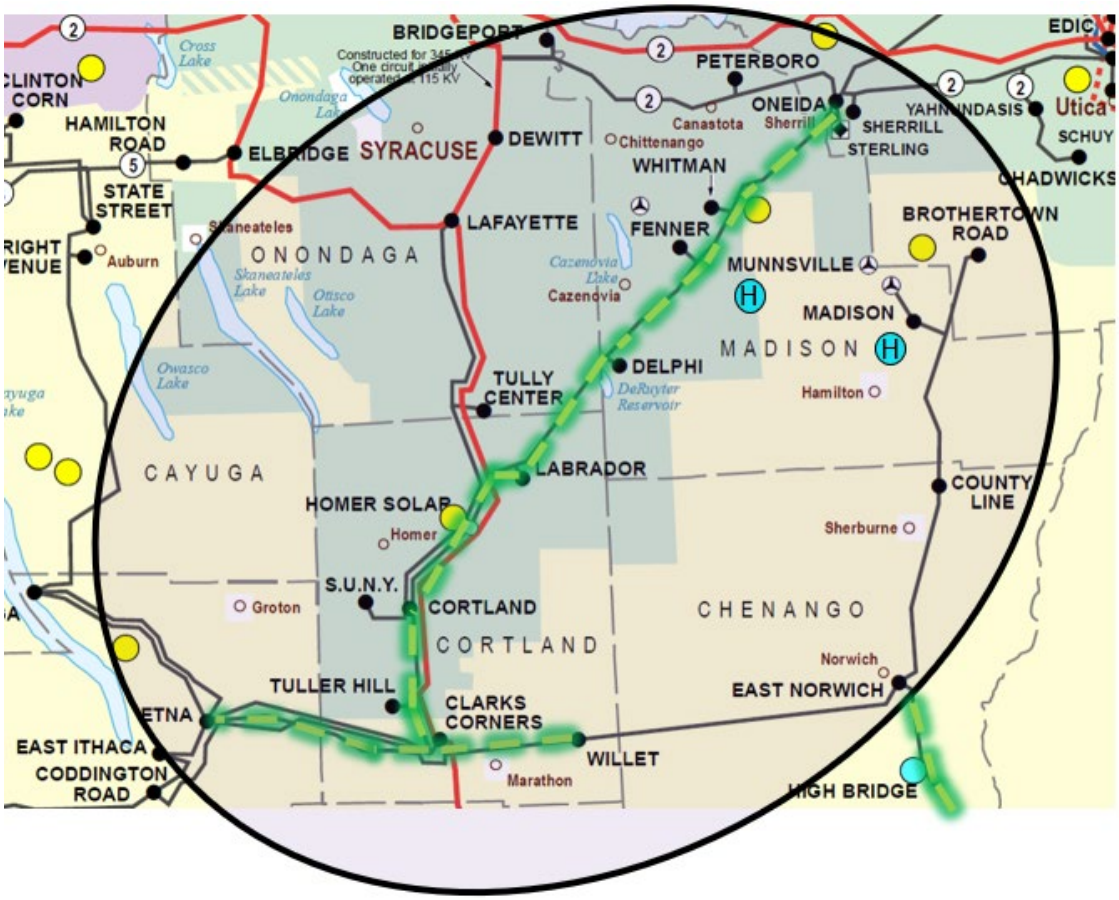
Type	Capacity (MW)			Energy Deliverability (%)		
	Contract Case	Policy Case: Lower Demand	Policy Case: Higher Demand	Contract Case	Policy Case: Lower Demand	Policy Case: Higher Demand
Wind	213	213	213	100%	100%	100%
Solar	205	205	205	97%	94%	95%

Pocket Z3

Pocket Z3 in the Syracuse area remains unconstrained in 2035 and has two added LBW units located in Madison County in the Higher Demand Policy Scenario. Energy deliverability decreases in

the Lower Demand Policy Scenario for both wind and solar to 96% as a result of the pocket being downstream of constraints in sub-pocket Y1 and increased congestion in adjacent sub-pocket Z1. The energy deliverability improves in the Higher Demand Policy Scenario with the addition of LBW capacity.

Figure XX: Pocket Z3 Congestion and Energy Deliverability Summary (2035)



ID	Constraint	Number of Limiting Hours		
		Contract Case	Policy Case: Lower Demand	Policy Case: Higher Demand
	-	-	-	-

Type	Capacity (MW)			Energy Deliverability (%)		
	Contract Case	Policy Case: Lower Demand	Policy Case: Higher Demand	Contract Case	Policy Case: Lower Demand	Policy Case: Higher Demand
Wind	76	76	183	98%	96%	99%
Solar	290	290	290	99%	96%	97%

Summary Pocket Metrics (2035)

Lower Demand Case (2035)					
Pocket	Type	Capacity (MW)	Scheduled Energy (GWh)	Curtailment (GWh)	Energy Deliverability (%)
W1	Wind	339	962	2	100%
	Solar	2,030	4,018	410	90%
W2	Wind	1,476	4,159	107	97%
	Solar	60	95	1	99%
W3	Wind	894	2,529	136	95%
	Solar	480	799	46	94%
X1	Hydro	1155	7,397	517	93%
	HQ Imports	1,930	10,727	799	93%
	Wind	977	2,613	265	90%
	Solar	1,308	2,574	225	91%
X2	Hydro	252	1,238	163	87%
	Wind	505	1,387	107	92%
	Solar	244	454	68	85%
X3	Hydro	224	657	38	94%
	Wind	80	218	16	93%
	Solar	469	879	26	97%
Y1	Hydro	32	100	7	93%
	Wind	74	182	7	96%
	Solar	1,700	3,305	269	92%
Y2	Hydro	39	102	10	90%
	Wind	-	-	-	-
	Solar	290	512	13	98%
Z1	Wind	691	1,894	29	98%
	Solar	927	1,706	31	98%
Z2	Wind	213	702	0	100%
	Solar	205	389	21	94%
Z3	Wind	76	189	8	96%
	Solar	290	540	20	96%

Higher Demand Case (2035)					
Pocket	Type	Capacity (MW)	Scheduled Energy (GWh)	Curtailment (GWh)	Energy Deliverability (%)
W1	Wind	1,001	3,049	491	84%
	Solar	2,030	4,018	311	92%
W2	Wind	1,959	5,477	243	96%
	Solar	60	95	2	97%
W3	Wind	917	2,593	145	94%
	Solar	480	799	59	93%
X1	Hydro	1,155	7,397	229	97%
	HQ Imports	1,930	10,727	450	96%
	Wind	977	2,613	164	94%
	Solar	1,396	2,752	131	95%
X2	Hydro	252	1,238	81	93%
	Wind	583	1,604	70	96%
	Solar	250	465	39	92%
X3	Hydro	224	657	17	97%
	Wind	932	2,407	2	100%
	Solar	469	879	25	97%
Y1	Hydro	32	100	4	96%
	Wind	324	889	4	100%
	Solar	1,700	3,305	219	93%
Y2	Hydro	39	102	7	93%
	Wind	151	505	0	100%
	Solar	290	512	18	97%
Z1	Wind	691	1,894	21	99%
	Solar	927	1,706	51	97%
Z2	Wind	213	702	0	100%
	Solar	205	389	19	95%
Z3	Wind	183	476	4	99%
	Solar	290	540	16	97%