

***NY-Sun Solar Photovoltaic Program Impact  
Evaluation for Systems Installed April 1, 2018  
through March 31, 2021***

***Appendices***

Prepared for:

**New York State Energy Research and Development Authority**  
Albany, NY

Dana Nilsson  
Senior Project Manager, NYSERDA

Prepared by:

**DNV**

Corporate Headquarters: Katy, TX  
Michelle Bruchs, Sr. Consultant, DNV  
Dale Tutaj, Sr. Engineer, DNV



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## Appendix A: Additional annual impact results

This section includes the annual impact results by region, purchase type, and module family. Some of these segments have poor relative precision with wide confidence intervals, making it difficult to assess trends in the results.

**Table A-1. Annual impact results by region**

Region		Sample Complete	Capacity Factor	Capacity Factor Relative Precision	Realization Rate	Realization Rate Relative Precision
Below 200 kW	Con Ed	21	12.6%	4.6%	100.5%	8.8%
	Long Island	2	15.3%	13.5%	111.5%	7.3%
	Upstate	11	12.5%	10.0%	108.8%	7.6%
≥ 200 to <750 kW	Con Ed	3	13.2%	3.3%	98.3%	3.3%
	Long Island	-	-	-	-	-
	Upstate	1	10.8%	0.0%	80.6%	0.0%
≥ 750 kW	Con Ed	1	11.2%	0.0%	86.1%	0.0%
	Long Island	-	-	-	-	-
	Upstate	92	12.7%	1.0%	94.2%	1.2%
<b>Overall</b>		131	12.7%	1.7%	96.5%	1.7%

**Table A-2. Annual impact results by purchase type**

Purchase Type		Sample Complete	Capacity Factor	Capacity Factor Relative Precision	Realization Rate	Realization Rate Relative Precision
Below 200 kW	Lease	11	11.7%	10.6%	115.5%	7.9%
	PPA	4	12.3%	11.5%	103.3%	13.4%
	Purchase	19	13.2%	5.2%	100.5%	7.6%
≥ 200 to <750 kW	Lease	1	13.1%	0.0%	97.8%	0.0%
	PPA	1	10.8%	0.0%	80.6%	0.0%
	Purchase	2	13.2%	5.2%	98.5%	5.2%
≥ 750 kW	Lease	21	12.7%	1.7%	95.1%	1.7%
	PPA	58	12.7%	1.3%	93.4%	1.5%
	Purchase	14	13.0%	2.6%	95.7%	3.7%
<b>Overall</b>		131	12.7%	1.7%	96.5%	1.7%

**Table A-3. Annual results by module type**

Module Type		Sample Complete	Capacity Factor	Capacity Factor Relative Precision	Realization Rate	Realization Rate Relative Precision
Below 200 kW	Thin Film	1	11.2%	0.0%	90.5%	0.0%
	Monocrystalline	29	13.0%	4.2%	103.9%	7.6%
	Polycrystalline	4	11.4%	23.6%	105.7%	11.5%
≥ 200 to <750 kW	Thin Film	-	-	-	-	-
	Monocrystalline	1	13.1%	0.0%	97.8%	0.0%
	Polycrystalline	3	12.3%	10.8%	91.6%	10.8%
≥ 750 kW	Thin Film	19	13.1%	2.1%	96.1%	3.1%
	Monocrystalline	45	12.7%	1.3%	93.8%	1.6%
	Polycrystalline	29	12.5%	2.0%	93.4%	2.0%
<b>Overall</b>		131	12.7%	1.7%	96.5%	1.7%

## Appendix B: Coincident peak impact results with localities

This section provides evaluated historical summer coincident peak impacts for the NYCA and localities. Table B-1 provides the summer coincident peak (MW) and corresponding capacity factor for the peak period. The peak hours are provided by the New York State Reliability Council for 2018–2022.<sup>1-2-3-4-5</sup> The relative precision for some peak hours and load zones is poor with wide confidence intervals. This is due to a limited number of projects (or no projects) having viable data. Additionally, the number of projects within a load zone varies across years as some projects were not completed until later in the evaluation period or had limited data. This analysis could only use production data from projects with hourly interval production data.

**Table B-1. Summer coincident peak impacts by NYISO control area load zones**

Year	Load Zones	Date	Hour Ending	Summer Coincident Peak (MW)	Summer Coincident Capacity Factor	Relative Precision @90%	Population Size (N)	Sample Size (n)
2018	NYCA	8/19/2018	17	526.9	50.9%	12.5%	30,746	11
	GHIJ	9/6/2018	16	238.2	60.6%	2.0%	22,219	2
	J	9/6/2018	17	79.0	60.7%	0.0%	14,344	1
	K	8/29/2018	17	0.0	0.0%	0.0%	3,309	-
2019	NYCA	7/20/2019	17	585.0	56.5%	3.8%	30,746	28
	GHIJ	7/17/2019	18	157.0	40.0%	8.5%	22,219	5
	J	7/17/2019	18	57.0	43.8%	5.9%	14,344	2
	K	7/21/2019	18	0.0	0.0%	0.0%	3,309	-
2020	NYCA	7/27/2020	18	480.4	46.4%	8.7%	30,746	67
	GHIJ	7/28/2020	15	147.4	37.5%	18.3%	22,219	25
	J	7/28/2020	16	40.6	31.2%	83.9%	14,344	2
	K	7/28/2020	16	0.0	0.0%	0.0%	3,309	-

<sup>1</sup> 2018 Peak Dates & Times, 2018 NYSRC Fall Forecast Update, & 2019 ICAP Forecast Schedules, September 18, 2018: [www.nyiso.com/documents/20142/2561845/2018\\_LFTF\\_Schedules\\_V2.pdf/96f0630a-827f-aec1-51ee-93598a3de1f6](http://www.nyiso.com/documents/20142/2561845/2018_LFTF_Schedules_V2.pdf/96f0630a-827f-aec1-51ee-93598a3de1f6)

<sup>2</sup> 2019 Peak Dates & Times, 2019 NYSRC Fall Forecast Update, & 2020 ICAP Forecast Schedules, August 30, 2019: [www.nyiso.com/documents/20142/8115627/2019\\_LFTF\\_Schedules.pdf/5a1bd9b3-ca30-9ac2-eb36-933ea8fed273](http://www.nyiso.com/documents/20142/8115627/2019_LFTF_Schedules.pdf/5a1bd9b3-ca30-9ac2-eb36-933ea8fed273)

<sup>3</sup> 2020 Peak Dates & Times, 2019 NYSRC Fall Forecast Update, & 2021 ICAP Forecast Schedules, August 24, 2020: [www.nyiso.com/documents/20142/14730608/02%202020\\_Peak\\_NYSRC\\_ICAP\\_Schedules.pdf/744c6ff4-a724-85e3-0b7f-037b40bd9992](http://www.nyiso.com/documents/20142/14730608/02%202020_Peak_NYSRC_ICAP_Schedules.pdf/744c6ff4-a724-85e3-0b7f-037b40bd9992)

<sup>4</sup> 2021 Peak Dates & Times (Updated), 2022 NYSRC Fall Forecast Update, & 2022 ICAP Forecast Schedules, August 30, 2021: [www.nyiso.com/documents/20142/24021175/2021\\_Peak\\_NYSRC\\_ICAP\\_Schedules\\_PeakUpdate.pdf/942bcd2a-3961-fd27-3a8b-cc31f5086912](http://www.nyiso.com/documents/20142/24021175/2021_Peak_NYSRC_ICAP_Schedules_PeakUpdate.pdf/942bcd2a-3961-fd27-3a8b-cc31f5086912)

<sup>5</sup> 2022 Peak Dates & Times, & 2023 IRM and ICAP Forecast Schedules, August 26, 2022: [www.nyiso.com/documents/20142/32974180/2023\\_IRM\\_ICAP\\_Schedules.pdf/06890138-b486-3303-e8e9-4beb9c48896a](http://www.nyiso.com/documents/20142/32974180/2023_IRM_ICAP_Schedules.pdf/06890138-b486-3303-e8e9-4beb9c48896a)

Year	Load Zones	Date	Hour Ending	Summer Coincident Peak (MW)	Summer Coincident Capacity Factor	Relative Precision @90%	Population Size (N)	Sample Size (n)
2021	NYCA	8/26/2021	17	559.0	54.0%	3.7%	30,746	90
	GHIJ	8/12/2021	17	237.1	60.4%	3.7%	22,219	37
	J	8/27/2021	15	63.3	48.6%	30.8%	14,344	3
	K	8/27/2021	17	0.0	0.0%	0.0%	3,309	-
2022	NYCA	7/20/2022	18	546.3	52.8%	2.5%	30,746	86
	GHIJ	8/9/2022	18	178.1	45.3%	4.7%	22,219	37
	J	8/9/2022	17	70.9	54.5%	16.3%	14,344	3
	K	8/9/2022	18	0.0	0.0%	0.0%	3,309	-

## Appendix C: Prototype SAM models

Prototype SAM models were used for developing weather normalization factors. The model assumptions are intended to be representative of a typical system as a basis for comparing production from each year relative to a typical meteorological year. Table C-1 provides the model components used in each of the three prototype models (residential, small commercial, large commercial & industrial).

**Table C-1. SAM prototype model characteristics**

Model Component	Input Parameter	Residential	Small Commercial	Large Commercial & Industrial
Location and Resource	Albedo	weather file	weather file	weather file
	Sky diffuse model	Perez	Perez	Perez
	Weather file irradiance	DNI and DHI	DNI and DHI	DNI and DHI
Equipment	Module	CSI Solar Co. Ltd. CSR-380MS-HL	CSI Solar Co. Ltd CS3N-380MS [Blk]	CSI Solar Co. Ltd. CS6P-255P
	Inverter	ABB: PVI-3.0 OUTD-S-US-A(240V)	CSI-50KTL-GS-FLB (480V)	Ingecon Sun 1000TL U B360 (360V)
	Type of inverter	single phase string	3-phase string	central
System Design	System Rated DC Power (kW)	5.3	180.5	5,078
	Number of inverters	2	3	5
	Modules per string	7	19	21
	Strings in parallel	2	25	950
	Tracking	fixed	fixed	fixed
	Tilt	26.6° (6/12)	10°	latitude
	Azimuth	225	195	180
	Ground cover ratio	0.5	0.5	0.3
Total module area (used with POA) m <sup>2</sup>	28	936	30,903	

## Appendix D: Weather normalization factors

Table D-1 provides the annualized weather normalization factors by city. The normalization factors shown here are weighted by monthly production to calculate values for each calendar year. For the weather normalization, the calibration factors are applied at the monthly interval. There are three different prototype models for which calibration factors have been developed (residential, small commercial, and large commercial & industrial). A value of 1.00 indicates that the production for that year is the same as TMY. A value less than 1.00 indicates that production for that year was greater than TMY. Similarly, a value greater than 1.00 indicates that the production was less than TMY.

**Table D-1. Weather normalization factor by city, prototype model and year**

City	Residential				Small Commercial				Large Commercial & Industrial			
	2018	2019	2020	2021	2018	2019	2020	2021	2018	2019	2020	2021
Altamont	0.94	0.99	1.01	0.99	0.93	0.98	1.01	0.99	0.93	1.00	1.00	1.00
Amsterdam	0.96	0.99	1.00	0.96	0.96	0.99	0.99	0.95	0.95	1.00	0.99	0.97
Batavia	1.00	1.01	0.99	0.99	1.00	1.03	0.99	0.98	1.00	1.03	1.00	1.00
Beacon	0.91	0.96	0.96	0.94	0.92	0.97	0.96	0.94	0.90	0.97	0.95	0.94
Beaver Dams	0.95	0.97	0.96	0.94	0.96	0.97	0.97	0.94	0.96	0.98	0.98	0.96
Brier Hill	0.97	0.98	0.95	0.96	0.98	0.98	0.96	0.96	0.96	0.99	0.94	0.97
Bronx	0.89	0.93	0.94	0.95	0.90	0.94	0.94	0.96	0.89	0.94	0.93	0.96
Brooklyn	0.90	0.92	0.94	0.95	0.90	0.93	0.94	0.95	0.89	0.93	0.93	0.95
Buchanan	0.93	0.97	0.98	0.98	0.93	0.97	0.98	0.98	0.92	0.97	0.97	0.98
Caledonia	1.00	1.01	0.99	1.00	0.99	1.02	0.98	0.98	1.00	1.02	1.00	1.00
Callicoon	0.95	1.00	1.01	0.98	0.96	1.00	1.00	0.98	0.94	1.00	1.00	0.99
Cambria Heights	0.94	0.96	0.97	0.99	0.95	0.96	0.96	0.99	0.94	0.97	0.96	0.99
Canandaigua	1.00	1.03	1.00	1.00	1.00	1.04	1.00	0.98	1.00	1.03	1.01	0.99
Canastota	0.96	0.96	0.96	0.94	0.96	0.95	0.96	0.94	0.95	0.96	0.96	0.95
Castle Creek	0.95	0.97	0.97	0.96	0.95	0.97	0.97	0.96	0.94	0.97	0.97	0.96
Chester	0.93	0.98	0.98	0.96	0.94	0.98	0.97	0.96	0.92	0.98	0.97	0.97
Colden	0.99	1.02	0.99	1.00	0.99	1.03	0.99	0.99	0.99	1.03	1.01	1.00
Delmar	0.94	0.98	0.97	0.95	0.94	0.98	0.97	0.95	0.92	0.99	0.96	0.96
Dix Hills	0.93	0.95	0.94	0.97	0.94	0.95	0.94	0.97	0.92	0.96	0.93	0.98
Dover Plains	0.95	0.99	0.97	0.96	0.95	0.99	0.97	0.96	0.93	0.99	0.96	0.96
Dryden	0.99	1.00	1.00	0.98	0.99	0.99	1.00	0.97	0.99	1.01	1.00	0.99
East Amherst	1.00	1.02	1.00	1.00	1.00	1.03	0.99	0.99	0.99	1.03	1.01	1.01
East Aurora	1.01	1.03	1.00	1.01	1.01	1.04	1.00	0.99	1.01	1.04	1.02	1.01
East Meadow	0.94	0.95	0.95	0.98	0.94	0.96	0.95	0.98	0.93	0.97	0.95	0.98
Ellenville	0.91	0.96	0.97	0.94	0.92	0.97	0.97	0.94	0.90	0.97	0.96	0.95
Flushing	0.89	0.93	0.94	0.95	0.90	0.93	0.94	0.95	0.88	0.93	0.93	0.95
Greenville	0.96	0.98	0.98	0.96	0.95	0.98	0.98	0.96	0.94	0.98	0.97	0.96
Hilton	0.90	0.91	0.93	0.92	0.91	0.93	0.94	0.92	0.89	0.90	0.94	0.92
Hopewell Junction	0.92	0.96	0.95	0.93	0.93	0.97	0.95	0.93	0.90	0.96	0.94	0.94

City	Residential				Small Commercial				Large Commercial & Industrial			
	2018	2019	2020	2021	2018	2019	2020	2021	2018	2019	2020	2021
Hudson	0.95	0.98	0.96	0.96	0.95	0.99	0.97	0.96	0.94	0.99	0.96	0.96
Hyde Park	0.94	0.99	0.97	0.95	0.94	0.99	0.97	0.95	0.93	0.99	0.96	0.96
Jamaica	0.90	0.92	0.93	0.95	0.92	0.93	0.94	0.95	0.90	0.94	0.93	0.96
Johnstown	0.98	1.00	1.01	0.96	0.97	1.00	1.00	0.96	0.97	1.01	1.01	0.98
Kingston	0.91	0.95	0.95	0.93	0.92	0.96	0.95	0.93	0.90	0.96	0.94	0.93
Lewiston	0.96	1.00	0.97	0.99	0.97	1.02	0.97	0.98	0.97	1.01	0.98	1.00
Liberty	0.95	0.99	0.99	0.97	0.96	0.99	0.98	0.96	0.94	1.00	0.98	0.98
Lockport	0.98	1.01	0.99	0.99	0.98	1.02	0.98	0.98	0.97	1.00	0.99	0.99
Lowman	0.97	1.00	0.99	0.98	0.97	1.00	1.00	0.97	0.97	1.01	1.00	0.99
Malone	0.98	1.00	0.96	0.96	0.99	1.00	0.96	0.96	0.97	1.01	0.96	0.98
Medina	0.99	1.02	0.99	1.00	0.99	1.03	0.99	0.99	1.00	1.03	1.00	1.01
Medusa	0.96	0.99	0.98	0.95	0.96	0.99	0.98	0.95	0.95	1.00	0.98	0.96
Middletown	0.92	0.97	0.97	0.95	0.92	0.97	0.96	0.94	0.90	0.97	0.95	0.95
Minisink	0.92	0.98	0.97	0.95	0.93	0.98	0.97	0.95	0.91	0.98	0.96	0.96
Montgomery	0.92	0.97	0.96	0.94	0.93	0.97	0.96	0.94	0.90	0.97	0.95	0.95
Monticello	0.93	0.99	0.98	0.96	0.94	0.98	0.98	0.96	0.91	0.98	0.96	0.97
Mooers Forks	0.99	1.01	1.02	0.96	1.00	1.00	0.97	0.95	0.98	1.01	0.95	0.97
Narrowsburg	0.93	0.94	0.95	0.97	0.94	0.98	0.98	0.97	0.92	0.98	0.97	0.98
New Windsor	0.87	0.96	0.95	0.91	0.89	0.94	0.95	0.91	0.86	0.93	0.94	0.91
Newfield	0.97	1.00	0.99	0.97	0.97	0.98	0.98	0.96	0.96	0.98	0.98	0.97
Nichols	0.94	0.99	0.98	0.97	0.95	0.96	0.98	0.97	0.94	0.98	0.98	0.98
North Creek	0.98	1.01	1.00	0.93	0.98	1.00	0.98	0.93	0.97	1.01	0.97	0.94
Norwich	0.99	1.06	1.06	0.97	0.99	1.00	1.00	0.96	0.98	1.01	1.00	0.98
Ogden	0.97	1.05	1.00	0.97	0.97	1.00	0.97	0.96	0.97	1.00	0.99	0.99
Olean	0.98	1.02	1.00	0.97	0.97	1.05	0.99	0.95	0.98	1.05	1.02	0.97
Oppenheim	0.98	1.00	1.01	0.96	0.98	0.99	1.01	0.95	0.98	1.01	1.02	0.98
Otisville	0.94	1.04	1.03	0.97	0.95	1.00	0.99	0.97	0.93	1.00	0.98	0.98
Owego	0.95	0.98	0.98	0.96	0.96	0.98	0.99	0.96	0.95	0.99	0.99	0.98
Palenville	0.95	0.92	0.92	0.94	0.95	0.99	0.96	0.94	0.93	0.98	0.94	0.94
Pine Bush	0.92	0.92	0.92	0.94	0.93	0.97	0.96	0.94	0.90	0.97	0.95	0.94
Poland	1.00	1.05	1.05	0.96	1.00	1.00	1.02	0.95	0.98	1.00	1.01	0.96
Port Jervis	0.93	0.92	0.93	0.96	0.94	0.99	0.98	0.96	0.92	1.00	0.97	0.97
Poughkeepsie	0.93	0.97	0.95	0.95	0.94	0.98	0.96	0.95	0.91	0.97	0.95	0.95
Queens	0.92	0.99	0.98	0.97	0.92	0.95	0.95	0.97	0.91	0.95	0.94	0.97
Queens Village	0.94	0.92	0.93	0.99	0.94	0.96	0.96	0.99	0.93	0.97	0.95	0.99
Red Hook	0.95	0.91	0.91	0.94	0.95	0.98	0.96	0.94	0.94	0.98	0.95	0.95
Rochester	0.95	0.97	0.99	0.96	0.95	0.93	0.95	0.95	0.94	0.93	0.93	0.97
Rome	0.97	0.96	0.97	0.95	0.97	0.97	0.97	0.94	0.96	0.98	0.96	0.95
Saint Johnsville	0.98	1.10	1.08	0.97	0.99	1.01	1.01	0.96	0.98	1.02	1.01	0.98
Sandy Creek	0.96	0.99	0.99	0.96	0.97	0.96	0.98	0.96	0.96	0.97	0.98	0.98
Schaghticoke	0.92	1.02	1.01	0.94	0.93	0.97	0.98	0.94	0.91	0.97	0.97	0.94
Schenectady	0.95	0.97	0.97	0.94	0.95	0.97	0.97	0.94	0.93	0.97	0.96	0.95
Sidney	0.97	0.95	1.00	0.97	0.98	0.99	1.00	0.96	0.96	1.00	1.00	0.98
Spencer	0.95	1.03	1.03	0.96	0.96	0.98	0.97	0.95	0.95	0.98	0.97	0.97
Thompson	0.93	0.96	0.94	0.96	0.93	0.98	0.97	0.96	0.91	0.98	0.95	0.97

City	Residential				Small Commercial				Large Commercial & Industrial			
	2018	2019	2020	2021	2018	2019	2020	2021	2018	2019	2020	2021
Tonawanda	0.97	1.05	0.99	0.97	0.97	1.01	0.96	0.96	0.96	0.99	0.96	0.96
Valatie	0.96	1.06	1.05	0.97	0.96	0.99	0.98	0.97	0.95	0.99	0.97	0.98
Walden	0.92	0.96	0.97	0.94	0.93	0.97	0.96	0.94	0.91	0.97	0.96	0.95
Wales	1.01	1.09	1.04	1.02	1.01	1.05	1.01	1.00	1.02	1.05	1.03	1.02
Wappinger	0.92	0.94	0.94	0.95	0.93	0.98	0.97	0.95	0.91	0.97	0.96	0.95
Watertown	0.98	1.02	1.02	0.98	1.00	0.99	0.99	0.98	0.98	0.99	0.98	0.99
Wawayanda	0.92	0.92	0.93	0.95	0.93	0.98	0.97	0.95	0.91	0.98	0.97	0.96
Webster	0.97	1.01	0.96	0.98	0.98	1.02	0.98	0.97	0.97	1.00	0.98	0.98
Westerlo	0.97	0.96	0.92	0.95	0.97	0.99	0.98	0.95	0.96	1.00	0.98	0.96
Westtown	0.92	0.94	0.94	0.95	0.93	0.98	0.97	0.95	0.91	0.98	0.97	0.97
White Plains	0.93	0.93	0.94	0.99	0.94	0.97	0.97	0.99	0.93	0.98	0.96	1.00
Whitehall	0.99	1.03	1.02	0.94	0.99	1.01	0.98	0.94	0.98	1.02	0.98	0.96
Williamson	0.98	1.06	1.01	0.98	0.99	1.02	0.99	0.97	0.99	1.01	1.00	0.99
Yonkers	0.91	0.92	0.94	0.96	0.92	0.95	0.95	0.96	0.90	0.95	0.94	0.97