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

Final Report

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Notice

Objective	Purpose	Method
		impacts to the program population and calculate realization rates.
Capacity Factor (%)	Determine the ratio of actual output over a period of time (including variations due to weather) to potential output if it were possible for the system to operate at full nameplate capacity continuously over the same period of time.	Calculate site-level capacity factors based on available nameplate and weather normalized first-year production data. Expand site-level results to population.
Summer Peak Coincident Demand Impact (kW)	Provide verified gross impacts for the program overall, including: • Verified gross summer peak coincident demand production (kW) • Verified gross summer peak capacity factor	Calculate site-level impacts for historical summer coincidence peak periods. Calculate capacity factors based on available nameplate and production data for peak periods. Expand site-level results to population.
Performance Model Data	Develop weather normalization factors using National Renewable Energy Laboratory (NREL) System Advisor Model (SAM)	Develop prototype systems. Calculate monthly production for each location and prototype model. Calculate typical meteorological year production for each location and prototype. Determine monthly weather normalization factors.
System characteristics	Identify technology and system characteristics for assessing system performance: • Array type (tracking and fixed) • Module family (monocrystalline, polycrystalline, and thin film) • Module configuration (Bifacial and monofacial) • Inverter type (string and microinverter)	Collect make and model for modules and inverters. Conduct contractor interviews. Identify technology features.
Disadvantaged Communities (DACs)[a]	Identify projects in DACs for assessing system performance.	Assign DAC designation to the sample frame.
Precision	Design samples to meet but not exceed a target of 10% precision level for program gross energy production at 90% confidence.	Collect population tracking data from NY-Sun database.

[a] Using the Climate Justice Working Group criteria released on March 27, 2023: https://www.nyserda.ny.gov/ny/Disadvantaged-Communities

2 Findings, results, and recommendations

2.1 Data collection results

NYSERDA's goal for this evaluation was to achieve an estimate of production capacity factors with ±10% relative precision at 90% confidence (90/10 precision) for the program. Four primary segments were assessed: region (Con Ed, Long Island, and Upstate), purchase type (lease, PPA, and purchase), system size (below 200 kW, 200 kW–<750 kW, and ≥750 kW), and customer sector (residential and non-residential). In addition to the primary segments, the evaluation team analyzed production data for various system technologies and projects located in Disadvantaged Communities. Prior evaluations did not study performance by system technology and DAC designation.

The NY-Sun program population and sample of first-year production data collection are shown in Table 2-1. To achieve target precisions across the program, the evaluation selected a sample of 125 sites from a sample frame of 30,783 unique records.

For the purposes of this evaluation, a "project" is defined as a single installed solar PV system enrolled through NY-Sun with a completed project date within the study period. Individual premises may host multiple program projects, such as when multiple solar PV systems are installed at a single address. The evaluated sample size, in some instances, exceeds the target sample due to data collection including back-up sample sites to account for unavailable data. The evaluation team also added projects that are identified as being located in a DAC and available in the Distributed Generation (DG) Integrated Database.[3]

[3] NYSERDA Distributed Energy Resources, Performance Data: https://der.nyserda.ny.gov/data/performance/

Table 2-1. NY-Sun evaluation data collection results

Region	System Size (kW)	Purchase Type	NY-Sun Population (N)	Target Sample	Evaluated Sample (n)
Con Ed	Below 200 kW	Lease	6,722	10	5
		PPA	1,649	4	4
		Purchase	8,410	16	12
	≥ 200 to <750 kW	All	41	0	3
	≥ 750 kW	All	12	1	1
Upstate	Below 200 kW	Lease	1,572	9	6
		PPA	527	1	0
		Purchase	9,123	31	5
	≥ 200 to <750 kW	All	87	0	1
	≥ 750 kW	All	216	39	92
Long Island	Below 200 kW	Lease	14	0	0
		PPA	14	1	0
		Purchase	2,354	13	2
	≥ 200 to <750 kW	All	39	0	0
	≥ 750 kW	All	3	0	0
Overall			**30,783**	**125**	**131**

Table 2-2 shows data collection results by DAC designation and technology. For some categories, system performance could not be assessed due to the limited number of projects in the evaluation period. Additionally, array type was largely unknown for the sample frame. When available, the array type was collected from contractors.

Table 2-2. NY-Sun evaluation data collection results by DAC designation and technology

Parameter	Category	NY-Sun Population Size (N)	Target Sample	Evaluated Sample (n)
DAC designation	DAC	8,090	26	42
	Non-DAC	22,693	99	89
	Overall	30,783	125	131
Array type	Fixed[a]	847	14	38
	Tracking[b]	5	4	0
	Unknown	29,930	106	92
	Overall	30,783	125	131
Module family	Monocrystalline	26,539	93	75
	Polycrystalline	2,196	20	36
	Thin film	224	0	20
	Unknown	1,824	12	0
	Overall	30,783	125	131
Module configuration[c]	Monofacial	28,921	125	128
	Bifacial	79	26	21
	Unknown	1,824	0	0
	Overall	30,824	151	149
Inverter type	Microinverter	16,314	50	24
	String/central	14,462	75	107
	Unknown	7	0	0
	Overall	30,783	125	131

[a] Includes fixed ground mount, fixed parking canopy, and fixed rooftop, and fixed roof canopy.

[b] Includes single axis tracking and dual axis tracking.

[c] For the evaluation period, 38 bifacial projects were identified. Additional projects completed through 2021 were included to better study this technology. These additional projects and period are not included in the discussion of the evaluation period performance.

The evaluation team collected production data for Residential and Small Commercial Program projects from installation contractors. A total of 13 contractors representing 35 projects across all sizes and sectors provided viable data for use in the evaluation. There were 21 companies from which the evaluation team was unable to collect data. Three were unable to provide production data because sampled systems did not have monitoring capabilities. One contractor was unable to identify the site within their database. Three contractors demonstrated intent to provide production data but later became unresponsive. A total of 14 contractors either did not respond or were otherwise unable to provide production data for the requested site(s).

For the sample of 96 Commercial and Industrial Program sites, the evaluation team primarily collected production data from the Distributed Generation (DG) Integrated Database. One project was not available in the DG Integrated Database; in this case the evaluation team collected production data from the contractor.

2.1.1 File review results

The evaluation team collected production data for a total of 131 projects. Contractors provided data for two additional projects, but these were suspected to be for the incorrect project and therefore could not be used in the analysis. Of the 131 viable projects, 33 (25%) were flagged for additional file review due to the capacity factor being outside of a typical range.[4] Table 2-3 shows resolutions from file reviews of sites with capacity factor discrepancies.

Table 2-3. File review disposition

Discrepancy Category	File Review Disposition	Count of Projects Reviewed	Percent of Total File Reviews	Percent of Evaluated Sample
Normal	Within ±4% of reported production	8	24%	6%
Low Production	Shading (persistent)	2	6%	2%
	Persistent low performance, more than 10% below reported production	1	3%	1%
High Production	Installed system larger than reported	1	3%	1%
	Persistent high performance, ≥±4% <±10% of reported production	11	33%	8%
	Persistent high performance, more than 10% above reported production	6	18%	5%
Data Inconsistency	Connectivity issue	4	12%	3%
Overall		33	100%	25%

2.1.1.1 Projects flagged for review

The evaluation found a significant decrease in the percentage of projects that were flagged for detailed review compared to the most recently completed impact evaluation (25% versus 39%, respectively).

2.1.1.2 Projects flagged for low production

The percentage of total projects identified as low production projects dropped dramatically, from 20% to 2%. This suggests that systems are performing more reliably, may be serviced more promptly when needed, have better system design (tilt and orientation), and experience less shading. Only three projects were identified as having low production, two of which were likely due to shading. One project had persistent low production, which was attributed to the system

[4] Sites with capacity factors above 14% or below 9% were flagged for file review. Note that some projects have an expected capacity factor outside of this range, but these projects were included in the file review. The expected production was considered in the review.

design. For that project, the reported Total Solar Resource Fraction (TSRF) was 66, indicating that relatively low performance was expected at the time of the application.[5]

2.1.1.3 Projects flagged for high production

A total of 14% of all evaluated projects were flagged for having high production. One of these projects had a larger system installed than reported, artificially inflating the capacity factor. Eight of the projects that were flagged for review were within 4% of the reported production and considered to be performing in their expected range. The others showed persistent high performance; in most instances, production was within 4% to 10% of the reported estimate.

Out of the 18 projects with high production, 10 were greater than 200 kW (not shown in Table 2-3). The majority of these projects adopted the reported capacity factor as a basis for the reported kWh. Therefore, the reported capacity factor is less likely to represent the system-specific performance. Data inconsistency and connectivity was another issue that was identified. This resulted in missing production data or production data containing erroneous date/time stamps which needed to be accounted for.

2.1.2 Annual impact results

This section provides weather-normalized verified gross impact results of the program, including first-year capacity factors and realization rates. The realization rates are ratios of verified normal-weather gross system production to reported production. For projects below 200 kW, reported production was based on the contractor-provided estimate of system production determined by system models. For projects over 200 kW, reported performance was based on either a fixed capacity factor of 13.4% or a contractor-provided estimate. This is a change from the previous impact evaluation period, where reported production for all projects was based on an assumed capacity factor of 13.4%.

Using the actual production data, the impact evaluation team determined weather-normalized annualized production for each project in the sample. The results of this analysis are displayed in the tables in this section, aggregated by various dimensions and with relative precision.

[5] An efficiency rating accounts for shading, tilt, and orientation of the system design, with an optimal value of 100.

Table 2-4 displays annual impact results by customer sector and overall.

Table 2-4. Annual impact results by customer sector and projects with bifacial panels

Customer Sector	Sample Complete	Capacity Factor	Capacity Factor Relative Precision	Realization Rate	Relization Rate Relative Precision
Below 200 kW – Residential	32	12.8%	6.3%	109.3%	4.6%
Below 200 kW – Non-Residential	2	12.7%	1.8%	89.7%	2.7%
≥ 200 to <750 kW – Non-Residential	4	12.5%	8.6%	93.1%	8.6%
≥ 750 kW – Non-Residential	93	12.7%	1.0%	94.2%	1.2%
Overall	131	12.7%	1.7%	96.5%	1.7%
≥ 750 kW –Non-Residential Bifacial[a]	*21*	*13.6%*	-	*98.4%*	-

[a] The bifacial results shown in this table are not included in the Overall results. The bifacial projects fell outside of the evaluation period and are shown for comparison with the ≥750 kW projects in the evaluation period that are monofacial.

The 90/10 precision target was achieved for each segment. The NY-Sun program overall capacity factor was 12.7%. This result continued the trend of gradually increasing overall capacity factors over time. The 2011–2016 evaluated overall capacity factor was 12.4%, and the 2016–2018 capacity factor was 12.6%. There was not a statistically significant difference across the size and sector categories. The capacity factor for residential projects was 12.8%, an increase from the prior evaluation result of 12.4%, though this increase was not statistically significant. However, to the extent this increase reflects a general improvement across the population, it may be the result of microinverters, discussed later in this section and shown in Table 2-6. Another contributing factor may be increased program activity in locations with higher annual solar insolation or differences in TMY weather used in the evaluation and by the contractors. Comparing the residential projects to the ≥750 kW projects, the residential projects have about 2.1% more solar insolation. This factor was not studied in the 2016–2018 impact evaluation, so it could not be compared. Trends in project locations and solar irradiance should be considered in future evaluations.

2.1.2.1 Residential project impacts

The realization rate for residential systems was 109.3%, with a confidence interval of 104% to 114%. This suggests that contractor-modeled production had been underestimated. For comparison, the 2016–2018 impact evaluation had a realization rate of 101.6% with a confidence interval of 98% to 105%. This evaluation found a capacity factor of 11.9%, down slightly from

12.1% in the prior evaluation. This result means that modeled production decreased slightly while evaluated production increased. One factor that might have contributed to changes in realization rates is the source of the weather data used in modeling systems. The evaluation team used current TMY data provided by the National Solar Radiation Database.[6] Some of the earlier projects had an application date of 2016 and likely used different TMY data for modeling.

2.1.2.2 Non-residential project impacts

The non-residential projects <200 kW saw the lowest realization rates. This sector dropped the most from the prior evaluation (95.7% versus 89.7%). However, this segment had only two projects that were evaluated, representing about 5% of the total population installed capacity. Similarly, the 200–750 kW segment had only four projects evaluated, making up about 6% of the total population installed capacity. This segment had the lowest capacity factor at 12.5%. However, it did not have a significant impact on the program's overall capacity factor.

The capacity factor for large sites (≥750 kW) stayed consistent with the prior evaluations (≥ 200 kW) at 12.7%. The prior evaluation did not differentiate between 200–750 kW and ≥750 kW projects. In this evaluation, the realization rates for 200–750 kW projects were lower than for the ≥750 kW projects. However, there were only four projects 200–750 kW. In the 2016–2018 evaluation, the realization rate was 94.6%. This is comparable to the ≥750 kW projects analyzed in this evaluation, which includes the majority of the installed kW for projects ≥ 200 kW. The ≥750 kW projects achieved a 94.2% realization rate.

2.1.2.3 Bifacial project impacts

There were very few bifacial projects during the evaluation period with sufficient data. However, this technology has been increasingly implemented over time. To assess the performance of bifacial projects, the evaluation team expanded the evaluation period to include bifacial projects that were completed through 2021, thus allowing an increase in the bifacial sample size. The evaluation team assessed 21 projects with bifacial panels. These 21 projects had an overall capacity factor of 13.6%. The bifacial projects were all greater than 750 kW and account for 78% of the installed bifacial capacity during the expanded period. For the purposes of comparison, this technology can be compared to the Non-Residential ≥ 750 kW projects from the evaluation

[6] National Solar Radiation Database (NSRDB), https://nsrdb.nrel.gov/

period. That segment had a capacity factor of 12.7%. The bifacial capacity factor from the current evaluation was about 7% higher than the Non-Residential ≥ 750 kW group from the prior evaluation, which represents a statistically significant difference in capacity factor. This evaluation found a realization rate for bifacial projects of 98.4%.

The evaluation team compared results by region and purchase type, but performance changes across these segments were not necessarily expected. Due to a shift in the population for some groupings, as well as production data availability (shown in Table 2-1), the extent to which regional and purchase type results could be compared was limited. For the groupings that had sufficient data, there were no statistically significant changes in performance. The results are provided in Appendix A.

2.1.2.4 Impacts by DAC designation

Table 2-5 provides annual impact results by DAC designation. The 90/10 capacity factor precision target was achieved for all segments. Although not statistically significant, DAC-located projects below 200 kW had a slightly lower capacity factor that non-DAC located projects. For projects ≥ 750 kW, DAC-located projects had a statistically significant higher capacity factor and realization rates. This was because the projects were located in areas with higher solar insolation (eastern and southern New York) than the non-DAC projects.

Table 2-5. Annual impact results by DAC designation

DAC Designation	Sample Complete	Capacity Factor	Capacity Factor Relative Precision	Realization Rate	Realization Rate Relative Precision
Below 200 kW – DAC	10	12.7%	5.3%	97.6%	11.0%
Below 200 kW – Non-DAC	24	12.8%	7.2%	108.6%	3.9%
≥ 200 to <750 kW – DAC	4	12.5%	8.6%	93.1%	8.6%
≥ 200 to <750 kW – Non-DAC	-	-	-	-	-
≥ 750 kW – DAC	28	13.3%	2.3%	97.3%	2.7%
≥ 750 kW – DAC	65	12.5%	0.9%	92.8%	1.2%
Overall	131	12.7%	1.7%	96.5%	1.7%

2.1.2.5 Impacts by inverter type

The results by inverter types are shown in Table 2-6. The residential string/central inverter category did not meet the 90/10 precision target due to small sample size. The residential sector saw the largest increase in capacity factor from the prior impact evaluation. Microinverters were not studied in the prior evaluation, however, this technology has become more common and may contribute to the increased performance in the residential sector. There was no difference in solar insolation between the residential projects with microinverters and string/central inverters. Microinverters are less efficient than string/central inverters; however, microinverters show better performance than string inverters when part of the system is shaded. Microinverters may also be an advantage when an inverter fails, as only a single panel is impacted instead of the entire system.

Table 2-6. Annual impact results by Inverter type

Inverter Type	Sample Complete	Capacity Factor	Relative Precision	Realization Rate	Realization Rate Relative Precision
Residential Microinverter	23	13.1%	7.0%	110.0%	5.7%
Residential String/central	9	11.9%	14.0%	107.2%	8.0%
Non-Residential Microinverter	-	-	-	-	-
Non-Residential String/central	99	12.7%	1.3%	93.7%	1.6%
Overall	131	12.7%	1.7%	96.5%	1.7%

2.1.2.6 Impacts by module family

This evaluation achieved limited results by module family (thin film, polycrystalline, and monocrystalline) which are included in Appendix A. Monocrystalline panels appear to outperform polycrystalline panels when comparing the averages. If monocrystalline panels are outperforming polycrystalline, it may be due to improved thermal coefficients and high temperature. This effect may be enhanced by urban heat islands. The number of projects containing information about array type (tracking and fixed) was not sufficient to analyze. System performance by array type can and should be assessed in a future evaluation, as the program has begun collecting array type data in more recent program tracking.

2.1.3 Coincident peak impact results

This section provides verified gross summer coincident peak impact results of the program. The peak impacts are historical impacts for specific peak periods and are not weather-normalized. Table 2-7 shows the yearly statewide impacts from 2018 to 2022. Each row is based on the sample of projects that had production data in each period. For most years, the coincident capacity factor was a little over 50%. The capacity factor for periods with hour ending 17 was lower than the average for periods with hour ending 18. This might be due to the solar angle. However, weather and variation in weather across the load zone will also affect the capacity factor. There are no realization rates for peak impacts as these impacts are not reported by the program.

Table 2-7. Summer peak coincidence impacts for NYCA load zone

Year	Date	Hour Beginning	Hour Ending	Sample Complete	Summer Coincident Peak (MW)[a]	Summer Coincident Capacity Factor	Summer Coincident Peak Relative Precision
2018	8/19/2018	16	17	11	527	50.9%	12.5%
2019	7/20/2019	16	17	28	585	56.5%	3.8%
2020	7/27/2020	17	18	67	480	46.4%	8.7%
2021	8/26/2021	16	17	90	559	54.0%	3.7%
2022	7/20/2022	17	18	86	546	52.8%	2.5%

[a] Results are based on the evaluated projects being expanded to all projects in the sample frame regardless of project completion date.

The summer peak coincidence impacts for all load zones are presented in Appendix B.

2.1.4 Findings and recommendations

Estimated production, realization rates, and capacity factors from the impact evaluation of the April 2018–March 2021 NYSERDA Solar PV Program Installations are shown in Table 2-8, by size, customer sector, and overall.

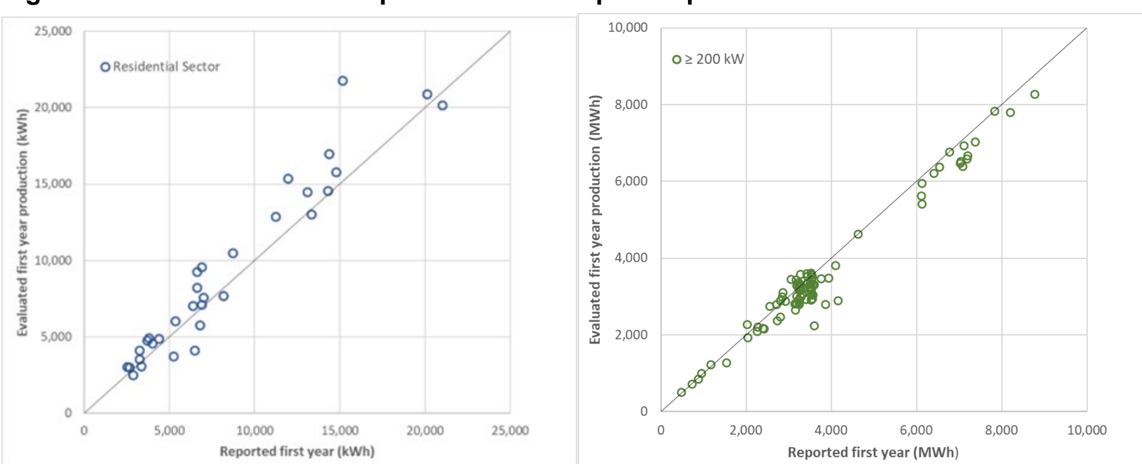
The realization rates were 96.5% for the program overall. This is a decrease from the prior evaluation of 99.2%. The overall decrease is due to a higher percentage of installed capacity being installed at larger projects which tend to use the fixed reporting capacity factor of 13.4%. In the 2016–2018 evaluation, 77% of the installed capacity was in systems less than 200 kW, with 23% installed in systems greater than 200 kW. In the current sample frame, only 26% of the installed capacity was installed in systems less than 200 kW, with 74% of installed capacity in systems greater than 200 kW. The program realized an overall capacity factor of 12.7% during the evaluation period. Though the difference is not statistically significant, the capacity factor was higher than that of the 2016–2018 evaluation result of 12.6%.

Table 2-8. Annual impact results by customer sector

Customer Sector	Sample Frame	Evaluated Sample	Total System Size (MW)	Verified Gross First-year Production (MWh)	Realization Rate	Capacity Factor
Below 200 kW Residential	29,286	32	220	246,049	109.3%	12.8%
Below 200 kW Non-Residential	1,099	2	53	58,819	89.7%	12.7%
≥ 200 to <750 kW Non-Residential	167	4	63	68,696	93.1%	12.5%
≥ 750 kW Non-Residential	231	93	700	780,917	94.2%	12.7%
Overall	30,783	131	1,036	1,154,480	96.5%	12.7%

Figure 2-1 displays plots of evaluated production vs. reported production for sampled projects, as a representation of how well production was estimated by installers. Note that the two plots have different scales: 0 to 25,000 kWh for residential projects and 0 to 10,000 MWh for larger projects. The line in each plot corresponds to a realization rate of 100%. The vertical distance from a point on the plot to the line is the error associated with the reported estimate. Sites above the line have realization rates above 100%, and sites below it have realization rates below 100%.

Figure 2-1. Plots of evaluated production vs. reported production



The residential projects are generally above the line, which is reflected in the realization rate of 109.3%. Only a handful of residential projects showed lower evaluated production than reported production. The 2016–2018 evaluation had more residential projects below the line with some significantly below the line. For the projects greater than 200 kW, most of the projects are slightly below the line. Many of the projects in this segment utilize an assumed capacity factor which overestimates the production on average.

Key findings and recommendations from the impact evaluation are summarized below:

Finding 1: System capacity factors increased compared to the prior evaluation period, with the residential sector seeing the most improvement. Factors contributing to the increase may include technology improvements, improved system maintenance practices, and system design. Additionally, trends in project location and solar irradiance may impact overall performance over time.

Recommendation: Continue to study potential drivers for improvements in performance and normalize performance with solar irradiance.

NYSERDA response to recommendation: ***Implemented. Quantifying improvements in performance attributed to solar irradiance and technology features continue to be a focus, as systems are completed.***

Finding 2: Recently completed PV projects show an increase in the number of bifacial panels being installed. Bifacial panels outperformed monofacial panels for the evaluated projects. Bifacial panels have more surface area and better collect diffused solar radiation. This technology may become more prevalent and drive an increase in NY-Sun's overall performance.

Recommendation: Continue to study bifacial panel technology for performance and cost effectiveness. If the improvement in performance is cost-effective, the program could encourage this technology's implementation.

NYSERDA response to recommendation: ***Implemented. Performance of systems utilizing bifacial panel technology is a focus of ongoing research as these systems are completed.***

Finding 3: This evaluation period saw a dramatic decrease in the percentage of projects flagged for review due to low production. For the few projects that were flagged, the low performance appears to be due to persistent excessive shading or system design (tilt and orientation). This finding diverges from the prior evaluation which found low performance projects had extended periods with low production anomalies.

Recommendation: Future evaluations and persistence studies should assess if this trend continues. If it does continue, the potential factors should be studied, including maintenance practices, system design, technology, and program influence.

NYSERDA response to recommendation: ***Implemented. A persistence study that includes these features is underway.***

3 Methods

This section summarizes the methods employed to collect production data for sampled sites and analyze program performance.

3.1 Data collection

NYSERDA's NY-Sun tracking database in Salesforce provided site-level account information, including installed capacity (kW), application-specific (modeled) production estimations (kWh), Total Solar Resource Fraction (TSRF), array type, system completion date, customer name and contact information, purchase type, installation contractor, and region. The evaluation sample frame was built from project information in this database.

The evaluation team leveraged the Open NY dataset for solar projects to identify additional project information including inverter and panel manufacturer, model, and quantities.[7] Technology type can be identified by cross-referencing manufacturer and model with databases maintained by the California Energy Commission (CEC).[8]

The production data collection effort for this study sought to efficiently coordinate outreach. The objectives of the data collection effort were two-fold:

- Collect production data (in kWh): first-year monthly
- Of lesser priority, the evaluation team sought to complete a short survey with installation contractors to obtain any additional information required to understand the system and production data.

Most of the Large Commercial and Industrial sites with publicly incentivized generation systems provide internet-connected monitoring data to NYSERDA and the public through the DG Integrated Database. Some of the large C&I projects' production data was not available through this resource, in which case site data was collected from the contractor.

[7] Solar Electric Programs Reported by NYSERDA: Beginning 2000, https://data.ny.gov/Energy-Environment/Solar-Electric-Programs-Reported-by-NYSERDA-Beginn/3x8r-34rs

[8] CEC Solar Energy Equipment list: https://www.energy.ca.gov/programs-and-topics/programs/solar-equipment-lists

Residential and small business participating sites' production data was collected through outreach to installation contractors. Follow-up outreach to residential homeowners (for non-responding sites) was deemed unnecessary because data collection from contractors was sufficient to meet precision requirements. The evaluation team had contact information through prior data collection efforts. Contractor contact information in the NY-Sun tracking database and the existing contacts were both utilized.

3.2 Analysis approach

All verified gross impact results for this evaluation were based on the first full 12 months of production data after installation. All results were weather normalized to account for differences in production caused by weather (solar insolation and precipitation) across years of installation.

The analysis of program data included cleaning and annualization of production data, calculation of case weights for expansion of site data to the program population, and ratio estimation to generate capacity factors with appropriate standard errors.

3.2.1 Annual capacity factor

The analysis calculated two key measures of annual performance from the production data for each evaluated site: capacity factor and realization rate.

Capacity factor provides a measure of system performance relative to rated capacity. Capacity factor (CF) for a group of sites is calculated as:

$$CF = \frac{\sum_j^V kWh\_eval_j \times w_j}{\sum_j^V CAP_j \times \ 8{,}760\ hrs \times w_j}$$

Where:

kWh_eval_j	= Evaluated first-year production for system *j* (kWh)
CAP_j	= System rated DC capacity *j*
W_j	= Weighting factor for system j
V	= Evaluation sample

3.2.2 Annual production realization rate

Realization rates (RR) provide the ratio of evaluated production over reported production for first year generation.

$$RR = \frac{\sum_j^V kWh\_eval_j \times w_j}{\sum_j^V kWh\_rep_j \times w_j}$$

Where:

kWh_eval_j = Evaluated first-year production for system j (kWh)

kWh_rep_j = Program production for system j (kWh)

W_j = Weighting factor for system j

V = Evaluation sample

The realization rate, kWh_rep_j, is based on NYSERDA-estimated solar PV system production for purposes of external program-level progress and benefits reporting to the PSC.

3.2.3 Summer coincident peak analysis

The analysis calculated two key metrics of peak period performance from the production data for each evaluated site: coincident peak kW and coincident peak capacity factor. These values are calculated for each peak event and load zone.

Summer coincident peak demand (kW) provides a measure of system performance during the defined period. Peak kW (kW) for a historical peak hour (k) is calculated as:

$$kW_k = \sum_j^V kW_{k}\_eval_j \times w_j$$

Where:

$kW_k\_eval_j$ = Peak Period evaluated production for system j (kW)

W_j = Weighting factor for system j

V = Evaluation sample size

Coincident peak capacity factor provides a measure of system performance at the peak conditions relative to rated capacity. Capacity factor (CF_k) for a historical peak period (k) is calculated similarly to the annual capacity factor as:

$$CF_k = \frac{\sum_j^V kWh_{k}\_eval_j \times w_j}{\sum_j^V CAP_j \times 1\ hr \times w_j}$$

Where:

$kWh_{k}\_eval_j$ = Peak Period evaluated production for system *j* (kWh)

CAP_j = System rated DC capacity *j*

W_j = Weighting factor for system *j*

V = Evaluation sample size

3.2.4 Weighting

The method for calculating the sample weights, w_x , for each sampling cell X is described below. In lay terms, the weight is simply the number of units in the sample frame (N) divided by the number of completed units in the sample (n). The interpretation of the weight is that each completed sample unit represents N/n units in the respective stratum. Projects were stratified by size, with the one exception that the stratum covering projects from 15 kW-1,723 kW was split into three sub-stratum including 15–200 kW, 20–750 kW, and 750–1,723 kW.

The weight W_x for sampling cell X is calculated as:

$$W_x = \frac{N_x}{n_x}$$

Where:

N_x = Number of units of analysis in cell X

n_x = Number of completed sample units of analysis in cell X

For each sampling cell X, all sample units *j* in that sampling cell were assigned the weight W_x for that stratum as their weighting factor W_j.

3.2.5 File reviews

The evaluation team conducted a file and QC data review to determine reasons for capacity factors and realization rates outside of the expected range (capacity factors above 14% or below 9%), and subsequently cleaned the production data. NYSERDA provided applications, site documentation, and QC data for these systems for comparison to collected production data and system details collected through contractor surveys. The team reviewed shading analysis and production estimation files from the system design to both the program-reported generation and the actual generation collected for this study to determine whether inaccurate modeled generation or metered data caused the unreasonably high or low capacity factors.[9] The team also reviewed QA/QC documentation, where available, to determine if differences between the designed and built systems were the source of unreasonably high or low realization rates.

Where file reviews did not illuminate the cause or reasonability of site performance outside of the expected range, the team conducted follow-up phone calls with contractors.

3.2.6 Weather normalization

The evaluation team normalized production and capacity factors for weather differences (solar insolation, temperature, snow, etc.) across installation years. The weather-normalized values represent performance under typical weather conditions and provide a more meaningful basis for comparison against the reported/expected production that was based on modeling.

The normalization approach modeled a set of representative solar PV sites (residential, small commercial and large commercial) in System Advisory Model (SAM) production estimation software using common characteristics and weather data, including solar insolation, wind, and temperature. Snow accumulation impacts are also accounted for in the normalization. The SAM prototype model summary is provided in Appendix C. The ratio of the monthly TMY-estimated production to the estimated production for each month of each year using actual weather data is used as a weather normalization ratio. The observed monthly production quantity for each site is adjusted to TMY conditions by multiplying it by the normalization factor for that corresponding region and month. Weather-normalization factors are provided in Appendix D.

[9] Inaccurate metered data could be caused by metering of multiple projects on a single meter, net metered data, or poorly captured data/meter failure.

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%
Overall		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%
Overall		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%
Below 200 kW Monocrystalline	29	13.0%	4.2%	103.9%	7.6%
Below 200 kW Polycrystalline	4	11.4%	23.6%	105.7%	11.5%
≥ 200 to <750 kW Thin Film	-	-	-	-	-
≥ 200 to <750 kW Monocrystalline	1	13.1%	0.0%	97.8%	0.0%
≥ 200 to <750 kW Polycrystalline	3	12.3%	10.8%	91.6%	10.8%
≥ 750 kW Thin Film	19	13.1%	2.1%	96.1%	3.1%
≥ 750 kW Monocrystalline	45	12.7%	1.3%	93.8%	1.6%
≥ 750 kW Polycrystalline	29	12.5%	2.0%	93.4%	2.0%
Overall	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.[10, 11, 12, 13, 14] 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
2018	GHIJ	9/6/2018	16	238.2	60.6%	2.0%	22,219	2
2018	J	9/6/2018	17	79.0	60.7%	0.0%	14,344	1
2018	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
2019	GHIJ	7/17/2019	18	157.0	40.0%	8.5%	22,219	5
2019	J	7/17/2019	18	57.0	43.8%	5.9%	14,344	2

[10] 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

[11] 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

[12] 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

[13] 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

[14] 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

Year	Load Zones	Date	Hour Ending	Summer Coincident Peak (MW)	Summer Coincident Capacity Factor	Relative Precision @90%	Population Size (N)	Sample Size (n)
2019	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
2020	GHIJ	7/28/2020	15	147.4	37.5%	18.3%	22,219	25
2020	J	7/28/2020	16	40.6	31.2%	83.9%	14,344	2
2020	K	7/28/2020	16	0.0	0.0%	0.0%	3,309	-
2021	NYCA	8/26/2021	17	559.0	54.0%	3.7%	30,746	90
2021	GHIJ	8/12/2021	17	237.1	60.4%	3.7%	22,219	37
2021	J	8/27/2021	15	63.3	48.6%	30.8%	14,344	3
2021	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
2022	GHIJ	8/9/2022	18	178.1	45.3%	4.7%	22,219	37
2022	J	8/9/2022	17	70.9	54.5%	16.3%	14,344	3
2022	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 and 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^2	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 and 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	Res 2018	Res 2019	Res 2020	Res 2021	SC 2018	SC 2019	SC 2020	SC 2021	LC&I 2018	LC&I 2019	LC&I 2020	LC&I 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

City	Res 2018	Res 2019	Res 2020	Res 2021	SC 2018	SC 2019	SC 2020	SC 2021	LC&I 2018	LC&I 2019	LC&I 2020	LC&I 2021
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
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

City	Res 2018	Res 2019	Res 2020	Res 2021	SC 2018	SC 2019	SC 2020	SC 2021	LC&I 2018	LC&I 2019	LC&I 2020	LC&I 2021
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
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