

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

Executive Summary

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Executive summary

This report presents the impact evaluation of solar photovoltaic (PV) projects installed under NYSERDA's NY-Sun program from April 1, 2018 through March 31, 2021. Prior installations under NY-Sun and predecessor programs were evaluated in NYSERDA Solar Photovoltaic Program Impact Evaluations covering the following periods: 2008, 2011–2016, and 2016–2018. Prior Impact Evaluations only reported first-year annual capacity factors. This evaluation has been expanded to include historical summer coincident peak impacts and technology characteristics of installed systems.

Approach

The evaluation team collected and analyzed PV production data for a sample of NY-Sun projects to assess system performance and energy impacts. The evaluation team drew a targeted sample of projects from NY-Sun program tracking data and collected production data for the sample from both installation contractors and the Distributed Energy Resources performance data website.¹ Production data was weather normalized to account for variations relative to typical weather conditions. Projects that performed outside an expected range were further reviewed and validated. The verified production and capacity factors from the sample were expanded to the full population.

This report presents results for several segments that have been studied in previous evaluations, such as: region, system size, and purchase type. New to this evaluation is the review of performance by the following variables:

- Disadvantaged communities (DAC) designation
- Array type (fixed and tracking)
- Module family (monocrystalline, polycrystalline, and thin film)
- Module configuration (monofacial, bifacial), and
- Inverter type (microinverter, string/central).

¹ NYSERDA Distributed Energy Resources, Performance Data website: <https://der.nyserda.ny.gov/data/performance/>

Results

Table ES-1 presents the NY-Sun first-year production data this evaluation collected by region, system size, and purchase type.² The overall evaluated sample count is greater than the target sample due to collection from additional projects to account for unavailable data of the primary sample. Additionally, projects were added after initial sample collection to increase representation of projects located in DACs. Many of the segments were evaluated in the prior impact evaluation with precision targets. These segments along with the new segments (DAC and technologies) were considered in this impact evaluation, but without precision criteria. The precision criteria is 10% precision with 90% confidence. The overall results, size, sector, and DAC designations achieved this precision criteria. Analyses by purchase type, module type, and inverter type only achieved precision targets for some of the types.

Table ES-1. NY-Sun data collection results by region, system size, and purchase type

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

² First-year production data collection was for the first full consecutive 12 months of production after system interconnection/inception of system production. The first, potentially incomplete, month of production data is dropped from the analysis.

Capacity factor results. Weather-normalized capacity factor results by size, sector, and overall are presented in Table ES-2. While many trends in performance are observed, the statistical significance of the observations is limited. Key findings shown in the table include:

- The program realized an overall 12.7% capacity factor during the evaluation period. Though not statistically significant, the capacity factor was slightly higher than that of the 2008/2011–2016 evaluation result of 12.4% and the 2016–2018 evaluation of 12.6%.
- The residential capacity factor was 12.8%. This is higher, but within the relative precision bands, than both the 2011–2016 NY-Sun residential impact capacity factor of 12.1% and the 2016–2018 capacity factor of 12.4%. The capacity factor for large projects remained the same as the prior evaluation at 12.7%. However, this evaluation assessed 200 kW–750 kW and over 750 kW groups while the previous evaluation grouped all projects over 200 kW—although the majority of projects over 200 kW are over 750 kW.
- The application-specific realization rates fell from 99.2% in the previous evaluation to 96.5%. The reduction is the result of a shift in the program’s mix of installed capacity from small systems to systems over 750 kW. Many of the large projects apply a fixed capacity factor of 13.4% as the basis for estimating expected production, which tends to overestimate production.
- The residential realization rate increased to 109.3% from 101.6% in the prior evaluation. This was the result of the project-specific capacity factors reported by contractors decreasing from the previous evaluation (not shown in Table ES-2) while the evaluated capacity factor increased. It is unclear why contractor estimates are more conservative than in the prior evaluation. The growing prevalence of microinverters is likely the largest driver of this increase in performance.

Table ES-2. Annual impact results by customer sector

Customer Sector		Sample Complete	Capacity Factor	Capacity Factor Relative Precision	Realization Rate	Realization Rate Relative Precision
Below 200 kW	Residential	32	12.8%	6.3%	109.3%	4.6%
	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		93	12.7%	1.0%	94.2%	1.2%
Overall		131	12.7%	1.7%	96.5%	1.7%

Performance by DAC vs. non-DAC designation. The evaluation found that DAC projects below 200 kW had slightly lower capacity factors than non-DAC projects below 200 kW, but the difference was not statistically significant. For this size group, the realization rate for DAC projects was 97.6% while the non-DAC projects had a realization rate of 108.6%. Among the greater-than-200 kW projects, DAC projects performed better than the non-DAC projects. This was due to the DAC projects in this size range being installed in locations with higher insolation. Capacity factors positively correlate with solar insolation levels. There was no similar correlation for residential DAC and non-DAC projects being installed in locations with different solar insolation.

Performance by inverter type. Systems with microinverters performed better than those with string inverters in the residential sector, with capacity factors of 13.1% and 11.9%, respectively. Projects with microinverters also had a higher realization rate of 110.0% versus 107.2% for projects with string inverters. This evaluation found a significant increase in the proportion of projects with microinverters compared to the previous evaluation period. Microinverters are likely responsible for a portion of the improvement in the residential sector capacity factor.

Bifacial panels outperform conventional monofacial panels. Systems with bifacial panels had a capacity factor of 13.6%, or about 7% higher than projects with monofacial panels.

Low-capacity factor projects decreased. The evaluation found a significant decrease in the number of projects that were flagged for additional file review due to low capacity factors compared to the previous evaluation period. This may be the result of many factors, including improvements in monitoring, maintenance, technology, and system design.

Peak coincidence impacts were at least 31% of capacity. Gross summer peak coincidence impacts for the NYCA load zone varied between 480 MW and 585 MW for 2018–2022. This equates to a peak capacity factor of 46.4% to 56.5%, which applies to a total capacity of 1,036 MW in the sample frame. Other load zones had coincident peak capacity factors ranging from 31.2% to 60.7%, although projects with viable data were limited for some periods. The hour, date, and weather conditions influence the peak capacity factor.

Findings and recommendations

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 include these features is underway and anticipated to be complete in Q2 2025.*