



**VOTE SOLAR**



**MILLION SOLAR STRONG NEW YORK:  
A Jobs and Economic Impact Assessment of  
New York State's 6 Gigawatt Solar Goal**

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## EXECUTIVE SUMMARY

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With the Federal Government failing to act on climate change or drive significant renewable energy progress, states across the country are leading the transition to a stronger, more resilient, more equitable clean energy future. New York has been at the forefront of states expanding access to clean energy. Building on years of leadership, Governor Andrew Cuomo recently established a statewide goal of 6 gigawatts (GW) of local, distributed solar by 2025, which is enough solar to power one million homes. In order to build a strong and inclusive solar economy, this target is designed to support development across diverse market segments, including residential, commercial, and community-scale solar (or community distributed generation as it is known in New York).

The purpose of this report is to determine the potential employment, earnings and economic impacts of New York State reaching 6 GW of distributed solar by 2025. With 1.425 GW already installed, an additional 4.575 GW of solar must be developed across the residential, commercial and community solar sectors in order to meet the Governor's goal. Achieving 6 GW by 2025 would solidify New York's place as a clean energy leader, help over a million households manage their energy costs, and – as this report explores - support significant local economic development.

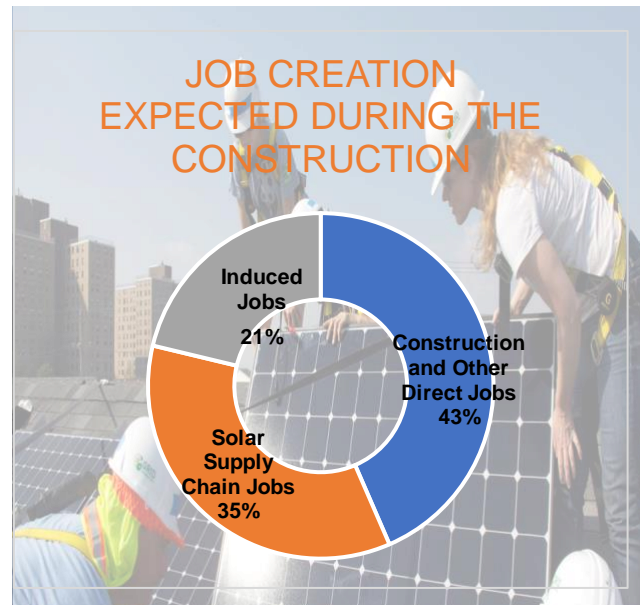
Vote Solar used the Jobs and Economic Impact (JEDI) Model developed by the National Renewable Energy Laboratory (NREL) to reasonably estimate the employment, earnings and economic impacts from the construction and operation of the solar energy facilities that could be expected if New York adopts this ambitious, yet achievable, target. The Solar Photovoltaic JEDI model has been used extensively by decision makers to assess the expected impacts of solar energy projects, proposed programs and policy decisions.

The analysis assumes the New York legislature approves the program target in 2019. The purpose of this report is to inform decision makers, advocacy organizations, and other interested parties of the benefits of a 6 GW by 2025 solar target in New York.

## Summary of Findings: Job & Economic Benefits of a Million Solar Strong NY

New York State can expect significant workforce and economic benefits from achieving 6 GW of total installed solar capacity, which is enough to power one million households. Specifically, installing an additional 4.575 GW of distributed solar from 2019 to 2025 is projected to deliver the following economic benefits:

- **A 116% increase in solar jobs<sup>1</sup> by adding 11,253 sustained full time jobs** during the construction of 4.575 GW of distributed solar by 2025.
- **\$5.7 billion** in earnings for those employed, with an average of \$41/hour for those employed for on-site construction activities.
- **\$10.9 billion** in local economic benefits for the state, excepting local tax revenues.
- **\$32 million** from property tax revenues in the first year of system operation alone.



*The above statistics yield an average of \$664 million/year of economic benefit each year during the 25-year minimum life of the solar projects.*

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<sup>1</sup> The Solar Foundation (2019). National Solar Jobs Census: 2018. Data retrieved from: <http://www.thesolarfoundation.org/wp-content/uploads/2019/02/Appendix-A.pdf>

## 1.0 METHODOLOGY

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### 1.1 JEDI Model Basics

The National Renewable Energy Laboratory developed the JEDI Photovoltaic (PV) model to estimate the impacts of project-related inputs and the associated jobs, earnings, and economic outputs during the construction and continued operation of solar photovoltaic arrays.<sup>2</sup> This input-output model utilizes economic data derived from the Minnesota IMPLAN group's accounting software, which applies state-specific data to provide a comprehensive estimate of economic impacts associated with new solar energy generating facilities.<sup>2</sup> IMPLAN's data and analytical software has been approved by industry-leading economic research analysis.<sup>3</sup>

The JEDI model utilized in this report specifically analyzes the benefits of 4.575 GW of distributed solar energy projects expected to be deployed between 2019 – 2025 as part of a 6 GW by 2025 distributed energy target. It accounts for various ways in which investments in PV projects may have effects during both the construction and the operations and maintenance period of the generating facility, as well as economic impacts across the solar supply chain and related industries.

NREL's JEDI model calculates jobs, earnings, and output distributed across three categories:<sup>2</sup>

- **Direct Impacts.** Direct impacts arise from on-site labor and professional services such as solar project development, design, permitting, construction, and labor. These results include labor only—no materials.
- **Indirect Impacts.** Investments into solar projects stimulate economic impacts in industries outside of onsite construction and maintenance activities. Indirect impacts refer to changes in local revenue and industry impacts across the PV supply chain.

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<sup>2</sup> National Renewable Energy Laboratory (2015). JEDI Methodology. Accessed online, <http://www.nrel.gov/analysis/jedi/methodology.html>.

<sup>3</sup> Parts of the analysis employed in this report have been utilized in other JEDI-based studies, most notably: Schatz, D., Tomic, M. (2016). Virginia's Community Solar Pilot Program. The Solar Research Institute. Accessed online, <http://solarresearchinstitute.org/product/study-community-solar-pilot-in-virginia-economic-impacts/>.

- **Induced Impacts.** Induced impacts result from reinvestment in the local economy, and spending of earnings by direct and indirect beneficiaries of solar projects. Examples of induced impacts include money spent on restaurants, gas and groceries.<sup>4</sup>

Direct, Indirect and Induced jobs and economic benefits were captured from the following:

- **Employment Impacts During Construction and Operations and Maintenance:** Solar installations require significant upfront private investment in capital and labor. Once installed and commercially operable, solar installations require a workforce for continued operation and maintenance.
- **Earnings from a Statewide Distributed Energy Target:** A robust distributed solar program would support tremendous earnings potential among New York’s citizens. Solar installation, operations and maintenance jobs are well-paying jobs, and significantly above minimum wage.
- **Economic Output in New York’s Economy:** The construction and operation of community solar facilities results in several economic impacts, which when combined into a currency metric, demonstrates the total economic output of near-term project development.

## 1.2 Project-Specific Inputs and Assumptions

The JEDI model allows users to calculate economic outputs for a range of system sizes or types of installations. These size ranges include:

- Residential (1 – 10 kilowatts or kW)
- Small commercial (10 – 100 kW)
- Large commercial (100 – 1000 kW)
- Utility scale (larger than 1000 kW)

Each system size range has varying multipliers in the JEDI model to appropriately estimate economic outputs due to economies of scale achieved with larger project sizes. The JEDI model does not have a specific category for community solar facilities. An analysis of 2018

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<sup>4</sup> The Solar Foundation (2017). U.S. Solar Industry Added \$184 Billion to U.S. GDP in 2016. Accessed online, <http://www.thesolarfoundation.org/solar-jobs-census/economic-impacts-report-2016/>.



Community Distributed Generation (CDG) projects in New York identified an average system size of 1,832 MW, placing these projects in the utility scale category for purposes of the JEDI analysis.<sup>5,6</sup>

In order to maximize the accuracy of JEDI outputs for the addition of 4.575 GW of distributed solar by 2025, this report applies system attributes from projects in development as well as those that are installed and operational projects for each project type, including residential, community distributed generation, and non-residential. Historical installation data was used to approximate the average system size of distribution-level projects and the associated installation cost.<sup>7</sup> The information gathered on projects in New York state provided the basis for project-specific assumptions associated with a 6 GW by 2025 target.

**Table 1: 6 GW by 2025 New York State Renewable Energy Targets**

Project Type	2019	2020	2021	2022	2023	2024	2025
<b>Residential</b>	150 MW	175 MW	175 MW	200 MW	250 MW	275 MW	300 MW
<b>Community Solar</b>	150 MW	175 MW	175 MW	200 MW	250 MW	275 MW	300 MW
<b>Non-Residential</b>	150 MW	175 MW	175 MW	200 MW	250 MW	275 MW	300 MW
<b>TOTAL</b>	<b>450 MW</b>	<b>525 MW</b>	<b>525 MW</b>	<b>600 MW</b>	<b>750 MW</b>	<b>825 MW</b>	<b>900 MW</b>

The average installed cost for each project type was determined from publically available information from NYSERDA’s website<sup>5</sup> Average installed cost data from 2018 was used for the basis of the analysis, with future price adjustments made according to GTM Research analysis.

<sup>5</sup> Assumptions regarding CDG installed cost and average system size were compiled from both completed CDG projects and those in the pipeline, as identified in the New York State Solar Electric Programs Reported by NYSERDA: Beginning 2000 Interactive map and database of community solar projects, retrieved from <https://www.nyserdera.ny.gov/All-Programs/Programs/NY-Sun/Solar-for-Your-Home/Community-Solar/Community-Solar-Map>.

<sup>6</sup> Projects up to 5 MW in size are considered distributed generation projects in New York. The categories in JEDI are fixed; therefore, both the non-residential and community solar capacity target analyses were categorized as utility scale for purposes of the JEDI analysis.

<sup>7</sup> Assumptions regarding residential and non-residential installed costs and average system size were compiled from completed projects identified in New York State Solar Electric Programs Reported by NYSERDA, Data & Trends, retrieved from: <https://www.nyserdera.ny.gov/All-Programs/Programs/NY-Sun/Data-and-Trends>.

According to Wood Mackenzie and SEIA’s December 2018 *U.S. Solar Market Insight Report Q4 2018*, residential, non-commercial projects and fixed-tilt utility scale projects saw a, 1.1%, 2.1% and 3.3% decrease, respectively, from Q2 2018 to Q4 2018. Price declines reflected in this report were applied to NYSERDA’s 2018 average installed cost assumptions for years 2019 – 2025.

CDG installed cost assumptions for 2019 - 2025 were taken from GTM Research’s *Vision for U.S. Community Solar: A Roadmap to 2030*.<sup>8</sup> GTM expected 5% price declines until 2020 then 3% price declines until 2025 attributable to falling development fees, overhead and margins “as community solar grows more competitive and project developers become more efficient”.



**Table 2: Key JEDI Inputs and Assumptions of the Model for NY**

Key JEDI Input	Assumptions
Year of Construction or Installation	2019 – 2025

<sup>8</sup> GTM Research (2018). *A Vision for U.S. Community Solar: A Roadmap to 2030*. Retrieved from: [www.votesolar.org/csvision](http://www.votesolar.org/csvision).

<b>Installation Type</b> (Residential, Commercial, or Utility Scale)	The JEDI model assumes large-commercial projects are those 100kW – 1000 kW. Given the average installed system sizes of commercial-scale and community distributed generation projects in New York (Reference Table 3), these projects technically fell under the “utility scale JEDI model. The JEDI Model was run separately for each type of installation (residential, community solar, and non-residential) and combined to derive an aggregate jobs and economic impact for: <ul style="list-style-type: none"> <li>• Residential: Less than 10 kW</li> <li>• Utility Scale: 1000 – 3000 kW</li> </ul>
<b>Solar Cell/Module Material</b>	Crystalline Silicon
<b>System Tracking</b>	Fixed Mount
<b>Average System Size</b>	Average System Size for each type of installation was obtained by reviewing data on solar installations in New York. The distribution of installed capacity for each installation type or size range was then applied to the total program size outlined as part of a 6 GW by 2025 target.
<b>Number of Systems Installed</b>	Utilizing the derived average system size above, we apply those estimated system sizes to the modeled sector sizes outlined for New York. The JEDI model is run separately for each sector and combined to derive an aggregate jobs and economic impact.

**Table 3: Model Assumptions for Average System Size, Base Installed Cost, and Number of Systems**

Project Scale	Residential	Community Solar	Non-Residential
<b>Average System Size</b>	5.96 kW	1,832.54 kW	1,758.04 kW
<b>Base Installed Cost 2018<sup>9</sup></b>	\$4,136.37 / kW	\$2,262.93 / kW	\$2,234.60 / kW
<b>Base Installed Cost 2019</b>	\$4,090.87 / kW	\$2,140.92 / kW	\$2,160.86 / kW
<b>Base Installed Cost 2020</b>	\$4,045.87 / kW	\$2,018.92 / kW	\$2,089.55 / kW

<sup>9</sup> 2018 Base Installed Costs were taking from publicly available information on NYSERDA’s website.



<b>Base Installed Cost 2021</b>	\$4,001.36 / kW	\$1,959.89 / kW	\$2,020.60 / kW
<b>Base Installed Cost 2022</b>	\$3,957.35 / kW	\$1,900.86 / kW	\$1,953.92 / kW
<b>Base Installed Cost 2023</b>	\$3,913.82 / kW	\$1,899.02 / kW	\$1,889.44 / kW
<b>Base Installed Cost 2024</b>	\$3,870.77 / kW	\$1,897.07 / kW	\$1,827.08 / kW
<b>Base Installed Cost 2025</b>	\$3,828.19 / kW	\$1,894.99 / kW	\$1,766.79 / kW
<b>6 GW by 2025 Expected Number of Systems</b>	Adjusted to meet 6 GW by 2025 annual targets		

## 2.0 RESULTS

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The JEDI model assesses the job, earnings and economic impacts derived from of a potential 6 GW by 2025 statewide renewable energy target in New York. Direct, indirect, and induced impacts to employment, earnings and economic impacts were calculated. Employment impact figures typically represent full-time equivalents (FTE), or 2080-hour units of labor (job years). However, it is assumed that solar jobs will be maintained over the 6-year period leading up to the 2025 target date, thereby making these sustained jobs. Earnings reflect wages, salary compensation, and benefits paid to workers. Economic output refers to economic activity or the value of production in the state or local economy, and it is reported in 2019 dollars.

Taken as a whole, these metrics of job impacts and output offer a comprehensive snapshot of the impacts of a 6 GW by 2025 target in New York. Results are grouped into three main categories reflecting employment impacts, earnings impacts, and economic outputs.

*Note: Totals included in the summary tables may not add up due to independent rounding.*

### 2.1 Employment Impacts During Construction and Operations and Maintenance

Solar installations require significant upfront private investment in capital and labor. Once installed and commercially operable, solar installations require a workforce for continued operation and maintenance.

While the JEDI model typically reports jobs in full time equivalent jobs (FTE), this analysis evaluates incremental renewable energy capacity over a five-year period as part of the 6 GW by 2025 target. Therefore, to assess sustained jobs, the total FTE jobs were divided by the number of years to attain the 6 GW by 2025 target.

As shown in Table 4, the JEDI model reveals that over 11,200 jobs will be needed to support the construction of 4.575 GW of distributed solar from 2018 – 2025. Approximately 43% of jobs created are direct jobs, reflecting on-site labor related to the construction and operation of PV arrays. Indirect jobs, or employment associated with the supply chain of PV array construction, accounts for 35%. The remaining 21% of jobs are attributed to induced jobs, or labor and spending resulting from both direct and indirect earnings in local economies.

**In summary, the addition of 4.575 GW of distributed solar in New York could result in the creation of over 11,200 sustained jobs during the near-term construction of distributed energy projects with additional employment opportunities during operations and maintenance over the life of the projects.**

**Table 4: Sustained Direct, Indirect, and Induced Employment During Construction, from 2019 - 2025**

Categories of Employment	During Construction
Direct	4,893
Indirect	3,968
Induced	2,391
<b>Total Employment</b>	<b>11,253</b>

**2.2 Earnings from a Statewide Community Solar Program**

The JEDI model also captures the expected employee salaries, wages and earnings during the construction and operation of distributed solar projects in New York. Table 5 illustrates that

providing solar for a million households across the state would support tremendous earnings potential among New York’s citizens. Solar installation, operations and maintenance jobs pay extremely well. According to the JEDI report, the on-site labor associated with construction activities are expected to earn approximately \$41/hour. These economic benefits significantly contribute to New York’s overall economy, both in terms of personal wealth creation and induced economic impacts from well-paying jobs in the clean energy sector.

**Table 5: Labor Earnings During Construction and Operations of Distributed Solar Projects expected During 2019 - 2025**

	During Construction	During Operations & Maintenance	Total
<b>Direct</b>	\$2.5 billion	\$59.3 million	\$2.6 billion
<b>Indirect</b>	\$2.0 billion	\$22 million	\$2.0 billion
<b>Induced</b>	\$1.1 billion	\$12.3 million	\$1.1 billion
<b>Total Earnings</b>	<b>\$5.6 billion</b>	<b>\$93.6 million</b>	<b>\$5.7 billion</b>

### 2.3 Economic Output in New York’s Economy

Overall, the JEDI model calculates the total economic impact of adding 4.575 GW of distributed generation from 2018 – 2025 to be nearly \$10.9 billion. The majority of the economic benefit is derived from the direct, indirect and induced impacts during the construction period. The addition of 4.575 GW of distributed solar in New York is expected to create over \$10.8 billion in economic benefits simply during the construction period of the solar installations. An estimated \$150 million of economic activity is expected during the continued operations and maintenance period. Reference Table 5.

**Table 5: Economic Output During Construction and Operations**

	During Construction	During Operations & Maintenance	Total
<b>Direct</b>	\$3.6 billion	\$59.3 million	\$3.6 billion
<b>Indirect</b>	\$4.6 billion	\$54.2 million	\$4.7 billion

<b>Induced</b>	\$2.6 billion	\$29.5 million	\$2.6 billion
<b>Total Economic Output</b>	<b>\$10.8 billion</b>	<b>\$142.9 million</b>	<b>\$10.9 billion</b>

## 2.4 Property Tax Revenue during System Operating Years

Distributed solar facilities also contribute to New York’s economy through the payment of local property taxes for each year over the 25-year operating life of the installed systems. Property tax rates differ across New York based on a project’s location. Due to the fact that these community solar installations will be spread across the state, a standard factor of \$7,000/MW(DC) installed was used for this analysis.<sup>10</sup> According to New York State Department of Taxation and Finance, property taxes are “still of major importance as the largest single revenue source for the support of municipal and school district services.”<sup>11</sup>

*Using this calculation, the State of New York can expect to receive approximately \$32 million in property tax revenues in just the first year of system operation.*

**Table 6: Local Property Tax Revenue During Operations and Maintenance**

<b>Cumulative Capacity</b>	4,575 MW DC
<b>Estimated Factor to Assess Local Property Taxes</b>	\$7,000/MW DC installed
<b>Total Year 1 Property Tax Revenue</b>	<b>\$32 million</b>

## 4.0 CONCLUSIONS

The JEDI model provides a useful tool to estimate job and economic impacts of the addition of 4.575 GW of distributed solar to achieve the 6 GW by 2025 distributed energy target in New York. The findings from the JEDI analysis suggest that target would sustain over 11,200 jobs

<sup>10</sup> According to local solar industry, a standard factor of \$7,000/MW(DC) is reasonable. Projects in New Jersey have property tax rates both above and below \$7,000/MW (DC).

<sup>11</sup> New York State Department of Taxation and Finance:  
<https://www.tax.ny.gov/pit/property/learn/proptax.htm>

during just construction-related activities from 2019 to 2025. Expected average hourly wages of \$41/hour creates an opportunity for local citizens to earn substantial annual salaries.

Policymakers in New York cannot ignore the \$10.9 billion dollars that a 6 GW by 2025 renewable energy target could bring to the state's clean energy economy. The economic benefit to New York's economy is driven by private investment, on-site labor, increased demand for professional services and supporting industries, as well as benefits from reinvestment in the state's infrastructure and economy. The JEDI findings clearly show that 6 GW by 2025 will meaningfully contribute to New York's economy both during the construction and ongoing operations and maintenance of the systems. In addition, New York's municipalities are expected to receive over \$32 million in property tax revenues during the first year of system operation between 2018 - 2025. Municipalities across New York use local property tax revenues to finance local governments and public schools.<sup>11</sup> As a result, New York's local governments and citizens stand to benefit tremendously from the economic benefits solar can bring to their communities.

It is also important to consider the range of additional environmental, health and societal benefits that a significant solar target with provisions for diverse market participation would mean for New Yorkers. Local solar power reduces the need for investment in expensive and polluting traditional power plants and utility infrastructure, which lowers energy system costs and improves community health. By providing growth opportunities for a range of distributed solar solutions, New York can expand consumer access to affordable clean electricity and the energy bill savings that it delivers. For example, community solar programs can provide affordable clean energy options to families and business that rent and other customers who face physical or financial barriers to installing rooftop solar. Furthermore, in order to maximize the benefits flowing to traditionally underserved communities, sound solar policy should also include an explicit target and provisions for serving low-income families and communities that represents an equitable portion, around 20 percent, of the residential-serving solar sector. These individuals stand to benefit most from affordable and predictable energy costs, yet under the current policy framework, largely lack access to clean renewable energy solutions.

New York has been a national leader with its renewable energy policies and programs. But now, it's time for the Empire State to create a robust, forward-looking statewide distributed solar target that can provide clean energy for all its citizens, drive new investment to the state, and provide meaningful economic benefits for years to come. For more policy recommendations for building a Million Solar Strong New York, visit:

[www.millionsolarstrongny.org](http://www.millionsolarstrongny.org)



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