New York's 10 GW Distributed Solar Roadmap:
Policy Options for Continued Growth in Distributed Solar

CASE 21-E-0629

In the Matter of the Advancement of Distributed Solar

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EXECUTIVE SUMMARY

The current 6 gigawatt (GW) NY-Sun distributed solar program target is nearly achieved, with more than 93 percent of the target either completed or at an advanced stage of development.[1] As called upon by New York State Governor Kathy Hochul during Climate Week 2021, the New York State Energy Research and Development Authority (NYSERDA) and New York State Department of Public Service Staff (DPS Staff) have analyzed the current distributed solar market in New York State and found that costs and NYSERDA-provided incentives have declined over time, while a thriving solar market has created approximately 12,000 jobs in New York. Together, these facts demonstrate the success of the NY-Sun program in transforming New York's distributed solar industry. Additionally, NYSERDA directed further analysis of future revenues, costs, and market support mechanisms needed for distributed solar development beyond the 6 GW target.

Informed by this analysis, NYSERDA and DPS Staff developed this Distributed Solar Roadmap (Roadmap) to propose a pathway to achieve 10 GW of distributed solar deployment by 2030. With the current 6 GW by 2025 goal nearly achieved, the Roadmap explores various options for setting incentive levels to achieve the expanded NY-Sun goal of an incremental 4 GW (Incremental 4 GW Target). These options include various procurement structures, pricing models, and funding mechanisms.

In the context of the 10 GW by 2030 goal, the Roadmap analysis determined that continued use of an administratively-

[1] The statewide total includes projects developed through all statewide funding programs inclusive of the Regional Greenhouse Gas Initiative (RGGI).

set incentive is preferable to an auction-based procurement approach since auctions do not always align with the typical distributed solar development process and timeline, particularly as related to New York's Standardized Interconnection Requirements (SIR), and could create unique implementation challenges. The analysis also found that index-based pricing like the methodology used in the Clean Energy Standard (CES) Tier 1, Tier 4 and offshore wind procurements, may be challenging for distributed solar projects due to lack of familiarity by developers and significant implementation issues.

The analysis further determined that extending the longstanding NY-Sun Megawatt Block (MW Block or MWB) Program incentive mechanism, which uses up-front incentive payments, rather than using an increased, variable Environmental Value (E Value) under the Value of Distributed Energy Resources (VDER) Value Stack is preferable to achieve the Incremental 4 GW Target since the MW Block Program has a proven track record for transparency and flexibility. Additionally, its existing programmatic infrastructure can be used to extend the program through 2030.

In addition to the discussion within the Roadmap, the comparative advantages and disadvantages of market support mechanism options evaluated to support the Incremental 4 GW Target are summarized in Appendix A: Policy Options Comparison Matrix. While the recommended option (upfront incentive) was not the lowest cost option, it possessed significant and fundamental advantages over other options with regard to implementation feasibility, market compatibility and ratepayer risk. The estimated costs of the different options, and the methodology used to derive those estimates, are detailed in Appendix B: Cost Analysis. Given the paramount importance of protecting

ratepayers from excessive or unnecessary cost burdens, the Roadmap fully explores the justification for the recommended option and the specific steps taken to assess and control costs, while still setting a firm path toward the 10 GW goal.

The Roadmap recommends the following geographical and segment-based breakdown of incentive blocks for the Incremental 4 GW Target presented in the table below, with the balance to be achieved by statewide solar projects without incentives or through non-Clean Energy Fund (CEF) incentives on Long Island.

Table 1

Geographical Breakdown of the Incremental 4 GW Target

Incentive Group	**MW**
Upstate MW Block Incentives - C/I	2,943
Con Edison MW Block Incentives - Residential	150
Con Edison MW Block Incentives - Small Projects	150
Con Edison MW Block Incentives - Large Projects	150
Subtotal: MW Block Incentives	***3,393***
Long Island, and Upstate Unincentivized Projects	607
TOTAL[2]	***4,000***

For C/I projects, NYSERDA anticipates approximately 30 percent of this new capacity will be developed as Remote Crediting or behind-the-meter projects and 70 percent will be Community Distributed Generation (CDG) projects.

The extension of the MW Block Program is proposed to emulate the existing program structure, which includes separate incentives for small and large projects where appropriate and

[2] NYPA will continue to work with its customer base in the development of projects to support the achievement of the Incremental 4 GW Target.

regionally separate rates for Con Edison and Upstate customers.[3] In total, approximately $419.9 million in MW Block base incentives, Community Adder, and other siting adders would go towards projects in Con Edison territory, with approximately $400.3 million going towards projects Upstate. In addition to the proposed additional MW Block incentives, NYSERDA and DPS Staff recommend several changes to the structure of the MW Block program and its implementation. The Roadmap recommends that no less than 1,600 MW of new incentives be directed toward low to moderate income (LMI) residents, regulated affordable housing, disadvantaged communities (DACs), and environmental justice communities to comply with the Climate Leadership and Community Protection Act (Climate Act) DAC requirement. DACs are defined as communities that bear burdens of negative public health effects, environmental pollution, impacts of climate change, and possess certain socioeconomic criteria, or comprise high-concentrations of low- and moderate- income households.[4] Of this, 1,357 MW should be targeted to an expanded Solar Energy Equity Framework (SEEF), with at least half of this capacity targeted to LMI residential customers with direct electric bill savings.

In addition to an expanded NY-Sun program, the Roadmap recommends interconnection policy improvements to enable the realization of the Incremental 4 GW Target, including: modification of utility planning processes, the inclusion and consideration of distribution system investments that expand

[3] This preference may not apply to LIPA's service territory, and LIPA may consider various means to achieve its share of the Incremental 4 GW goal.

[4] Climate Leadership and Community Protection Act § 2, amending Environmental Conservation Law §75-0101(5). Chapter 106 of the Laws of 2019.

hosting capacity in future utility Capital Investment Plans, and expansion of the Cost-Sharing 2.0 framework.

Through this filing, NYSERDA requests a total budget of $1,474 million in NY-Sun Program funding to achieve the Incremental 4 GW Target by 2030. Of this, $12.3 million is requested for the continued administration of the NY-Sun Program through 2030. The ratepayer impact will vary by year based on expenditures, but on average is estimated to be about 0.79%, or $0.71 per month for the average residential customer for the 11-year period of ratepayer collections, and to peak in 2024 at 1.07%, or $0.92 per month. This funding is expected to support approximately $4.4 billion in private investment, and the developers are expected to leverage the federal investment tax credit (ITC) and other tax incentives to reduce the costs of these solar projects. Additional cost reductions could occur as a result of federal policy changes, which would reduce the estimated ratepayer impact. NYSERDA proposes that program costs be collected through 2032 using the existing Bill-As-You-Go method established under the CEF Framework Order.[5]

Societal benefits associated with the Incremental 4 GW Target include the value of reduced greenhouse gas emissions associated with the estimated 4,937 gigawatt hours (GWh) of annual generation, estimated at over 64 million US tons (58

[5] The Commission authorized the Bill-As-You-Go payment structure whereby ratepayer funds are held at each of the utilities and transferred to NYSERDA as monies are necessary to meet near-term obligations. The Bill-As-You-Go structure has been utilized in recent years, per Commission Orders, as an efficient means to transfer funds as necessary between NYSERDA and utilities as uncommitted funds have been repurposed. See Case 14-M-0094 et al., Clean Energy Fund, Order Authorizing the Clean Energy Fund Framework (issued January 21, 2016), pp. 96-103 (CEF Framework Order).

million metric tons) over the lifetime of the projects deployed (2022-2054). The distributed solar projects associated with the Incremental 4 GW Target are projected to bring bill savings to an estimated 127,000 new solar customers and off-takers, and create approximately 6,000 jobs statewide, many of them providing prevailing wages. To continue to demonstrate the State's commitment to creating well-paying jobs in this industry, this Roadmap considers future labor policies including the reduction of the MW threshold for renewable energy projects being subject to prevailing wage requirements or project labor agreements from 5 MW AC to 1 MW AC. NYSERDA included $239 million in its budget proposal to assist the industry with this transition to increased prevailing wage requirements while ensuring the continued growth of the distributed solar market in New York and achievement of the Incremental 4 GW Target.

Distributed solar resources are also particularly well suited to contribute to grid resiliency due to project siting closer to load. These projects' location near the site of use, and ability to feed energy directly into the local system where it is needed, may help reduce line losses and mitigate the need for new transmission, thereby potentially reducing costs system-wide. Distributed solar can also be paired with energy storage to provide additional resiliency benefits.

I. INTRODUCTION

For the past seven years, the NY-Sun program has been supporting distributed solar photovoltaic installations (distributed solar) in New York State by providing the industry with the incentive certainty and transparency needed to forecast project economics and attract investment. The Commission issued the MW Block Order on April 24, 2014, which authorized NYSERDA to implement the NY-Sun MW Block Program during the 2016 through 2023 period with a target of 3 GW[6] of distributed solar in New York State and an incremental budget of $960.6 million.[7] The distributed solar industry in New York has grown rapidly under NY-Sun, due in part to its incentive structure and a thriving community solar market.

The Climate Act[8] subsequently increased the NY-Sun target to 6 GW by 2025, within the larger context of seeking to achieve 70% of the State's electric load through renewable energy resources by 2030 (70 by 30 Goal) and reaching a zero-carbon emissions power system by 2040 (Zero-Emissions Target). The Climate Act also requires DACs to receive at least 35 percent with a goal of 40 percent of the overall benefits of clean energy program efforts. The State is on its way to securing the clean energy resources needed to achieve the 70 by 30 Goal. According to NYSERDA's most recent CES Annual Progress Report, 50 percent of 2030 statewide load (75,113 GWh) will be met by

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[6] Unless otherwise noted, all capacity figures are measured in direct current (DC).

[7] Case 03-E-0188, Retail Renewable Portfolio Standard, Order Authorizing Funding and Implementation of the Solar Photovoltaic MW Block Programs (issued April 24, 2014) (MW Block Order).

[8] See Section 7 of Chapter 106 of the Laws of 2019.

existing, awarded, and contracted renewable generation. Generation associated with Tier 4 projects, selected in the 2021 Tier 4 procurement finalized after the most recent CES Annual Progress report, will contribute a further 10 percent toward the 70 by 30 Target. The remaining share is expected to come from large-scale, onshore renewable generation, offshore wind, and distributed energy resources.[9] The 2020 CES White Paper estimated that the NY-Sun 6 GW target would contribute 7,366 GWh to the 70 by 30 Target.[10]

On May 14, 2020, the Commission issued the NY-Sun Expansion Order, which extended the NY-Sun Program through 2025 and authorized an additional $573 million to support the expanded 6 GW goal.[11] The Commission also adopted the SEEF that dedicates no less than $200 million in NY-Sun funding for projects benefiting LMI households, affordable housing, environmental justice (EJ) communities, and DACs.

While NY-Sun's upfront incentives have provided transparency to solar developers and driven companies to develop projects in New York State, the Commission's distributed generation (DG) compensation reform under the VDER proceeding has provided the "bankable" revenue streams needed by investors within the overall goal of providing more value-based and

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[9] Case 15-E-0302, Clean Energy Standard, Clean Energy Standard Annual Progress Report: 2019 Compliance Year (filed February 1, 2021), pp. 15–16.

[10] Case 15-E-0302, supra, White Paper on Clean Energy Standard Procurements to Implement New York's Climate Leadership and Community Protection Act (filed June 18, 2020), p. 21 (2020 CES White Paper).

[11] Case 19-E-0735, Additional NY-Sun Program Funding and Extension of Program Through 2025, Order Extending and Expanding Distributed Solar Incentives (issued May 14, 2020 (NY-Sun Expansion Order).

sustainable compensation and lower ratepayer impacts. Under this effort, the Commission directed the immediate sunsetting of net energy metering (NEM) rates under Public Service Law (PSL) 66-j and 66-l, and established the Value Stack as the preferred compensation methodology for eligible DG technologies.[12]

The Value Stack provides monetary crediting for net hourly injections based on the actual value provided to the grid, including energy, capacity, environmental, and distribution system values. The Commission required new CDG projects, remote net-metered projects, and large on-site projects using these technologies to immediately transition to Value Stack compensation. All residential and smaller commercial projects (i.e., on-site projects with a nameplate rating under 750 kilowatts alternating current) can remain on a modified form of NEM called Phase One NEM. The Commission also established several transitional mechanisms to moderate the changeover for CDG customers from NEM to the Value Stack, including the Market Transition Credit (MTC) for mass market participants and its successor, the Community Credit, for all participants.

Driven by rapid distributed solar market growth and the near exhaustion of the NY-Sun C/I MW Block incentive, the NY-Sun Community Adder, and the Value Stack Community Credit, DPS and NYSERDA held technical conferences on April 21, 2021, and May 7, 2021, to discuss future C/I distributed solar and community

[12] Case 15-E-0751, Value of Distributed Energy Resources, Order on Net Energy Metering Transition, Phase One of Value of Distributed Energy Resources, and Related Matters (issued March 9, 2017) (VDER Transition Order).

solar market support mechanisms.[13] During the first technical conference, DPS Staff and NYSERDA presented on the benefits of distributed solar and three potential policy approaches to support its continued development beyond the 6 GW by 2025 target. During the second technical conference, the Clean Energy Parties (CEP)[14], Borrego Solar, and Joint Utilities (JUs)[15] presented their responses to the first conference, and the topic of the E Value under the Value Stack as a potential mechanism to support continued development of distributed solar beyond the 6 GW target was discussed.[16]

Subsequently, on September 20, 2021, New York State Governor Kathy Hochul announced an expansion of the distributed solar goal from 6 GW to 10 GW by 2030.[17] In the Climate Week 2021 announcement, Governor Hochul called upon NYSERDA and DPS Staff

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[13] See Case 15-E-0751, supra, Technical Conference Proceedings Document: Commercial/Industrial & Community Distributed Generation Solar Markets (filed June 7, 2021). (Technical Conference Proceedings Document)

[14] The Clean Energy Parties is a coalition of the Solar Energy Industries Association (SEIA), the Alliance for Clean Energy New York, the Coalition for Community Solar Access, the New York Solar Energy Industries Association, and Vote Solar.

[15] The Joint Utilities include Central Hudson Gas & Electric Corporation (Central Hudson), Consolidated Edison Company of New York, Inc. (Con Edison), New York State Electric & Gas Corporation (NYSEG), Niagara Mohawk Power Corporation d/b/a National Grid (National Grid), Orange and Rockland Utilities, Inc. (O&R), and Rochester Gas & Electric Corporation (RG&E).

[16] See Technical Conference Proceedings Document.

[17] Press Release, NYSERDA, Governor Hochul Announces Expanded NY-Sun Program to Achieve at Least 10 Gigawatts of Solar Energy by 2030 (September 20, 2021), available at https://www.nyserda.ny.gov/About/Newsroom/2021-Announcements/2021-09-20-Governor-Hochul-Announces-Expanded-NY-Sun-Program-to-Achieve-at-Least-10-Gigawatts-of-Solar-Energy-by-2030.

to develop a distributed solar roadmap "to chart a path to advance an expanded NY-Sun goal of at least 10 gigawatts by 2030 in a resilient, cost effective and responsible manner."[18] In response, DPS Staff and NYSERDA developed this Roadmap to provide policy options to continue the rapid development of distributed solar to reach the 10 GW goal. The Roadmap builds upon the work already undertaken by DPS Staff and NYSERDA, including the Spring 2021 Technical Conferences. It also discusses progress toward the 6 GW target, emphasizing lessons learned from that effort to help the State achieve the 10 GW by 2030 goal. The recommendations put forth in this Roadmap correspond specifically to achieving 10 GW of distributed solar by 2030. Should the State seek a larger target, and as markets evolve, different mechanisms may become more attractive than those recommended here.

II. NEW YORK'S DISTRIBUTED SOLAR MARKET

New York is a nationwide leader in the distributed solar industry, ranking first among states in annual community solar installed in 2020, second in annual non-residential distributed solar project completions,[19] and third in solar industry jobs.[20] The current 6 GW target is nearly achieved, and the initial NY-Sun budget of approximately $1.573 billion has spurred over $5.8 billion in private investment by the New York solar industry.[21]

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[18] Id.

[19] U.S. Solar Market Insight Full Report, 2020 Year in Review, Wood Mackenzie and the Solar Industries Association, March 2021.

[20] National Solar Jobs Census 2020. Available for download at: https://irecusa.org/programs/solar-jobs-census/

[21] Data from NYSERDA internal reporting, December 15, 2021.

The NY-Sun MW Block Program, launched in 2014, provides upfront incentives on a dollars per Watt ($/Watt) basis in a declining block structure. The MW Blocks have provided varying incentive levels for different distributed solar market sectors (i.e., residential and non-residential projects smaller than 750 kW and C/I projects larger than 750 kW) in three regions of the State (i.e., Con Edison service territory, Long Island Power Authority service territory, and Upstate).[22] Under VDER, Value Stack compensation, and the E Value in particular, provides distributed solar projects with value-based compensation for any injections into the distribution network, including for the avoided environmental externalities associated with the generation.

The distributed solar industry in New York has grown rapidly under NY-Sun, due in part to the MW Block incentive structure and a thriving community solar market fueled by CDG-specific incentives under VDER. Presently, 93.5 percent of the 6 GW by 2025 target consists of either completed projects or projects in the NY-Sun pipeline, with 3,322 MW completed[23] and

[22] In addition to the base incentives provided in the MW Block program, NY-Sun expanded its offerings in 2018 to include additional upfront incentives for projects that support specific policy goals, including installations on affordable housing properties, landfills, brownfield sites, on carports/parking canopies, and various incentives for community solar.

[23] NY-Sun pipeline projects are defined as projects that have submitted for and been awarded funding through the NY-Sun MW Block incentive program, after meeting all NY-Sun program requirements such as the attainment of all local approvals and payment of 25% of interconnection costs to the utility. Pipeline project data taken from NYSERDA Open NY dataset, but completed taken from Statewide Solar Projects dataset. Data adjusted to prevent double-counting of projects.

2,461 MW in development.[24] Another 4,095 MW of projects are at an early stage of development (i.e., in the utility interconnection queue but 25% of the interconnection costs have not been paid).[25]

Other drivers of strong distributed solar growth in New York include multiple "soft cost" reduction efforts by the Commission and NYSERDA. Improvements in community solar program rules, the adoption of net crediting, the expansion of the maximum project size eligible for the Value Stack from 2 MW to 5 MW, and improvements in interconnection queue management and the SIR have all been foundational factors in driving down distributed solar project costs.[26] In addition, NYSERDA's New York State Solar Guidebook provides developers, municipalities, and other stakeholders with resources regarding project siting, development, and permitting. The PILOT Toolkit and Value Stack Calculator are additional NYSERDA-developed resources which help model project taxes and revenues. NYSERDA also offers free technical assistance and training to municipalities on project siting and zoning issues related to distributed solar.[27]

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[24] NYSERDA Statewide Solar Projects dashboard, see https://www.nyserda.ny.gov/All-Programs/NY-Sun/Solar-Data-Maps/Statewide-Projects. Data current through October 31, 2021.
NYSERDA-Supported Solar Projects dashboard, see NYSERDA web site. Full dataset available on OpenNY, data current through November 30, 2021.
https://data.ny.gov/Energy-Environment/Solar-Electric-Programs-Reported-by-NYSERDA-Beginn/3x8r-34rs

[25] SIR Inventory Information, as posted on DPS website. Queue data as of August 2021. MWac converted to MWdc at a 1.38 factor
https://www3.dps.ny.gov/W/PSCWeb.nsf/All/286D2C179E9A5A8385257FBF003F1F7E

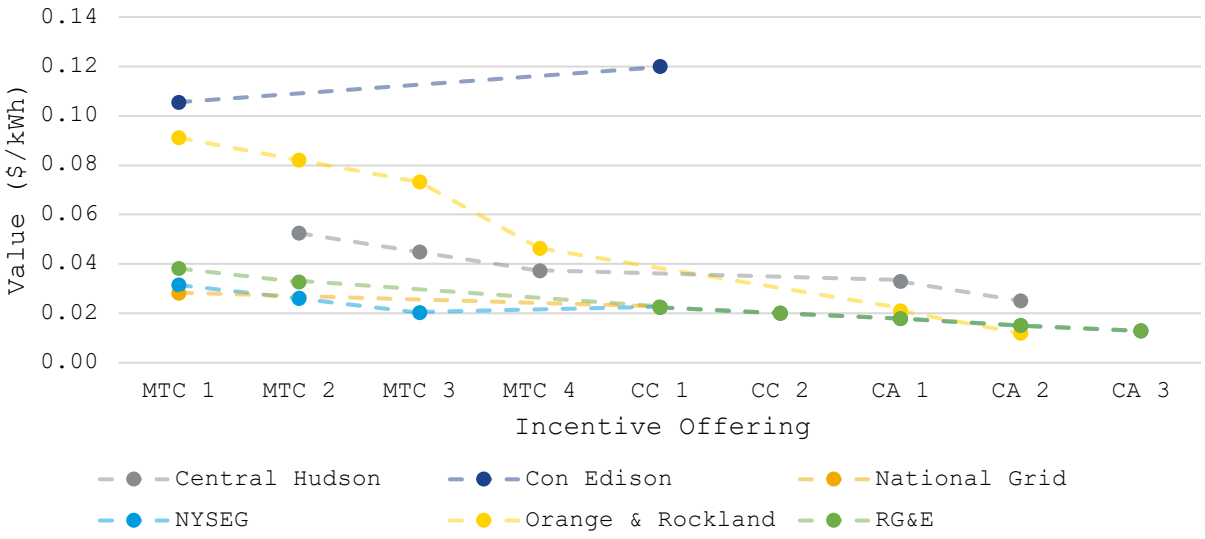
[26] See Technical Conference Proceedings Document.

[27] To date, NYSERDA has met with over 380 local governments and trained over 3,000 officials.

As deployments increase as a result of these efforts and installation costs decrease, a commensurate reduction in incentive levels has also occurred. CDG-specific incentives such as the MTC, Community Credit, and Community Adder, have declined considerably from 2017 to 2021, as shown in Figure 1. It is the goal of the State to step down and ultimately phase out incentives in any market segment where project economics are adequate.

Figure 1

MTC, Community Credit, and Community Adder Rates [28]



The MW Block program was designed to dynamically support distributed solar in areas where it is most needed, with incentives adjusting, increasing in areas requiring additional support, or decreasing, and ultimately phasing out, as markets mature. For example, declining installation costs for C/I distributed solar have been matched in the MW Block program with

[28] For ease of comparison, Figure 1 shows the respective MTC, Community Credit, and Community Adder rates in cents per kWh, although the CA is structured in cents per Watt.

declining incentives. The average cost for completed NYSERDA supported C/I projects in 2021 has decreased by 64% since 2012, from $3.87/Watt to $1.40/Watt, while the NY-Sun incentive level has also declined by 73% over this period.

Much of the NY-Sun MW Block incentives have been largely exhausted. The Upstate C/I block became fully allocated on May 20, 2021 and is now only offering incentives for projects located on brownfields or landfills. The NY-Sun MW Block incentive closed for Long Island residential projects in April 2016. If further incentives are needed to achieve LIPA's contribution to the Incremental 4 GW Target, additional non-CEF[29] support will need to be identified.

There are approximately 171 MW of available MW Block capacity remaining to be filled in the Con Edison region, where 48 MW remain in the final residential block and 123 MW remain in two nonresidential blocks. Approximately 129 MW remains in the Upstate nonresidential block program, split across two blocks. NYSERDA has announced changes to the Upstate residential block structure, to go into effect January 1, 2022.[30]

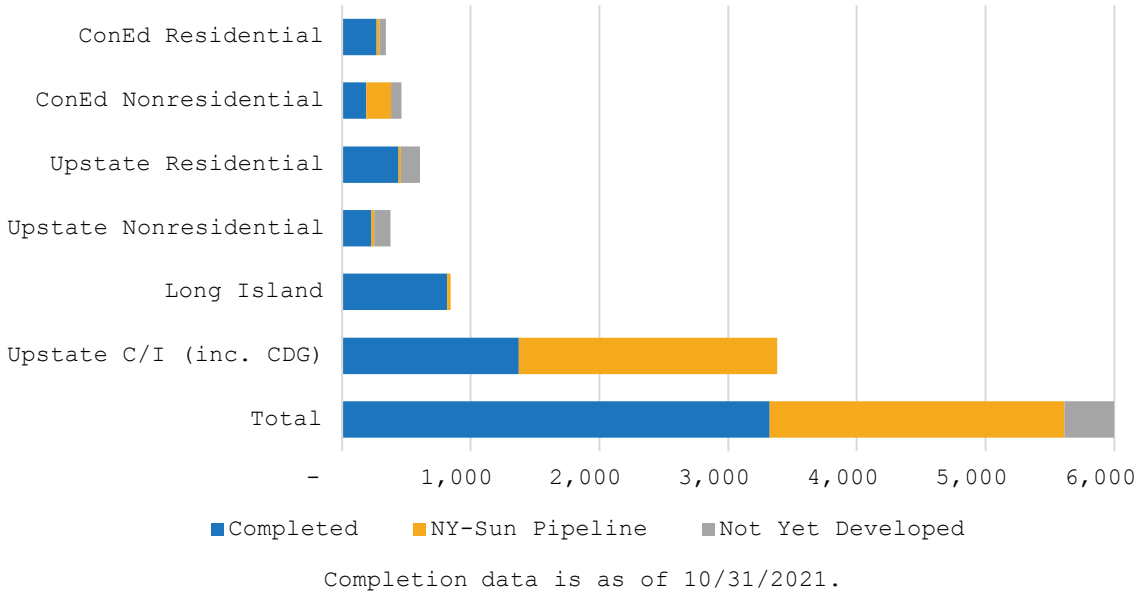
Figure 2 provides an overview of the progress made toward the 6 GW target, by development phase, market sector, and region. Most of the progress to date has been in the Upstate region for C/I onsite and community solar projects.

[29] RGGI funds were used in the past to fund upfront solar incentives in LIPA's service territory. LIPA also procures solar through feed-in-tariffs and other solicitations.

[30] See November 16, 2021 Customer Benefit Contribution (CBC) Charge Webinar, posted at https://www.nyserda.ny.gov/-/media/Files/Programs/NYSun/Overview-of-Customer-Benefit-webinar-presentation.ashx

Figure 2

Progress Toward 6 GW Mandate

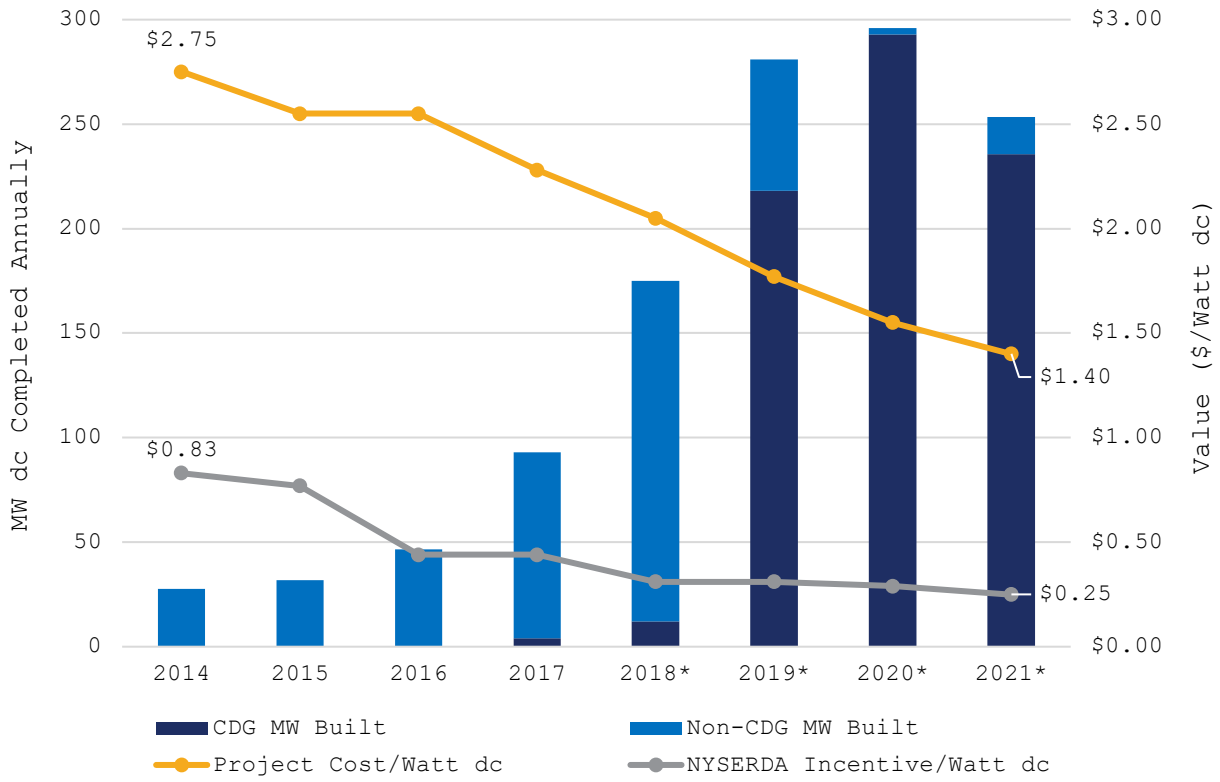


Completion data is as of 10/31/2021.

Annual C/I distributed solar development under the program has grown substantially over time despite declining incentive levels, with two thirds of the total 1,232 MW of C/I distributed solar capacity completed in 2019-21. Most of these completed projects were structured as CDG, as shown in Figure 3.

Figure 3

Annual C/I Projects Installed Cost and Incentive Levels



*Note that 2018-2021 completions included new incentive adders for brownfield/landfill projects and those in strategic grid locations.

2021 data is as of 11/30/2021.

C/I projects sized between 1-5 MW occupy an important space in New York's solar portfolio. Compared to residential rooftop and small commercial sectors, projects in this range have much lower development costs per Watt, primarily due to economies of scale. Currently, project costs for completed NYSERDA-supported projects in 2021 are $3.38/Watt for project sizes less than 1 MW, and $1.42/Watt for projects sized 1 MW or greater. These C/I Projects still must go through local approval processes and

therefore offer an opportunity for direct benefits for community members through CDG subscriptions.

While these C/I projects do not have the same economies of scale as utility-scale projects (i.e., greater than 20 MW), they efficiently make use of land parcels and interconnection sites that are not of sufficient size to host larger projects. NYSERDA conducted a review of co-located projects, or distinct projects with independent interconnections but located on adjacent land parcels, and found that while some co-located C/I distributed solar projects exist, few were made up of more than two grouped projects and only one set of co-located projects would have exceeded 20 MW in aggregate. Likewise, smaller utility-scale projects are not being broken up into 5 MW project sizes to qualify for Value Stack compensation.

II.a Value Stack Compensation

With the Upstate MW Block program fully allocated for the C/I sector, the Value Stack currently represents the sole compensation mechanism for customers with eligible distributed generators in those regions of the State.[31] Under VDER, facilities are compensated for their generation based on the time and location of the generation and its value to the grid and environment.[32] The Value Stack components recognize the benefits that distributed generators provide to the grid and society, including avoided carbon emissions, cost savings to

[31] CDG projects were also eligible to receive an MTC or CC, which are now fully allocated for all utilities.

[32] Eligible technologies include distributed solar, stand-alone, and co-located energy storage, certain types of combined heat and power, anaerobic digesters, wind turbines, small hydro, and fuel cells.

customers and utilities, and offsetting the need for utility distribution network upgrades.[33] Value Stack compensation is provided to a project in the form of monetary bill credits from the utility.

The Value Stack currently is made up of five components: (1) an Energy Value;[34](2) a Generation Capacity Value; (3) a Demand Reduction Value (DRV); (4) a Locational System Relief Value (LSRV); and (5) the Environmental or "E" Value. Both the Energy Value and the Capacity Value change on a rolling basis in order to accurately reflect the current market conditions and prices. LSRV, in contrast, is locked in for 10 years and is available in limited areas where distributed generators can provide additional grid benefits, as designated by the utility. DRV is determined by a project's ability to reduce the need for future grid upgrades and is also locked in for 10 years.

The E Value captures the environmental benefits of any injections made to the grid and is locked in for a 25-year period.[35] The E Value is currently set at the higher of the most recent CES Tier 1 Renewable Energy Credit (REC) price, or the Social Cost of Carbon (SCC) net of the expected Regional Greenhouse Gas Initiative (RGGI) allowance values, as calculated by DPS Staff. Currently, the SCC is greater than the Tier 1 REC

[33] This Roadmap only addresses distributed solar in the context of the Value Stack, although the Value Stack also applies to other technologies.

[34] Energy and generation capacity are grossed up for avoided losses.

[35] Utilities receive a CES Tier 1-compliant credit for every kWh of generation injected into their system and compensated via the "E" value.

price and, therefore, the E Value is set at the modified SCC of 3.103 cents per kWh.[36]

Customers may forego E Value compensation and retire non-tradable, non-monetizable RECs for their own environmental compliance purposes if they make a non-revocable election at the time of interconnection.[37] Most customers have not elected the Customer Retention Option, but more customers may choose to do so in the future to meet corporate sustainability objectives or other voluntary carbon-reduction efforts.

II.b CDG & Remote Crediting

The growth of CDG has been crucial to expanding opportunities for customer participation in renewable energy, fulfilling a central policy objective articulated in the CDG Order.[38] Community solar projects represent a robust sector in the New York solar industry, with 784 MW completed (representing 511 projects) and 2,497 MW more in the NY-Sun pipeline. With nearly 300 MW of CDG installed in 2020 alone, New York State was ranked number one nationally in annual CDG project completions. CDG project size has also been increasing over time, growing from an average project size of 0.3 MW in 2016 to 2.0 MW in 2020. Development has not slowed in 2021, with 256 MW installed as of November 30, 2021. CDG growth is expected to continue contributing prominently to achieving the Incremental 4 GW Target. Continued improvements to the CDG program framework,

[36] Case 15-E-0751, supra, E Value Update April 2021 (filed April 21, 2021).

[37] VDER Transition Order, p. 65.

[38] See Case 15-E-0082, Community Net Metering, Order Establishing a Community Distributed Generation Program and Making Other Findings (issued July 17, 2015) (CDG Order).

such as the adoption of net crediting, should help further reduce soft costs for CDG development.[39]

In the NY-Sun Expansion Order, the Commission also recognized the benefits of facilitating additional participation in community solar projects, and therefore directed electric utilities to implement a Remote Crediting program allowing Value Stack-eligible resources to distribute credits to multiple, separately-sited, and unaffiliated customers.[40] Remote Crediting provides additional opportunities for participation in clean energy by allowing, for example, non-residential customers who cannot host on-site renewable generators to receive credits. Remote Crediting projects are also less expensive to develop than CDG due to lower customer acquisition and financing costs. This difference between developing CDG and remote crediting projects is estimated to be the equivalent of 0.6 to 0.9 cents per kWh for Upstate projects, although this estimate does not fully reflect the anticipated cost savings once net crediting is completely implemented.[41]

II.c Opt-Out Community Solar

Community solar on an "opt-out" basis could offer several potential improvements to the traditional CDG program framework.

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[39] See Case 19-M-0463, Consolidated Billing, Order Regarding Consolidated Billing for Community Distributed Generation (issued December 12, 2019).

[40] NY-Sun Expansion Order, pp. 25-26; see also, Case 19-E-0735, supra, Order Clarifying Remote Crediting Program (issued September 17, 2020), and Order Authorizing Changes to the Remote Crediting Program (issued July 15, 2021).

[41] The evaluation below of potential future solar development scenarios in New York is based on likely project costs and whether they would be developed as CDG or Remote Crediting projects.

Under an opt-out configuration, customers are automatically enrolled into a CDG project, in contrast to an opt-in program where customers must proactively research the program and affirmatively contact the administrator to enroll. Opt-out community solar could provide benefits to a wider group of customers than might otherwise be possible through the traditional CDG framework.[42] Opt-out community solar also offers a new element of efficiency and soft cost reductions to CDG development, since a project owner could avoid substantial customer acquisition costs associated with recruiting many individual participants. Conversely, opt-out CDG also introduces additional complications as compared to traditional CDG projects, including data transfer and customer consent issues.

Currently, opt-out CDG is only possible through Community Choice Aggregation (CCA), which allows municipalities to purchase electricity supply, including clean electricity supply options, for their entire community on an opt-out basis. As of April 2021, there are four Commission-approved CCA Administrators and 14 CCA aggregation groups statewide, and there are approximately 100 municipalities in various stages of joining or implementing a CCA program.[43] A small number of CCAs have received Commission approval for the integration of opt-out CDG into their CCA supply offerings.

On April 14, 2021, DPS Staff filed a White Paper proposing updated rules for CCAs, including provisions for CCAs to provide

[42] A minority of customers choose to actively manage their electric supply; 15% of Upstate residential customers have migrated to competitive suppliers. See Matter 19-00157, Electric Migration Data Year End Summary, Electric Migration Year End Summary (filed June 17, 2021) (Electric Migration Year End Study).

[43] Case 14-M-0224, Community Choice Aggregation Programs.

opt-out community solar to all CCA members.[44] The CCA White Paper also requested stakeholder feedback regarding the potential for opt-out CDG to be offered on a standalone basis (i.e., not tied to a CCA supply product). On November 22, 2021, the Commission issued an Order addressing only the opt-out CDG issues identified in the CCA White Paper.[45] The Opt-Out CDG Order directs DPS Staff to file proposed opt-out CDG program operation, oversight, and enforcement rules for future Commission consideration. The Opt-Out CDG Order also specifically paused consideration of various petitions from existing CCA providers for authorization to operate standalone CDG programs, as well as consideration of additional opt-out CDG implementation plans (whether integrated with a CCA program or standalone), until programmatic rules for a statewide opt-out CDG program are established.

II.d Solar Energy Equity Framework

Increasing access to solar energy can help address household energy burden, improve resilience in affordable housing, and advance equity as part of the clean energy transition. The NY-Sun program offerings focused on serving LMI households, affordable housing providers, disadvantaged communities, DACs, and environmental justice communities have grown continually since the initiative was launched.

[44] Case 14-M-0224, supra, Staff CCA Whitepaper (issued April 14, 2021) (CCA White Paper).

[45] Case 14-M-0224, supra, Order Identifying Further Procedural Steps Regarding the Development of Opt-Out Community Distributed Generation (issued November 22, 2021) (Opt-Out CDG Order).

The Climate Act requires that DACs receive at least 35 percent with a goal of 40 percent of the overall benefits of clean energy program efforts which has sharpened this focus. Pursuant to the Climate Act, NYSERDA is required to "consider enhanced incentive payments for solar and community distributed generation projects, focusing in particular but not limited to those serving disadvantaged communities ... which result in energy cost savings or demonstrate community ownership models." The 2014 MW Block Order authorized $13 million for LMI customer access to clean energy opportunities.[46] Subsequently, in 2017, $21.5 million in Clean Energy Fund monies was directed toward the first phase of Solar for All, a low-income community solar program.[47] The NY-Sun Expansion Order approved an incremental $200 million in funding for LMI customers, including: (1) $135 million in incentives to projects dedicated to serving LMI customers, affordable housing, and environmental justice and disadvantaged communities; and (2) at least $65 million of MW Block and Community Adder incentives to support projects serving these communities.[48] The programs and activities undertaken by NYSERDA to achieve these goals collectively make up New York's SEEF.

As of December 6, NYSERDA has committed a total of $25 million in SEEF incentives, with an additional $17.1 million of MW Block and Community Adder funds leveraged through these projects. Currently, NYSERDA has approximately $50 million in

[46] MW Block Order, p. 2.

[47] The program was previously called the Low Income Community Solar Initiative. See Matter 16-00681, Clean Energy Fund Investment Plan, Clean Energy Fund Investment Plan: Low- to Moderate-Income Chapter (filed October 5, 2017), pp. 67-75.

[48] NY-Sun Expansion Order, pp. 23-24.

Inclusive Community Solar Adder applications under review, and expects to have committed this additional SEEF funding and a similar amount of leveraged MW Block and Community Adder funding by the end of February 2022.

While NYSERDA estimates that approximately 85% of the SEEF funding will be committed to direct project incentives, significant barriers to the early-stage planning and predevelopment of projects serving communities prioritized by the SEEF continue to exist. To help address these barriers, NYSERDA offers an Affordable Solar and Storage Predevelopment Technical Assistance Program that provides funding for community organizations, housing providers, and other eligible entities. As of this filing, $5.1 million has been committed to 35 local initiatives throughout the State.

NYSERDA currently offers two other NY-Sun incentives for onsite solar installations benefiting LMI households: the Affordable Solar Residential Incentive and the Multifamily Affordable Housing Added Incentive. The Rooftop Residential Added Incentive, launched in 2015, provides additional NY-Sun incentives for homeowners installing residential solar at their homes.[49] The Multifamily Affordable Housing Added Incentive, launched in 2018, provides additional NY-Sun incentives for projects under 200 kW sited on multifamily affordable housing properties that are either owned by a public housing authority (PHA) or are managed under a regulatory agreement with local, state, or federal housing agencies. In total, NYSERDA has committed $19.9 million in NY-Sun funds to 721 eligible

[49] NYSERDA, NY-Sun Upstate + Long Island Program Manual – Version 13 (September 2021), p. 9-11, available at https://www.nyserda.ny.gov/All-Programs/NY-Sun/Contractors/Resources-for-Contractors.

residential projects and 397 eligible affordable housing projects. In New York City specifically, NYSERDA provides both technical assistance and incentive funding to the New York City Housing Authority (NYCHA)'s Solar Access Initiative, and the New York City Housing Preservation and Development (HPD) Solar Where Feasible mandate.

While onsite incentive adders for projects benefiting LMI households have value, a key premise of the SEEF is that community solar, primarily through C/I distributed solar, offers the greatest opportunity to benefit LMI households and DACs. The NY-Sun Expansion Order recognized the unique role of CDG in serving these communities, stating "before the establishment of CDG, these communities could only be reached through rooftop solar, which faces significant barriers including the lower likelihood of homeownership, the potential for LMI customers moving more often, and the lack of suitable roofs."[50]

As the first major community solar strategy to be implemented within the SEEF, the Inclusive Community Solar Adder was launched on July 20, 2021, with an initial budget of $52.5 million to provide additional incentives to community solar projects serving a broader set of eligible subscribers, including LMI households, affordable housing providers, and small nonprofit/public organizations serving DACs.[51] Projects must dedicate at least 20% of capacity to guaranteed-savings subscriptions for individual LMI households, and incentive payments are based on performance. A higher added incentive is

[50] NY-Sun Expansion Order, pp. 23-24.

[51] More information about NYSERDA's Inclusive Community Solar Adder is available at https://www.nyserda.ny.gov/All%20Programs/Programs/NY%20Sun/Contractors/Dashboards%20and%20incentives/Inclusive%20Community%20Solar%20Adder.

available to projects that benefit EJ communities burdened by, for example, proximity to fossil-fuel based electric power generating facilities. Since the Adder launched, NYSERDA has received applications for 538 MW across 173 community solar projects for $68 million in Inclusive Community Solar Adder funding, leveraging an additional $184 million in NY-Sun base incentives and Community Adder funding. The Inclusive Community Solar Adder was developed with over a year of stakeholder engagement and market research in 2020-21, and its program design is largely applicable to the successor options described in this Roadmap, including the recommended option.

II.e Interconnection Costs & Hosting Capacity

Interconnection costs have fluctuated as commercial project sizes have grown, as shown in Table 2.

Table 2

C/I Interconnection Capacity and Costs[52]

	Average Project Size (MWac)	Total Project Capacity (MWac)	Total Cost ($Million)	Unit Cost ($/kW)
2015	1.7	10.0	1.4	136
2016	1.8	38.9	7.5	193
2017	1.9	167.5	24.8	148
2018	2.5	216.7	43.6	201
2019	3.8	284.3	29.8	105
2020	4.0	1014.5	124.7	123
2021 (Through October)	4.0	911.3	120.7	132

Improved interconnection costs under the Cost-Sharing 2.0 framework, which was adopted with modifications on July 16, 2021, should improve the general hosting capacity of the distribution system.[53] Previously, interconnections were subject to the first-mover requirement, which required the developer of the first interconnection project that triggered a need for a system modification to pay 100 percent of the upgrade cost, subject to potential reimbursement by other projects that interconnect later and benefit from the upgrade. Notably, "the

[52] SIR Inventory Information, as posted on DPS website. Queue data as of October 2021. Calculations include the JUs, but not LIPA. Projects are totaled by full payment date and do not represent annual completions. The queue data in this table are current as of October 2021. additional SIR inventory information is available on the DPS website at https://www3.dps.ny.gov/W/PSCWeb.nsf/All/286D2C179E9A5A8385257FBF003F1F7E.

[53] Case 20-E-0543, Cost-Sharing Amendment to the New York State Standardized Interconnection Requirements, Order Approving Cost-Sharing Mechanism and Making Other Findings (issued July 16, 2021) (Cost-Sharing Order).

[previous] cost-sharing mechanism [had] not resulted in any DG/ESS projects taking on the first-mover cost impact and paying for substation upgrades, and as such, no DG/ESS projects have been sited in distribution-saturated areas of the Joint Utilities' respective service territories."[54]

Under the Cost-Sharing 2.0 framework adopted in the Cost-Sharing Order, a project pays only for the specific distribution hosting capacity assigned to it, as opposed to the entire cost of the upgrade. The cost of distribution system upgrades would be equitably allocated to each project interconnected on the same substation, and applicants would have greater certainty regarding their upgrade cost obligations. These measures will drive savings by better integrating the interconnection queue with other utility T&D investments, unlocking previously saturated areas of the distribution system for hosting and promoting economies of scale.

The Commission recently has taken steps to improve coordinated grid planning. For example, in its Phase 2 Order, the Commission directed the Utilities to, among other things: (a) develop and file a coordinated power grid planning process; (b) identify specific Phase 2 transmission upgrades to meet "Areas of Concern", which "... are characterized by the presence of existing renewable generation that is already experiencing curtailments and a strong level of developer interest that

[54] Case 20-E-0543, supra, Petition of Interconnection Policy Working Group seeking a cost-sharing amendment to the New York State Standardized Interconnection Requirements (filed October 29, 2020), p. 3.

exceeds the capability of the local transmission system";[55] (c) revise their benefit-cost analysis framework and develop a cost-allocation mechanism for the Phase 2 Upgrades; and (d) develop a "unified and shared data base and models."[56] Though solar developers face increasing interconnection costs as attractive sites are developed, New York State and the Joint Utilities can help mitigate these costs and improve annual interconnection capabilities through the cost-sharing interconnection process, coordinated transmission planning with Phase 2 Upgrades, and future policy improvements.

This Roadmap does not contemplate an overall limit to distributed solar hosting capacity due to transmission and distribution topology. However, DPS Staff and NYSERDA reviewed the current ability of the State's electric utilities to perform system upgrades and interconnect distributed solar. C/I distributed solar interconnections have grown every year from 2012 to 2020, and the New York utilities project a nearly threefold increase in distributed solar interconnections from 2020 to 2021, as shown in Table 3. Meeting these projections would require a large uptick in completions in the second half of 2021, even relative to the historical trend of project completions in the second half of the calendar year, and would be dependent on weather and other factors that impact construction and employee availability.

[55] See Case 20-E-0197, Transmission Planning, Order on Local Transmission and Distribution Planning Process and Phase 2 Project Proposals (issued September 9, 2021), p. 34 (Phase 2 Order).

[56] Phase 2 Order, pp. 46-47.

Table 3

C/I Interconnections per Year (Estimated MW) [57]

	Central Hudson	Con Edison	National Grid	NYSEG	O&R	RGE	Grand Total
2012	-	-	1	-	-	-	1
2013	1	5	3	2	-	-	11
2014	-	1	6	2	4	3	16
2015	2	3	9	7	5	5	30
2016	-	3	30	14	5	4	56
2017	-	4	73	17	2	20	116
2018	8	7	123	25	13	17	194
2019	44	2	55	124	15	22	262
2020	34	8	226	84	26	6	384
2021 (projected)	*101*	*69*	*397*	*323*	*42*	*139*	*1,071*

Interconnections from 2012 to 2020 were calculated using the Statewide Solar Projects: Beginning 2000 dataset, which is maintained by NYSERDA and available on the data.ny.gov website.[58] The dataset is based on the utilities' interconnection queues. Interconnections for 2021 were projected by the utilities. Based on the increased interconnection activity expected in all utility service areas, it appears that the utilities can meet demand for distributed solar project interconnections for the entire 10 GW goal, provided work is spread more evenly throughout the year instead of concentrated in the final months of the year.[59]

[57] MWac values from interconnection studies are converted to DC utilizing a 1.38:1 DC-to-AC factor.

[58] See https://data.ny.gov/Energy-Environment/Statewide-Solar-Projects-Beginning-2000/wgsj-jt5f.

[59] See National Grid, Interconnection Policy Working Group Presentation (February 17, 2021), p. 5, available at https://www3.dps.ny.gov/W/PSCWeb.nsf/All/0D7596DBBEF0380885257FD90048ADFA.

III. DISTRIBUTED SOLAR POLICY OPTIONS

While the NY-Sun program has successfully incentivized solar development in New York, with the State well on track to achieve 6 GW of distributed solar before 2025, further efforts are needed to achieve the more aggressive 10 GW goal. Establishing a procurement target is a foundational step and provides investor certainty and transparency in the solar marketplace, which attracts market participants like solar developers, financiers, project aggregators, tax equity partners, and customer acquisition entities to New York, creates market efficiency and competitiveness, and drives down costs. Setting a new target provides more investor certainty on the prospects of future development, which requires costly and time-intensive pre-development work such as site identification and utility interconnection studies.

NYSERDA and DPS Staff recommend setting a revised NY-Sun target of 4 GW of additional distributed solar by 2030, on a glidepath to achieving Governor Hochul's 10 GW by 2030 target. The Incremental 4 GW Target is an achievable goal based on the status of New York's distributed solar market. Under the Incremental 4 GW Target, 3,393 MW of new capacity would be incentivized through the expanded program. The remaining capacity would be comprised of new projects installed in Long Island (estimated to total 560 MW) and an estimated 47 MW of statewide residential deployment, both of which would not be part of the proposed incentive program. NYSERDA and DPS Staff further recognize that, pursuant to the Climate Act, it is required that DACs to receive at least 35 percent with a goal of 40 percent of the overall benefits of clean energy program effort.

Several policy options are evaluated that could be implemented in order to cost-effectively achieve the Incremental 4 GW Target by 2030. As part of developing the Roadmap, NYSERDA contracted with Energy and Environmental Economics, Inc. (E3) to analyze different procurement and incentive pricing options to achieve the Incremental 4 GW Target. The evaluation concluded that adopting the new distributed solar target will require further ratepayer support under the modeled scenarios in Table 4.

Table 4

Overview of Potential Program Designs

Scenario	Procurement Type	Incentive
1	Administrative	Fixed E Value
2		Index E Value
3	Auction	Fixed E Value
4		Index E Value
5	JU Proposal	Fixed E Value
6	**MW Block**	**Up-Front Payment**

The analysis in the Roadmap leads to the conclusion that the sixth scenario, an expansion of the NY-Sun MW Block program funding with a stable E Value set at the current level[60], would support a cumulative goal of 10 GW of distributed solar by 2030 in a balanced and cost-effective manner. In addition to this recommended approach, the Roadmap analyzed both administratively-set and auction-based E-Value incentive models, each with a fixed and an indexed pricing mechanism. The JU

[60] The E Value is currently set at 3.103 cents per kilowatt hour.

proposal was also modeled with an administratively-set fixed incentive, excluding customer participation costs.[61] These policy options and general recommendations for achieving the Incremental 4 GW Target are discussed below. A matrix comparing the cost-effectiveness, feasibility, developer efficiency, and market compatibility of the six proposed policy options is provided in Appendix A.

III.a General Policy Recommendations

In evaluating the market support mechanisms available to achieve the Incremental 4 GW Target, several broader policy considerations will factor into the overall recommended approach. These include geographic equity, benefits to LMI households and DACs, interconnections issues, farmland protection, prevailing wage standards, and federal policy.

III.a.1 Geographic Considerations

As NYSERDA noted at the first technical conference, "solar adds resource and geographic diversity to New York's renewable energy portfolio."[62] The policy options must balance the competing interests of maintaining geographic diversity in future distributed solar installations, minimizing program costs due to incentives or "missing money" required to support future solar installations, and controlling administrative costs and complexity of multi-region procurement strategies. Additionally,

[61] The full analysis report is included as Appendix B. The JU proposal was modeled a modification to the Fixed Administrative case with no upfront customer acquisition costs, no customer management ongoing costs, and no customer bill discount for most customer subscribers (10% for LMI).

[62] See Technical Conference Proceedings Document, p. 53.

many of New York State's DACs (as identified in the State's interim criteria for DACs) are located in the Downstate region, raising equity concerns about the geographic distribution of projects.[63]

Hosting capacity varies in different parts of the State, and C/I developments to date do not match the distribution of customers and demand throughout New York State.

[63] The Climate Leadership and Community Protection Act (CLCPA) directs the Climate Justice Working Group (CJWG) to establish criteria for defining disadvantaged communities. However, until the criteria are established, New York State has specified interim criteria for disadvantaged communities, which includes two types of communities, those: (i) located within census block groups that meet the U.S. Housing and Urban Development (HUD) 50% area median income (AMI) threshold of the top quartile of census block groups in New York, ranked by the percentage of low and moderate income (LMI) households, defined as households with annual incomes at or below 50% of the AMI of the county or metro area where the census block group resides, that are also located within the DEC Potential Environmental Justice Areas; or (ii) located within New York State Opportunity Zones.

Table 5

Completed Statewide Distributed Solar (MW) and Electricity Sales Percentages by Utility[64, 65]

	Central Hudson	Con Edison	LIPA	National Grid	NYSEG	O&R	RG&E
Solar Capacity	7.3%	14.2%	22.8%	29.5%	16.0%	5.5%	4.7%
Electricity Sales	3.5%	39.6%	13.5%	24.4%	11.1%	2.8%	5.1%

As shown in Table 5, the Upstate utilities have distributed solar developments that are generally consistent with or in excess of their electricity sales. By contrast, Con Edison represents almost 40% of utility energy sales in New York, but only about 14% of the distributed solar completions to date have occurred there.

Several options for including geographic considerations were considered, including segmenting procurement targets by utility territory, NYISO Zone, and system size. NYSERDA and Staff considered segmenting the target by utility and geography, but further review suggested that Upstate project costs and revenues are similar enough to warrant grouping the five Upstate utilities together.[66] Setting an overly prescriptive locational signal for the five Upstate utilities could constrain cost-effective development. Relatedly, segmentation by system size

[64] These figures are based on solar project information as of August 31, 2021. A full dataset is available via Data NY, at https://data.ny.gov/Energy-Environment/Statewide-Solar-Projects-Beginning-2000/wgsj-jt5f.

[65] See U.S. Energy Information Administration, 2019 Annual Electric Power Industry Report (October 7, 2021), available at https://www.eia.gov/electricity/data/eia861/. Customer count includes all sectors.

[66] See section 2.2 and 2.3 of Appendix B.

could provide better price signals to recognize scaling limitations in areas with limited land use options (such as the Downstate region) but could also produce opportunities for gaming if developers subdivide otherwise viable sites for use in a more attractive pricing tier. To avoid this sort of behavior, no system size segmentation was considered for Upstate procurement options.

The discrepancy between distributed solar development in Con Edison and the rest of the State is primarily driven by siting constraints, particularly in New York City. Large parcels or rooftops capable of supporting more than several hundred kilowatts are both expensive and difficult to secure. Costs (including labor costs) and regulatory hurdles also make new development in the Con Edison service territory particularly challenging. Additionally, many projects sited in Con Edison are likely to be under 1 MW, and projects of this size have different development timelines and challenges as compared to larger projects.

Although Downstate development carries unique challenges, it also has crucial benefits. According to the NYISO's Power Trends 2021 report, the Upstate region, defined as NYISO load zones A – E, is supplied by 90% zero-emission resources, while the Downstate region (zones F - K) is supplied by 77% fossil fuel-fired generation.[67] While nearly all generation in New York City (Zone J) is currently supplied by fossil-fired generation, the State's clean energy pipeline including Tier 4 transmission

[67] NYISO, Power Trends 2021: New York's Clean Energy Grid of the Future (May 2021), p. 6, available at https://www.nyiso.com/documents/20142/2223020/2021-Power-Trends-Report.pdf.

projects and offshore wind will reduce the city's fossil fuel use by more than 80 percent by 2030.

As noted in the CES White Paper, "Distributed solar is an effective tool for decarbonizing the New York City electric system, but on a limited scale."[68] When deployed in combination with Tier 4 projects and offshore wind, distributed solar in Con Edison can contribute to further reducing the city's fossil fuel use. Distributed solar would also contribute to grid resilience associated with the diverse portfolio of clean energy replacing New York City's retiring fossil fueled generation, particularly for LMI communities. The Solar Energy Industries Association noted that "evacuations, property damage and other impacts from natural disasters are disproportionately harmful for these communities. Increased solar deployment can help mitigate future climate events by lowering carbon emissions, and locally-sited energy generation increases resilience and reliability for local populations."[69]

To achieve continued and meaningful distributed solar development in the Con Edison footprint, this Roadmap proposes a carve-out of approximately 450 MW of distributed solar projects developed in the Con Edison service territory. Due to the factors specific to the Con Edison market described earlier, the Roadmap recommends a policy that supports a mix of residential, non-residential, and C/I projects. The residential sector in the Con Edison service territory continues to enjoy strong growth, with approximately 234 MW installed to date, accounting for over

[68] CES White Paper at 46.

[69] Solar Energy Industries Association, Solar Industry Policy Principles on Environmental Justice & Equity (April 2021), *available at* https://www.seia.org/sites/default/files/2021-04/SEIA-Solar-Environmental-Justice-Platform-April2021.pdf

half of the utility's installed distributed solar capacity. To maintain this diverse project mix and leverage the relative cost and roof availability of residential solar in New York City and Westchester County, additional residential incentives are recommended to be included within a Con Edison carve-out, as detailed in Section III. Additionally, the carve out should include a separate incentive for both the small (i.e., less than 1 MW) and large (greater than 1 MW) projects.

Long Island also plays an important role in New York's distributed solar accomplishments. As of November 30, 2021, 819 MW of statewide distributed solar has been installed in Long Island, and annual deployment continues at a robust rate. Based on LIPA's prior progress and expected economics, Long Island is expected to contribute an additional 560 MW towards the Incremental 4 GW Target. Since Long Island electric customers do not pay into the CEF, incentive support, if needed, would need to come from other sources.

NYPA too plays an important role in New York's distributed solar accomplishments. NYPA works with private developers and its energy service customers across all service territories, and to date has deployed 30 MWs of distributed solar. Certain NYPA customers do not pay into the CEF and will not be eligible for the funding recommendations of this whitepaper. However, $29 million in RGGI funding was set aside to help these customers deploy distributed solar and $7.3 million remains as of the date of this filing.

III.a.2 Solar Energy Equity Framework

In the NY-Sun Expansion Order, the Commission authorized the SEEF as a means for NYSERDA to meet the Climate Act's DAC

mandate. This Roadmap proposes expanding and adapting the SEEF to encompass additional investments in distributed solar. No less than 1,600 MW, or 40%, of the Incremental 4 GW Target should be targeted toward LMI residents, regulated affordable housing, DACs, and environmental justice communities under SEEF.

Additional requirements may be identified to balance the full range of potentially qualified subscribers/beneficiaries. For example, public housing authorities and public schools serving DACs would be considered qualified subscribers under the SEEF. While these larger, institutional customers may represent a lower cost path to meeting the Climate Act requirements, the SEEF also seeks to balance the inclusion of individual LMI residential customers receiving direct cost savings. For example, the existing NY-Sun Inclusive Community Solar Adder sets a minimum requirement of 20% LMI household subscribership.

This Roadmap therefore proposes that half of the SEEF capacity (or 20% of total incremental capacity) be targeted specifically to providing LMI residential customers with direct, guaranteed electric bill cost savings, including LMI homeowners who install residential solar, LMI residents that individually subscribe to community solar, and those that are automatically enrolled in community solar through opt-out community solar programs. Consistent with the CDG Order, residents of master-metered, multifamily buildings who receive cost savings from Value Stack credits applied to the master meter through sub-metering or other means would be included in this targeted capacity.

Regarding an expanded SEEF, this Roadmap primarily focuses on potential higher incentive levels and/or capacity targets for projects that provide direct cost savings benefits to customers targeted by the SEEF. However, the Roadmap is not intended to

de-prioritize other components of the SEEF, such as technical assistance, predevelopment funding, and programmatic support for community-led solar projects with stakeholders representing DACs and EJ communities. Rather, those efforts also should be extended to include projects and planning related to the Incremental 4 GW Target.

Beyond strategies to increase adoption of distributed solar, NYSERDA will focus on models to integrate distributed solar into the broader set of clean energy interventions and approaches to address energy affordability for low-income households. As outlined in the August 2021 Order Adopting Energy Affordability Policy Modifications, the Commission views the coupling of bill discounts with permanent usage reductions via energy efficiency as the best approach for furthering longer-term energy affordability for low-income households.[70] While energy efficiency upgrades can significantly reduce household energy consumption and provide long term energy burden reductions, electric load reduction is an increasingly difficult proposition for energy efficiency programs to address due to the growth of plug load associated with consumer electronics; in these cases, electric bill reductions associated with distributed solar can help to offset the electric bills for these households. Similarly, community solar subscriptions or rooftop solar installations can help to offset the increased electric load associated with heat pump installations.

As New York State advances building electrification, including for low-income households, access to distributed solar can help mitigate the bill impacts associated with increased

[70] Case 14-M-0565, Energy Affordability, Order Adopting Energy Affordability Policy Modifications and Directing Utility Filings (issued August 12, 2021), p. 48.

electricity consumption for single family and multifamily buildings as they electrify their heating. Models that integrate heat pumps and distributed solar will be a priority for NYSERDA to demonstrate over the next year. NYSERDA will collaborate with utilities to incorporate models for integrating distributed solar and energy efficiency interventions as part of the Statewide LMI Portfolio of energy efficiency programs.

III.a.3 Distribution System Investments

Existing distribution system hosting capacity constraints and the costs associated with system upgrades necessary to expand hosting capacity are key challenges impacting the growth trajectory of distributed solar deployment in New York. While the adoption of the Cost-Sharing 2.0 framework in the Commission's July 2021 Order, as discussed in Section III.a.3, is expected to expand the general hosting capacity of the distribution system, it is likely that additional policy actions, outlined below for the Commission's consideration, will be necessary to expand hosting capacity to enable the realization of the Incremental 4 GW Target advanced in this Roadmap.

1. Utility planning processes should be modified to ensure that existing distribution system hosting capacity and expected distribution system investments are periodically evaluated in relation to the additional hosting capacity necessary to realize the Incremental 4 GW Target.
2. The inclusion and consideration of distribution system investments that expand hosting capacity in line with the Incremental 4 GW Target at locations of high distributed solar market interest in future utility Capital Investment Plans.

3. The Cost-Sharing 2.0 framework should be revisited, in light of the Incremental Target and the Commission's Climate Act planning initiatives, to determine whether the cost allocation methodology for distribution system upgrades should be revisited and whether utility investment in hosting capacity upgrades can be accelerated, without increasing ratepayer risk.

III.a.4 Agricultural Protection and Land Use

Farmland protection and the maintenance of a vibrant agricultural economy are important State policy goals. New York State recognizes the importance of collaboration between the agriculture and clean energy sectors as a critical part of the State's overall decarbonization strategy. NYSERDA works in close coordination with the Department of Agriculture and Markets (NYSAGM) and other stakeholders to responsibly support the development of renewable energy projects. In the 2019 NY-Sun Expansion Petition, NYSERDA described the interaction of distributed solar with agriculture in New York:

> "The majority of projects in [the Upstate C/I] market sector are expected to be ground-mounted arrays ranging between 5 MW and 7.5 MW in size, which occupy approximately 20 – 25 acres of land, typically on rural properties that are leased or sold to the solar developer by the landowner. Notably, this includes properties that are currently used, or could potentially be used for, agricultural production. While NYSERDA expects that the total agricultural acreage utilized for distributed solar projects will remain modest as compared to total farmland in New York State, through its implementation efforts, NYSERDA will act to ensure that negative impacts to farmland and the State's agricultural economy are avoided and minimized, and where they are unavoidable, mitigated. NYSERDA, working with partner agencies and stakeholders, has already taken multiple

> actions along these lines and will pursue additional actions under an expanded NY-Sun program."[71]

In the subsequent two years, NYSERDA and NYSAGM have continued to work in partnership to put in place requirements for solar projects to minimize impact to farming and agricultural soils.[72] These requirements have already demonstrated their effectiveness: In 2021 to date, all 50 distributed solar projects subject to these requirements, totaling 1,037 acres of affected area, have committed to avoiding and minimizing impacts to prime soils in consideration of the solar layout. For 48 of these projects, all unaffected portions of the farms hosting the solar projects, a total of 3,385 acres, will remain in agricultural production. Many of the farmers hosting projects on a portion of their land report that the steady lease revenue from the solar projects has enabled them to continue farming on most of their property despite challenging agricultural economic pressures.

This Roadmap foresees the existing requirements being extended to distributed solar projects developed through the Incremental 4 GW Target. The State's Agricultural Technical Working Group (A-TWG), an independent advisory body convened by NYSERDA early in 2021, will continue to serve as the primary forum for stakeholder and interagency collaboration on policies and practices pertaining to distributed solar and agriculture.

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[71] NY-Sun Petition, p. 21.

[72] These requirements include, inter alia: complying with New York State Agriculture and Markets Law; submitting appropriate notices to NYSAGM and local Agricultural and Farmland Protection boards; executing a copy of the Guidelines for Solar Energy Projects – Construction Mitigation for Agricultural Lands document published by NYSAGM; and making a Mitigation Fund payment or committing to other mitigation measures where impacted agricultural soils exceed 30 acres.

Guidance provided by the A-TWG and the New York State Farmland Protection Working Group will continue to inform agricultural preservation and mitigation requirements and practices going forward. NYSERDA also continues to provide and expand resources to landowners and local governments through the New York State Solar Guidebook and direct technical assistance.

III.a.5 Prevailing Wage Standards

As part of its transition to a green economy, New York State is committed to creating well-paying jobs. The labor industry is a key partner on the clean energy investments the State is making to achieve the ambitious goals of the Climate Act. Setting clear standards for job quality will ensure the creation of good jobs, protect workers in the ongoing transition of the energy sector, and result in positive economic impacts. This Roadmap considers future labor policies including reducing the MW threshold for renewable energy projects being subject to prevailing wage or project labor agreements from 5 MW AC to 1 MW AC.

Prevailing wage and project labor agreement requirements are a longstanding practice of NYSERDA's large-scale renewables programs and have been required for all LSR projects since 2018, including offshore wind since the first solicitation in 2018. Consistent with requirements for large-scale renewables procurements[73], this Roadmap recommends the payment of prevailing

[73] Construction activities included within the scope of the prevailing wage requirement for large-scale renewables include, but are not limited to, the clearing, grubbing, grading, staging, installation, erection and placement of the generating facility, energy storage component and electrical interconnection, as well as start-up and commissioning of the facility.

wage as a programmatic requirement for NY-Sun incentives for larger distributed solar projects (1 MW AC and above) that submit their initial utility interconnection application subsequent to the filing of this Roadmap. This milestone date-based provision is recommended so that projects already under development are not impacted by an unexpected policy change. DPS Staff and NYSERDA estimate that the proposed prevailing wage standards would apply to 1,550 to 1,850 MW of the Incremental 4 GW Target.

For the purpose of budget planning and based on the industry feedback, the Roadmap uses an estimated additional cost of $0.125/Watt for Upstate C/I projects, and $0.20/Watt for Con Edison C/I projects. Based on the above assumptions, an estimated additional $239 million in NY-Sun incentives would be required to reach the capacity targets included in the Roadmap. For the purpose of this estimation, the figure does not include any new offsetting incentives (e.g., increased federal tax credits) that may accompany a change in policy pertaining to prevailing wage at the federal level. Projects that began the interconnection application process prior to the filing of this Roadmap, or that already have a NY-Sun incentive secured, would not be eligible for additional NY-Sun funds to defer the incremental cost of prevailing wage.

III.a.6 Build Back Better Act Considerations

The U.S. House of Representatives recently passed the Build Back Better Act (BBB Act),[74] which may affect the recommendations made herein if enacted. Although the financial impact of each

[74] Build Back Better Act, H.R. 5376, 117th Cong. (2021) (as passed by House, November 19, 2021).

item or combination of items under deliberation in the BBB Act are not calculated at this time, the potential impact of the proposed changes on individual project economics, as well as total program costs, are likely to be significant. While difficult to quantify potential savings, an increase of the Federal ITC to 30% for the duration of the program could reduce the total program cost by $525 million or more. The impact may be even more pronounced if developers could invoice the Treasury Department directly for the ITC payment. If the BBB Act is enacted, NYSERDA will amend and refile the NY-Sun Program Operating Plan as needed to reflect relevant adjustments to the incentive rates. Further, in the mid-program review filing, as discussed in Section III.d.2, NYSERDA will include the BBB impact analysis and adjustments to total calculated program budget, program structure, and recommendations.

III.a.7 Continued Involvement of New York Green Bank

Under its mission to transform clean energy financing markets, the New York Green Bank (NYGB) has emerged as one of New York's leading lenders to distributed solar market developers and project owners. NYGB provided its first interconnection bridge loan in 2017 and has since committed over $490.6 million to community solar projects and $160.9 million to community solar plus storage projects. To date, NYGB estimates its investments will support over 1,100 MW of community solar and solar plus storage projects.

NY Green Bank has provided important liquidity to the New York community solar market and has established financing structures which other lenders have started to adopt. NYGB offers a range of products to CDG developers and owners to

address development, construction, and long-term financing needs.

In an expanded 10 GW Target, NYGB can continue to play an ongoing role in financing. NYGB is collaborating with financing partners to stimulate greater private lending into development and construction projects, where NYGB's capital has been catalyzing to date. NYGB has an expanding part to play in the nascent segment of paired solar-plus-storage, where project economics are more complex and less predictable. Finally, NYGB is supporting the Climate Act's equity goals by seeking projects that target low- and moderate-income New Yorkers as subscribers and that provide other benefits to the State's historically disadvantaged communities.

III.b Procurement Structure Options

This Roadmap analysis leads to the recommendation that a "missing money" approach be used to set the incentive level, with the incentive level for each geography (Con Edison, Upstate) reflecting the amount needed by the marginal resource block to reach its assumed IRR, in the year in question. There are two approaches that were considered for setting the incentives in the context of the Incremental 4 GW Target: (1) an administratively-set approach, or (2) an auction-based approach. Under the administratively-set approach, the incentive would be set based on modeled distributed generation market conditions within the context of project characteristics and costs, timing, location, and program targets. Under an auction-based approach, the incentive would be set through a competitive procurement in which developers bid in a price that would make their projects

viable and cost effective. Additionally, the JU proposal was considered.[75]

Each of these options has its own set of challenges and benefits. Competitive procurements have precedence in New York State under the CES, while administratively set prices have previously been effective as used in the NY-Sun MW Block program, the Community Adder, MTC, and CC. E3 conducted analysis of both approaches and the JU Proposal, for which the methodology is explained in Appendix B.

III.b.1 Auction Approach

Under competitive procurements, or auctions, market participants would determine the amount of incentive needed through their bids. An auction-based approach tends to reflect current market conditions most accurately and yield the most competitive prices as developers bid based on their specific revenue requirements. However, potential implementation challenges must be considered, both from the perspective of administrative feasibility and from the perspective of potential erosion in realized cost savings (i.e., higher-than-modelled bid prices due to increased developer soft costs and uncertainty).

Competitive procurements have been used in New York to procure renewable energy. In recent years, competitive procurements have only been used in conjunction with the provision of RECs for large-scale projects, including onshore resources and offshore wind. C/I distributed solar competitive solicitations were used by NYSERDA to provide compensation for

[75] The JUs did not specifically endorse either procurement approach, but instead focused on changes to other design characteristics. See Technical Conference Proceedings Document.

C/I distributed solar from 2011 to 2014, resulting in a total of 238.5 MW deployed. Subsequently, the MW Block program was adopted which used an administrative approach.

Auctions, by their nature, reward projects with the lowest bid price. While this can lead to cost-effective project procurement, there is a risk that low-cost bids may reflect speculative projects, over-optimistic revenue assumptions, or developer inexperience, and result in a disproportionately high level of project attrition. It is therefore crucial that any auction-based approach account for attrition and carefully consider project maturity requirements as well as contractual provisions related to timely project delivery post-award.

Tier 1 procurements take place on an annual basis and typically require a long development cycle from project selection to deployment. Appendix A of the 2020 CES White Paper assumed a four-year lag between procurement year and deployment year for Tier 1 solicitations.[76] Tier 1 project developers most commonly pay interconnection upgrade costs after receipt of a NYSERDA award in a Tier 1 procurement and enter operation several years after making this payment.

In contrast, in New York, distributed solar is developed and deployed via a different sequence and on a much shorter timeline. The current NY-Sun program provides developers with certainty of project economics, such that project milestones can be achieved without waiting for notice of a competitive solicitation award. Time from down payment on interconnection upgrade costs (the current threshold for securing a specific E value and DRV) to final interconnection (commercial operation)

[76] 2020 CES White Paper, Appendix A.

averages about two years.[77] Auctions for distributed solar procurement would require greater-than-annual frequency to align with the now-typical distributed solar project development cycle in New York, as projects that are not selected in an annual procurement would experience a delay that would represent about half of the remaining development time. Delays would incur additional costs including carrying the land lease, potential penalty charges from tax equity, and additional administrative costs of bid preparation.

Auction participants would also be required to maintain compliance with the Standardized Interconnection Requirements (SIR). Each major step in the interconnection process is itself time-gated by the SIR. For example, a project must make the 25% down payment on interconnection upgrade costs within 60 business days of the completion of the Coordinated Electric System Interconnection Review (CESIR) by the utility. Furthermore, the SIR currently does not have a mechanism for a project in the interconnection queue to "skip to the front of the line" if, in an auction scenario, a project later in the queue receives an award while an earlier project does not. Were the SIR to be modified to allow reordering the queue in this way, this process would in turn force a recalculation of each project's interconnection costs, undermining the validity of their auction bids. An auction approach can only be accomplished by fully modifying the SIR, and that may inevitably result in significant trade-offs and a lengthy stakeholder process.

[77] This time frame is based on NYSERDA's analysis of utility interconnection queue data as of August 2021. See https://www3.dps.ny.gov/W/PSCWeb.nsf/All/286D2C179E9A5A8385257FBF003F1F7E.

The NY-Sun MW Block incentive program also set the 25% payment as a threshold requirement for project eligibility to secure incentives, in addition to local planning and zoning board approvals. However, it is unlikely that an auction-based approach could continue to require this level of project maturity as a threshold requirement to participate in an auction, as it would require project developers to make significant capital outlays with very high levels of uncertainty. Either option would require significant administrative effort and adjustments to implement.

Implementing the Climate Act requirements for equity and inclusion can, at a high level, be achieved under an auction-based approach by requiring that no less than 40% of the capacity procured be dedicated to benefiting eligible customers (i.e., project owners or subscribers). In practice, this may require additional administrative time and cost associated with auction carve-outs and/or holding multiple separate, stand-alone auctions.

Within the broader range of customers considered eligible under the SEEF, an auction-based approach can also include more specific carve-outs. As discussed in Section III.a.2, this Roadmap recommends that no less than 20% of total program capacity (or half of the capacity dedicated to equity and inclusion) be dedicated to LMI residential customers receiving direct, guaranteed electric bill cost savings. Therefore, capacity for LMI residential customers would, under the auction approach, require its own carve-out or minimum, with nonresidential customers such as regulated affordable housing and public schools serving DACs being eligible for the remainder of the 40% carve-out. (For clarity, this would not exclude customers that are considered eligible for capacity within the

SEEF carve-out from participating in capacity procured in the general auction.)

III.b.2 Administrative Approach

Administrative approaches to determining distributed solar incentives typically involve modeling revenue requirements for reference projects. In this context, the incentive would represent the monetary value that covers the difference between the project's market revenues (*i.e.*, the other components in the Value Stack) and tax incentives, and the cost of building and operating the project. Basing the administratively set solar incentive on parameters that reflect market conditions provides project developers with a level of financial certainty without overpaying. As discussed below, there are two main potential mechanisms for an administratively set incentive: a tariff-based mechanism (i.e., an increased E Value inclusive of missing money) and an upfront incentive (i.e., the NY-Sun MW Block program).

For an administratively set incentive approach, the value would need to be periodically updated to reflect changing market conditions and project economics, but the frequency of updates should not be excessive to the point of undermining developer certainty. However, regardless of the administrative incentive mechanism used, developer certainty will need to be balanced against the need to be response to ratepayer cost. Updates to the incentive value should therefore also be made based on pre-determined and transparently communicated capacity thresholds, in the manner of the NY-Sun MW Block structure. In concept, this kind of structure could apply to a tariff-based administrative incentive structure: i.e., an E Value that is re-evaluated and

reset at predetermined capacity thresholds in order to control costs while ensuring the Incremental 4 GW target is hit.

An administrative incentive approach would also, in practice, require different incentive levels based on project characteristics such as geographical location (Con Edison versus Upstate), remote crediting vs community solar, system size, and benefit to DACs and LMI households. The need for multiple incentive levels reflects fundamental market characteristics and exists regardless of the specific mechanism, tariff-based or upfront, used for an administrative incentive.

The administrative approach to setting prices to compensate distributed solar has precedent in several other states, in addition to New York. For example, the recently adopted New Jersey Successor Solar Incentive (SuSI) Program uses administratively set pricing incentives for C/I distributed solar and community solar.[78] Solar incentive prices under SuSI were determined using a cost-based modeling approach. Similarly, distributed solar incentive prices in Illinois are set using a cost-based modeling administrative approach under the Illinois Power Agency's (IPA) Long-Term Renewable Resources Procurement Plan. The IPA revisits distributed solar prices every two years as part of its Plan updates, determining whether prices should continue to decline at 4% annually as recommended by

[78] New Jersey Board of Utilities Docket No. QO20020184, In the Matter of a Solar Successor Incentive Program Pursuant to P.I. 2018, C. 17, Order 7-28-21-8A (issued July 28, 2021), available at https://publicaccess.bpu.state.nj.us/DocumentHandler.ashx?document_id=1244671.

stakeholders or whether the cost-based model should be refreshed with updated input assumptions.[79]

Both the SuSI and IPA incentive setting mechanisms have successfully taken a transparent approach to determining the value of environmental attributes associated with distributed solar. These programs have benefited from the transparent nature of using a modeled approach and stakeholder feedback on model local cost input parameters.

Taking an administrative approach to setting the incentive in New York would similarly be based on modeling a supply curve that analyzes future project economics. Administratively setting the incentive levels provides certainty and transparency in the pricing and process, allowing developers to set expectations. For these reasons, an administrative approach works well with achieving a target at a reasonable cost to ratepayers. The administrative approach to procurement sets prices based on the revenue requirements of a calculated "marginal" product. Relative to an auction procurement approach, the administrative approach may not capture as much ratepayer savings as lower-cost projects will still receive the marginal, incentive-setting value rather than an as-bid price that may represent a less generous rate of return.

Projects have historically reserved their E value, MTC, and/or CC once the 25% utility upgrade payment was made, while projects reserved their NY-Sun incentive and the CA when they had both the 25% payment and local permit approvals.

[79] See Illinois Power Agency, Long-Term Renewable Resources Procurement Plan, Section 6.3.2 (June 7, 2021), available at https://www2.illinois.gov/sites/ipa/Documents/Final%20Reopening%20Revised%20Long-Term%20Plan%20%287%20June%202021%20rev%29.pdf

Not requiring proof of planning and zoning permit approval could lead to speculative incentive reservations that contribute to either overallocation of funds or project attrition from immature projects. An administrative incentive reservation would be contingent on both the 25% interconnection payment and proof of planning and zoning permit approval. This requirement has proven successful under the NY-Sun MW Block program, which follows a similar pattern of predictability to an administrative incentive value.

Implementing the Climate Act requirements for equity and inclusion can, at a high level, be achieved under an administrative approach by 1) targeting no less than 40% of the capacity receiving an administratively-set incentive be dedicated to benefiting eligible customers (i.e., project owners or subscribers, and 2) setting the incentive for this capacity at a level that reflects the additional costs incurred and direct benefits targeted by projects serving eligible customers.

As discussed in Section III.a.2, this Roadmap recommends that no less than 20% of total program capacity (or half of the capacity dedicated to equity and inclusion) be dedicated to LMI residential customers receiving direct, guaranteed electric bill cost savings. Therefore, capacity for LMI residential customers would require its own carve-out or minimum target, with nonresidential customers such as regulated affordable housing and public schools serving DACs being eligible for the remainder of the 40% carve-out. (For clarity, this would not exclude customers that are considered eligible for capacity within the SEEF carve-out from participating in projects that are not within the carve-out.)

Under an administrative incentive approach, the SEEF could be extended with a continued emphasis on community solar

strategies. Additional dedicated incentive funding for the SEEF would offset specific additional costs incurred by eligible projects, and ensure that these projects deliver meaningful direct customer benefits.

III.b.3 JU Proposal

The JUs did not present a fully fleshed-out proposal at the technical conference, but instead offered some potential design characteristics and a desire to work with stakeholders on details of the proposal.[80] The JUs assert that the E Value should be set based on the REC clearing price, and that "if additional financial support is necessary for distributed generation, NYSERDA should provide it".[81] The JUs recommend this approach so that "to the extent out-of-market costs remain, they would be collected fairly from utility customers".[82] While the JU Proposal does not recommend an option from the administratively-set or auction-based procurement approaches, in quantitative modeling, NYSERDA assumed the proposal would be procured through an administratively-set fixed value. JUs would eliminate customer subscriptions and meet the Climate Act's DAC requirements by reducing surcharge collections, and NYSERDA would provide additional support for projects located within DACs. Eliminating customer acquisition costs and bill crediting would reduce program costs, but the JU approach would require further refinements to ensure DAC/LMI requirements are met, given that LMI subscriptions to CDG and the attendant bill savings to

[80] See Case 15-E-0751, supra, Post 6 GW Tech Conference Compressed (filed May 7, 2021), p. 59 (Technical Conference Presentations Document).

[81] Technical Conference Presentations Document, p. 55.

[82] Id., p. 56.

offtakers would not be part of the proposal. As currently contemplated, this proposal is not compatible with the SEEF.

III.c Pricing Structure Options

NYSERDA's CES procurements utilize an alternative pricing structure from the traditional fixed-price REC procurement, which provides a fixed incentive for every MWh produced by the generator. In contrast, the Commission adopted the index pricing methodology for offshore wind procurements in 2018.[83] The Commission later adopted index pricing as a bidding option in Tier 1 solicitations in January 2020, and the October 2020 CES Modification Order directed NYSERDA to include index pricing as an option for the Tier 4 procurement.[84,85] Under index pricing, developers bid a "strike price" based on their estimated revenue requirements for the project. Index REC prices then vary over the life of the contract based on the net difference between the strike price and a reference price expressed in a market index. This section considers how fixed and indexed pricing could be utilized for the achievement of the Incremental 4 GW Target.

III.c.1 Fixed Incentive

In the current Value Stack, the E Value works similarly to a fixed-price REC, as the E Value is fixed over the life of the project (a 25-year period). Under an administratively set procurement approach, pricing and settlements would work

[83] Case 18-E-0071, Offshore Wind Energy, Order Establishing Offshore Wind Standard and Framework for Phase 1 Procurement (issued July 12, 2018).

[84] Case 15-E-0302, supra, Order Modifying Tier 1 Renewable Procurements (issued January 16, 2020).

[85] CES Modification Order, p. 96.

similarly to the existing Value Stack mechanism. The difference would be that incentives would be periodically reset for new projects by DPS Staff with NYSERDA consultation and support. NYSERDA would conduct or supervise supply curve modeling estimating future project economics. Under an auction procurement approach, the incentive would be set a similar fashion to how Tier 1 procurements worked prior to 2020, whereby winning bidders would receive a fixed as-bid price throughout the contract lifetime for the environmental attributes associated with every megawatt hour produced by the facility.[86] Either approach would leave the remaining Value Stack compensation parameters intact. Developers are familiar with the fixed REC structure through the Value Stack E Value as it exists today.

III.c.2 Index Incentive

Index pricing has been adopted under auction-based procurement approaches. NYSERDA's comments on the AWEA/ACE-NY petition for index REC pricing in Tier 1 recommended that the Commission add an index pricing mechanism. NYSERDA cited as benefits the (i) potential increase in bidders and projects driving competition, (ii) increased flexibility and responsiveness to market reforms, namely carbon pricing, (iii) reduced risk exposure through index pricing which may translate to lower financing costs, and (iv) reduced overall price volatility for ratepayers as index REC payments will vary inversely to commodity prices. For an index incentive, the strike price would be netted against the Energy and Capacity

[86] Id.

credits in the Value Stack. Further details on how the Index options were modeled are available in Appendix B.

In existing CES procurements, index pricing has exclusively been used in procurements, where the strike price is taken as-bid rather than utilizing a clearing price. If index pricing was utilized in an administratively set E Value approach, projects that are funded would receive the administratively calculated strike price which would act as a fixed product settled against reference energy and capacity prices per the Value Stack.

It is unclear how an indexed product could be made compatible with an up-front incentive, so the up-front incentive option is not considered in the form of a potential Index variant in this Roadmap.

While index pricing may allow for lower financing costs and reduce project costs relative to fixed pricing under similar market outcomes, ratepayers bear some risk of wholesale market declines. NYSERDA does not expect that an indexed incentive would have the same level of financing cost reductions for distributed solar as for CES resources. Stakeholder comments to date in this proceeding have not indicated interest or support for index pricing, likely given the fact that the distributed solar industry does not typically advance or finance projects through the same processes as large-scale renewable project developers. An additional administrative challenge is one of scale. The 2020 Tier 1 procurement resulted in the selection of about twenty projects to administer; hundreds or thousands of projects will be procured under the Incremental 4 GW Target. Another downside to index pricing is that it could potentially blunt beneficial price signals from the Value Stack.

III.d Incentive Structure and Cost Recovery

In line with the analysis and recommendations in the previous sections, DPS and NYSERDA have further explored two administratively set incentive structures with attendant funding options: first, an increased E Value; and second, an expanded NY-Sun MW Block program with the E Value maintained at or near its current level. DPS and NYSERDA conclude, that on balance the second option is recommended.

III.d.1 Increased E Value with Multiple Values and Periodic Review

Under a tariff-based "E Value only" incentive structure designed in line with the recommendations laid out in the proceeding sections, developers would receive a fixed per-kWh incentive over the 25-year assumed life of the project, which would be administratively calculated and revised periodically for new projects to reflect changes to expected costs and revenues for distributed solar projects. DPS and NYSERDA's exploration of this option identified two main challenges: the administrative complexity of maintaining multiple, periodically adjusted E Values across different regions, sizes, and levels of DAC benefit; and the potential increase in out-of-market E Value costs and resulting imbalance of cost recovery obligations across ratepayer groups.

Per the 2017 VDER Implementation Order, the Commission directed utilities as to how to recover the costs associated with the both the "market value" portion and the out-of-market E

Value.[87] The "market value" portion of the E Value was ordered to be "recovered from all supply customers with costs allocated on a per kWh basis." The out-of-market E Value was ordered to be "recovered from all delivery customers with their respective costs allocated to the Service Classes of the subscribers or off-takers who receive the credits, in proportion to the credits members of each Service Class receive." Appendix C of the Order provides exact cost recovery mechanisms by utility territory.

Under the higher E Value compensation levels contemplated under a tariff-based "E Value only" option, out-of-market costs would grow. These out-of-market costs may be unevenly distributed across service classes and utility customer bases.

III.d.2 MW Block Expansion With Stable E Value

Alternatively, the Incremental 4 GW Target could be met by offering new upfront incentives to projects in tandem with an E Value that remains stable. This approach, which is recommended by DPS and NYSERDA, would continue the NY-Sun MW Block program with new funding for additional capacity sufficient to meet the Incremental 4 GW Target. As described in the next section, NYSERDA would continue to offer MW Block "base" incentives and additional upfront incentives for community solar, projects meeting SEEF requirements, and projects achieving other policy goals, such as siting on brownfields and landfills. Con Edison projects would continue to receive MW Block incentive rates different from Upstate projects with a capacity carve-out. NYSERDA would continue to implement its Standards & Quality

[87] Case 15-E-0751, supra, Order on Phase One Value of Distributed Energy Resources Implementation Proposal, Cost Mitigation Issues, and Related Matters (issued September 14, 2017).

Assurance (SQA) procedures, including inspections, to ensure the technical quality of solar installations in New York.

DPS and NYSERDA recommend that the E Value continue to be used, in addition to further NY-Sun incentives, as a mechanism to provide compensation to Value Stack eligible DER projects for environmental attributes, and that the E Value be set at the current rate of 3.103 cents per kilowatt hour[88] subject to a mid-program review described in detail below. Pursuant to the Climate Act's directives, the New York State Department of Environmental Conservation (DEC) conducted a review of options to establish a value for carbon.[89] The DEC Guidance Document considered two alternatives for carbon pricing: (1) based on the SCC, or the monetary damages associated with an incremental increase in emissions as a result of climate change, or (2) based on a marginal abatement cost (MAC), which represents the cost to reduce the last ton of emissions by the amount needed to meet a particular emissions target. The DEC Guidance Document generally recommended using the SCC at a 2 percent discount rate, while recognizing that approaches to valuing carbon, such as a MAC approach, may be more effective in certain decision-making contexts. Specifically, the DEC Guidance Document states:

> "Whereas the damages approach is intended to establish a value of carbon for all sectors, marginal abatement costs are typically estimated with regard to sector-specific technologies, markets, and emission reduction goals. That is, the marginal abatement approach requires an analysis of the relevant economic sector

[88] For clarity, DPS and NYSERDA recommend that the E Value be set at the current rate of 3.103 cents per kilowatt hour for all technologies eligible for Value Stack compensation.

[89] DEC, Establishing a Value of Carbon: Guidelines for Use by State Agencies (issued December 2020), available at https://www.dec.ny.gov/docs/administration_pdf/vocguidrev.pdf (DEC Guidance Document).

> or sectors and policy options of interest for the relevant timeframe, which could result in multiple values of carbon that differ between economic sectors or policies. In New York State today, the electric power sector is best positioned to apply marginal abatement approaches, due to available cost information and its longer history of effective emissions reductions policies. In its recent review of the federal IWG social cost of carbon, the U.S. Government Accountability Office referred to the marginal abatement cost as a type of "target-consistent approach" to valuing emissions, which reflects the fact that this approach establishes a value that depends in part on the relevant emission reduction target."[90]

The E Value currently reflects the SCC at the 3 percent discount rate and an assumed system marginal emission rate of 0.553 tons per MWh. In an Appendix to their May 7, 2021 presentation at the second technical conference day, the CEP calculated that using a 2 percent discount rate would result in an increase of roughly 5 cents per kilowatt hour to the E Value, up to 8 cents a kilowatt hour.[91] Setting the E Value using the SCC at a 2 percent discount rate could lead to market inefficiency, and overpayment for carbon avoidance through DERs could impose higher costs on ratepayers than project economics require.

Using a supply curve-based MAC approach in lieu of the value of carbon to set compensation levels for sector-specific policy targets provides an alternative to the SCC. While a MAC approach may be better positioned to capture the ever-changing complexities associated with valuing DER compensation, this Roadmap does not recommend using a MAC approach to set the E Value. A MAC approach to valuing carbon could be appropriate if

[90] DEC Guidance Document, p. 10.

[91] Technical Conference Presentations Document, pp. 25, 37.

the E Value represented the sole compensation mechanism available to Value Stack projects. Since this Roadmap recommends that upfront NY-Sun incentives continue to be made available to Value Stack projects, setting the E Value using a MAC approach as well could lead to uncertainty and unnecessary administrative burden as NYSERDA and DPS would need to adjust two values to meet program goals rather than one.

In addition to continuity with the current, successful system of incentivizing distributed solar through the NY-Sun program, an up-front incentive has the advantage of modest cost savings compared to the "E Value Only" option, assuming a fixed, administratively set incentive for both options. Upfront incentives reduce the total costs that must be capitalized by developers over the 25-year life of projects, in turn reducing total financing costs and revenue requirements. NYSERDA has modeled this cost savings as approximately $175 million across the entire proposed Incremental 4 GW, or 11.9% of total program costs.

III.d.3 Annual Deployment Projections and Cost Analysis

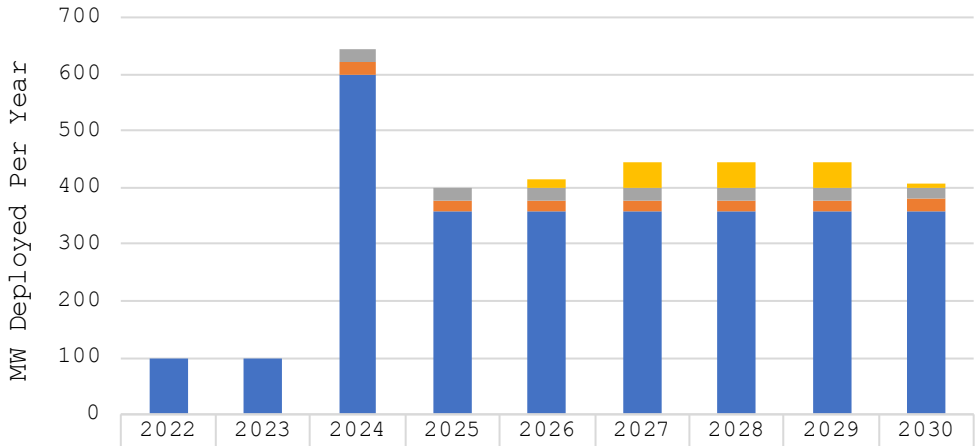
NYSERDA expects that the peak year with regard to the pace of MW Block incentive uptake would be 2022, due to pent-up demand from the large pipeline of projects that have not secured a NY-Sun MW Block incentive due to an extended period without NY-Sun incentive availability, but have reached a mature stage of development (interconnection upgrade down payment made, or executed interconnection agreement for projects in the Con Edison territory not requiring a CESIR study) as of the filing of the Roadmap. Consequently, assuming an approximate two-year lag between incentive awards and deployment, NYSERDA expects that the peak year for the deployment of the Incremental 4 GW

deployment would be 2024, as shown in Figure 4 below. Following the initial expected rapid uptake in the Upstate Commercial/Industrial MW Block, subsequent MW incentive levels would be adjusted to maintain a more sustainable year-to-year MW Block incentive allocation avoiding "boom-bust" trends.

The specific recommendations described below are based on an analysis of costs and annual capacity deployment projections that take into account market conditions and the present federal policy path (i.e., step-down of ITC per current law). Appendix B presents a detailed description of the methodologies and assumptions used to derive total and annual costs, as well as modeled upfront NY-Sun MW Block incentives in the "Stable E + MWB" program structure for each market sector.

Figure 4

Expected Annual Deployment of Newly-Incentivized 3,393 MW[92]



	2022	2023	2024	2025	2026	2027	2028	2029	2030
ConEd Residential	0	0	0	0	15	43	43	43	6
ConEd Large Projects	0	0	21	21	21	21	21	21	22
ConEd Small Projects	0	0	21	21	21	21	21	21	22
Upstate C/I	100	100	600	357	357	357	357	357	357

[92] Figure 4 does not include expected capacity deployments from the current NY-Sun MW Block program (i.e., 6 GW of total

In each sector, NYSERDA recommends slightly higher initial incentive levels than the analysis indicates for projects completed in 2024 or earlier. NYSERDA makes this recommendation based on a review of the current pipeline and market conditions compared to the modeling assumptions for costs. The construction cost assumptions used in the model are primarily based on pre-2021 data and trends, and do not reflect recent inflationary trends in material and labor costs. Additionally, supply chain constraints due to the COVID-19 pandemic have driven up real prices, due to manufacturing shortages and shipping constraints, and interconnection costs are increasing due to saturation of the distribution network. While these economy-wide cost increases are, for the purpose of the overall program budget, assumed to be short-to-mid-term in duration, they are expected to impact costs for projects currently in the NY-Sun pipeline, making it prudent to consider them in proposing an initial incentive rate. The proposed initial incentive rates plus the proposed initial Community Adder rate still represent a modest stepdown from the final Upstate C/I MW Block ($0.11/Watt) and the final Community Adder block ($0.16/Watt), and from the Con Edison MW Block plus the $0.12/kWh Community Credit.

Likewise, NYSERDA recommends that the Community Adder incentive rate be based on the incremental cost to develop a community solar project compared to a Remote Credited project, including cost of initial customer acquisition and differences in ongoing costs. For projects developed during the extended program period, these costs should reflect the reductions allowed by the full deployment of net crediting. However, NYSERDA's recommendation in the following section of a higher

statewide deployment by 2025), which will remain significant in 2022-2025.

initial Community Adder incentive for new CDG projects than what is suggested by an incremental cost analysis inclusive of full savings from net crediting reflects a recognition that not all of these assumed cost reductions have as of yet been realized in practice. Additionally, while the cost analysis assumes that CDG project owners provide their offtakers with 5% of the value stack as a bill savings, a significant number of project owners provide a customer discount of up to 10%.

While this introduces a risk of over-incentivizing some projects, investing in the current pipeline yields public and private savings from a total cost perspective, as well as faster deployment of clean electricity generation. Higher attrition from the current pipeline would create the necessity for additional project deployment in the later years of the program period. Deployment in later years may be more expensive due to the continued step-down of the ITC. Continued cost declines will partially offset the reduction in ITC, but these declines are not currently projected to fully offset the reduction in ITC value.

NYSERDA and DPS will, per the NY-Sun Operating Plan and current Commission orders, evaluate project economics and market conditions as a whole before adding new capacity blocks beyond the initial blocks proposed below, with incentive rates adjusted accordingly. Nevertheless, shifts of annual deployment from the projected peak year of 2024, which could theoretically be forced by a cap on total annual incentivized capacity commitments, would likely result in higher public costs, as well as significant private costs due to lost investment in current pipeline projects.

NYSERDA and DPS applied additional cost analysis to the proposed SEEF capacity and budget. This budget is primarily

derived by applying the following additional cost assumptions, which are further detailed in Appendix B, to the SEEF capacity target.

Based on program experience, market data, responses to a prior RFI, and additional stakeholder feedback, NYSERDA estimates that there is an average incremental cost of approximately $0.05/Watt associated with recruiting and managing eligible LMI residential community solar subscribers. Further, while the analysis used for the Roadmap assumes market-rate customer bill discounts of 5% (reflecting the market standard for new projects and minimum allowable under net crediting), NYSERDA and DPS recommend that a minimum bill savings of 10 percent be required for LMI residential customers and other customers considered eligible under the SEEF. This in turn increases projects costs and the required incentive.

For the purpose of setting a proposed SEEF budget, these cost assumptions were applied the bulk of capacity in the SEEF that is anticipated to be CDG. However, project-specific incentives will continue to vary based on project type and location. In addition to the Inclusive Community Solar Adder and other potential CDG offerings within the SEEF, NYSERDA will continue offering the Affordable Solar Residential Incentive and the Multifamily Affordable Housing Incentive, as well as support for project predevelopment and technical assistance support. These program costs are factored into the recommended dedicated budget of $207 million.

The potential introduction of opt-out CDG models, as discussed in section II.c., represents another factor in the overall program cost analysis. As described above, NYSERDA and DPS recommend that the Community Adder be set at a level equivalent to the estimated additional costs associated with

traditional community solar. Opt-out community solar projects are expected to have lower costs related to customer acquisition and management, which may be roughly in line with Remote Crediting projects. However, market experience and data on this topic is limited, and DPS and NYSERDA seek stakeholder feedback on whether, on a go-forward basis, opt-out community solar projects should be (i) eligible for the new CA, (ii) ineligible for the new CA, or (iii) eligible for a reduced or partial CA. For clarity, no change is contemplated to the treatment of projects that have already received the CA in previous blocks (both traditional and opt-out community solar projects previously were eligible for the CA).

In total, the overall cost of the proposed program expansion is approximately $0.37/Watt averaged across the proposed 3,440 MW of incremental capacity. The 6 GW expansion approved in May 2020 approved $573 million in new funding for an incremental 1,910 MW, averaging $0.30/Watt. While the proposal in this Roadmap has a higher average per-Watt cost than the 6 GW expansion, the Roadmap includes items not present in the 6 GW petition such as significant funding ($420 million) for projects in Con Edison territory (which require higher per-Watt incentives) as well as $239 million to assist the industry with the transition to increased prevailing wage requirements. Finally, as discussed above, the federal ITC is on a declining schedule, decreasing the ITC funding available to a significant portion of the incremental capacity proposed herein.

III.d.4 Mid-Program Review

Continuing the NY-Sun program and leveraging and updating the existing Operating Plan also provides a clear approach to managing uncertainty in the solar market due to supply chain

problems, cost instability, potential federal policy changes, and other factors.[93] The current 2020-2025 NY-Sun Operating Plan effective June 2020 gives DPS and NYSERDA the flexibility to, within the program structure approved by the Commission, to adjust incentive and capacity levels in response to market and policy factors.[94] This flexibility will be especially important in an uncertain federal policy environment, as described in Section III.

In addition, to provide additional transparency and the opportunity to adjust to larger market and policy trends, NYSERDA and DPS propose a formal mid-program review process. In the mid-program review, NYSERDA and DPS would consider changes in project revenue requirements, state and federal policy and other market factors in conjunction to determine whether any changes to NY-Sun incentive structure and/or the E Value or method for setting it should be considered.

NYSERDA could conduct the mid-program review to file with DPS and/or present at a technical conference or file with the

[93] Case 03-E-0188 Proceeding on Motion of the Commission Regarding a Retail Renewable Portfolio Standard, Order Authorizing Funding and Implementation of the Solar Photovoltaic MW Block Programs, Issued April 24, 2014, p.24; NY-Sun Expansion Order, p.23, required NYSERDA to develop and file an Operating Plan as a compliance filing that defines the final budgets, MW Block program details, and procedures such as identifying and securing funding from other available sources and metrics for energy savings and clean energy market penetration in the low- and moderate-income market and in disadvantaged communities. NYSERDA updates and files, if needed, the Operating Plan to reflect relevant changes resulting from subsequent statutory, regulatory or market development.

[94] Case 19-E-0735, supra, NY-Sun Operating Plan Revised (filed June 8, 2020).

PSC for stakeholder comment. The mid-program review would include:

- Current project costs based on developer-reported data, utility-reported interconnection costs, and international cost trends in modules and other components. DPS staff and NYSERDA would conduct a comparison of current costs based on this review as compared to the 3.103 cents per kilowatt hour E Value and NY-Sun incentives.
- Description of other market or policy factors that may be driving change in rate of uptake and/or costs, such as broader adoption of net crediting, opt-out CDG, or other changes to state or federal policy.
- An analysis of the impact of potential adjustments to the E value or NY-Sun incentives in response to these factors.

The mid-program review would be filed by NYSERDA upon the earlier of 1) the commitment of half of the proposed incentivized capacity (1,696 MW), or 2) December 31, 2025. The mid-program review and recommendations, including changes to the E value and/or incentive value and structure, if any, would be subject to the Commission's review and adoption.

III.e Specific Recommendations for Expanded NY-Sun MW Block Program

On the basis of the analysis and justification provided in Section III.d., DPS Staff and NYSERDA therefore recommend that the program requirements and processes established by the 2014 NY-Sun Order and extended by the May 2020 6 GW Extension Order be further extended to achieve the Incremental 4 GW Target. This section details specific proposed adjustments and updates to the NY-Sun program approved in the May 2020 Order. The following actions are recommended:

- Extension of the NY-Sun program through 2030. For clarity, this extension would not alter NYSERDA's responsibility for

ensuring that at least 6 GW of distributed solar is completed by 2025 under the terms of the May 2020 Order.

- Authorizing an additional NY-Sun budget of $1,474 million, with $807 million for base project incentives, $207 million for the SEEF, $192 million for incentive adders including the Community Adder and beneficial siting adders, $239 million to assist the industry with the transition to increased prevailing wage requirements and to mitigate the impact on project economics, $16 million for the Cost Recovery Fee(CRF), $12.3 million for Administration, and $1.0 million for Evaluation.
- Authorizing an additional 3,393 MW of NY-Sun program capacity, which represents the NYSERDA-incentivized capacity that this Roadmap estimates is necessary to achieve statewide Incremental 4 GW Target. The additional NY-Sun capacity can be broken down as follows:
    - 2,943 MW of new Upstate C/I scale project capacity would be incentivized with new MW Block incentives. The initial base incentive block could be 800 MW, with an incentive rate of $0.17/Watt.[95] This rate is higher than the last existing Upstate C/I Block (Block #17) rate of $0.11/Watt, with the adjustment due to 1) the planned federal ITC step down for projects developed in the applicable time period, and 2) the significantly lower Community Adder rates proposed for new projects, described below.
    - 300 MW of new Con Edison nonresidential and C/I project capacity would be funded by an expanded MW

[95] The incentive rate may be further adjusted to reflect the Commission adoption of prevailing wage requirement and associated budget, as discussed in Section III.a.5.

block design. As discussed in Section III.a.1, there would be separate incentive blocks for large (greater than or equal to 1 MW) and small (<1 MW) projects, due to their different project economics and development profiles. NYSERDA proposes initial incentive rates of $0.75/Watt for large projects and $1.30/Watt for small projects, with initial block sizes of 30 MW for each size category. Each size category would incentivize a total of 150 MW across multiple blocks.

- The addition of 2,270 MW of Community Adder capacity, with the added incentive rate based on the incremental cost to develop a community solar project compared to a Remote Credited project, including cost of initial customer acquisition and differences in ongoing costs. For projects developed during the extended program period, these costs should reflect the reductions allowed by the full deployment of net crediting. NYSERDA proposes to initially set the new Community Adder rate at $0.07/Watt for Upstate and $0.10/Watt in Con Edison territory. These rates and capacity targets reflect an anticipated balance of approximately 70 percent of new capacity being developed as community solar, and 30 percent of new capacity being developed as Remote Crediting or behind-the-meter projects.
- The extension of the SEEF, with a target of 40% of the incremental NYSERDA-incentivized capacity (1,357 MW) to be included under the SEEF, and a dedicated budget of $207 million for additional incentives and support for eligible projects. NYSERDA estimates that the proposed dedicated budget will be further leveraged by approximately $400 million in additional base and CA incentives for eligible

projects, for a total estimated commitment of $607 million to projects within the SEEF.

- The continuation of other added incentives for projects that meet certain criteria and achieve other State policies and objectives, including balancing land use pressures. These include added incentives for projects sited on a brownfield or landfill and projects utilizing a parking or rooftop canopy design.
- Creation of a new Con Edison Residential incentive block of 150 MW at an incentive rate of $0.15/Watt. Additionally, the cancelation of all remaining unallocated capacity in the current Con Edison Nonresidential MW Block structure (approximately 122 MW) to be replaced by the Con Edison nonresidential incentives described above. Funds recaptured from the cancelled Con Edison Nonresidential block capacity will be added to the new Con Edison Residential block at a rate of $0.15/Watt. This adjustment will rebalance the Con Edison MW Block structure to reflect current market activity and project economics for residential solar, including the implementation of the CBC.
- No changes to the existing Upstate Nonresidential MW Block structure. Once all Upstate Nonresidential incentives are committed, eligible projects may apply for the available Upstate C/I MW Block incentives. (For clarity, these projects would be subject to the NY-Sun nonresidential program rules, including incentive payment schedule, but would receive the Upstate C/I incentive rate and draw capacity from the Upstate C/I MW Block structure.)
- Upstate C/I projects that have already received a NY-Sun incentive at the time this Roadmap is published will not be permitted to cancel their applications and re-apply at a

higher incentive rate. Projects that have not previously received a NY-Sun incentive commitment may apply for newly available NY-Sun incentives subject to regular program rules and eligibility requirements.

- Con Edison Nonresidential projects that apply to the NY-Sun program subsequent to the filing of this Roadmap, as well as Con Edison Nonresidential projects that submitted applications to the current block (Block 10) and were not previously awarded the Community Credit may, subject to an authorizing Commission Order, opt into the new incentive structure proposed above.

Table 6

Proposed MW Block and Adder Budget Breakdown

	MW	Requested Funding
Upstate MW Block Incentives – C/I	2,943	$400,303,283
TOTAL – Upstate-Specific Budget	***2,943***	***$400,303,283***
Con Edison MW Block Incentives – Residential	150	$22,500,000
Con Edison MW Block Incentives – Small Projects	150	$230,786,000
Con Edison MW Block Incentives – Large Projects	150	$153,858,000
Con Edison Rooftop Canopy Adder	4	$800,000
Con Edison Parking Canopy Adder	60	$12,000,000
TOTAL – Con Edison-Specific Budget	***450***	***$419,944,000***
Community Adder (Upstate and Con Ed)	2,270	$165,207,000
Landfill/Brownfield Adder (Upstate and Con Edison)	93	$13,918,500
TOTAL –Incentives and Adders	***3,393***	***$999,372,783***

III.e.1 Program Implementation

As of September 30, 2021, approximately $15.6 million in uncommitted implementation funds remain. NYSERDA is not requesting new funds for this purpose. During the extended program period, NYSERDA will continue the quality assurance and quality control functions of the program, implement the proposed prevailing wage requirements, continue to develop technical assistance responses to existing and emerging barriers, and, as

warranted, support pilot or demonstration efforts to test new approaches.

III.e.2 Program Administration

NYSERDA has carefully considered the work to be undertaken to position the NY-Sun program to achieve the Incremental 4 GW Target, with at least 35 percent of the benefits from those investments supporting disadvantaged communities and low-to moderate- income New Yorkers. NYSERDA's project planning indicates that approximately $40 million of the total funding requested should be budgeted for administrative and project coordination activities in order to successfully deliver the intended outcomes. Of this total, $28.9 million can be provided by existing uncommitted funds and $12.3 million in additional administrative funds would be required. In that context, NYSERDA requests that $12.3 million of new funding be available for program administration for attainment of desired outcomes, as well as for administering necessary post-completion performance payments, reporting, and other "close out" activities beyond 2030.

This funding request represents a continuation of the annualized administrative costs that were approved by the Commission in the NY-Sun Expansion Order, and the associated staffing levels. In addition to the day-to-day administration of the MW Block incentive program, NYSERDA's administrative activities include implementing the Climate Act's requirements for investment in DACs, oversight of the proposed prevailing wage requirements, addressing agricultural protection issues, and other siting and land use concerns.

III.e.3 Program Evaluation

As of November 30, 2021, approximately $2.1 million in uncommitted program evaluation funds remain. NYSERDA requests that, in addition to these currently uncommitted funds, $1.0 million of new funding be available for program evaluation through the revised program end date of December 31, 2030, as well as for post-program evaluation activities beyond 2030. The evaluation funding will support internal NYSERDA staffing requirements and external consultant activities pertaining to evaluation.

Evaluation activities are anticipated to include impact assessments, market characterization, and process evaluation. Impact assessment is used to verify that energy production is meeting expectations, and makes use of system infrastructure, program data, and reporting inherent in the program delivery model to keep costs as low as possible. Impact assessment can also serve as a benchmark to support the ongoing the performance measurement of new and emerging technologies in this area. Market characterization studies will document empirical evidence of market transformation and identify any barriers that impede market transformation from occurring as expected. Market characterization may include the analysis of market trends related to business models, analysis of installed costs and balance-of-systems costs, and the longitudinal measurement of awareness and adoption of new technologies, among other things. NYSERDA will also conduct process evaluation activities as warranted to assess installer and customer engagement with the program over time, including, but not limited to understanding customer satisfaction with program processes. Collectively, the evaluation will help position the program for maximum

effectiveness. Evaluation will also inform how NY-Sun is helping address the goals of the Climate Act.

III.e.4 Proposed NY-Sun Budget

The NY-Sun Expansion Order and the Commission's September 9, 2021 Order modifying the CEF[96] fully funded the 6 GW goal using the remaining uncommitted legacy funds of $343 million. At this time, all uncommitted legacy funds have been exhausted. To fund the Incremental 4 GW Target, NYSERDA proposes collection in the aggregate amount of $1,473.9 million through 2032 using the Bill-As-You-Go method to transparently account for NYSERDA's relevant receipts and expenditures.[97] The cost of up-front incentives would be distributed across utilities proportional to load via a CEF surcharge. Funding would not require new processes or ongoing settlements between utilities or NYSERDA. NYSERDA's cashflow analysis has been updated to reflect the projected expenditure forecast of the $1,473.9 million.

NYSERDA estimates that while some incentives could be allocated to a small number of early projects completed in 2022-2023, most incentive payments would occur 2024-30, with a modest amount of performance-based incentives made in 2031-32. Assuming collections occur over the 11-year period of 2022-32, the average levelized ratepayer bill impact is 0.79%. The levelized impact on residential bills would be $0.71 per month. Expenditures, collections, and ratepayer impact are forecasted to peak in 2024. The 2024 bill impact is calculated at 1.07%, with an average 2024 statewide residential bill impact of $0.92

[96] Case 14-M-0094, supra, Order Approving Clean Energy Fund Modifications (issued September 9, 2021).

[97] CEF Framework Order, pp. 96-103.

per month. The 2024 average residential bill impact would be 0.52% for Con Edison residential customers and 1.07% for National Grid residential customers. 2024 ratepayer impact for Commercial/Industrial ratepayers could range from 0.97% in Con Edison to 3.14% in National Grid.

Given the proposed NY-Sun Program approach described above, NYSERDA offers the following table to provide the current budget status and the additional funding requested herein.

Table 7

Summary Budget Table, with Commitments as of 11/30/2021

	Current Committed/ Expended	**Current Uncommitted**	**Requested Additional**	**TOTAL**
MWB Incentives and Adders	$1,342,629,120	$188,225,497	$999,372,783	$2,530,227,400
Funds to Assist Transition to Prevailing Wage	-	-	$238,725,000	$238,725,000
Administration	$17,526,540	$28,929,460	$12,300,000	$58,756,000
Implementation	$17,384,574	$15,215,426	-	$32,600,000
Customer Education	$3,500,000	$3,000,000	-	$6,500,000
Solar Energy Equity Framework	$35,235,456	$112,762,144	$206,740,000	$354,737,600
Evaluation	$394,150	$2,105,850	$1,000,000	$3,500,000
NY Cost Recovery Fee	$5,804,256	$20,237,340	$15,758,404	$41,800,000
TOTAL	$1,422,474,096	$370,475,717	$1,473,896,187	$3,266,846,000

Table 8

Anticipated Expenditures by Year

Year	Anticipated Expenditures
2022	$28,900,000
2023	$33,100,000
2024	$220,600,000
2025	$182,800,000
2026	$198,800,000
2027	$193,200,000
2028	$192,800,000
2029	$191,100,000
2030	$180,300,000
2031	$34,300,000
2032	$17,800,000
Total	$1,473,900,000

Table 9

Proposed Collections by Year

Year	Incremental Collections
2022	$28,900,000
2023	$62,100,000
2024	$317,000,000
2025	$278,000,000
2026	$210,000,000
2027	$133,000,000
2028	$115,000,000
2029	$112,000,000
2030	$172,000,000
2031	$32,000,000
2032	$13,900,000
Total	$1,473,900,000

APPENDIX A: POLICY OPTIONS COMPARISON MATRIX

Section III of the Solar Roadmap includes quantitative and qualitative advantages and disadvantages of policy options. Here an overall assessment of policy options is considered against several evaluation criteria:

1. Cost Effectiveness: Does this policy option minimize ratepayer costs? Is there a ratepayer risk?
2. Feasibility: What is relative ease of implementation and administration, noting dependencies on third parties and legal risks?
3. Developer Efficiency: Does this policy option provide developers adequate signals to make informed project development and financing decisions? Relative to the status quo, will the policy option introduce uncertainty and risk in project development and/or financing?
4. Market Compatibility: Does the policy option synergize with the existing Value Stack and encourage DER deployment to maximize grid benefits?

Table: Matrix of Potential Program Structures

		Evaluation Criteria			
Procurement Option	**Pricing Option**	Cost Effectiveness	Feasibility	Developer Efficiency	Market Compatibility
Admin-Set	Fixed E Value	-	-	++	++
		Costs driven by marginal facility in incentive calculation, higher financing costs than indexed	Familiar concept, but significant administrative complexity to maintain multiple, periodically adjusted E Values across regions, sizes, and DAC benefit levels; drives imbalance of cost recovery obligations across ratepayer groups	Very similar process to existing Value Stack	Maintains performance and locational incentives (DRV, ICAP)
Admin-Set	Index E Value	+	-	+/-	+
		Fails to capture full strike price savings of as-bid projects but reduces developer WACC. Index introduces some risk to ratepayers	Some unfamiliarity with DG implementation; significant admin complexity to maintain multiple, periodically adjusted E Values; drives geographic cost recovery imbalance	Familiar procurement process for NYSERDA, but index product unfamiliar to most developers and some lenders	Energy and Capacity signals somewhat dampened by hedge, undermining signals to energy storage
Auction	Fixed E Value	+	--	-	++
		Captures consumer surplus from more cost-effective bids through as-bid prices	Some implementation challenges for NYSERDA, bid preparation may deter some projects. Auction timing will be challenging and is not compatible with SIR queue management rules.	Auction process may increase soft costs by introducing uncertainty and delay.	Maintains performance and locational incentives (DRV, ICAP)
Auction	Index E Value	++	--	-	+
		As-bid prices capture more consumer surplus, hedge value decreases WACC. Index introduces some risk to ratepayers	Unfamiliar product offering for bidders, most difficult and time-consuming to implement. Auction timing will be challenging and is not compatible with SIR queue management rules.	Auction process may increase soft costs by introducing uncertainty and delay.	Energy and Capacity signals somewhat dampened by hedge, undermining signals to energy storage
JU Proposal: Admin-Set	Fixed E Value	+	--	+	++
		No customer acquisition costs, limiting bill crediting reduces costs	DAC/LMI approach not fully formed. No CDG customer involvement or offtaker bill savings.	Removes need for customer acquisition/management.	Maintains performance and locational incentives (DRV, ICAP)
Admin-Set	Up-Front Incentive	-	++	++	++
		Costs driven by marginal facility in incentive calculation, higher financing costs than indexed	Familiar concept, simple implementation	Very similar process to existing MW Block.	Maintains performance and locational incentives (DRV, ICAP)

APPENDIX B: COST ANALYSIS

1 OVERVIEW

The New York State Energy Research and Development Authority (NYSERDA), working in collaboration with the New York Department of Public Service (DPS), led analysis to assess the deployment, program cost, and required incentive levels of incremental distributed solar resources towards a 2030 distributed solar target of 10 GWdc[1] in deployed capacity, and market support mechanism options that could deliver this target. NYSERDA and DPS acknowledge the contribution of Energy and Environmental Economics, Inc. (E3) for its primary analytical role in the development of the analysis.

1.1 Distributed Solar Analysis

The analysis estimates the extent to which distributed solar resources may require additional revenue or incentives. Such estimates are calculated as a function of a number of variables including (i) technology cost; (ii) financing cost; (iii) available tax benefits (federal investment tax credit (ITC) and the NYC property tax abatement benefit); (iv) technology performance; (v) value stack revenue, including revenue from energy and capacity; and (vi) costs associated with the Solar Energy Equity Framework (SEEF), which ensures that the Climate Act requirement that DACs receive at least thirty-five percent with a goal of forty percent of the overall benefits of clean energy program efforts is met. Required incentive rates or premiums are calculated as the difference between the project's levelized cost of energy (LCOE) and the project's forecasted revenue from the value stack.

[1] All capacity figures in this appendix are in direct current (DC) unless otherwise noted.

The analysis assesses 72 distinct "Resource Blocks". Each resource block represents a project use case to which a MW potential is assigned. As a modeling simplification, the supply potential within a specific geographic zone with similar characteristics (location, resource intensity, interconnection cost, etc.) is combined into a single Resource Block. The market segments for the Resource Blocks in this analysis are community distributed generation (CDG) and remote crediting (RC). The analysis represents a diversity of Resource Block characteristics, reflecting electric utility and region, market segment (CDG or RC), mount type (single axis tracker, fixed open rack, or fixed rooftop), and associated interconnection cost (average cost or high cost groupings). This resulted in 72 Resource Blocks for consideration. Residential and behind-the-meter projects were outside the scope of this analysis; however, residential costs and uptake assumptions for these segments were estimated by NYSERDA using historic program data.

An annual potential is set for each Resource Block, based on historic deployment and expected 2021 deployment.

Resource Blocks are defined by the following inputs:

- The Block's location (NYISO zone and geography) within New York;
- The maximum annual potential developable quantity (MW);
- Production characteristics, including levelized annual net capacity factors (%);
- Capital expenditures (CAPEX) (excluding interconnection costs) ($/kW);
- Interconnection cost characteristics (current average cost or high cost);

- Fixed operations and maintenance expenditures (O&M, or OPEX) ($/kW);
- Project-specific ongoing costs, including a 5% discount (10% for project capacity within the SEEF) to revenue which reflects a project subscriber's bill savings, and
- An aggregation of financing cost assumptions.

Detailed inputs are described in Section 2 of this appendix. These inputs are used in combination with a forecast of energy and capacity market revenues (discussed below) to calculate the following outputs for each Resource Block:

- The levelized cost of energy (LCOE) (nominal $/MWh), calculated as the total upfront and ongoing project costs, levelized over the project lifetime at a discount rate equivalent to a target Internal Rate of Return (IRR);
- The levelized market value (nominal $/MWh) of value stack revenue: energy, capacity, the Environmental value (E) and DRV over the project's lifetime;
- The levelized incentive or premium (nominal $/MWh), derived as the difference between LCOE and levelized market value.

To determine a project's date of commercial operation, a two-year lag was assumed between the time of incentive allocation and commercial operation. Assuming a program launch in 2022, projects are modeled as becoming operational over the seven-year period of 2024-30.

In order to benchmark cost assumptions used in the analysis, NYSERDA reviewed historic and contemporary industry data and consulted with project developers. Project economics were found to fall within a similar range, providing confidence in the model's underlying technology cost and financing cost assumptions.

1.2 Market Support Mechanisms

Program design options with incentive payments above the current value stack are modeled as either an upfront incentive ($/Watt) or a nominally constant ongoing volumetric incentive ($/kWh) paid annually over a 25-year contract period based on energy generated.

Resource Blocks are ranked by their premium amounts (expressed as the levelized premium for ongoing incentive structures or the equivalent net present value amount for the upfront incentive structure), and stacked from lowest to highest according to their annual resource potential. For all program design options, Resource Blocks are selected from the supply curve, starting with lower levelized premium amounts and increasing until selected Resource Blocks equal the annual procurement target.

For the upfront incentive, the incentive amount was modeled using the existing NY-Sun MW Block incentive payout structure of 50% in Year 1, 25% in Year 2, and 25% in Year 3 of operation.

For the ongoing incentive, programs that provide administratively-set levels of compensation and auction-type programs were each considered. In the administratively-set incentive program, the incentive amount is set as the levelized premium of the marginal Resource Block on the supply curve, such that all selected Resource Blocks receive the same incentive amount. In the auction-type program, the incentive is set individually for each Resource Block based on its supply curve "bid price." The bid price for each Resource Block in the supply curve is based on the levelized premium for the block. Resource Blocks below the marginal clearing price are assumed to engage in profit-maximizing behavior, and adjust their bids upward by 50% of the difference from the marginal clearing price.

Given the difference in project economics between downstate and upstate (described below), Con Edison projects were separated into distinct supply curves and Con Edison-specific incentives. Additionally, the administrative complexity and additional soft costs of an auction-based approach are not a good fit for projects in Con Edison territory, as such projects are generally much smaller in size than upstate C/I projects. The analysis therefore limits the auction approach to upstate projects, and an administratively-set incentive is used in all cases for Con Ed projects.

Ongoing incentive options were assessed as either Fixed or Indexed structures. In the Fixed approach, the incentive is constant for the lifetime of the project, based on the levelized premium. In the Indexed approach, the incentive is established relative to energy and capacity prices, with the incentive amount reduced if energy and capacity revenue increase and vice versa, such that the total amount – the sum of the energy, capacity, and the program incentive – is constant for the lifetime of the project. Such Indexed structures are currently used in NYSERDA's Clean Energy Standard Tier 1 and Offshore Wind programs. Since Indexed structures provide developers with a hedge against commodity price fluctuation, this option is modeled with a lower IRR requirement reflecting the reduced level of risk exposure.

Finally, the analysis also evaluated the Joint Utilities' proposal, which is an administratively-set Fixed incentive with the following modifications:

- No upfront customer acquisition costs
- No customer management ongoing costs
- No customer bill discount for most customers

Reflecting the options discussed above, six possible program designs were considered as mechanisms to support the achievement of the Incremental 4 GW Target:

- An administratively-set upfront incentive, which would continue the NY-Sun MW Block program;
- An administratively-set Fixed incentive;
- An administratively-set Indexed incentive;
- An auction-based Fixed incentive;
- An auction-based Indexed incentive;
- A proposal described by the Joint Utilities at the May 7, 2021 technical conference.

1.3 Procurement Quantities

As discussed in the Roadmap, the Incremental 4 GW by 2030 Target was used as the basis for this analysis. Scenarios were modeled for commercial operation dates of 2024 through 2030. The target amount of 4 GW is incremental to New York State's current 6 GW by 2025 goal, resulting in a total target of 10 GW by 2030. This analysis is limited to incentivized nonresidential and C/I capacity within the State's six IOUs, and therefore excludes expected residential and Long Island deployment.

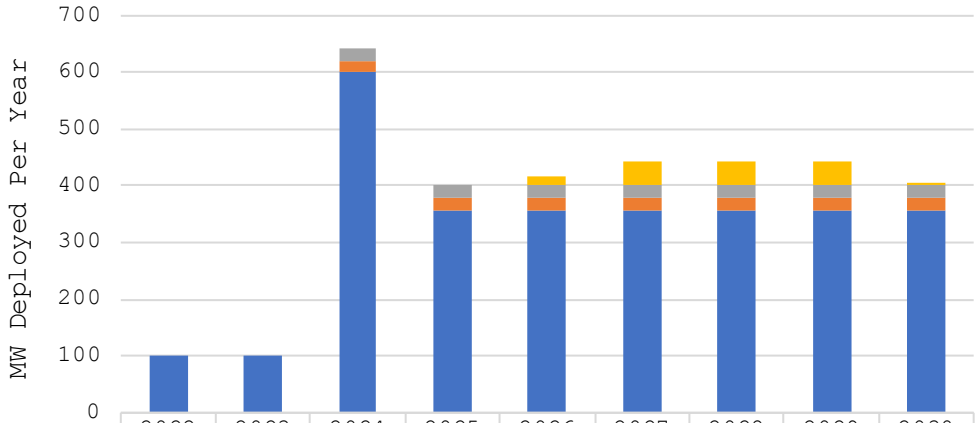
The analysis is based on a capacity target of 2,943 MW of upstate C/I capacity, 150 MW of small (<1 MW) Con Edison capacity, and 150 MW of large (>1 MW) Con Edison capacity. The additional 757 MW of capacity consists of residential projects and capacity in Long Island that could be incentivized with non-CEF funding.

Solar development in Con Edison territory has distinct cost, revenue, and siting constraints that are significantly different from upstate development. The Roadmap proposes a distinct

incentive structure for Con Edison projects based on size. The larger (>1 MW) projects are assumed to have a lower per-Watt installation cost than the smaller projects. Con Edison deployment is assumed to be at a consistent rate for 2024-2030, with 21.4 MW of small and 21.4 MW of large projects per year for 7 years.

In the model, Upstate incentive allocation is weighted toward the initial year. The Upstate C/I NY-Sun MW Block incentive became fully allocated in May 2021, and a large number of projects without incentive allocations have advanced in the interconnection queue in the intervening seven months, creating significant pent-up demand. Due to the large number of projects currently in the interconnection inventory which have made their initial upgrade payment, the model targets 800 MW of upstate capacity to reserve their incentive in 2022 upon the program launch. While many of these (approximately 600 MW) could be built in 2024 with a two-year construction timeline, a small portion (100 MW/year) are at a more advanced stage of development and could be built in 2022 and 2023. The annual technical potential for 2024 was doubled to reflect this large queue of projects. Deployment in later years 2025-30 uses a simpler modeling assumption, with all C/I projects (357 MW/year) being built two years after reserving their incentive.

Figure 1 – Expected Annual Deployment of Newly-Incentivized 3,393 MW



	2022	2023	2024	2025	2026	2027	2028	2029	2030
ConEd Residential	0	0	0	0	15	43	43	43	6
ConEd Large Projects	0	0	21	21	21	21	21	21	22
ConEd Small Projects	0	0	21	21	21	21	21	21	22
Upstate C/I	100	100	600	357	357	357	357	357	357

2 INPUTS AND METHODOLOGY

2.1 Resource Blocks

2.1.1 Resource Potential

The scope of this analysis is for utilities directly under the Public Service Commission's jurisdiction programs. Therefore, this analysis includes six investor-owned electric utilities: Central Hudson Gas & Electric (CH&E), Consolidated Edison (Con Edison), National Grid, New York State Electric and Gas (NYSEG), Orange and Rockland Utilities (O&R) and Rochester Gas and Electric (RG&E).

To create the Resource Blocks for the supply curve, Con Edison was further divided into New York City and Westchester, and National Grid was divided into West and Capital regions. Each other utility corresponds to one region.

For each utility and region, a Resource Block was established for stationary-mounted ground mount projects as well as single-axis tracking projects. For the Con Edison territory only, small roof mounted projects were also considered. All ground-mounted projects are assumed to use bifacial modules. For the purpose of modeling, the analysis uses each utility's past annual interconnection capacity, as well as expected annual interconnection capacity for 2021 as a proxy for the available capacity for each reference installation type in each year of the program. These inputs were developed in consultation with the utilities. These values are used as an annual estimate for each reference installation's potential. The technical potential for the O&R and CHG&E utilities was further reduced to reflect limits on remaining suitable project sites in those territories. Higher interconnection potential may be possible based on potential policy changes and utility allocation of resources to interconnection activities.

The total annual potential for each utility assumed for this analysis is shown below in Table 1.

Table 1 – Assumed Annual Resource Potential by Utility

Utility	Annual Commercial/Industrial PV Interconnection Potential (MW DC)
CHG&E	20 MW
Con Edison	85 MW
National Grid	397 MW
NYSEG	323 MW
O&R	10 MW
RG&E	139 MW

The total annual potential by utility was distributed to each Resource Block in that utility's territory using the following assumptions:

- 40% of capacity is on single axis trackers and 60% of capacity is on fixed racks, based on NYSERDA estimates from recent historical data. Not all sites are appropriate for tracker installations, based on topography and geological conditions.
- For Con Edison, 50% of projects are assumed to be small, fixed roof mount installations less than 1MW, and the remaining 50% are 1MW or larger.
- Half of projects have interconnection costs in line with recent historic values, and half have interconnection costs 50% higher, due to increased saturation of the distribution grid.
- 70% of projects will be developed as CDG, with 30% developed as Remote Crediting.

These assumptions are used to translate the total available potential for each utility to the individual Resource Blocks corresponding to each utility.

2.2 Distributed Solar Cost and Quantity

2.2.1 Capital Expenditures (CAPEX)

Baseline upfront engineering, procurement, and construction (EPC) costs, inclusive of labor but exclusive of interconnection costs and customer acquisition, were assumed at $1.04/Watt in most of the state, with $2.08/Watt for large projects in Con Edison territory and $2.48/Watt for smaller projects in Con Edison. Interconnection costs were estimated at base and high values for each utility territory, ranging from $0.02/Watt to $0.15/Watt. All projects, exclusive of roof-mounted projects in Con Edison, were assumed to use bifacial modules, with an added cost of $0.03/Watt. Installations with single axis trackers had an additional cost of $0.10/Watt. Initial customer acquisition costs were assumed to be $0.069/Watt for CDG and $0.03/Watt for Remote Crediting. Labor costs due to prevailing wage requirements were excluded from this portion of the analysis. Resulting total EPC costs are shown below in Table 2.

Table 2 – Total CAPEX by Location, Market Segment, and Mount Type

Market Segment	Mount Type	EPC Cost in NYC and Westchester (2021 $/Watt)	EPC Cost in Upstate (2021 $/Watt)
CDG	Bifacial fixed open rack	$2.18	$1.14
	Bifacial single-axis tracker	$2.28	$1.24
	Con Edison Under 1 MW	$2.55	Not modeled outside Con Edison
RC	Bifacial fixed open rack	$2.14	$1.10
	Bifacial single-axis tracker	$2.24	$1.20
	Con Edison Under 1MW	$2.51	Not modeled outside Con Edison

Non-module hard costs – the inverter, electric balance of system, and structure balance of system – were assumed to be 20.9 percent of the total upfront cost, and soft costs were assumed to be 46.7 percent of total cost, based on historic cost data. Both soft costs and non-module hard costs were assumed to have a 10 percent nominal learning rate.[2] Future module hard costs were estimated based on learning curve parameters extracted from global historical module prices and installations.

The analysis assumes that as part of the CDG and Remote Crediting programs, developers provide a 5% electricity bill

[2] Based on cost data from LBNL "Tracking the Sun" reports, Open NY and NYSERDA data.

discount to their customers, which is accordingly included as an equivalent cost to the project.

As described in the "General Recommendations" section, this Roadmap proposes that 40% of the additional proposed capacity goal of 4 GW (i.e., 1,600 MW) should target projects meeting the requirements of the Solar Energy Equity Framework (SEEF). Therefore, the model applies a cost adder of $0.05/Watt on 40% of projects, to reflect the increased customer acquisition and management costs associated with projects within the SEEF serving LMI households and DACs. Additionally, a customer billing discount rate of 10% is applied to all capacity within the SEEF to align with current program rules and reflect the policy goal of greater cost savings for LMI solar customers.

The modeling of the Joint Utilities' proposal does not include these customer acquisition, management or bill discount costs. However, costs associated with the DAC benefit requirement of the Climate Act (i.e., 10% of value stack for 40% of capacity) were calculated and added to the estimated total cost for comparison with other design scenarios.

2.2.2 Operations & Maintenance Expenditures (OPEX)

In addition to the upfront costs above, the model assumes the following ongoing costs: O&M costs of $10/kW at an annual escalation of 2% (with a $3/kW adder for trackers), plus an additional $12-$32/kW (escalated at 2% annually), which varies by geography and includes land lease, PILOT, insurance, payment to a decommissioning fund, and other ongoing costs. Inverter replacement costs of $100/kW are applied 10 and 20 years into the project life. Remote crediting projects have additional annual ongoing customer management, replacement, and billing costs of

$3/kW, and for CDG projects these costs are set at 1% of their value stack credits, per net crediting requirements.

Table 3 – Ongoing Costs by System Type, Utility, and Location[3]

Utility	Mount Type	Total Ongoing Costs (2021 $/kW-yr)
Central Hudson	Fixed Mount	$25.34
	Single-Axis Tracking	$27.33
Con Edison – NYC	Small Roof Mount	$34.61
Con Ed - Westchester	Fixed Mount	$34.61
	Single-Axis Tracking	$36.60
National Grid – Capital	Fixed Mount	$22.69
	Single-Axis Tracking	$24.68
National Grid - West	Fixed Mount	$21.37
	Single-Axis Tracking	$23.36
NYSEG – Upstate	Fixed Mount	$21.37
	Single-Axis Tracking	$23.36
Orange & Rockland	Fixed Mount	$27.33
	Single-Axis Tracking	$29.31
RG&E	Fixed Mount	$21.37
	Single-Axis Tracking	$23.36

[3] Exclusive of customer billing and management costs.

2.2.3 Non-NYSERDA Incentives

The federal investment tax credit (ITC) for commercial distributed solar projects is 26% of capital costs in 2021-2022, 22% in 2023, and subsequently 10% in 2024 and beyond.[4] The modeling assumes developers will lock in or "safe harbor" their ITC approximately one year in advance of deployment: therefore, a project to be interconnected in 2024 can lock in the 22% ITC in 2023, and projects in all later years are assumed to have a 10% ITC. While changes to the ITC are contemplated in the Build it Back Better Act, the model assumes the current ITC trajectory.

Reference installations in New York City are eligible for the Solar Electric Generating System (SEGS) Tax Abatement until 2024. This incentive is 5% of the installation cost for four years, up to a maximum of $62,500.[5]

2.2.4 Capacity Factors

Capacity factors for each region and system type were estimated using generation outputs from NREL's PVWatts Model, as embedded in the NYSERDA VDER Calculator. All ground-mounted projects are assumed to be bifacial modules. Each reference installation was assumed to have an annual generation degradation of 0.5% per year.

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[4] US Department of Energy, Office of Energy Efficiency and Renewable Energy, "Guide to the Federal Investment Tax Credit for Commercial Solar Photovoltaics," January 2021, https://www.energy.gov/sites/default/files/2021/02/f82/Guide%20to%20the%20Federal%20Investment%20Tax%20Credit%20for%20Commercial%20Solar%20PV%20-%202021.pdf

[5] New York City, Solar Electric Generating System (SEGS) Tax Abatement, https://www1.nyc.gov/site/finance/benefits/landlords-solar-roof.page

The capacity factors for each Resource Block are shown below in Table 4.

Table 4 - Resource Block Capacity Factors

Utility & Region	Capacity Factor (DC capacity to AC generation) for Fixed Mount	Capacity Factor (DC capacity to AC generation) for Single Axis Tracker	Capacity Factor (DC capacity to AC generation) for Roof Mount
CHG&E	15.8%	17.9%	N/A
Con Edison – NYC	15.7%	18.0%	13.3%
Con Edison – Westchester	15.7%	18.0%	13.3%
National Grid – West	15.3%	17.6%	N/A
National Grid – Capital	15.8%	17.9%	N/A
NYSEG	14.7%	16.7%	N/A
O&R	15.7%	18.0%	N/A
RG&E	14.2%	16.6%	N/A

2.3 Financing Assumptions

The model calculates each Resource Block's levelized premium to achieve a target post-tax (and post-tax credit) internal rate of return (IRR), based on the project's assumed weighted average cost of capital (WACC). Target IRRs vary for Fixed incentive and Index REC incentive approaches. For CDG projects with a fixed incentive (including upfront incentives), the target post-tax IRR is assumed to be 8.0%, based on the weighted average cost of

capital (WACC) for distributed solar.[6] For Indexed incentives, the target post-tax IRR is lowered to 7.0% due to the greater financeability of a fixed revenue stream.[7] Additionally, remote credited projects have target IRRs that are 0.5% lower than CDG projects, as they have a smaller number of offtakers, which are generally nonresidential and have a higher degree of creditworthiness. Assumed target post-tax IRRs are shown in Table 5.

Table 5 – Target Post-tax IRRs (Nominal) for Levelized Premium

Market Segment	Target Post-tax IRR for Fixed Incentives	Target Post-tax IRR for Indexed Incentives
CDG	8.0%	7.0%
RC	7.5%	6.5%

2.4 Supply Curves for Levelized Cost of Energy

Based on the input assumptions as described above, Figure 2 and Figure 3 show the resulting projected resource quantity and LCOEs (on a nominal basis) for all modeled distributed solar

[6] New York State, Department of Taxation and Finance, "Appraisal methodology for solar and wind energy projects," accessed August 5, 2021, https://www.tax.ny.gov/research/property/renewable-appraisal.htm

[7] Limited industry data is available on this topic, but NYSERDA and E3 consulted with industry finance experts who concurred that a modest reduction in WACC due to a fixed value stack appears reasonable. NYSERDA's Large Scale Renewables team reports a WACC reduction of 2.47% when offering an indexed REC, but distributed projects are unlikely to realize the same discount, due to the novelty of the product offering and smaller project and portfolio sizes, where fixed underwriting costs represent a larger portion of total financing costs.

Resource Blocks, for installations in 2024. Due to their different project characteristics and costs, Upstate and Con Edison projects are shown in separate Figures.

Figure 2 – Levelized Cost of Energy for Upstate Projects COD Year 2024

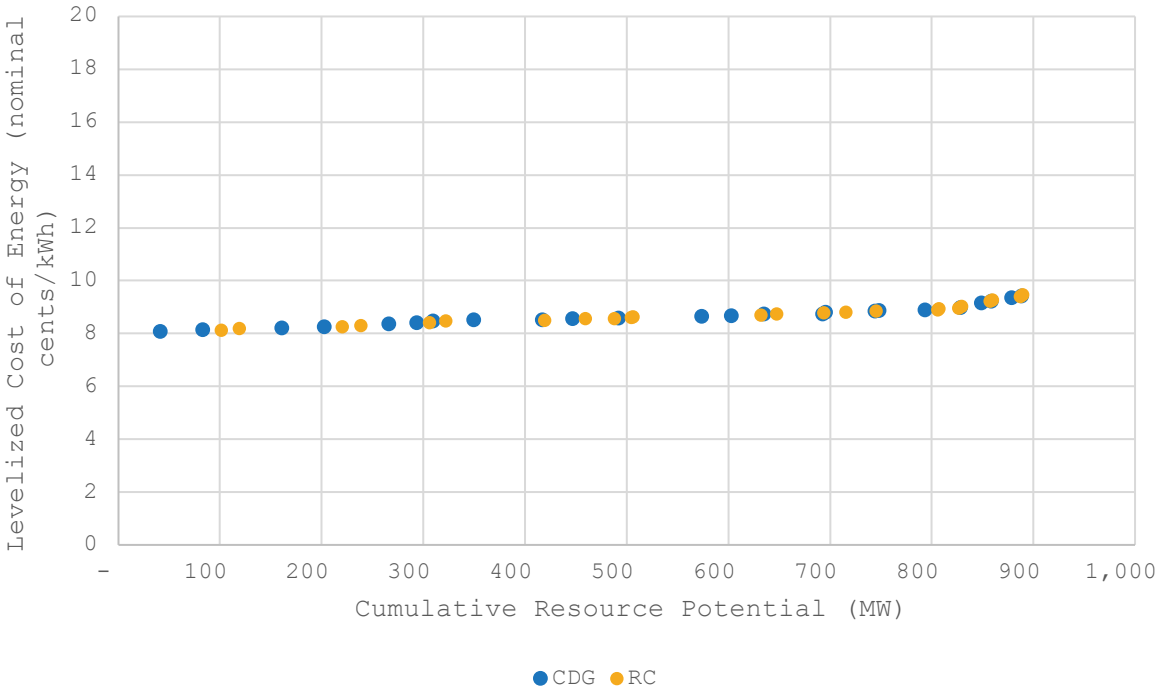


Figure 3 – Levelized Cost of Energy for Con Edison Projects COD Year 2024

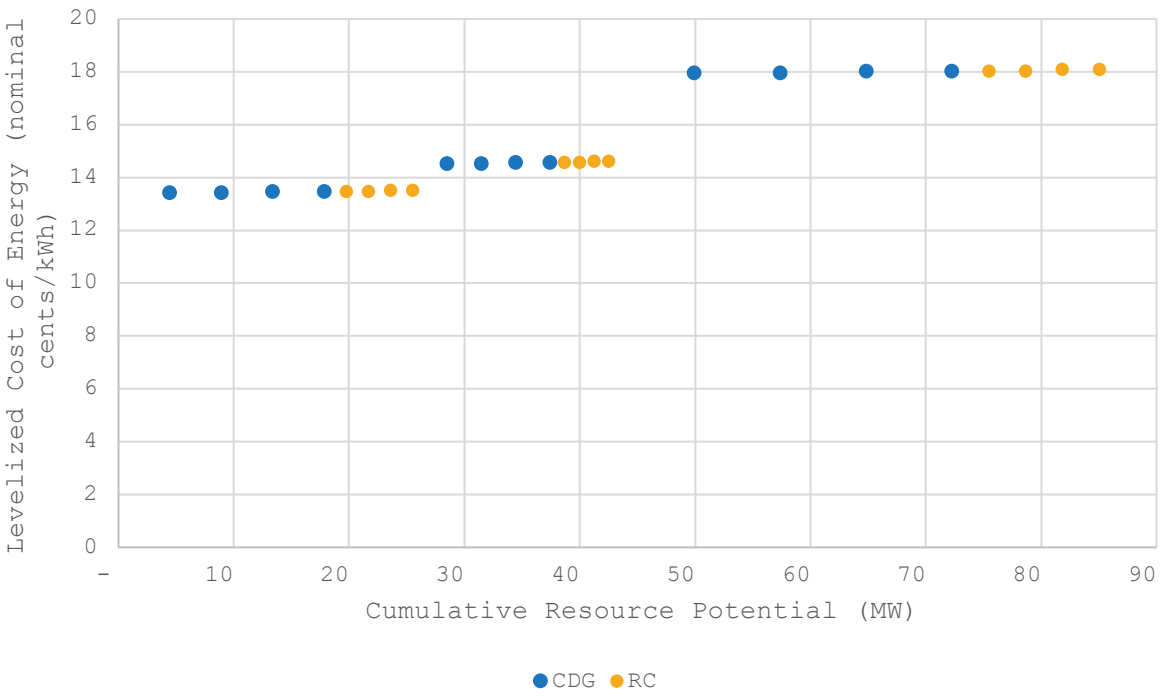
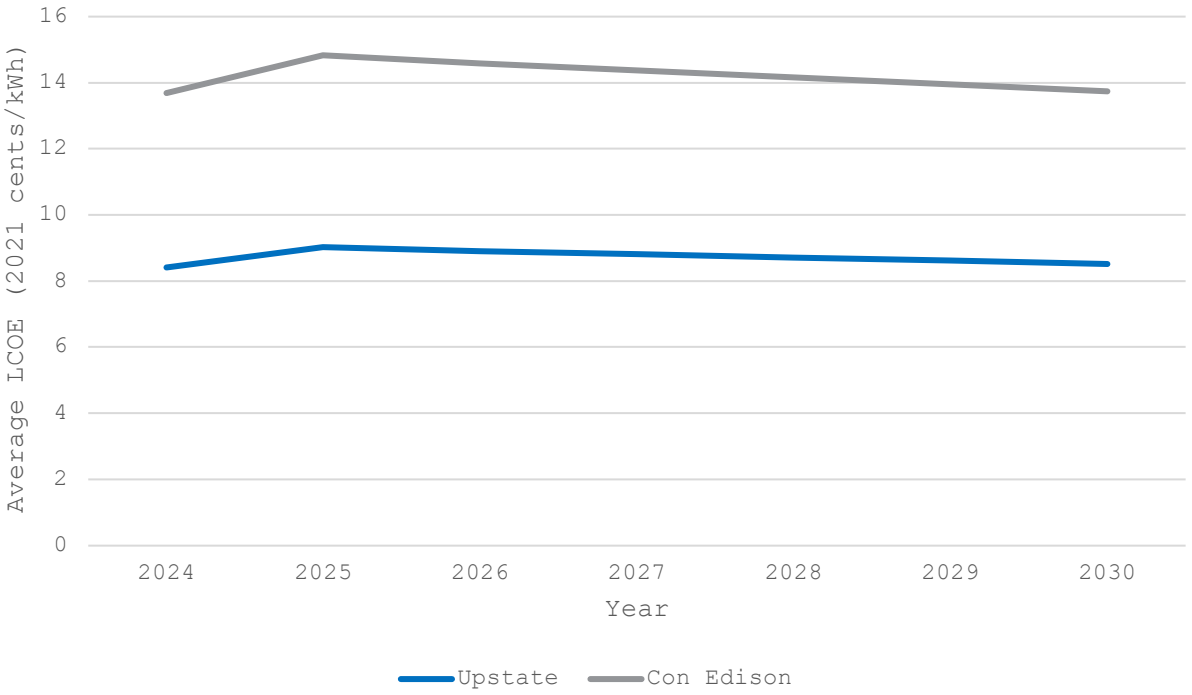


Figure 4 – Levelized Cost of Energy in Real Dollars, for Projects COD 2024-2030



The following observations are noteworthy:

- LCOE is shown net of the ITC.
- In real dollars, LCOE increases from 2024 to 2025 due to stepdown of the federal ITC from 22% to 10% for projects deployed in 2025 and onward. The LCOE then decreases slightly for Con Edison and remains flat in real dollars from 2025 to 2030, driven by declines in CAPEX costs.
- In nominal dollars, the LCOE increases slightly from 2025 to 2030.
- The supply curves shown here reflect financing costs under the Fixed Incentive option as described in Section 2.3. LCOEs are lower under the Index Incentive option.

2.5 Project Revenue

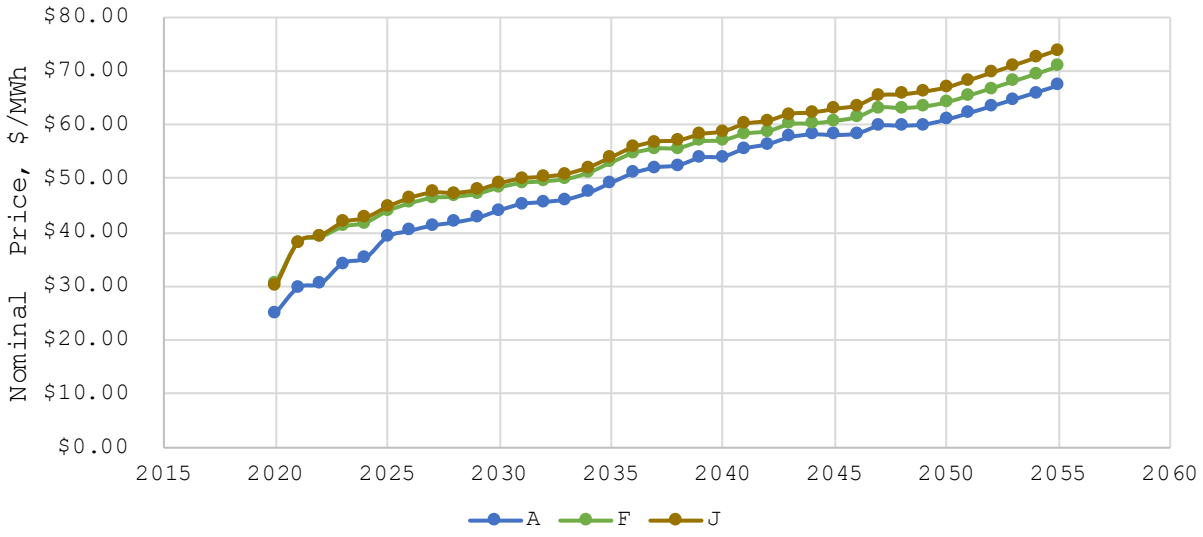
The Value of Distributed Energy Resources (VDER) tariff determines the project revenue for the distributed solar projects in this analysis. The components of the VDER tariff, or value stack, include the energy value, capacity value, environmental value, and demand reduction value.

2.5.1 Wholesale Energy Price Forecast

A project's energy value is based on the day-ahead hourly marginal price (LBMP) for its NYISO zone, adjusted by a transmission and distribution loss factor. Because the NYISO's CARIS forecast does not fully reflect NY's CLCPA requirements, it was averaged with an alternative, lower forecast to allow for the potential downward pressure of new CLCPA resources on wholesale energy prices. The LBMP forecast for each zone is therefore

projected as an average of the 2019 CARIS[8] forecast and 2020 Wood Mackenzie forecast.[9]

Figure 5 – Wood-Mackenzie-CARIS Blended LBMP for Select NYISO Zones, Nominal $/MWh



2.5.2 Capacity Price Forecast

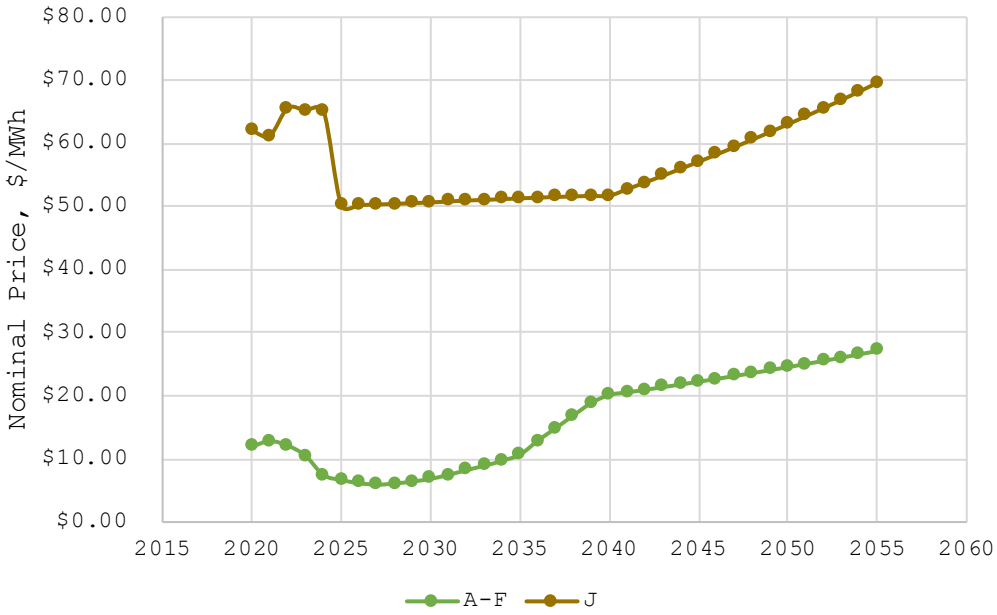
The capacity value is awarded based on the NYISO Installed Capacity (ICAP) market's monthly auctions. At the time of evaluation, the latest available forecast was the DPS August 2020 forecast, which provides zonal summer and winter ICAP generator

[8] The New York State Independent System Operator (NYISO). 2019 Congestion Assessment and Resource Integration Study; Comprehensive System Planning Process, CARIS – Phase 1, Appendices B – M. (CARIS. This forecast extends to 2028. Thereafter, the energy price was assumed to stay constant in real dollar terms at the 2028 level (i.e., continuing to increase with inflation annually in nominal dollar terms). https://www.nyiso.com/documents/20142/13246341/2019_CARIS_Report_v20200617.pdf/fa44a341-786d-2b83-0c00-22951bb112a0

[9] Wood Mackenzie. https://www.woodmac.com/store/outlook/power-and-renewables-outlook/.

prices from 2020 to 2040. In 2041 and thereafter, capacity prices were held constant at the 2040 level in real dollar terms (increasing with inflation in nominal dollar terms).[10]

Figure 6 – ICAP Forecast, Nominal $/MWh



2.5.3 Demand Reduction Value (DRV)

The demand reduction value (DRV) is calculated by multiplying a project's output by the relevant DRV value ($/kWh) during a utility-specific set of peak hours. In the model, the DRV is added as a levelized value over the entire life of a project. Since projects lock in their DRV rate for 10 years, the model uses

[10] Zonal Summer and Winter Installed Capacity Market (ICAP) generator prices from 2025 to 2040 were projected as per the DPS August 2020 Capacity Price Forecast per the BCA Order (Order Establishing the Benefit Cost Analysis Framework, Case 14-M0101, January 21, 2016). In 2041 and thereafter, the capacity prices were held constant at the 2040 level in real dollar terms. https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={F8C835E1-EDB5-47FF-BD78-73EB5B3B177A}

current DRV prices for the first ten years of a project's life, and uses 50% of that value for years 11-25.

2.5.4 Environmental Value (E-Value)

All model runs assume the current E Value of $0.03103 per kWh. For the ongoing incentive designs, the incremental incentive is calculated in addition to the existing E Value. Projects reserve their E Value for their 25-year VDER term.

2.6 Incentive Levels

Based on the levelized cost of energy by resource block (as shown in Section 2.4 of this Appendix) and the projected amount of market revenue (as discussed in Section 2.5 of this Appendix), the analysis projects the amount of support needed by each resource block in order to meet the required IRR. The supply curves on Figures 7-9 show the required incentive calculated by the model for the upfront fixed incentive structure option (reflecting the policy option recommended in the Roadmap), for projects with a 2024 COD year, based on the methodology and inputs described in Section 2 of this Appendix. Incentive amounts were also modeled for the non-upfront incentive structures, with results described in Section 3.1 below.

As described in Section III.d.3 of the Roadmap, the modeled values were used as starting points for incentive design, and NYSERDA applied additional market intelligence in refining the incentive structure. Therefore, the incentive rates and budget proposed in Roadmap Section III.d.2 and III.d.5 vary somewhat from the rates and budgets in this Appendix.

For all regions, the modeled incentive increases slightly from 2024 to 2025, reflecting an increase in LCOE due to the

step-down of a project's assumed ITC from 22% to 10%. The modeled incentive rates then decline slightly on an annual basis from 2025 to 2030.

Figures 7-9 show the modeled incentive rate at which the target number of capacity (800 MW Upstate, 21 MW for Large and Small Con Edison) can be procured, most of which will have a build year of 2024. Each Resource Block is represented by a point on the curve, and they are ranked from lowest to highest required premium.

Figure 7 – Upfront Incentive Supply Curve for Upstate (COD 2024)

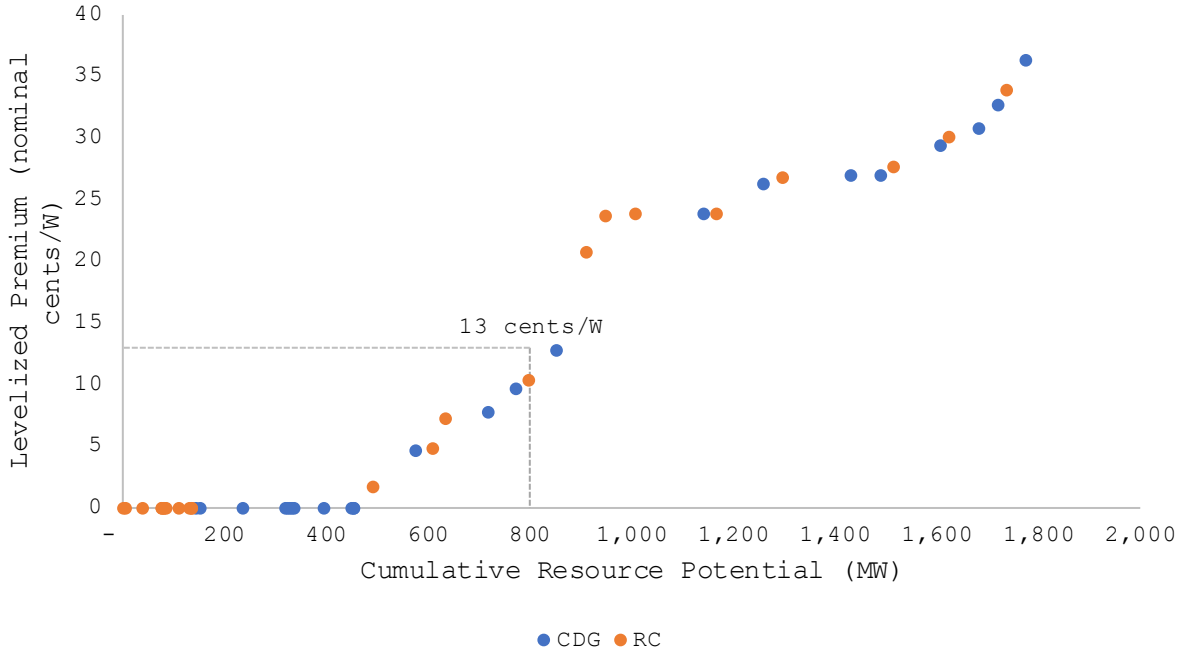


Figure 8 – Upfront Incentive Supply Curve for ConEd Territory Large Installations (COD 2024)

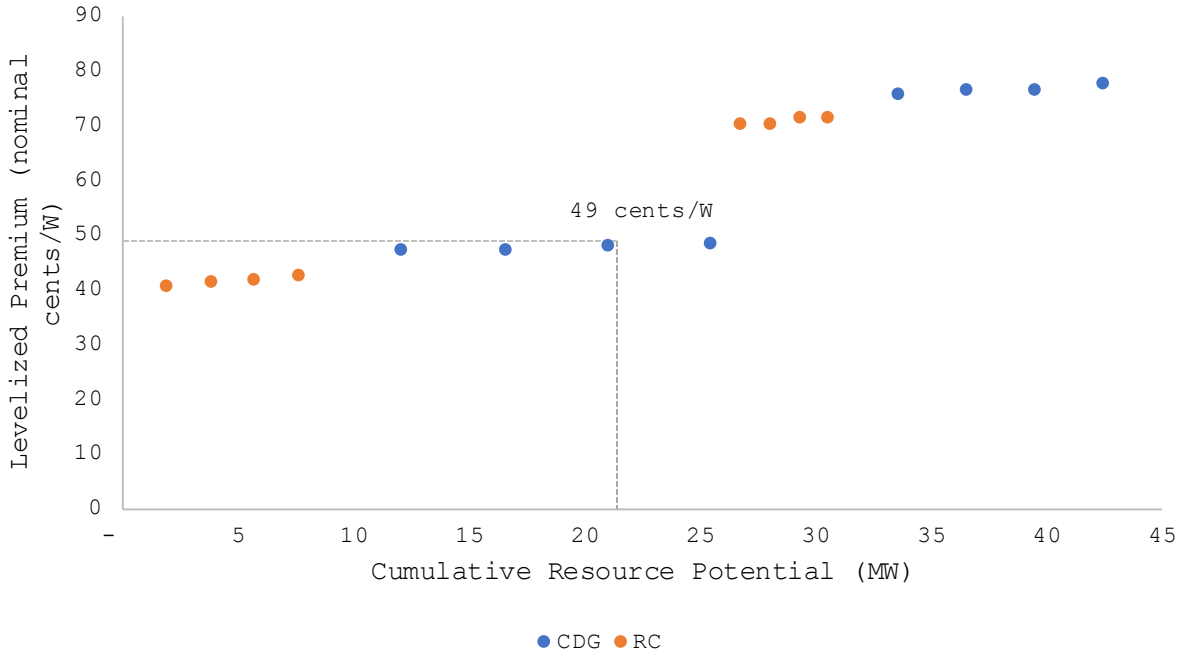
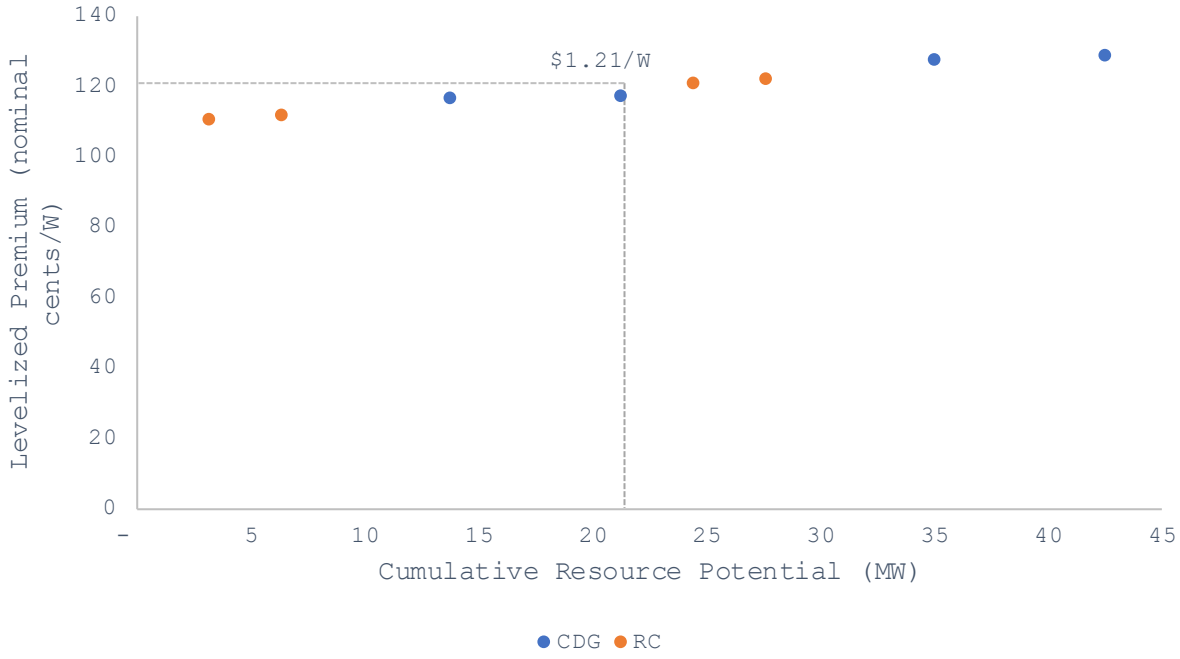


Figure 9 – Upfront Incentive Supply Curve for ConEd Territory Small Installations (COD 2024)



3 Results

The key outputs for the program design analysis are:

- Net present value of incentive costs over the program period ($);
- Customer bill impact from program costs (%);
- Avoided carbon dioxide (CO_2) emissions (million metric tons) and avoided monetary damages.

3.1 Summary of Key Findings

High-level observations from the distributed solar incentive policy options analysis are summarized below:

1. An upfront incentive reduces a project developer's financial burden by paying the incentive near project completion, rather than over a 25-year term. Developers thus finance a lower portion of the project development cost. The administratively-fixed upfront incentive design could save approximately $175 million (NPV in $2021) in ratepayer incentive funds, compared to an administratively-set volumetric incentive.
2. An auction-based incentive results in hypothetically lower total program costs than the administratively-set scenario. In the auction, each Resource Block receives an incentive based on its bid price,[11] whereas the marginal clearing price is used as the incentive for the administratively-set scenario, but is subject to significant downsides in terms of

[11] However, this may overstate actual savings. Under a pay-as-bid approach, bidders may submit bids that are higher than their costs if they think the market can bear it. Further, the complexities discussed in the Roadmap may lead to other hidden costs.

complexity and feasibility, as discussed in Section III.b.1 of the Roadmap.

3. The Indexed incentive results in lower expected program costs than the Fixed, due to the lower target IRR for developers in this approach, but the difference in IRR and thus the inherent cost advantage of the Indexed option is expected to be smaller than is the case for the large-scale renewables programs in New York that currently apply an Index REC approach. In addition, applying this option to distributed solar would be subject to complexity and feasibility issues discussed in Section III.c.2 of the Roadmap.
4. Under any program design option, ultimate program costs will depend on actual energy and capacity prices, instead of a forecast modeled with perfect foresight here. If market values are lower than expected, resulting program incentive costs will need to be higher than shown in this analysis, reflecting a ratepayer risk.
5. The Joint Utilities' proposal results in lower program costs compared to the other administrative incentive options, due to bypassing customer acquisition and management costs. However, this is subject to the simplifying assumption that in other respects the project costs incurred by a utility would be the same as those incurred by competitive entrepreneurs, and disregards the role of customer inclusion and engagement in distributed solar.
6. This analysis concludes that while there are potential cost advantages to program design options that would apply an Index approach, an auction approach and/or remove community engagement aspects of distributed solar, these are partially offset by the cost advantage of an upfront approach compared to ongoing payments over 25 years, and more broadly need to

be balanced against qualitative policy considerations explored in the Roadmap in terms of complexity and feasibility (which could have their own difficult-to-estimate cost impacts), as well as the importance of a community component of the program.

3.2 Program Design Scenario Results

For the production-based incentive structures, program costs are calculated as the annual generation from all selected installations multiplied by their incentive, then calculated as a Net Present Value (NPV) using the nominal social discount rate of 5.75%.

For the upfront incentive structure, program costs are calculated as the annual deployment from all selected installations multiplied by their incentive, then calculated as a Net Present Value (NPV) using the developer's assumed average WACC (7.75%).

Tables 6-8 provide the estimated program cost of base incentives, CDG-specific incentives (Community Adder), and DAC funding for the identified program design options. Additional program design elements are not included in Tables 6-8 such as beneficial siting incentive adders, funds to address the incremental cost of prevailing wage, administrative and implementation funds, and the Cost Recovery Fee. Totals are provided using a net present value (NPVs) in 2021 dollars to facilitate comparison of upfront and volumetric incentives.

Table 6 - Program Costs for Upstate, COD 2024-2030 (NPV 2021 $M)

Incentive Distribution	Incentive Type	Base Incentive and Community Adder	DAC Funding	Total of Base Incentive, CA, and DAC
Upfront ($/W)	Admin Fixed	384	132	516
Volumetric ($/kWh)	Admin Fixed	469	165	634
	Admin Index	215	160	375
	Auction Fixed	321	161	482
	Auction Index	87	155	242
	JU Proposal (Admin Fixed)	116	263	379

Table 7 - Program Costs for Con Edison Territory, COD 2024-2030 (NPV 2021 $M)

Incentive Distribution	Incentive Type	Base Incentive and Community Adder	DAC Funding	Total of Base Incentive, CA, and DAC
Upfront ($/W)	Admin Fixed	236	19	255
Volumetric ($/kWh)	Admin Fixed	289	24	313
	Admin Index	206	22	228
	Auction Fixed	-	-	-
	Auction Index	-	-	-
	JU Proposal (Admin Fixed)	233	40	273

Table 8 - Program Costs for Upstate and Con Edison, COD 2024-2030 (NPV 2021 $M)

Incentive Distribution	Incentive Type	Base Incentive and Community Adder	DAC Funding	Total of Base Incentive, CA, and DAC
Upfront ($/W)	**Admin Fixed**	621	151	772
Volumetric ($/kWh)	**Admin Fixed**	758	189	947
	Admin Index	421	183	604
	Auction Fixed	610	185	795
	Auction Index	293	177	470
	JU Proposal (Admin Fixed)	350	303	653

As described above, administrative incentive options select one incentive amount for all selected Resource Blocks, whereas the auction option sets the incentive amount for each Resource Block based on its bid price. Therefore, the auction-based programs result in lower estimated total program costs than their administrative incentive counterparts. Likewise, in Indexed programs, the Resource Blocks have a lower target IRR than under the Fixed REC approach, so the levelized premium for each Resource Block is lower and the total program costs are lower. The lowest-cost policy option under this simplified analysis, therefore, is the Index REC incentive with the

auction-based program for Upstate and the administrative incentive for Con Edison.

Additionally, the administratively-set upfront incentive structure has a lower cost than the administratively-set volumetric structure, since the incentive is paid to the developer sooner, and reduces their total financing costs.

In addition to the program costs associated with the incentive, the analysis also calculated additional program costs associated with the Solar Energy Equity Framework (SEEF), which ensures the Climate Act requirement that DACs receive at least thirty-five percent with a goal of forty percent of the overall benefits of clean energy program efforts. As described above, the model applies a cost adder of $0.05/Watt on 40% of projects, and assumes projects will provide a customer bill discount of 10% of the value stack, instead of the base value of 5%, resulting in additional program costs. NYSERDA then adjusted these modeled costs, which are based on costs associated with CDG subscriber models, to account for the presence of different project types, namely onsite residential and multifamily distributed solar projects, within the SEEF; as well as a continued commitment to provide technical assistance and predevelopment support to initiatives serving LMI households, affordable housing providers, and DACs. This final proposed SEEF budget of $206,740,000 (in nominal dollars) is indicated in Section 3 of the Roadmap.

3.3 Ratepayer Impact

NYSERDA estimates that while some incentives could be allocated to a small number of early projects completed in 2022-2023, most incentive payments would occur 2024-30, with a modest

amount of performance-based incentives made in 2031-32. Levelized percentage bill impact metrics are calculated as the net present value of the annual program costs over the expected program period, divided by net present value of the statewide spend on energy over the same period.

Assuming collections occur over the 11-year period of 2022-32, the average levelized ratepayer bill impact is 0.79%, or $0.00082 per kWh. The levelized impact on residential bills would be $0.71 per month.

Expenditures, collections, and ratepayer impact are forecasted to peak in 2024. The 2024 collection rate is calculated as $0.00154 per kWh. 2024 customer bill impact is calculated at 1.07%, with an average 2024 statewide residential bill impact of $0.92 per month. Cost is borne equally by all customers based on load. Nevertheless, the percentage impact can vary by utility, mostly because energy bills are lower upstate so an equal program cost share results in a higher percentage bill impact. For instance, the 2024 average residential bill impact would be 0.52% for Con Edison residential customers and 1.07% for National Grid residential customers. 2024 ratepayer impact for Commercial/Industrial ratepayers could range from 0.97% in Con Edison to 3.14% in National Grid.

3.4 Carbon Emissions Reduction

The Incremental 4 GW of distributed solar is expected to generate approximately 4,937 gigawatt-hours (GWh) of annual generation. This clean energy generation is expected to offset over or 58 million metric tonnes (64 million US tons) over the years 2022-2054, based on a marginal emission factor of 0.5 metric tonnes per MWh. Table 9 provides an estimated monetary value for the avoided damages from CO2, for different SCC rates

and marginal emission factors. Several emission factors are included to reflect the ongoing changes to New York's energy mix and the ongoing analysis regarding emissions rates.

Table 9 – Monetary Value of Avoided Damages from CO2 Offset in Millions of Dollars, Net of RGGI Costs (Metric Tonnes)

Marginal Grid Emission Factor	**0.5 Metric Tonnes of CO2e/MWh**	**0.4 Metric Tonnes of CO2e/MWh**	**0.3 Metric Tonnes of CO2e/MWh**	**0.2 Metric Tonnes of CO2e/MWh**
Avoided emissions, MMtCO2e	58	47	35	23
2% Social Cost of Carbon	$4,456 million	$3,566 million	$2,674 million	$1,783 million
3% Social Cost of Carbon	$1,807 million	$1,446 million	$1,085 million	$723 million