

2020

Clean Energy Fund Portfolio Summary



NYSERDA

The Clean Energy Fund is comprised of four portfolios that work collectively to meet ambitious energy, environmental, and economic goals and are expected to contribute significantly toward the broader New York State goals.

Each portfolio is summarized to describe its investments, strategies, and accomplishments to date.



01 NY-Sun

17 NY Green Bank

30 Market Development

60 Innovation & Research



NY-Sun Portfolio Summary

Expanding solar capacity throughout New York State by utilizing public funds in a strategic manner to build a self-sustaining solar market. Built to deliver 3 gigawatts by 2021; recently amended to deliver the Climate Leadership and Community Protection Act's (Climate Act) 6 gigawatt solar PV goal by 2025.

Objectives and Portfolio Characterization

The NY-Sun Program was created to expand solar photovoltaic (PV) capacity throughout New York State, utilizing public funds in a strategic manner to build a self-sustaining solar market. The program included an original goal of installing 3 gigawatts (GWdc) of PV capacity by 2023. Since the creation of the NY-Sun Program, the State has made significant progress on its clean energy goals.



**installed solar capacity has grown
by more than 2,000%**

Recognizing the success of the program, Governor Andrew M. Cuomo announced that distributed solar PV will continue to serve as a critical component for achieving the State's ambitious clean energy agenda, which includes the updated and expanded 6 GWdc by 2025 target to help obtain 70% of the State's electricity from renewable resources by 2030 and 100% from carbon-free resources by 2040.

Following the subsequent passage of the Climate Act NYSEDA filed a petition in September 2019 requesting an additional \$573 million to support the expanded 6 GWdc policy goal and the extension of the NY-Sun Program through 2025.

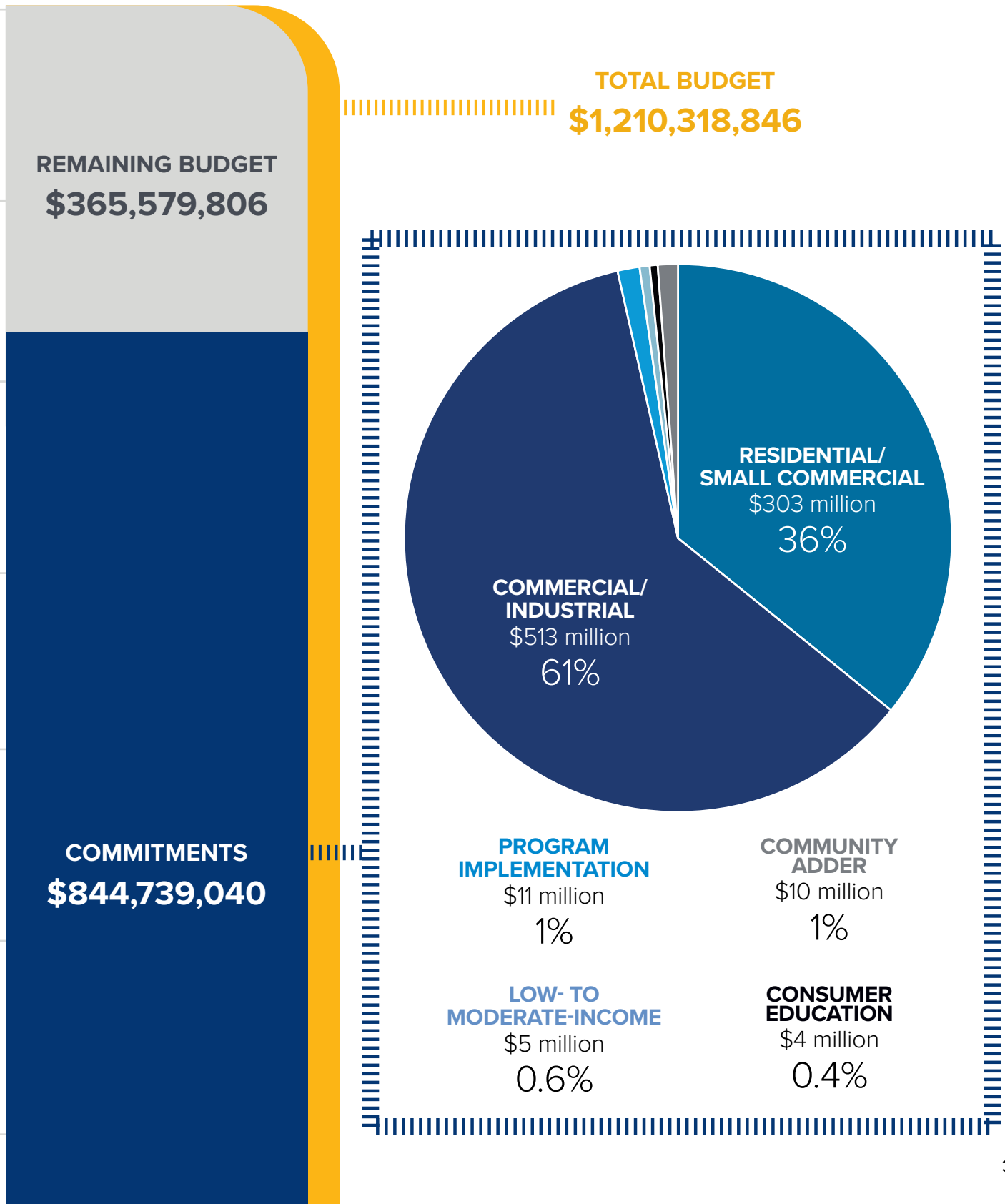
From this new allocation, NYSEDA will make \$290 million available for the main "Megawatt (MW) Block" incentive program and \$111 million for a Community Adder incentive to support the development of community solar once the prior "Community Credit" tranche capacity has been fully allocated.

In addition, in a major focus on program expansion, **\$135 million of the allocation will be for projects benefitting low- to moderate-income (LMI) customers, affordable housing, environmental justice communities, and disadvantaged communities.** Coupled with at least \$65 million in base incentives and Community Adder incentives, this funding commitment provides a total investment of more than \$200 million to benefit those communities, in line with the Climate Act's required level of benefits for disadvantaged communities.

Through the end of Q4 2019, \$845 million in program funding had been committed to facilitate solar project deployment across New York State. This was out of a total NY-Sun budget for the 3 GW goal of \$1,210 million (including approximately \$43 million approved for the original Community Adder), or roughly 70%.

The distribution of these funding commitments by market segment and other categories alongside overall progress of committed funding toward the total 3 GW budget is highlighted below.

NY-SUN 3 GIGAWATT TOTAL BUDGET AND COMMITMENTS THROUGH DECEMBER 31, 2019 (\$ MILLION)



Beyond the delivery of project incentives, NY-Sun — in partnership with NYSERDA supporting programs such as Standards and Quality Assurance, Clean Energy Communities, NY Green Bank, and Clean Energy Siting — has implemented numerous complementary strategies and initiatives to increase the cost-effectiveness of solar deployment in New York State and widen access to this important resource. Major focus areas to date are described in the table below.



REDUCING SOLAR COSTS AND BARRIERS

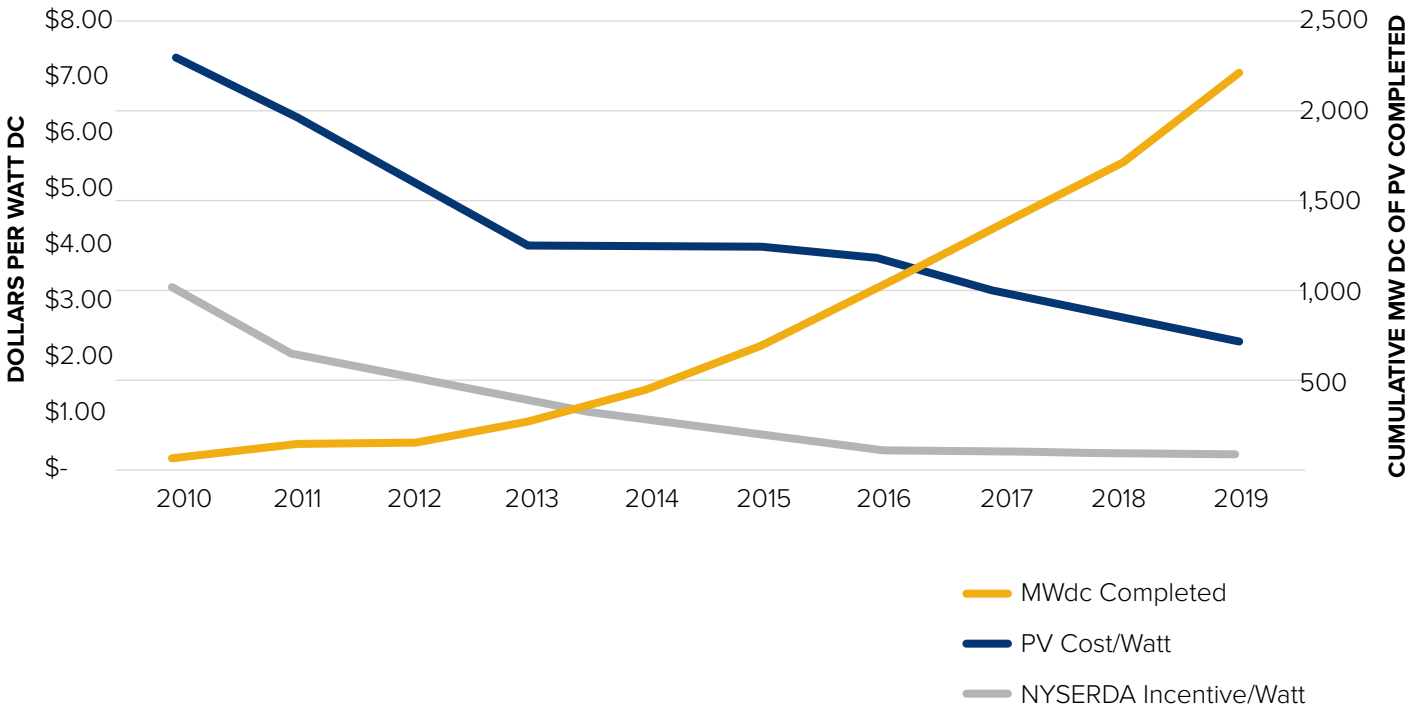
KEY STRATEGIES TO DATE

NY-Sun has engaged in a comprehensive set of strategies to reduce solar costs and barriers. NY-Sun seeks to reduce non-hardware costs in key areas such as interconnection, customer education and outreach, and local policies and permitting processes. NYSERDA continues efforts to reduce solar soft costs through initiatives such as the New York Solar Guidebook for Local Governments. NY-Sun, in collaboration with other NYSERDA programs and external partners, will also continue to seek new ways to support grid efficiency by incorporating energy storage, locational incentives, and financing when needed. These strategies are being implemented alongside the NY-Sun incentives.

MAJOR INITIATIVES IN THE MARKET

- Clean Energy Siting and Sort Cost Reduction
- NY Solar Guidebook for Local Governments
- Technical Assistance
- Interconnection Assistance
- Siting in Agricultural Districts
- Value of Distributed Energy Resources
- Community Distributed Generation Crediting and Billing

NEW YORK STATE SOLAR PROGRESS, 2010–2019



LMI AND DISADVANTAGED COMMUNITY SOLAR ACCESS



KEY STRATEGIES TO DATE

NY-Sun is continuing to advance new opportunities to expand solar access for LMI households, while maintaining a suite of existing programs. These program strategies, as reflected in the Solar Energy Equity Framework proposed and approved by the PSC, are designed to help the NY-Sun program meet the objectives of the Climate Act, ensuring that 40% (and no less than 35%) of the benefits of spending will accrue to disadvantaged communities.

To operationalize more detailed program strategies, NYSERDA will engage in a robust and inclusive stakeholder engagement process that will both respect prior stakeholder contributions and engage a wider range of relevant parties in program design, utilizing activities including:

- Meetings (in-person and/or web-based) with stakeholder organizations to discuss affordability and equity barriers and ideas and review potential program design and partnership approaches.
- Requests for Information (RFIs) seeking formal feedback on proposed program design elements.
- Periodic web-based meetings to review progress and outcomes for active programs and discuss potential changes to programs or the stakeholder engagement process.

MAJOR INITIATIVES IN THE MARKET

- Affordable Solar On-Site Residential Incentive
- Multifamily Affordable Housing Adder Incentive
- Affordable Solar Predevelopment and Technical Assistance Program
- Low-Income Community Solar Initiative: Solar for All
- Revised and relaunched Technical Assistance and Predevelopment (PON 3414)
- Community Solar
- Solar Paired with Storage
- Solar deployments that support the potential for solar and energy storage to repower or replace electric generating peaker units



QUALITY ASSURANCE

KEY STRATEGIES TO DATE

- NY-Sun employs a rigorous Quality Assurance (QA) process, which involves both document review and field inspections on completed projects using a targeted sampling method.
- NY-Sun continues to build on the success of designating QSI, a designation given to active PV installers who demonstrate consistent and quality workmanship. Following its inaugural year of 2019 when 17% of 156 active contractors received this designation, interest in quality improvements has grown. Now in the second year, 25% of the 121 active contractors will receive the QSI designation for 2020.
- NY-Sun is also developing a QA process to ensure continued oversight once the MW Block program is complete and solar projects are no longer receiving funding from NYSERDA.

MAJOR INITIATIVE IN THE MARKET

- Quality Solar Installers (QSI)

OUTCOMES TO DATE

In 2019, 716 field inspections were performed, which included 659 inspections of residential and small commercial/nonresidential projects and 57 commercial/industrial projects. NY-Sun continued to expand the residential and nonresidential photo inspection process to provide additional oversight cost-effectively, while giving contractors and installers more timely feedback. In furtherance of this goal, NY-Sun performed photo inspections on over 542 projects in 2019.

In November 2019, NY-Sun announced that new QA functionality will be available for installers directly in the NY-Sun Incentive Portal, which they already have access to, beginning in January 2020. The new QA functionality will provide installers with greater visibility to inspection results, the ability to respond to inspection requests in the portal and via email, the capability to better track which inspections require action, and the ability to monitor overall QA trends.



FINANCING



KEY STRATEGIES TO DATE

- NY Green Bank has developed a suite of financing products to support community solar market actors.
- NY Green Bank has committed over \$200 million to support the development, construction and financing of community solar projects in New York State.

MAJOR INITIATIVES IN THE MARKET

- Through Interconnection bridge, construction, and term loans, NY Green Bank has helped support more than 300 MW of community solar projects in New York State.

OUTCOMES TO DATE

Each of these financing products has served specific needs and addressed market barriers faced by project developers, owners, financiers, and consumers.

Overall Impacts of the NY-Sun Portfolio through 2019

THE NY-SUN PROGRAM HAD A LANDMARK YEAR IN 2019

SOLAR CAPACITY INSTALLED IN NY

more than any previous year

EMPLOYMENT GROWTH

 10%

10,740

total full-time solar jobs¹ in NY

Highlights of 2019 include the exponential growth of community solar project completions, the rapid development of pipeline projects pairing battery storage with solar, and the ongoing support for LMI households and affordable housing providers. NY-Sun continues to help local governments, solar developers, and other stakeholders address ongoing challenges, such as the siting and interconnection processes for larger (>750 kilowatts) projects as well as the billing/crediting procedures for community solar.

Through December 31, 2019, 2,223 megawatts direct current (MWdc) of solar, including projects completed without New York State Energy Research and Development Authority (NYSERDA) support, were installed statewide.² As of the end of 2019, NYSERDA has directly supported 1,651 MWdc, with an additional 1,256 MWdc under development. The NYSERDA-supported solar capacity installed statewide as of the end of 2019 generates approximately 1,920,824 megawatt-hours (MWh)³ of electricity each year, reducing annual carbon dioxide equivalent emissions by 974,922 metric tons.^{4,5}

NY-SUN THROUGH 2019

INSTALLED PROJECT CAPACITY

1,651 MWdc

the ability to serve 275k households

PROJECT CAPACITY IN PIPELINE

1,256 MWdc

the ability to serve 210k households

CO₂e EMISSIONS REDUCED

974,922 MT

like 208,763 cars taken off the road

JOBS SUPPORTED

10,740

Third most solar jobs in the nation

ANNUAL ELECTRICITY GENERATION

1,920,824 MWh

per year



26% of NY-Sun 6 GW annual contribution to 70x30 target (CES White Paper).

INCREMENTAL YEARLY STATEWIDE SOLAR ELECTRIC CAPACITY INSTALLATIONS (MW DC)

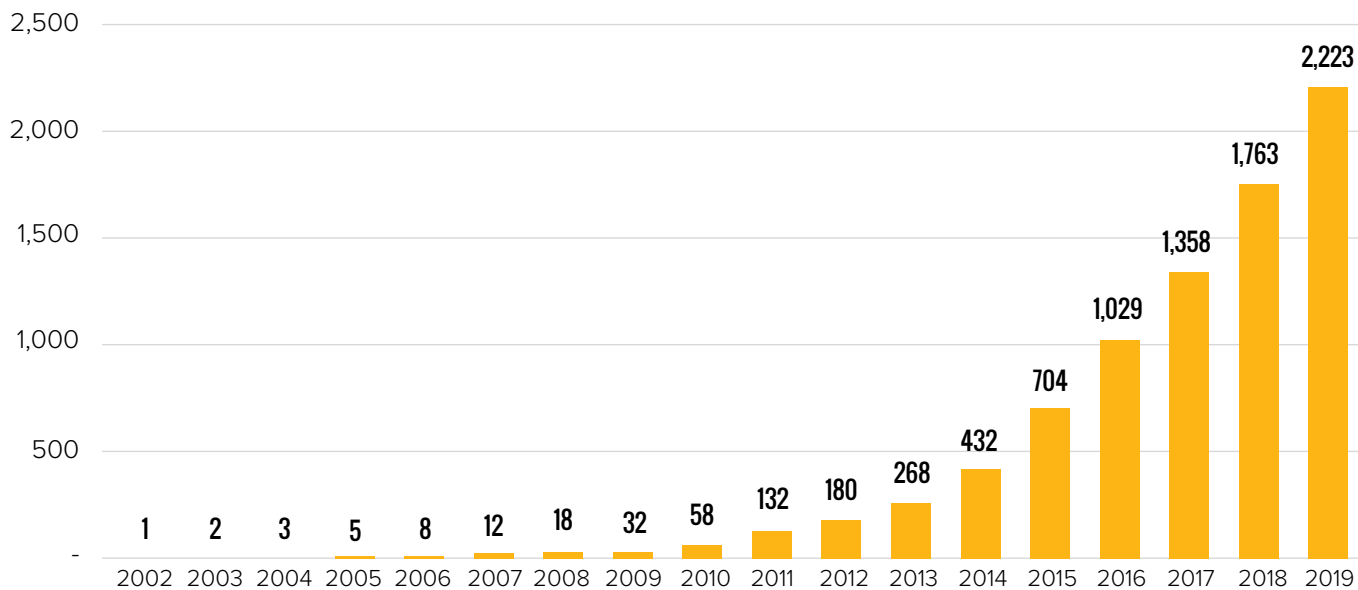
NY-SUN SUPPORTED

384.3 MW
in 2019



enough to earn **#2 spot**
in year-end ranking of state-distributed
solar deployment in 2019
(Wood Mackenzie/GTM).

CUMULATIVE INSTALLED EACH YEAR STATEWIDE (MWdc)



BREAKDOWN OF NY-SUN INSTALLED CAPACITY BY PROJECT TYPE THROUGH 2019 (MWDC)

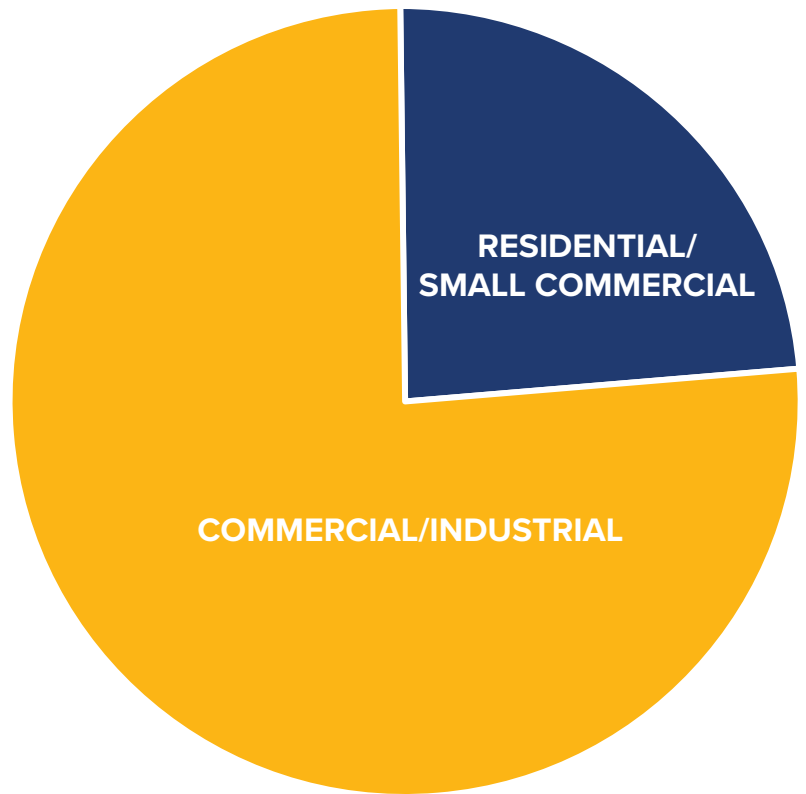
As shown below, the majority (almost two-thirds) of installed capacity under NY-Sun has been in the Commercial/Industrial sector through 2019. While there are many more times the number of individual residential and small commercial projects, the smaller typical project sizes mean that residential and small commercial projects compose just 30% of total installed capacity.

COMMERCIAL/INDUSTRIAL

69%
1,545 MW

RESIDENTIAL/SMALL COMMERCIAL

31%
682 MW



NY-SUN EXPECTED ANNUAL PRODUCTION THROUGH 2019 (MWH)

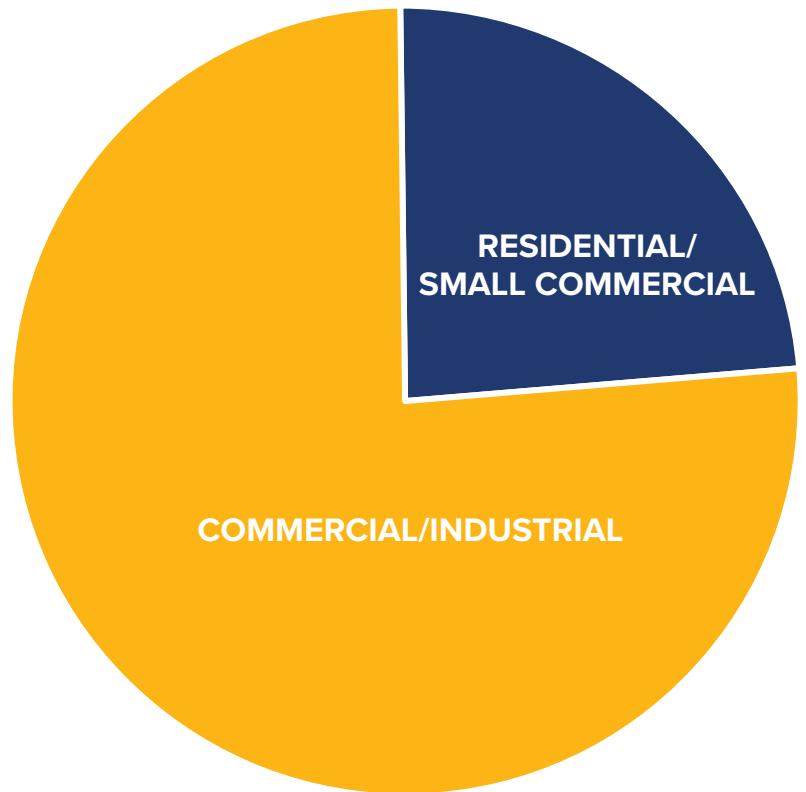
As expected, the expected annual production in MWh from the portfolio of installed NY-Sun projects closely mirrors the amount of installed capacity in each market segment/project type.

COMMERCIAL/INDUSTRIAL

69%
1,814,008 MWh

RESIDENTIAL/SMALL COMMERCIAL

31%
800,611 MWh



Lessons Learned

NY-Sun is a mature program and has many lessons learned since the MW Block program commenced in 2014. Some examples below highlight important insights helping drive the success and stability of the NY-Sun program.

- Strong partnership and open communication with the solar industry provides a valuable understanding as to how to position NYSERDA to help solve problems and overcome barriers.
- An incentive program alone is not enough. Providing local government with the knowledge and tools necessary to make permitting and zoning decisions for solar projects is key. NYSERDA created a siting team to assist local governments with information and support, and The Clean Energy Guidebook provides twelve chapters including Solar Basics and a Municipal Solar Procurement Toolkit that has been used by hundreds of municipalities.
- High quality assurance standards ensure the State invests in well-built projects that conform to code.
- Strong project maturity requirements for program participation is paramount for a stable program.
 - NY-Sun increased project maturity for Non-Residential and Commercial Industrial projects to reduce the risk of attrition.
- Making incentive payments only when project has received permission to operate from the utility eliminates the risk of paying out incentive dollars to a project that does not get completed.
- Giving the solar industry transparency and certainty can help to lower costs.
 - The design of the MW block with a live dashboard gives the solar industry stability and confidence to grow in New York which helps to lower costs through scale of economy.
- The value stack is proving to be an effective and bankable compensation mechanism driving an active solar market using single axis tilt PV systems and energy storage to provide electricity when the grid needs it the most.
- Consolidated billing is very important to access large numbers of subscribers to partake in community solar projects.

Future Directions

As described previously, the NY-Sun program is both building on progress to-date and adopting new strategic priorities that have come into sharper focus since the passage of the Climate Act. Current forward-looking budgets are laid out in detail in NYSERDA's June 2020 NY-Sun Operating Plan, reflecting the approvals in the May 2020 Public Service Commission Order.

One strategic priority for the future of the NY-Sun program is the solar energy equity framework, which commits no less than \$200 million to serve LMI households, affordable housing providers, disadvantaged communities, and environmental justice populations. Work is already well under way following the PSC's May 2020 Order to expand the NY-Sun program, including:

- \$10.6 million available to help underserved New Yorkers access clean, affordable solar grants provided through the Affordable Solar and Energy Storage Predevelopment and Technical Assistance Program.
- Expanded incentives to offset the cost of installing solar for LMI homeowners and affordable housing to make it more affordable to access.
 - LMI homeowners may now receive a higher incentive for larger projects than under the previous design.
 - Multifamily affordable housing also may now receive a higher incentive than previously designed as well as be compensated for larger projects.

NY-Sun staff are actively developing additional program changes to benefit LMI households and disadvantaged communities as discussed in the May 2020 PSC Order and June NY-Sun Operating Plan such as:

- Continued refinements to existing efforts such as the added incentives for LMI homeowners and affordable housing.
- Additional incentives for community solar projects that are inclusive of LMI customers.
- Utility partnerships to implement low income community solar programs.
- Solar paired with storage to provide resilience and/or financial benefits.
- PV and storage deployments that support the potential to repower or replace electric generating peaker units.

With the combination of a dedicated budget for disadvantaged communities in the May 2020 Order and promising regulatory developments such as consolidated billing, NY-Sun is positioned to work with DPS, advocacy organizations, solar developers, community groups, the utilities, and other stakeholders to deliver benefits to disadvantaged communities.

In addition to the incentive adders for LMI households and affordable housing, NYSERDA will also be expanding the incentive adders to support PV deployment in specific market segments. Incentive adders are an effective way to encourage projects that contribute to the NY-Sun capacity goals while also meeting other policy or market objectives. NYSERDA will offer up to a total of \$19 million in funding for the following incentive adders:

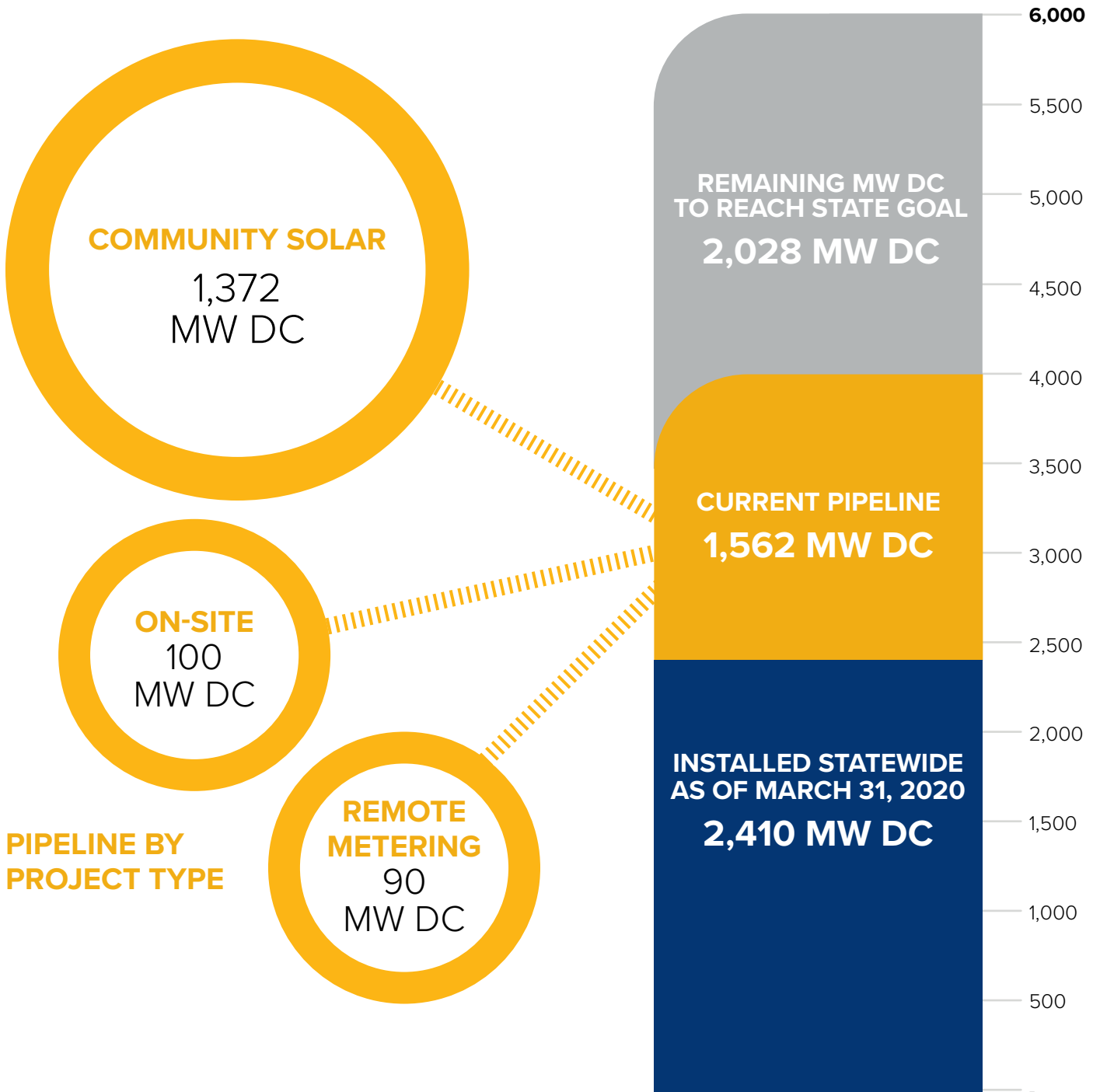
- Parking and Rooftop Canopy Adder available for ConEd nonresidential projects
- Landfill/Brownfield Adder available for all nonresidential and commercial/industrial projects

Furthermore, as authorized in the May 2020 Order and the April 2019 Order Regarding Value Stack Compensation, NYSERDA will offer the “Community Adder” for Community Distributed Generation projects in utility territories where the Community Credit and Market Transition Credit allocations have been fully committed. The Community Adder marks the continued support for, and maturation of, the community solar market in New York State and under NY-Sun. This market trend has contributed greatly to the growth in installed and pipeline capacity, to the expansion of solar access to New Yorkers who are unable to install rooftop solar, and to the prospects for megawatt-scale energy storage-paired deployments that relieve grid stress. NY-Sun will be committing \$154 million in total to the Community Adder in pursuit of the 6,000 MWdc goal.

In addition, in implementing the expanded NY-Sun program, NYSERDA will continue to employ strategies to further encourage the positive impact of solar development on agriculture and New York’s rural economy and will work closely with impacted and interested stakeholders in doing so. Ground-mounted commercial scale solar projects have emerged as a leading source of the growth in solar development in Upstate New York. 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 minimized or avoided.

The NY-Sun program is on track to meet the updated 6 GW by 2025 statewide goal for distributed solar deployment. Q1 2020 has shown continued robust uptake with more than 2.4 GW of distributed solar installed statewide and more than 1.5 GW of additional capacity in the development pipeline. Updates on the State’s progress toward the 6 GW goal can be tracked online on NYSERDA’s ‘Statewide Solar Projects’ webpage.

STATEWIDE PROGRESS TO 6 GIGAWATT GOAL





Highlights

The NY-Sun Program has a significant impact on integrating diverse clean energy sources into New York's grid. The following highlights outline the achievements the program has made toward the State's clean energy goals.





Projects on Farmland

As the number of commercial and industrial scale projects increases in the upstate region, solar developers and landowners have found new ways to integrate projects into the community. At Delaware River Solar’s Baer Road project, sheep can be found grazing beneath the solar panels. NYSERDA has been working with the Department of Agriculture and Markets to protect farmland while accelerating New York State’s clean energy goals.



Solar Serving Upstate Cerebral Palsy in Oneida County

In October 2019, NYSERDA and Citizens Energy Corporation announced the completion of a 1.4-MW solar project in the Mohawk Valley. Located in Oneida County, Upstate Cerebral Palsy is the sole beneficiary of the commercial solar project. Upstate Cerebral Palsy was thrilled to partner with Citizens Energy and NYSERDA on the newly constructed 7-acre solar farm, which will provide discounted electricity to more than 50 sites.

The sites house or provide programs to thousands of people with developmental disabilities and the nearly 2,000 staff who support them. With the help of their partners and consulting group, WMR Services LLC, they were able to partner with Citizens Energy Corporation to achieve cost savings to support critical programs while harnessing renewable energy to reduce their emissions and carbon footprint.

NYSERDA, through the NY-Sun program, provided nearly \$300,000 in support for the array, which is comprised of 3,600 panels. The project will offset almost all of Upstate Cerebral Palsy’s annual electricity load, providing an estimated savings to the organization of more than \$30,000 annually. Located behind the organization’s Barneveld facility, the 1.4-megawatt array will produce more than 1.5 million kilowatt-hours annually—the equivalent of taking 184 cars off the road or powering 245 homes annually.

Nexamp Seneca

The Nexamp Seneca Solar for All project became the first project to be fully subscribed in November 2019. The 640 low-income subscribers are expected to receive more than \$115,000 in electric bill savings annually.



Sun-Powered Brewery

In May 2019, Governor Cuomo announced the completion of a 2.76-MW solar project in Central New York. Located in the Town of Van Buren, Anheuser-Busch’s Baldwinsville brewery is the sole off-taker of the commercial solar project, which complements “Central New York Rising,” the region’s comprehensive strategy to generate robust economic growth and community development, and supports Governor Cuomo’s nation-leading climate goals. NYSERDA, through the NY-Sun program, provided more than \$1.1 million in support for the array, which is comprised of more than 8,300 solar panels—making it Anheuser-Busch’s largest off-site installation to date in the United States. Located six miles from the company’s Baldwinsville brewery, the 2.76-MW array will produce more than 3 million kilowatt-hours annually, the equivalent of providing enough to brew 3 million cases of beverages annually. The solar array is owned and operated by AES Distributed Energy, Inc. and was developed to support Anheuser-Busch’s ambitious goal to purchase 100% of its electricity from renewable sources by 2025.



Urban Homesteading Assistance Board Co-Ops Go Solar Project

The Urban Homesteading Assistance Board represents more than 1,600 HDFC co-ops across New York City. Through the Co-ops Go Solar campaign, UHAB opened the door for the development of solar projects on multifamily affordable housing across New York City. In the process of exceeding the initial project goals, the 643 households served by this project will save \$4.5 million over the lifetime of the solar systems.



Saratoga Springs Affordable Solar Initiative

The Saratoga Springs project supported an innovative model connecting community solar and a housing authority. Through this project, 2.4 MW of community solar will provide \$100,000 in energy efficiency investments.

Funding Source

The Commission directed that \$230 million of initial funding for the NY-Sun expansion be sourced from existing uncommitted NYSERDA funds, and the Commission will consider the appropriate source of funding for the remainder of the \$343 million as part of its review of all aspects of the Clean Energy Fund.



NY Green Bank Portfolio Summary

\$1 Billion Investment Fund – Designed to accelerate clean energy deployment in New York State, NY Green Bank is globally recognized as a leading sustainable infrastructure investor. NY Green Bank’s participation in a growing number of diverse transactions spurs clean energy development across New York.

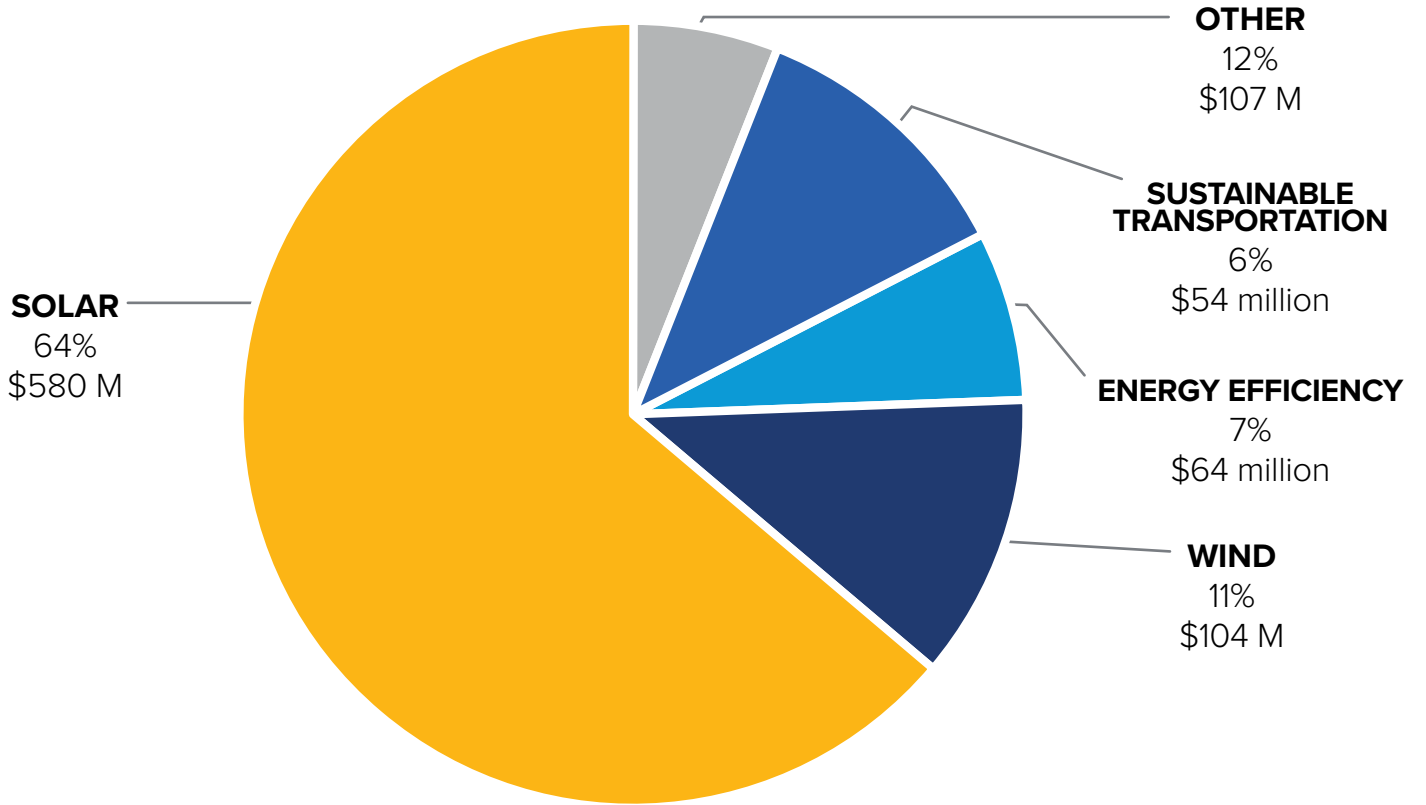
Portfolio Characterization and Impacts

NY Green Bank is a division of the New York State Energy Research and Development Authority (NYSERDA). Since its formation, NY Green Bank has worked to increase the size, volume, and breadth of sustainable infrastructure investment activity throughout the State, expand the base of investors focused on clean energy, and increase market participants' access to capital on commercial terms. To achieve these objectives, NY Green Bank collaborates with the private sector to develop transaction structures and methodologies that overcome typical clean energy investment barriers. These barriers include challenges in evaluating risk and addressing the needs of distributed energy and efficiency projects where underwriting may be oriented toward larger opportunities and/or toward groups of investments that make up larger portfolios.

NY Green Bank invests where there are limited precedents, less familiar asset structures, and/or deal structuring complexities that require specialized skillsets. NY Green Bank applies project and structured finance transaction approaches that isolate project assets, allocate and protect against downside risks to the greatest possible extent and monetize low-volatility project-generated cash flows to produce appropriate risk-adjusted returns. NY Green Bank focuses on opportunities that create attractive replicable models, standardized practices, and roadmaps that capital providers can readily replicate and scale. As funders "crowd in" to a particular area within the sustainable infrastructure landscape, NY Green Bank moves on to other areas that have received less investor interest.

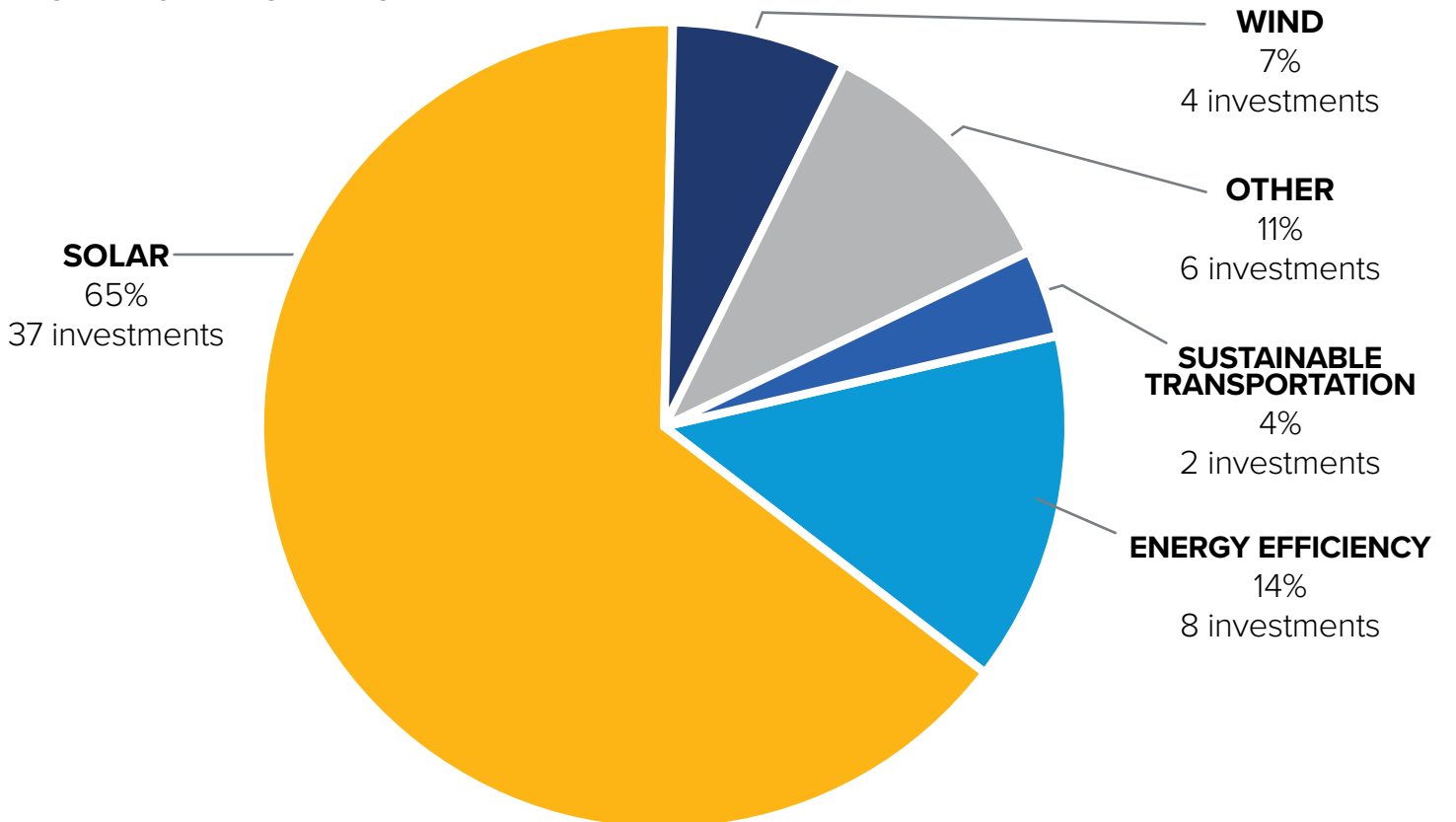
NY Green Bank has invested in the renewable energy segment of New York's clean energy market more than in any other segment.

TECHNOLOGY DISTRIBUTION OF PORTFOLIO, INCEPTION TO 12/31/2019
TOTAL COMMITMENTS (\$ MILLION) AND NUMBER OF INVESTMENTS



|||||

TECHNOLOGY DISTRIBUTION OF PORTFOLIO, INCEPTION TO 12/31/2019
NUMBER OF INVESTMENTS



NY GREEN BANK OFFERS A RANGE OF STRUCTURES TO ADDRESS CLEAN ENERGY MARKET FINANCING GAPS AND SPECIFIC COUNTERPARTY NEEDS.

CREDIT ENHANCEMENTS



KEY STRATEGY

- Structured to absorb a portion of losses that may be incurred in project-specific loans or leases and alleviate some of the default risks associated with clean energy loans or leases in return for a risk-appropriate fee.

EXAMPLE TRANSACTIONS

- Energy Improvement Corporation and Energize NY Finance
- Carlyle Power Partners II

FUNDING COMMITMENTS AND OUTCOMES THROUGH 2019

FUNDING COMMITTED
\$13 M

EMISSIONS REDUCTIONS
13,400 MT

CONSTRUCTION FINANCE



KEY STRATEGY

- Temporary loan provided before a project is operating and longer-term debt capital can be arranged. Construction finance will typically capitalize interest, with a lump sum repayment at maturity. The parent, sponsor or another entity will make periodic draw downs during the construction period.

EXAMPLE TRANSACTIONS

- Delaware River Solar
- New York City Energy Efficiency Corporation

FUNDING COMMITMENTS AND OUTCOMES THROUGH 2019

FUNDING COMMITTED
\$102 M

EMISSIONS REDUCTIONS
1,835,000 MT

CONSTRUCTION FINANCE AND TERM LOAN



KEY STRATEGY

- These loans are similar to Construction Finance, except the outstanding principal balance at the end of the construction financing period may become a term loan (subject to the satisfaction of certain conditions precedent). In short, at maturity the Construction Finance vehicle is coupled with a term loan.

EXAMPLE TRANSACTIONS

- Northport-East Northport Union Free School District
- AES Distributed Energy

FUNDING COMMITMENTS AND OUTCOMES THROUGH 2019

FUNDING COMMITTED
\$89 M

EMISSIONS REDUCTIONS
1,991,000 MT

TERM LOANS AND INVESTMENTS



KEY STRATEGY

- Term loans and investments are generally made along with other private sector capital providers, and involve the provision of both longer-term products and short-term products. These can be advanced to projects through senior, mezzanine, or subordinated debt facilities and/or in certain cases, equity.

EXAMPLE TRANSACTIONS

- Spruce Finance
- BQ Energy Development
- NRG Renew

FUNDING COMMITMENTS AND OUTCOMES THROUGH 2019

FUNDING COMMITTED

\$483 M

EMISSIONS REDUCTIONS

8,270,000 MT

WAREHOUSING AND AGGREGATION



KEY STRATEGY

- A form of finance where multiple draws and repayments are made on a revolving basis for the availability period. Repayment is from a refinancing on more advantageous terms. As opposed to a term loan where assets remain in the facility, assets flow through a warehouse or aggregation facility.

EXAMPLE TRANSACTIONS

- Sealed
- Sunrun, Inc. (Construction Revolver)
- Sunrun, Inc. (Aggregation Revolver)

FUNDING COMMITMENTS AND OUTCOMES THROUGH 2019

FUNDING COMMITTED

\$149 M

EMISSIONS REDUCTIONS

371,000 MT

PREFERRED EQUITY



KEY STRATEGY

- A type of equity investment in a company that grants holders certain preferences over the company's common equity holders. Such preferences may include (i) the right to receive a fixed portion of the distributions of the company's earnings before the common equity holders and (ii) the right to receive a fixed portion of the proceeds from a liquidation of the company's assets before the common equity holders. Even though preferred equity is a type of equity investment, the voting rights of preferred equity holders are customarily limited with respect to the company.

EXAMPLE TRANSACTION

- Saranac Lake Resort

FUNDING COMMITMENTS AND OUTCOMES THROUGH 2019

FUNDING COMMITTED

\$5 M

EMISSIONS REDUCTIONS

744 MT

Overall Impacts of the NY Green Bank Portfolio through 2019

INVESTMENTS SUPPORTED THROUGH DECEMBER 31, 2019 RESULT IN LIFETIME ENERGY AND ENVIRONMENTAL BENEFITS:

FUNDING COMMITTED

\$846 million

January 2016 through December 2019

and exceeded \$1B by June 30, 2020

CUMULATIVE REVENUES

\$79+ million

January 2016 through December 2019

with revenues surpassing expenses earlier than planned in Q3 2017 (see graph on page 5)

CLEAN ENERGY GENERATION AND ELECTRICITY SAVINGS

1,589,541

MWh

over lifetime

ENERGY EFFICIENCY (FUEL SAVINGS)

115,843

MMBtu

over lifetime

METRIC TONS OF CO₂e

up to **844,000** saved each year over the lifetime of portfolio measures

up to **19 million**

saved over lifetime

EQUIVALENT TO REMOVING

up to **184,000 cars**

from the road each year

CAPITAL MOBILIZED FOR CLEAN ENERGY PROJECTS

\$2.4 billion

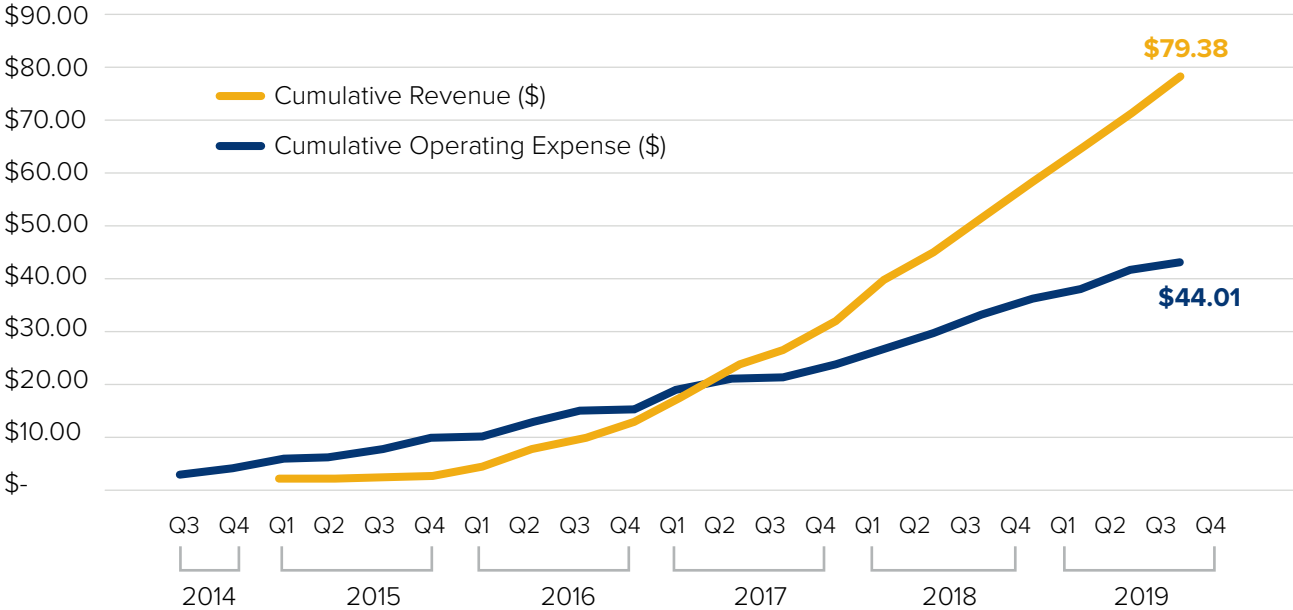
57 TRANSACTIONS SUPPORTING 7 TECHNOLOGY SEGMENTS

NY Green Bank manages a portfolio of investments across a range of sectors, contract types and technologies including:

- Agricultural, Commercial, Industrial, Residential, Transportation, and Electricity
- Energy Savings Agreements, Power Purchase Agreements, Community Distributed Generation, Equipment Leases, and Uncontracted Sales
- Energy Efficiency, Solar, Wind, Transportation, Combined Heat and Power, and Energy Storage

NY Green Bank has experienced continued revenue growth – \$79 million in revenue has been generated since its inception. NY Green Bank continues to be self-sufficient, covering its expenses through the generation of annual net income, and achieved self-sufficiency ahead of schedule.

CUMULATIVE REVENUES VS CUMULATIVE EXPENSES (\$ MILLIONS)



Market Transformation Progress

In May 2019, the first NY Green Bank market evaluation was published. The evaluation was designed to assess the influence of NY Green Bank's early activities on the following characteristics of clean energy finance markets in New York State:

- Knowledge of and confidence in clean energy investments among financial institutions
- Number and type of financial institutions active in clean energy markets
- Availability of favorable terms in financing offered to clean energy projects and companies
- Pace of clean energy project deployment
- Volume of clean energy project financing

The May 2019 evaluation found that:

- NY Green Bank has made a strong start in achieving its goals.
- Progress in many of the evaluated market indicators was identified and was directionally consistent with hypotheses concerning the market effects of NY Green Bank activities.
 - For example, there is evidence of increased scale of clean energy project financings; increased clean energy transactions with risk/return profiles acceptable to financiers; increased number of clean energy project financings; and increased volume of clean energy project financings.
 - Evidence was generally not significant enough to support a definitive connection between NY Green Bank activities and the market changes observed. This finding was anticipated given that the study period covered only the earliest stages of NY Green Bank's operation.
 - The success of NY Green Bank's Mosaic transaction, in particular, and following NY Green Bank's catalytic investments early on, is a strong and representative example confirming the efficacy of NY Green Bank's strategy and approach.

Given the longer-term trajectory of NY Green Bank's efforts, future market evaluation studies will continue to measure NY Green Bank's impact in clean energy finance markets.

Lessons Learned

- NY Green Bank's structuring creativity positions it well to meet the state's carbon-neutral goals under the Climate Act.
 - NY Green Bank has provided early support to nascent clean energy sectors, often investing considerable time and intellectual capital before closing its first transactions. For example, in part because of NY Green Bank's readiness to finance community distributed generation ("CDG") projects, developers and their potential equity/tax equity providers were willing to invest time and energy in pursuit of CDG. As of December 31, 2019, NY Green Bank had made 14 CDG investments, helping to buoy this nascent sector. This success demonstrates NYGB's ability to identify attractive markets in early stages and add momentum to their development through creative financing solutions. A carbon-neutral future will require major investments in new infrastructure across all sectors of New York State's economy. NY Green Bank expects that its early experience creatively structuring investments across emerging sectors will allow it to better support the State's actions to improve the carbon footprint of its entire economy.
- NY Green Bank's investment mix has differed from initial forecasts, with higher concentrations in renewable energy generation
 - At inception, NY Green Bank estimated that 45% of its investment would be in renewable energy projects and 55% would finance energy efficiency projects. In fact, investments in renewable energy have exceeded initial projections, while energy efficiency project volumes and corresponding savings have been lower than expected. NY Green Bank has its greatest investment concentration in the State's electricity sector, where it has addressed the needs of residential, distribution, and utility scale project developers, owners and operators with structured products that have led to increased deployment of clean energy generating resources.
- To date, private capital mobilization has been lower than NY Green Bank initially anticipated
 - NY Green Bank's financing of a larger percentage of overall project costs than originally forecasted has resulted in lower mobilization ratios for individual investments and the NY Green Bank portfolio in aggregate. Each investment (or series of investments) tackles nuanced financing barriers faced by NY Green Bank's counterparties. While NY Green Bank continues to focus on mobilizing large amounts of capital for clean energy and sustainable infrastructure in the State, it also prioritizes its market transformation mandate by seeking to create, accelerate and grow new clean energy asset classes through the successful implementation of projects in the State where such development may not otherwise occur at all, as quickly or at the requisite scale. While capital mobilization to date has been lower than expected, future investments may not require as large a percentage of NY Green Bank capital, which could result in higher private capital mobilization.
- NY Green Bank's large and growing portfolio has necessitated changes to NY Green Bank operations
 - In conjunction with portfolio growth and an increased volume of fundings, amendments, and other portfolio administration activities, NY Green Bank has adapted its organizational design over time to mirror best-in-class investment and portfolio management, compliance, and risk management function practices. For example, NY Green Bank added staff and centralized aspects of its investment administration and portfolio support areas to administer and manage many of the ongoing operational aspects of its growing portfolio that had initially been conducted by NY Green Bank's investment team in its first years of operation. NY Green Bank made additional investments in data and technology resources to support its origination and investment functions and sees these changes as key to long-term operational efficiency.

Future Directions

While continuing to drive financing market transformation broadly across clean energy and sustainable infrastructure markets, going forward NY Green Bank will take action to deliver on specific investment commitments it has made in key segments, including:

- \$150 million for clean energy improvements in affordable housing properties per Governor Cuomo's July 27, 2020 announcement
- \$100 million in financing to help clean transportation businesses locate or expand in New York as announced by Governor Cuomo in his 2020 State of the State proposal
- \$200 million toward energy storage-related investments as proposed by Governor Cuomo in his 2018 State of the State

Consistent with the focus in the Climate Leadership and Community Protection Act on disadvantaged communities, NY Green Bank will seek to invest \$350 million in projects to benefit disadvantaged communities. NY Green Bank's affordable housing initiative is a first step toward achieving the \$350 million investment target and ensuring that 40% of the benefits of its investments accrue to LMI and disadvantaged communities. The initiative was informed by NY Green Bank's engagement of independent consultants to help identify financing barriers and opportunities through facilitated conversations with the State's and New York City's housing finance agencies; CDFIs and specialty finance companies specializing in the sector; public, private and non-profit developers and owners of affordable housing; and key advocacy groups such as Energy Efficiency for All New York. By offering flexible capital underwritten to higher expected energy savings than is typical of other finance providers, NY Green Bank will not only deliver direct benefits to affordable housing properties, but will also play a role in transforming financing markets, where capital scarcity often precludes the implementation of energy-related measures. To reflect the prioritization of its affordable housing and disadvantaged community energy efficiency finance commitments, NY Green Bank is making changes to certain internal processes, including its investment RFPs and scoring of investment proposals.



Highlights

The NY Green Bank market evaluation also included development of case studies to provide a more detailed narrative of NY Green Bank’s involvement in individual transactions and identify the impact of those transactions on the State’s clean energy sector and participants more broadly, including project developers and the financiers that support their activities.





Increasing the availability of capital for deploying proven clean energy technologies across New York State through a flexible and dynamic approach to financing.



As the largest green bank in the nation, NY Green Bank’s wholesale investing approach is critical to evolving clean energy financing markets. NY Green Bank helps identify and alleviate existing financing market gaps and barriers, stimulating greater private sector activity and supporting a more robust marketplace.

“NY Green Bank’s involvement in our first major warehousing was significant and led directly to investor confidence in later securitizations.”

– Alex Kaplan, Director of Capital Markets, Solar Mosaic, Inc.

“Municipalities and other off-takers also take comfort in NY Green Bank participation, aiding our marketing. Also, their involvement, especially their strong due diligence protocols, makes it more likely additional lenders will entertain us.”

– Paul Curran, BQ Energy

In 2014, **Solar Mosaic, Inc.**, a financial technology company, launched a novel business model for financing solar projects to reduce the high customer acquisition and financing costs that inhibit growth in the residential solar market. NY Green Bank provided capital to Mosaic early in the development of its business model and was one of only two participants in Mosaic’s first major warehouse credit facility.

The systems, experience, and volume Mosaic built using the credit facility enabled the company to complete more than \$1 billion in securitized financing of its project receivables between 2017 and 2019. Since early 2017, Mosaic has completed the largest share of residential solar securitizations of any issuer in the market—about 40%.

Since 2002, **BQ Energy** (BQE) has been dedicated to developing clean energy facilities, specifically on brownfield sites and community landfills. In 2008, BQE expanded to solar PV development, but had not initially attracted interest from traditional lenders, primarily due to its small size and the complexity of smaller solar projects.

NY Green Bank’s commitment of capital enabled BQE to execute and streamline a project model that offers potential for significant scaling. BQE believes strongly that NY Green Bank’s support will increase the firm’s ability to attract additional capital and provide other developers and financiers with an example of how to develop smaller community and commercial/industrial solar projects.

NY Green Bank committed more than \$300 million* across 15 investments to support installed residential solar capacity in New York State equal to:

\$709+ million
in project costs

223 megawatts

☰ Mosaic

NY Green Bank's participation in Mosaic's first large warehouse credit facility helped the company address four critical growth challenges related to financial markets.

🚫 FUNDING EARLY GROWTH

In the year prior to the launch of its first warehouse credit facility in April 2016, Mosaic had increased its monthly pace of solar loan initiation from \$3.2 million in December 2014 to \$25.2 million by November 2015.

🚫 SCALING OPERATIONS

Lending operations supported by funding enabled Mosaic to extend dealer networks and improve IT platforms, increasing efficiency and its ability to meet financial obligations.

🚫 ATTRACTING INVESTORS

In 2017, Mosaic closed its first credit-rated securitization of \$140 million.

🚫 REDUCING BORROWING COSTS

Interest rates charged to Mosaic decreased continuously from the first NY Green Bank-supported credit facility through its subsequent three securitizations.

\$50 M committed in two stages to loan warehousing facility totaling \$270 million to aggregate consumer loans that finance residential solar installations nationwide.

NY GREEN BANK'S COMMITMENT IN MOSAIC SUPPORTED

residential solar installations throughout New York State

☰ BQ Energy

NY Green Bank helped BQE overcome several financing barriers to develop a standardized, repeatable approach to developing community and commercial/industrial solar installations.

🚫 SCALE **\$23 M** SECURED FINANCING

Typically, there is limited private capital interest in relatively small community and commercial/industrial solar projects.

🚫 RISK IMPACT OF CHANGING REGULATIONS ON PROJECT REVENUE STREAMS

Several risks were associated with the portfolio of projects which BQE felt deterred lenders from extending credit.

🚫 STANDARDIZATION & COST REDUCTION

Standard approaches with trusted partners has greatly reduced costs of customer acquisition, site selection and approval, underwriting, vendor procurement, permitting, and legal support.

\$32 M total project cost

NY Green Bank provided construction-to-term loans that were structured to encourage BQ to work with traditional capital providers to refinance the loans once seasoned.

5 solar installations financed on closed landfills and other brownfields

CAPACITY
18.0 MW installed

ESTIMATED GENERATION
up to **22,240 MWh** per year

EMISSIONS REDUCED
up to **12,671 Metric Tons CO₂e** per year

Learn more.

Visit greenbank.ny.gov or email info@greenbank.ny.gov

* Metrics are accurate as of 12/31/2019



Market Development Portfolio Summary

Enabling delivery of energy efficiency and clean energy solutions by providing financial support, technical knowledge, data, education, and workforce training to service providers and customers. Supports initiatives that benefit low- to moderate-income households.

Portfolio Characterization and Impacts

The Market Development portfolio is the largest of the four CEF portfolios, providing \$2.4 billion of programmatic funding through 2025 to enable the delivery of energy efficiency and clean energy solutions, with a strong focus on energy efficiency and decarbonizing buildings. Initiatives in this portfolio provide financial support, technical knowledge, data, education, and workforce training to serve providers and customers. This portfolio also specifically supports initiatives that benefit low- to moderate-income (LMI) households.

THE MARKET DEVELOPMENT PORTFOLIO OPERATES IN 11 FOCUS AREAS:



**Commercial/Industrial/
Agriculture**



**Renewable and Distributed
Energy Resources (DER)**



**Single-family
Residential**



**Multifamily
Residential**



**Workforce
Development**



**Low- to
Moderate- Income**



Communities



Clean Heating and Cooling



Transportation



New Construction



Multisector

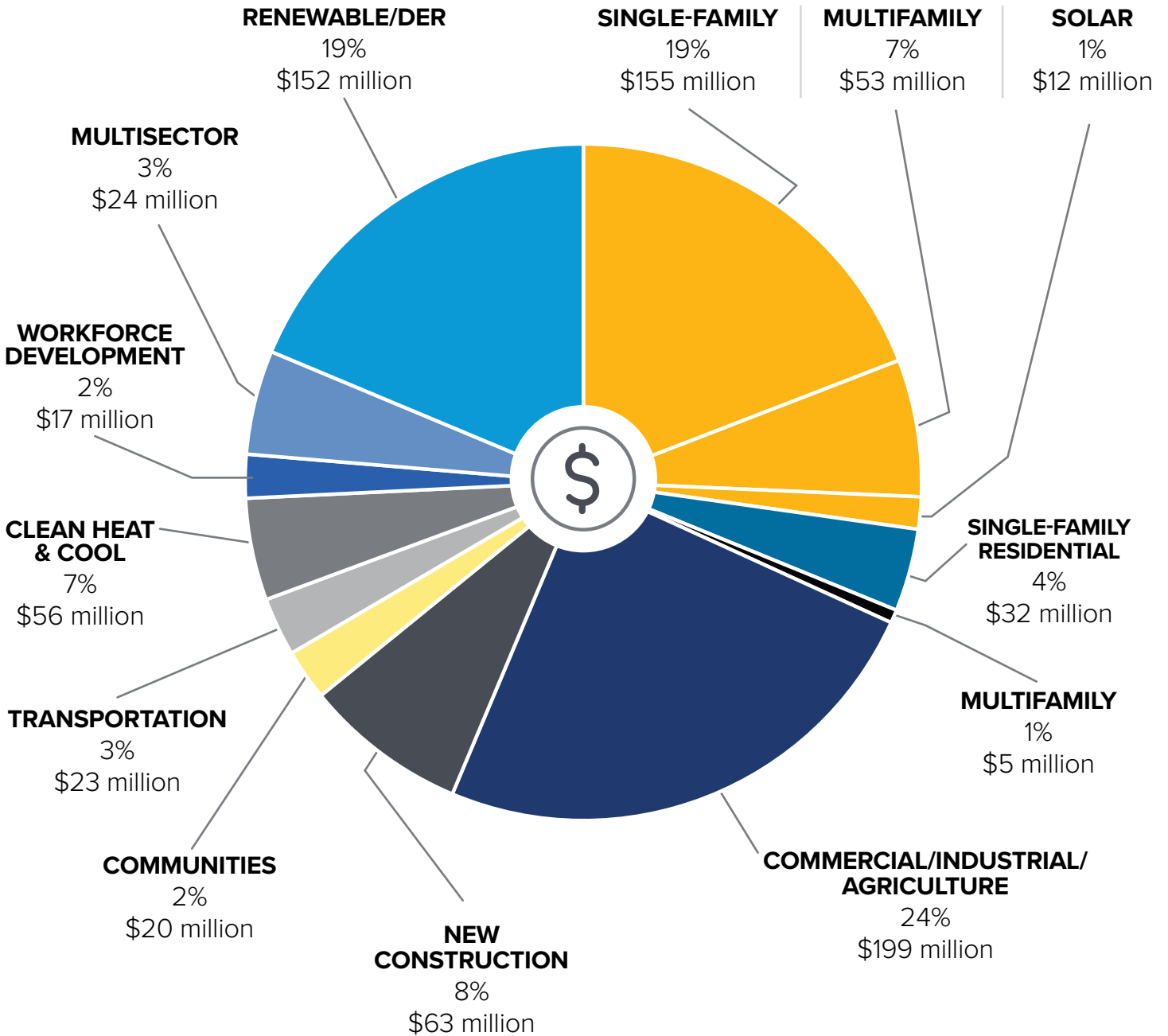
COMMITTED CEF MARKET DEVELOPMENT PORTFOLIO Q4 2019 BY FOCUS AREA (\$ MILLION)

Through the end of Q4 2019, \$1.7 billion of the authorized Market Development funding has been approved in investment plans and \$813 million of the approved funding has been committed to the market through projects.

The distribution of these funding commitments by the 11 focus areas can be seen below.

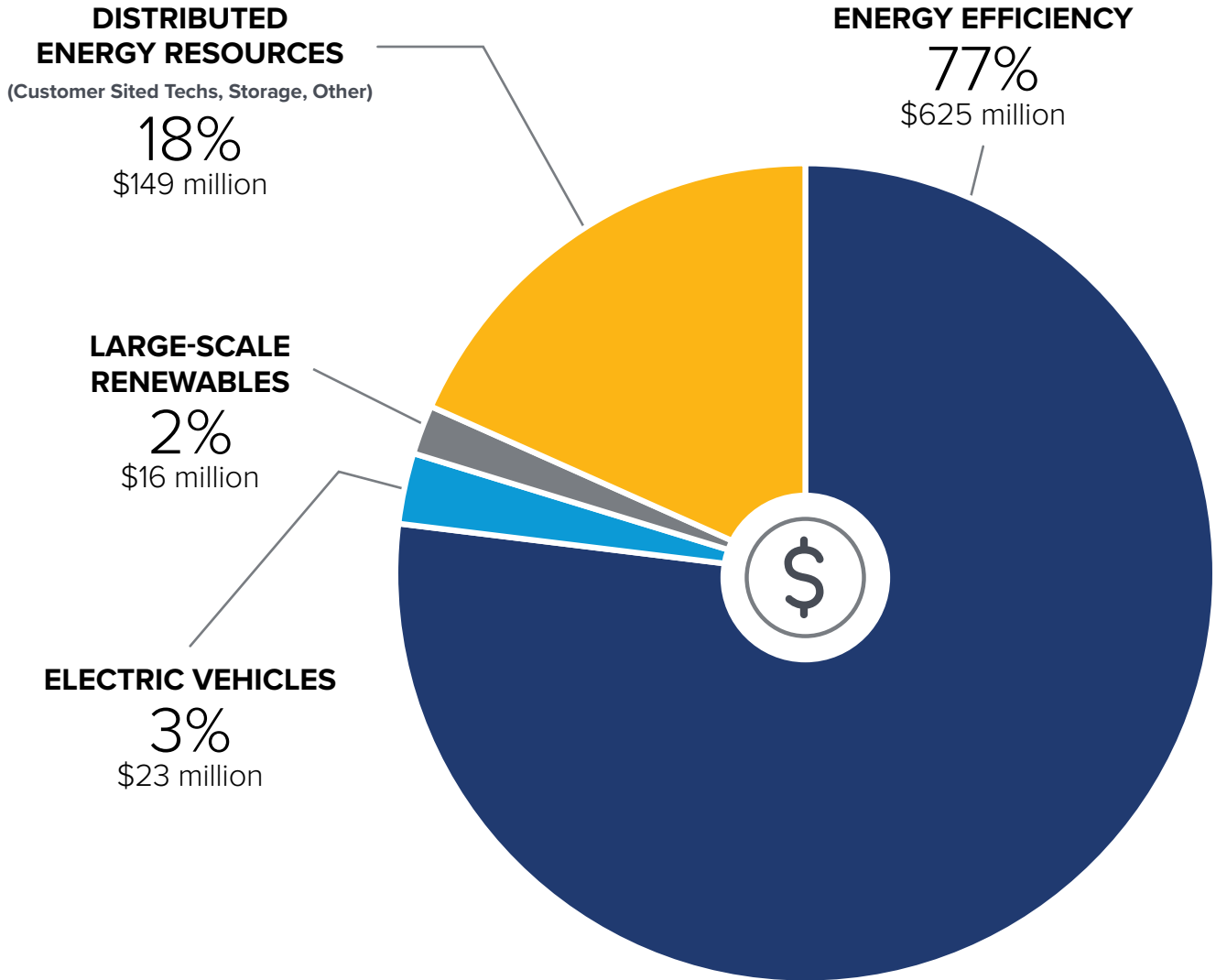
LOW- TO MODERATE-INCOME

LMI consumers are receiving the largest share of funding commitments to date (27% collectively)



COMMITTED CEF MARKET DEVELOPMENT PORTFOLIO Q4 2019 BY POLICY GOAL (\$ MILLION)

The distribution of Market Development funding commitments by major policy goal is highlighted below. Nearly 80% of funding commitments to date support the Energy Efficiency policy goal. NYSERDA anticipates a total of \$2 billion of the CEF funding will go to energy efficiency over the 10-year funding period and is on track to meet this expectation based on current funding commitments and plans. In the first few years of the program, significant funding support has been provided to advance Distributed Energy Resources, including customer-sited technologies and energy storage.



THE STRATEGY, INITIATIVES, AND BENEFITS TO DATE OF EACH OF THE ELEVEN FOCUS AREAS ARE DESCRIBED BELOW.

LOW- TO MODERATE-INCOME



KEY STRATEGIES TO DATE

- Provide technical and financial assistance for LMI New Yorkers to implement energy efficiencies, helping to reduce energy consumption and energy bills.
- Address unique issues associated with the LMI building stock and energy burden, integrating health and energy issues where possible, and developing scalable retrofit solutions.

MAJOR INITIATIVES IN THE MARKET

- EmPower New York [see page 56 for highlight]
- Assisted Home Performance with ENERGY STAR®
- Multifamily Performance (MPP)
- LMI New Construction (standard offer and Buildings of Excellence)
- Solar for All
- Healthy Homes Pilot
- RetrofitNY

FUNDING COMMITMENTS AND OUTCOMES THROUGH 2019

FUNDING COMMITTED

\$221 M

RELATED OUTCOMES

2.0 MMT_{lifetime CO₂e}

1.4 TBtu_{site energy savings}

CUSTOMERS

over 69,000

multifamily units and small homes

2,641

community solar participants

SINGLE-FAMILY RESIDENTIAL



KEY STRATEGIES TO DATE

- Deliver low-cost/free audits and low-cost financing statewide to make efficiency more affordable and more appealing to residential consumers.
- Transition from long-standing Home Performance with ENERGY STAR® program model to new approaches to reduce customer acquisition costs and deliver more consumer value, including:
 - Standardized efficiency packages to increase home comfort and make homes ready for electrification.
 - Streamlined/verified energy efficiency offers such as Pay-for-Performance.
- Pilot Home Energy Ratings to provide information on efficiency at critical times such buying/selling a house.

MAJOR INITIATIVES IN THE MARKET

- Home Performance with ENERGY STAR (phased out in 2019)
- Home Energy Ratings Pilot
- Comfort Home Pilot
- Green Jobs – Green New York: Low-Cost financing/free audits
- Pay-for-Performance

FUNDING COMMITMENTS AND OUTCOMES THROUGH 2019

FUNDING COMMITTED

\$32 M

RELATED OUTCOMES

0.3 MMT_{lifetime CO₂e}

0.2 TBtu_{site energy savings}

CUSTOMERS

11,600+

audits performed

MULTIFAMILY RESIDENTIAL



KEY STRATEGIES TO DATE

- Provide technical assistance aligned with capital planning cycle.
- Develop standardized low-carbon solutions for common building types and support demonstrations to de-risk new solutions.
- Make energy information visible and actionable with building energy labeling.

MAJOR INITIATIVES IN THE MARKET

- Flexible Technical Assistance (FlexTech)
- Real Time Energy Management
- Building Energy Labeling Pilot
- Others to launch in 2020

FUNDING COMMITMENTS AND OUTCOMES THROUGH 2019

FUNDING COMMITTED

\$5 M

RELATED OUTCOMES

0.5 MMT_{lifetime CO₂e}

0.6 TBtu_{site energy savings}

Piloted Building Energy Label

subsequently adopted by NYC

COMMERCIAL/INDUSTRIAL/AGRICULTURE



KEY STRATEGIES TO DATE

- Advance applications of sensors and improved analytics to identify and deliver energy efficiency and improved facility operation.
- Bring energy efficiency into tenant spaces.
- Benchmark performance and support sustainability planning and tracking.
- Launch clean energy challenges to drive progress.

MAJOR INITIATIVES IN THE MARKET

- Real Time Energy Management [see page 50 for highlight]
- Commercial Tenant [see page 54 for highlight]
- Strategic Energy Management for Industrial and Commercial
- REV Campus Challenge
- P-12 Schools

FUNDING COMMITMENTS AND OUTCOMES THROUGH 2019

FUNDING COMMITTED

\$199 M

RELATED OUTCOMES

19.6 MMT_{lifetime CO₂e}

12.6 TBtu_{site energy savings}

CUSTOMERS

4,100+
buildings and participants

NEW CONSTRUCTION



KEY STRATEGIES TO DATE

- Provide technical and financial support to demonstrate high performance buildings, paving the way for accelerated codes:
 - Engaging with projects in early concept or design-development phase.
 - Focusing on key verticals, such as multifamily, where we see a near term path based upon current technologies and costs to drive high performance buildings into code.
 - Integrating offerings into Regional/Community Economic Development.

MAJOR INITIATIVES IN THE MARKET

- Buildings of Excellence
- New Construction for LMI, small homes, multifamily buildings, and commercial

FUNDING COMMITMENTS AND OUTCOMES THROUGH 2019

FUNDING COMMITTED

\$63 M

RELATED OUTCOMES

1.4 MMT lifetime CO₂e

0.8 TBtu site energy savings

CUSTOMERS

164

buildings

4,100+

housing units

CLEAN ENERGY COMMUNITIES



KEY STRATEGIES TO DATE

- Provide grants, coordinator support, guidance, and recognition for implementing high-impact actions to help local governments understand, act on, and benefit from the clean energy economy
- Focus on high-impact actions that local governments can advance: benchmarking, clean energy upgrades in municipal facilities, LED street lights, clean fleets/transport, unified solar permit, energy code enforcement training, climate smart communities certification, community choice aggregation, Energize NY financing, and Solarize.
- Develop local capacity to advance clean energy.

MAJOR INITIATIVES IN THE MARKET

- Clean Energy Communities [see page 46 for highlight]
- Community Energy Engagement Program

FUNDING COMMITMENTS AND OUTCOMES THROUGH 2019

FUNDING COMMITTED

\$20 M

RELATED OUTCOMES

2.5 MMT lifetime CO₂e

1.5 TBtu site energy savings

CUSTOMERS

500+

Clean Energy Communities

COVERING

90%

of New York's Population

TRANSPORTATION



KEY STRATEGIES TO DATE

- Implement a point-of-sale EV rebate program for new EV buyers that will help reduce the price differential between EVs and conventional vehicles. The program will help accelerate EV sales, raise consumer awareness of EVs, and encourage auto manufacturers and car dealers to invest more time and effort in selling EVs in New York State.

MAJOR INITIATIVE IN THE MARKET

- Drive Clean Rebate

FUNDING COMMITMENTS AND OUTCOMES THROUGH 2019

FUNDING COMMITTED

\$23 M

RELATED OUTCOMES

0.4 MMT_{lifetime CO₂e}

0.7 TBtu_{energy savings}

CUSTOMERS

14,200+
vehicles rebated

CLEAN HEATING AND COOLING



KEY STRATEGIES TO DATE

- Provide financial assistance to increase consumer adoption of heat pump technologies and other clean heating solutions (such as high efficiency biomass).
- Provide consumer education and community engagement to build demand and reduce soft costs.
- Provide technical assistance to help consumers navigate/assess options and build market confidence.
- Invest in technology demonstrations to drive performance improvements.
- Train and develop a clean heating and cooling workforce that ensures a talent pipeline to support the market growth necessary to meet New York State goals.

MAJOR INITIATIVES IN THE MARKET

- Renewable Heat NY (efficient biomass heating)
- Heat Pump Incentive Program
- Community Heating and Cooling
- Geothermal Campus Challenge

FUNDING COMMITMENTS AND OUTCOMES THROUGH 2019

FUNDING COMMITTED

\$56 M

RELATED OUTCOMES

1.0 MMT_{lifetime CO₂e}

1.0 TBtu_{site energy savings}

CUSTOMERS

9,785
air source heat pump projects
including over 20,300
heat pump units

1,851
approved ground source
heat pump projects

WORKFORCE DEVELOPMENT



KEY STRATEGIES TO DATE

- Provide energy efficiency training for facility operation and maintenance staff working in partnership with businesses, labor organizations, and large portfolio companies.
- Build the workforce through on-the-job training and internships, in partnership with businesses.
- Support employer-driven training programs that deliver job placement and upskilling, with a focus on energy efficiency, offshore wind, electrification, and storage.
- Focus on historically disadvantaged priority populations.

MAJOR INITIATIVES IN THE MARKET

- Building Operation and Maintenance Training [see page 48 for highlight]
- Clean Energy Internships
- On-the-Job Training
- Clean Energy and Energy Efficiency Capacity Building

FUNDING COMMITMENTS AND OUTCOMES THROUGH 2019

FUNDING COMMITTED

\$17 M

RELATED OUTCOMES

1.4 MMT_{lifetime CO₂e}

2.2 TBtu_{site energy savings}

CUSTOMERS

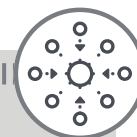
>26,000

workers trained for clean energy jobs

41

organizations participating in buildings operations projects

MULTISECTOR



KEY STRATEGIES TO DATE

- Support advanced building codes and appliance standards to drive more efficient products into buildings and more efficient building construction and upgrades.
- Develop information tools and resources to accelerate customer adoption of energy efficiency and clean energy by reducing project soft costs and acquiring, aggregating, and sharing data resources.
- Advance innovation and new business models, building partnerships between solution providers and utilities.

MAJOR INITIATIVES IN THE MARKET

- Appliance Standards
- NYStretch Code [see page 52 for highlight]
- Information Products and Brokering
- REV Connect

FUNDING COMMITMENTS AND OUTCOMES THROUGH 2019

FUNDING COMMITTED

\$24 M

RELATED OUTCOMES

3 localities

adopted Stretch Code including New York City



RENEWABLES AND DISTRIBUTED ENERGY RESOURCES

KEY STRATEGIES TO DATE

- Support modular combined heat and power.
- Address siting barriers to energy storage.
- Support high-value applications of energy storage, including storage plus solar
- Develop offshore wind masterplan and support predevelopment work for offshore wind.

MAJOR INITIATIVES IN THE MARKET

- Combined Heat and Power
- Solar plus Storage

FUNDING COMMITMENTS AND OUTCOMES THROUGH 2019

FUNDING COMMITTED

\$152 M

RELATED OUTCOMES

1.6 MMT lifetime CO₂e

CUSTOMERS

934

includes, installation sites, trainees, and Authorities Having Jurisdiction

Overall Impacts of the Market Development Portfolio through 2019

PROJECT COMMITMENT RESULTS:

FUNDING COMMITTED

\$813 million (36%)
of this \$370 million
is expended

METRIC TONS OF CO₂e

~31 million
saved over project lifetime

METRIC TONS OF CO₂e

2+ million
saved annually

EQUIVALENT TO REMOVING

490,000 cars
from the road annually

PARTNERING WITH AND SERVING:

450+ PARTNERS AND SOLUTION PROVIDERS

ANNUAL SITE ENERGY USE SAVINGS

including electricity, natural gas, and other fuels

~19 TBtu

~105k SINGLE/MULTIFAMILY RESIDENTS

FUEL SAVINGS

equivalent to average use of

250,000+
households annually

ELECTRICITY SAVINGS

enough to serve

320,000
households annually

~6.7k NON-RESIDENTIAL CUSTOMERS

Lesson Learned

The CEF was designed around a fundamental principle of **Test-Measure-Adjust**, underscoring the need to innovate the delivery of programs and services over time to achieve maximum impact. While we have driven substantial progress through Market Development initiatives in the first few years of the program, as outlined on pages 34–39 and illustrated through the program highlights, there are several areas we will seek to improve upon in the next phase of the CEF. Some opportunities for improvement and accelerated progress include:

- Simplifying and streamlining offers for customers and ensuring that any customer knows what is available not just from NYSERDA but also from utilities.
- Putting money to work faster in the market to help more customers and drive accelerated progress.
- Leveraging and building more local capacity to deliver on CEF goals, learning from the Clean Energy Community Program.
- Driving more progress with portfolio companies who can scale adoption, as opposed to delivering one-size-fits all offers.
- Better leveraging channel partners (including industry associations, trade groups, union, and utilities), to achieve impact.

Future Directions

The need to **build an inclusive clean energy economy, support the economic recovery, and accelerate the transition away from natural gas** looms large in the future of the CEF market development portfolio, in addition to being a primary vehicle by which the State will advance strategies to decarbonize buildings.

Given the current policy landscape and market and consumer dynamics, the following strategic adjustments are proposed for the future Market Development portfolio of the CEF:

- Climate Act goals and the disproportionate impacts of the COVID crisis and economic recession steer toward increasing investment in low-income and disadvantaged communities to advance climate justice.
- The looming economic recession calls for some restructuring of programs to increase uptake, while maximizing economic impact and job creation, stimulating green economy
 - Workforce development and training must increase to address current worker dislocation in the near-term and build the labor capacity over the longer term, to deliver clean energy solutions at the scale needed for Climate Act goals.
- A comprehensive approach will be needed to accelerate New York’s transition from natural gas.
 - Successful transition requires that non-fossil fuel solutions to heat and cool businesses and homes be available in the market, affordable, understood by customers, and part of our energy future. NYS Clean Heat will be a new pillar of NYSERDA’s work going forward.
- Investments should strive for revised level of ambition.
 - Aim for net zero carbon building solutions in the most practical and cost-effective way possible, working with market participants, innovating, and demonstrating real-world solutions.
 - Leverage the increased roles of the utilities in delivering program offerings, capitalizing on our respective strengths—with NYSERDA playing the long game and advancing new breakthrough approaches.
 - Optimize building systems for indoor health in a carbon-constrained world.
- Adopt and pioneer best practices to protect clean energy investments from climate resilience risks.

MARKET DEVELOPMENT PRIORITIES AND ESTIMATED FUNDING ALLOCATION (2020-2025)

NYSERDA's Market Development Portfolio will focus on the strategic directions outlined below. These build on lessons learned in the first few years of the CEF and reflect necessary adjustments given the current policy and market landscape.

FOCUS AREA	ESTIMATED CEF FUNDING (2020–2025, \$M)	PORTFOLIO/STRATEGY ADJUSTMENTS
LMI	\$540	<ul style="list-style-type: none"> ▪ Substantially increase annual funding (as outlined in the July NYSERDA-utility LMI implementation plan) and increase allocation to affordable multifamily housing—seeking to double the LMI customers served. ▪ Ensure best impact and highest level of benefit to these New Yorkers from these increased investments. ▪ Increase funding for local capacity buildings to serve LMI and disadvantaged communities through creation of clean energy hubs. ▪ For regulated affordable housing, align investments with housing financing processes where possible for impact.
Single Family	\$77	<ul style="list-style-type: none"> ▪ Continue with free audits, Heat Pump Ready/Comfort Home (providing standardized/simplified packages), and Pay-for-Performance. ▪ Coordinate with utilities to achieve impact.
Multifamily	\$66*	<ul style="list-style-type: none"> ▪ Provide technical assistance aligned with capital planning cycle, develop standardized low-carbon solutions for common building types, and support demonstrations. ▪ Prioritize work in gas-constrained urban areas and disadvantaged communities.
Commercial, Industrial, & Agriculture	\$302	<ul style="list-style-type: none"> ▪ Support high-performing initiatives such as Real Time Energy Management and FlexTech to achieve New Efficiency: New York goals and serve customers. ▪ Focus business development in target geographies (disadvantaged communities/gas-constrained areas). ▪ Refine commercial tenant strategy to capitalize on emerging needs. ▪ Advance expanded schools initiative to better serve disadvantaged communities. ▪ Continue with competitions/clean energy challenges to drive progress (including competitions focused on large commercial office buildings and large industrial facilities).
New Construction	\$117	<ul style="list-style-type: none"> ▪ Focus on developers with market share and portfolio companies who can impact large parts of the market, to facilitate market transformation. ▪ Focus on carbon neutral/electric new construction and resiliency. ▪ Focus market engagement in target geographies (gas-constrained metro areas to avoid load growth/disadvantaged communities).
Communities	\$63	<ul style="list-style-type: none"> ▪ Launch Clean Energy Communities Leadership round to help existing and new Clean Energy Communities take deeper action. ▪ Provide increased support for community capacity building and disadvantaged communities. ▪ Adjust strategies as needed to accommodate impacts on local governments from economic recession.
Transportation	\$24	<ul style="list-style-type: none"> ▪ Use limited CEF transportation funds to advance strategic opportunities for leverage, focusing on electrification.

FOCUS AREA	ESTIMATED CEF FUNDING (2020–2025, \$M)	PORTFOLIO/STRATEGY ADJUSTMENTS
Clean Heating & Cooling**	\$68	<ul style="list-style-type: none"> Work in partnership with utilities to transform the way New Yorkers heat and cool their homes and businesses through building electrification. Implement strategies in recent NYS Clean Heat Implementation Plan to build market capacity for building electrification—focusing on workforce development, supply chains, consumer awareness, and cost-reducing strategies.
Workforce Development	\$91	<ul style="list-style-type: none"> Increase focus on building skills and job placement for priority populations and in disadvantaged communities. Continue with support of Building Operation and Maintenance training, on-the-job training, clean energy internships, and development of training infrastructure for energy efficiency and clean energy.
Codes and Standards, & Other Multisector Initiatives	\$110	<ul style="list-style-type: none"> Provide code training for design professionals and code officials. Support development of advanced code, with goal of getting to a carbon neutral building code by 2032. Support development of advanced appliance standards.
Renewables/DER	\$37	<ul style="list-style-type: none"> Support renewables/DER siting and soft-cost reduction. Shift focus from support of onsite combined heat and power to support of storage solutions, in support of Climate Act goals.
Total Market Development	\$1,547***	

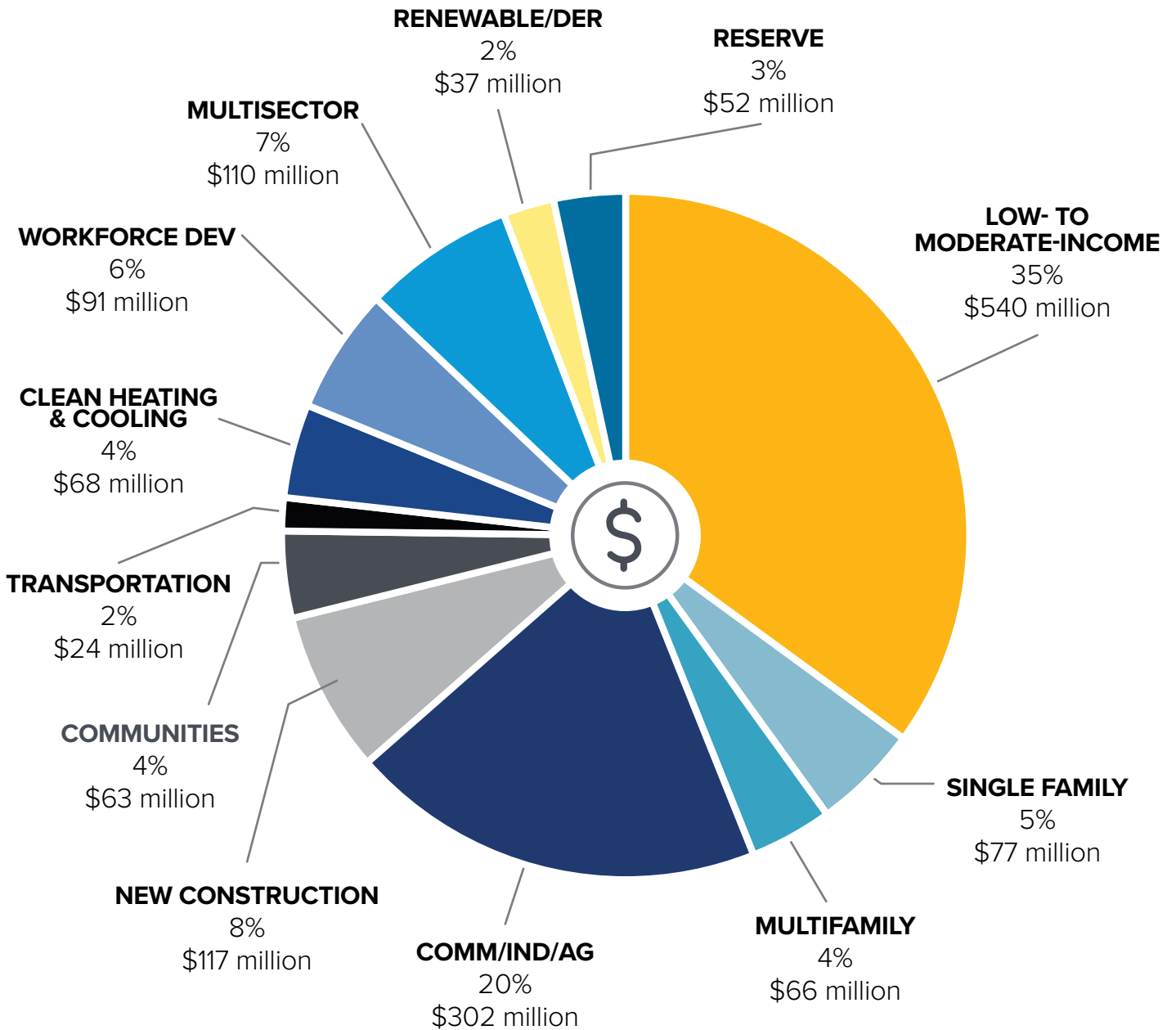
*Includes \$6M repurposed from CEF Evaluation budget.

**The NYS Clean Heat Market Development investment is approximately \$230 million and is supported through the Clean Heating and Cooling focus area as well as several other focus areas (e.g., Multifamily, Commercial, Single Family, Workforce Development, and LMI).

***Includes ~3% reserve to accommodate emerging needs over the 2020-2025 horizon.

New and modified initiatives will be advanced through specific investment plans. See nyscrda.ny.gov/About/Funding/Clean-Energy-Fund for a current listing of investment plans.

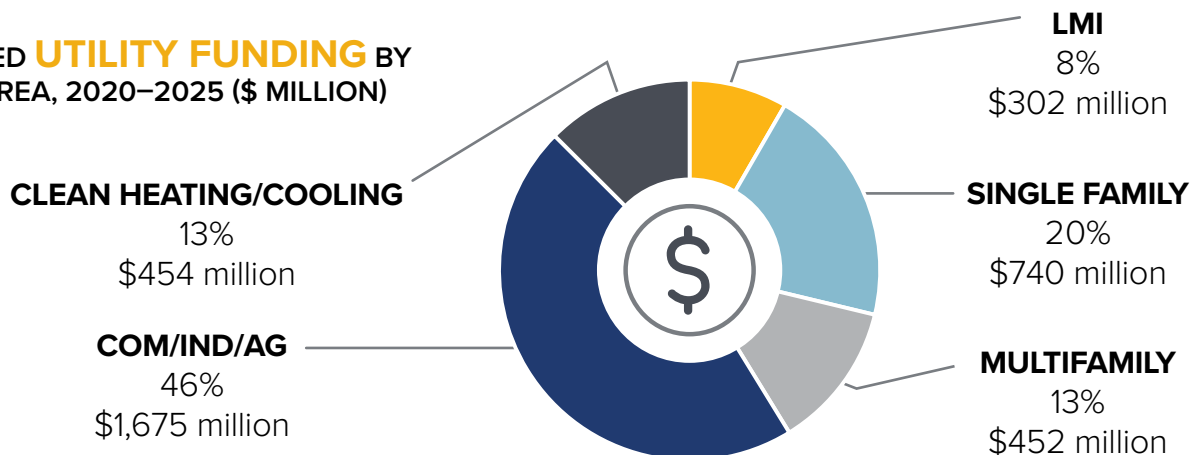
ESTIMATED **CEF FUNDING** BY FOCUS AREA, 2020–2025 (\$ MILLION)



This NYSERDA Market Development work, which **focuses heavily on energy efficiency (EE)**, will be designed to **complement the utility energy efficiency approaches** summarized below.

FOCUS AREA	ESTIMATED UTILITY EE FUNDING (2020–2025, \$M)	UTILITY PORTFOLIO APPROACHES
LMI (includes Single Family, Multifamily and Solar)	\$302	<ul style="list-style-type: none"> Coordinated delivery with NYSERDA, including standardized offerings statewide under common umbrella, and community engagement with key partners Utilities newly entering LMI space
Single Family	\$740	<ul style="list-style-type: none"> HVAC and water heating equipment rebates Home Energy Reports (behavioral programs); Smart Kids Program; online audits and comparison tools Pay-for-Performance models for comprehensive work ENERGY STAR retail products programs at retailer/distributor level Appliance recycling programs Online Marketplaces for discounted energy efficiency products Shift to building envelope work, consistent with New Efficiency: New York
Multifamily	\$452	<ul style="list-style-type: none"> Prescriptive and custom incentives for electric/gas measures with some offering in-unit direct install Identified by Con Ed as largest potential for peak day savings
Commercial, Industrial, & Agriculture	\$1,675	<ul style="list-style-type: none"> Small Commercial Direct Install providing audits targeting lighting, controls and commercial refrigeration equipment Prescriptive and custom incentives for commercial electric and gas measures Technical services and custom incentives for larger commercial customers, including process improvements in some areas Some offering on-bill/other financing offerings for commercial customers
Clean Heating/Cooling	\$454	<ul style="list-style-type: none"> Incentives for ground source/air source heat pumps and heat pump hot water heaters; Emphasis on heat pumps for full heating load; Budget authorization allows for weatherization work to be included to improve the sizing/performance of heat pumps; Coordination with NYSERDA efforts which will focus on market development
Total	\$3,623	

ESTIMATED UTILITY FUNDING BY FOCUS AREA, 2020–2025 (\$ MILLION)





Highlights

The CEF Market Development portfolio is addressing the needs of multiple market segments across a range of customers and building types. The following brief highlights show the early efforts and impact to date of six representative Market Development initiatives in the CEF.





Clean Energy Communities

Highlight

Building a more sustainable New York starts with building more sustainable communities.



When local governments lead by example, clean energy and sustainability are more likely to be implemented in homes, businesses, and community institutions.

Because local governments enact codes, regulate land use, and control infrastructure, NYSERDA recognizes they have a far-reaching impact on their community's energy picture. The Clean Energy Communities (CEC) Program provides a clear path forward for clean energy action in towns, cities, villages, and counties, while saving local governments and their residents money on energy bills, creating local jobs, and realizing significant opportunities to expand the green economy.

NYSERDA provides resources and guidance to help communities determine which actions will have the most potential for impact. Regional technical assistance providers are available free of charge to assist local governments in prioritizing and implementing clean energy actions, saving energy costs, and improving facilities for residents. In addition to providing tools, resources, and technical assistance, NYSERDA recognizes and rewards leaders for the completion of the clean energy optimization projects. Designated CEC communities serve as an example for other communities in the State and across the country.

Since the program's launch in 2016, three out of every four cities and more than half of all county governments in New York are now CEC participants.

The program's success has empowered the nearly 18 million residents of participating communities to consider clean and efficient energy as part of their everyday lives. As a result, CEC is one of the top CEF programs in the State driving carbon emission reduction.

High-Impact Actions

- Benchmarking
- Clean Energy Upgrades
- LED Street Lights
- Clean Fleets
- Solarize
- Unified Solar Permit
- Energy Code Enforcement Training
- Climate Smart Communities Certification
- Community Choice Aggregation
- Energize NY Finance

573 communities participate – representing more than 90% of New York State's population.

Clean Energy Communities is driving dramatic progress toward the State's climate targets. To date, local governments in New York have reduced carbon emissions by nearly 3 million metric tons (lifetime) through the program.

Since 2016, nearly 1,700 high-impact actions have been completed. These actions reduce costs; create safer, more attractive communities; and reduce our carbon footprint. They include:



290,000

street lights converted to LED



635

electric vehicles deployed to existing municipal fleets



960

electric vehicle charging ports installed at municipal locations



930

code officers & municipal officials completed energy code training



342

communities adopted the NYS Unified Solar Permit

A total of 47 cities across the State have completed 140+ high-impact actions

Westchester County's three largest cities — Yonkers, White Plains, and New Rochelle — have each earned the Clean Energy Community designation

11,300

city street lights converted to LED

Yonkers

FOUR

municipal parking garages converted to LED

White Plains

100%

renewable energy supplied to majority of homes & small businesses

New Rochelle

51 communities went beyond the four-action minimum

showing that helping communities prioritize initial clean energy actions empowers and equips them to pursue other clean energy investments on their own.

Most of the State's Environmental Justice areas are within participating clean energy communities

Designated clean energy communities are making a significant impact in every region of New York State, from Long Island to Western New York

Long Island

100 actions completed across region

25 communities tracking energy use

31 communities completed energy code training

Central New York

48 communities earned CEC designation

120 communities implemented at least one high-impact action

50 communities converted street lights to LED

Western New York

37 communities earned CEC designation

57 communities implemented at least one high-impact action

4 communities converted street lights to LED

Learn more.

Visit nyscrda.ny.gov/Clean-Energy-Communities or email cec@nyscrda.ny.gov



Workforce Development

Building Operation & Maintenance — Highlight

Workforce development and training are essential to ensuring a thriving 21st century economy, combating climate change, and delivering a cleaner, healthier, and more equitable New York.



One of the most cost-effective ways to save energy in a building is to ensure quality operation and maintenance of existing equipment. Improving the skills of a building operator can significantly improve building efficiency and reliability, and tenant satisfaction, while helping meet the State’s energy efficiency and emissions reduction goals.

“I am responsible for 80 boilers. This was a great class and made me more appreciative of the need for energy efficiency.”

– Prestige Property Manager

“32BJ workers gain a new understanding of fundamental building operation concepts and how their daily activities make a difference. They gain hands-on training with the systems in their buildings and learn to apply the concepts and strategies immediately in their work”

– Local 32BJ

Numerous studies show that most building equipment is not optimized for performance. Controls are turned off, dampers are closed where they should be open, and the list goes on. The building operator is well positioned to deliver these savings opportunities, with some extra training and with the support of the building owner. In 2016, under the Clean Energy Fund, NYSERDA launched the Building Operation and Maintenance (BOM) training program, providing financial assistance for the training of building operators, superintendents, and property managers, leveraging the expertise of skilled trainers in the field. A key success of the program has been to partner with large property owners who take what they learn from one project and replicate successes across their full portfolio. Another critical piece of the strategy is to work through training providers including unions and engineering companies, who can have impact well beyond the NYSERDA workforce development program.

The program targets operations and maintenance workers employed in large buildings including multifamily housing, office buildings, retail, colleges and universities, hospitals and healthcare, and K-12 schools.

Successful projects build upon employees’ technical skills and reduce facility energy use, while realizing other corporate benefits such as:

- Reduced equipment downtimes
- Increased occupant comfort
- Reduced occupant complaints and tenant turnover
- Increased numbers of staff with national certifications
- Opportunities for promotion and career advancement

NYSERDA's Building Operations and Maintenance Workforce Development program is preparing the current and future workforce to meet the demands of clean energy jobs.

<p>\$20 million* total investment which could yield</p> <p>~\$32 million in annual energy savings — an average per-building energy savings of</p> <p>7%</p>	<p>250 million+ square feet of building space with annual energy costs of</p> <p>\$450 million+</p>	<p>5,000 individuals are being trained, covering</p> <p>diverse audience of trainees with building operations experience ranging from</p> <p>0-30+ years in roles ranging from porter to superintendent to property manager</p>
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*\$9 million NYSERDA investment.

Training across more than 40 large portfolios

The City College of New York (CCNY)

CCNY is partnering with West Harlem Group Assistance and 3Q Innovation, Inc. to train building operations and maintenance personnel supporting 70 multifamily residential buildings in Harlem. Workers, including some underserved individuals, will be trained in energy use analytics and optimization managements system.

Expecting to train:

250 workers in 12 months

and a total of: **550 workers in 3 years**

Memorial Sloan Kettering Cancer Center

Memorial Sloan Kettering Cancer Center developed and implemented a new, informal **apprenticeship program** to integrate clean energy training, using an apprenticeship model that can be replicated for future openings.

250 workers **12 new building operator positions**

Real Estate Companies

Steve Winter Associates is working with Lefrak Estates and A&E Real Estate to develop training that includes a **mentorship program** aimed at training senior building staff to mentor junior staff.

Local 32BJ Training

Local 32BJ's Thomas Shortman is working with the Realty Advisory Board on Labor Relations, Albanese Organization, MBD Community Housing Corp., Douglas Elliman and Charles H. Greenthal & Co. to develop **new curriculum on HVAC and building management systems** that meets the common needs of multiple employers and will be used to train building operators across several portfolios.

hundreds expected to be trained

Learn more.

Visit nysesda.ny.gov/bom or email wfinfo@nysesda.ny.gov



Real Time Energy Management

Highlight

Managing a building's operational performance provides actionable insights that lead to better energy management and cost savings.



Real Time Energy Management (RTEM) is a combination of devices like sensors and meters, data services, and software that enable the continuous monitoring of a building's performance. Live and historical data is transformed into actionable insights for property owners, building managers, and tenants, allowing them to make smarter decisions about building energy use and to detect issues before they lead to costly inefficiencies.

Since 2017 — the amount of square feet under RTEM contract has grown each year, and as of December 2019 is

100+ million square feet

- **720 buildings**
- **8% to 15% average annual energy savings**
- **2.0 million MMBTU equivalent annual energy reduction**
- **248,000 metric tons of CO₂e emission reduced annually**
- **Paybacks in less than 5 years**

With the Clean Energy Fund, NYSERDA sought to accelerate the emerging market of “intelligent efficiency,” and in 2016, launched the RTEM program, helping to bring advances in sensors, cloud computing, and data science—already transforming many other industries—into building management. NYSERDA proved out the savings from RTEM solutions and recruited top-tier, quality solution providers to build confidence among building owners. As a result, energy management tools are now serving more than 150 million square feet of buildings in the State and growing with each quarter.

NYSERDA provides a 30% cost share to qualified RTEM vendors implementing projects for customers in the multifamily, commercial, and industrial sectors. In addition, qualified vendors are featured on the RTEM website and have the opportunity to cobrand case studies and collateral materials, which helps increase credibility and visibility with prospective clients.

NYSERDA continues to develop ways to support the adoption of RTEM in harder-to-reach segments of the market, such as small businesses, schools, commercial tenants, and affordable housing; as well as support robust integration of RTEM across multiple systems within a building.

Building owners and operators traditionally use RTEM to optimize energy efficiency and equipment performance, with energy savings of up to 30%. In the post-COVID operating environment, RTEM systems can be utilized to monitor indoor air quality, outside air ventilation, and occupancy levels to deliver healthy, sustainable, and productive spaces for occupants.

The adoption of RTEM solutions puts the power of information and data into the hands of building managers across New York State.

NYSERDA's RTEM program has been developing the market by vetting and qualifying vendors to help expand their businesses across New York State.

NYC Commercial Office Segment — largest energy efficiency projects funded in the CEF



\$58 million
total investment

\$15 million NYSERDA cost share

Will enable real-time centralized platforms for monitoring and managing energy and non-energy systems for:

- > **more than 56 million square feet** of office and retail space
- > **more than \$125 million** in annual energy costs

Program Participants

Significant **real estate** portfolio owner adoption of RTEM

- | | |
|------------|-------------------|
| Brookfield | Related Companies |
| Durst | Rudin |
| ESRT | RXR |
| Hines | SL Green |
| LeFrak | Tishman Speyer |

RTEM **multifamily** continues to grow

178% increase
in committed funding

in 2019, compared to 2018



Robust Pool of Vendors

110
qualified vendors participate

70
vendors actively investing in business development in NY

First Industrial Internet-of-Things vendors joined

OSISoft, one of the world's largest Industrial IoT vendors and Rockwell Automation

RTEM PROJECT PIPELINE QUARTERLY DEMAND



World's six leading Building Management System firms have joined

Trane, Johnson Controls, Siemens, Honeywell, Schneider Electric, and ALC

Learn more.

Visit nysesda.ny.gov/RTEM or email rtem@nysesda.ny.gov



NYStretch Energy Code 2020

Highlight

Buildings built or renovated to a standard above and beyond minimum State energy code requirements can make meaningful strides toward mitigating climate change.



Building codes are a set of minimum standards that address all aspects of building construction—fire, life safety, structural, plumbing, electrical, and mechanical. The Energy Conservation Construction Code of New York State (ECCCNYS) sets the baseline requirement for energy efficiency performance standards for residential and commercial buildings.

While building energy codes are necessary for improving efficiency, base codes are not always sufficient in keeping up with advancing technology and design practices. Stretch codes provide an opportunity to accelerate energy savings and put buildings on a path to a low carbon future.

NYSERDA worked with stakeholder advisory groups and consultants to develop

the NYStretch Energy Code 2020 (NYStretch)—a voluntary, locally adoptable stretch energy code that offers municipalities a more energy-efficient alternative to the minimum requirements of ECCCNYS. NYStretch is a pivotal tool for communities across the State to accelerate the savings obtained through their local building portfolio.

Training building and development professionals in advanced practices is crucial to help accelerate NYStretch adoption. NYSERDA provides training and activities to improve and support code compliance and enforcement. Thousands of building professionals and code officials have benefited from in-person and web-based classes and workshops, print resources, pilots, and participation in the development of future code improvements.

By adopting NYStretch, communities can increase property values, improve community attractiveness, provide long-term value and cost savings to residents and businesses, and improve the health and well-being of all New Yorkers.

NYStretch Energy Code—2020 10–12% more efficient than 2020 ECCCNYS

Will significantly reduce:

- energy consumption
- operating costs
- utility costs
- greenhouse gas emissions

Stretch Code Benefits

- Significant energy/utility cost savings for homeowners, tenants, and building owners
- Reduced building operational costs
- Reduced environmental impact
- Increased occupant comfort/health
- Increased real estate value and community attractiveness
- R&D stimulation and commercialization of products that improve energy efficiency performance
- Green job creation related to next-generation technologies, code enforcement, quality control, building commissioning, energy auditing, and modeling

Training for code officials, architects, and builders, ensures communities enacting NYStretch are prepared and supported for enforcing and complying with its requirements.

700 events/webinars

supporting ECCCNYS training delivered throughout NY since 2015

22,000 professional trainers

including enforcement, design, and construction professionals

83% commercial compliance

of New York Energy Code as compared to 74% in 2015

~40%

of all NY municipalities that perform code enforcement including more than half with populations of 40,000+ completed Clean Energy Community Energy Code Enforcement Training



Helping Inform The Next National Energy Code Model

NYSERDA's efforts with NYStretch and engagement with stakeholders helped inform the International Energy Conservation Construction Code [IECC] 2021

Several new requirements — electric vehicle charging-readiness, verification and commissioning of continuous air barriers, and mandatory ventilation in residential buildings; plus improvements to existing requirements — insulation and lighting, were proposed and adopted for IECC 2021.



Cities Are Adopting NYStretch

New York City

2020 adoption



50% of the State's new construction occurs in NYC

results could be over 93,400 MMBtu of energy savings across sources annually

"We couldn't have done it without NYSERDA. Your efforts gave us the validation and added the critical mass to give the necessary momentum to get it done." — NYC Mayor's Office of Sustainability

Ithaca

2020 adoption

carbon-neutral by 2030

using NYStretch as part of the Green Building Code to support their 2030 carbon-neutral community goal

Beacon

2020 adoption

"Adopting the NYStretch code means that new development in Beacon will be less harmful to the environment and will save homeowners money over time. Beacon is proud to be a leader in the state around mitigating climate change." — Mayor Lee Kyriacou

Communities considering NYStretch: Albany, Bethlehem, Glens Falls, Hastings-on-Hudson, Marletown, New Paltz, Poughkeepsie, Rochester, Tarrytown, Saratoga Springs, and the Towns of Easthampton, Southampton and Brookhaven on Long Island

Learn more.

Visit nyserda.ny.gov/stretchenergy2020 or email codes@nyserda.ny.gov



Commercial Tenant

Highlight

Identifying substantial energy savings opportunities in commercial leased spaces throughout the State.



New York State has the highest percentage of tenant-occupied space in the country, mostly concentrated in New York City. Tenants typically control more than 50% of a commercial office building's energy use, representing a substantial opportunity to improve energy efficiency.

**20-50%
reduction
in energy use
with three- to
five-year payback**

**“The upgrades
reduced staff
complaints about
temperature
by 35%.”**

– White and Case, LLC

The biggest opportunity to influence energy efficiency is at the point of lease turnover. However, energy considerations are often omitted from the lease negotiation and space design process due to the speed of leasing decisions, split incentives between tenants and landlords, the low cost of energy relative to rent and payroll, and limited information on the benefits of energy efficiency improvements in tenant spaces.

To address these challenges, the Commercial Tenant program was created to build market confidence in the business case for high-performing, energy efficient tenant spaces. By working with landlords, tenants, brokers, architects and engineers to support the integration of energy efficiency into the leasing, design, and ongoing operations of tenant spaces, NYSERDA has impacted more than 56 million square feet of leased space to date.

With recent climate legislation, New York City now requires buildings more than 25,000 square feet to meet increasingly stringent carbon emissions limits or be subject to fines.

Decisions made during the initial design phase of an office retrofit substantially impact the energy costs and environmental footprint of office space throughout the lease term.

The program works with tenants and their landlords, architects, and engineers to identify and plan for energy saving projects, from space selection through occupancy as well as help reduce operating costs, increase asset value, improve productivity, and foster a culture of sustainability.

Tenants can expect a 20–50% reduction in energy use with a three- to five-year payback. Plus, energy savings accrue over time, so over longer leases, these add up to significant avoided costs. In addition to realizing cost savings, other major benefits include increased employee productivity, comfort, and wellness as well as improved talent attraction and retention.

There are more than 45 portfolios currently participating, including some of the largest and most influential building owners/managers in New York City. The largest include:

48

tenant sites
at Empire State Realty Trust

30

tenant sites
at Morgan Stanley

26

building portfolio
at SL Green

Participant Success

Gensler

world's largest architecture firm

- > **25% increase** in workplace satisfaction
- > **74% of staff** felt physical work environment had positive impact on overall job satisfaction

“We were excited to see what opportunities we would uncover through this analysis...We are always looking for fast, replicable ways to present energy saving measures to our clients, alongside first cost, ROI, and operational energy savings.”

White & Case LLP

- > **\$390,000** – estimated annual cost savings
- > **\$7.7 million** over the 20-year lease term

Law firms have substantial energy savings opportunities

given their large footprint and traditionally long leases as well as an increased focus on sustainability to attract and retain talent.

Paul Hastings LLP

- > **\$270,000** – estimated annual cost savings
- > **\$4.3 million** over the 16-year lease term

Program (through Q4 2019)

57 million

Total square footage impacted

209,000+

Total energy savings (site MMBTU equivalent)

728

Total sites

36

Active service providers

16

Total building owners

45+

Portfolios/multi-site projects

Learn more.

Visit nyscrda.ny.gov/CTP or email commercialprograms@nyscrda.ny.gov



EmPower New York

Highlight

Increasing the energy efficiency of homes can reduce energy bills and greenhouse gas emissions while improving the health, safety, and overall sustainability for residents in lower income households.



NYSERDA’s EmPower New York program has provided no-cost energy efficiency solutions to nearly 165,000 income-eligible New Yorkers.

TO DATE

165,000

low-income households received energy efficiency upgrades through EmPower

EmPower New York identified as an exemplary program

in 2019 by the American Council for an Energy Efficient Economy (ACEEE)

Approximately 2.3 million or 30% of all households in New York State have annual incomes at or below 60% of the State Median Income—\$54,000 for a family of four. With many households experiencing energy burdens and financial barriers to completing efficiency upgrades, energy bills can have a disproportionate impact on lower income residents.

Existing public programs have not been sufficient to provide New York’s large low-income population with the financial assistance and support necessary for improving the energy efficiency of their homes, emphasizing the need to bolster available resources. In coordination with the Weatherization Assistance Program (WAP) and the Home Energy Assistance Program (HEAP), NYSERDA is working to expand the reach of energy assistance funding with the EmPower New York program.

Through the EmPower New York, participating households receive a no-cost comprehensive home energy assessment and in-home energy education and may be eligible for upgrades that include air sealing, insulation, electric load reduction, LED lighting, replacement of inefficient refrigerators, and minor health and safety repairs.

Energy upgrades are delivered through a network of more than 175 credentialed home performance and weatherization contractors. The majority of participating contractors are local small businesses employing between 1 and 20 people from their communities. In addition, NYSERDA incorporates a quality assurance program to ensure energy efficiency upgrades are performed according to strict program and industry standards.

Initiatives like EmPower New York, prioritize the access and affordability of energy efficiency improvements for disadvantaged households and communities.

EmPower New York Program Partners

- 175 home performance and weatherization contractors
- New York Utilities
- NYS Homes and Community Renewal
- NYS Office of Temporary and Disability Assistance
- Local Government: Local Departments of Social Service; Offices for the Aging
- Community-based organizations

Completed projects have a range of energy savings which can vary by occupant behavior, weather, and pre-existing conditions in the home.



Mary from Syracuse, NY



825 ft²
single-family home

\$3,962
funding for home upgrades

~\$240
annual energy bill savings

Efficiency upgrades included new LED lighting, air sealing, and insulation in the attic and walls to prevent heat loss as well as a heating system repair, gas leak repair and water leak repair on a hot water pipe.

Customer Experience

The performing contractor, Energy Savers, did a wonderful job and the whole experience has been a blessing.



Barbara & Richard from Addison, NY



1,744 ft²
single-family home

\$7,587
funding for home upgrades

~\$725
annual energy bill savings

Efficiency upgrades included a refrigerator replacement and insulation and air sealing measures in the attic and crawl space. Health and safety measures were also addressed by installing a combination smoke and carbon dioxide detector.

Customer Experience

We are on a fixed income and could not have made these improvements without the work of Snug Planet's team and EmPower New York.



Christina from Cleveland, NY



2,132 ft²
single-family home

\$13,041
funding for home upgrades

~\$1,063
annual energy bill savings

Efficiency upgrades included air sealing measures in the attic and basement; insulation added in the attic, basement, and a crawlspace. The home was made safer by installing program funded smoke and carbon monoxide detectors and the clothes dryer was properly vented to prevent moisture build-up.

Customer Experience

Life was confined to our one room for 7-8 months of the year. Now, we will be able to use our kitchen and bathroom in the winter... My children and I are so thankful to Standard Insulating Co., Inc.!

Learn more.

Visit nyscrda.ny.gov/empower or call 1-877-NYSMART

Market Transformation Benchmarks

Market transformation initiatives strategically intervene in markets to create lasting structural changes by reducing or removing barriers and leveraging other opportunities to accelerate adoption. NYSERDA has many complimentary clean energy market transformation initiatives in the Market Development portfolio.

NYSERDA develops initiative-level metrics based on specific hypotheses of market change, and tracks these at a granular level to gauge progress of its programs at bringing about the desired market change.⁶ The initiative-level metrics are focused and direct in terms of their cause-effect relationship with each program.

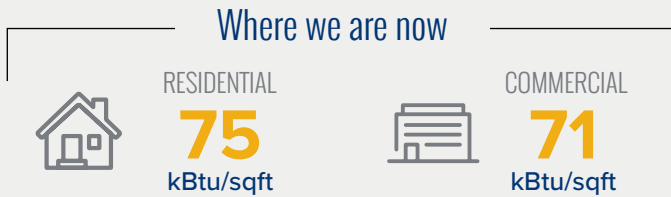
NYSERDA is conducting leading-edge work to identify broad market baselines and progress indicators to track over time. Although many of the metrics included in this broader view are expected to fluctuate with changes in the economy and other factors outside NYSERDA's control, this view provides a more complete picture of progress and understanding of market conditions when viewed with the initiative-level metrics. Many metrics presented in this broad view are being presented for the first time and NYSERDA intends to track these metrics over time.

Clean Energy Fund Market Transformation Metrics

NYSERDA is measuring and tracking a number of broad market-based metrics to understand the impacts of our initiatives.

Energy Intensity

Reductions in overall site energy intensity can help us understand the impact of energy efficiency.



Soft Cost Reduction

Customer acquisition, project design and installation, and transaction costs such as training and permitting represent a significant portion of the total cost of many clean energy investments. Several NYSERDA initiatives aim to reduce these soft costs, thereby reducing a key barrier to adoption of clean energy measures.



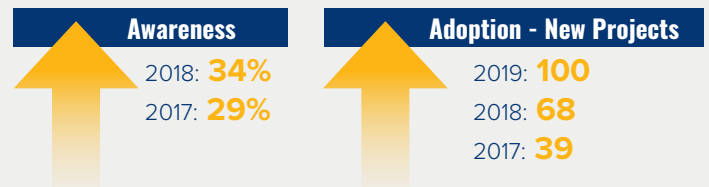
Clean Energy Job Creation

All employees from qualifying clean energy firms that spend any portion of their time supporting the research, development, production, manufacturing, distribution, or installation of clean energy products and services are considered clean energy jobs.



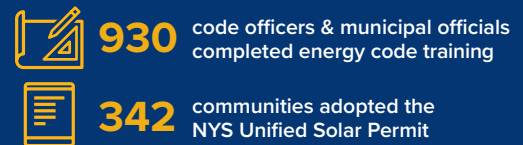
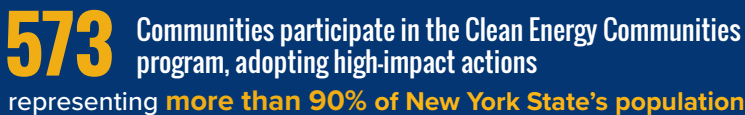
Energy Management

Real-time access to energy use through a combination of building data collection systems, analytics, and building data information services.



Sustainable Communities

Local governments across New York have used the Clean Energy Communities program to implement clean energy actions, save energy costs, create jobs, and improve the environment – affecting energy choices in their communities, from government operations to homes, businesses, and community institutions.

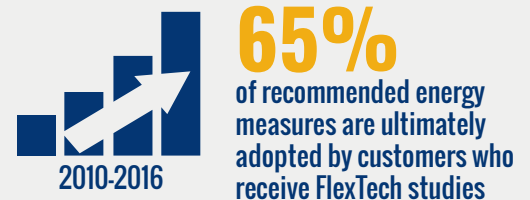


Clean Energy Penetration

Households across New York have completed energy efficiency and renewable energy improvements in their homes.



Commercial adoption rates from FlexTech audits remain strong over time, providing continued evidence these low-cost studies are highly impactful in capital planning.



Expected Savings From Proposed Product and Appliance Standards

Product and appliance standards limit wasted energy and water in the items used by households and businesses every day while at the same time preserving quality and affordability.

Save Money	Save Energy	Save Water	Cut Greenhouse Gases
<ul style="list-style-type: none">\$80/year on utility bills by 2025\$130/year on utility bills by 2030	<ul style="list-style-type: none">12 million MWh of electricity & 9.7 million MMBtu gas & oil annually by 2035	<ul style="list-style-type: none">49 billion gallons annually by 2035	<ul style="list-style-type: none">16 million metric tons of CO₂e through 2035like taking 300,000 cars off the road

\$14 BILLION for New Yorkers through product lifetime.



Innovation & Research Portfolio Summary

Driving innovation across climate technology sectors through direct investments in R&D projects and early-stage companies, as well as funding incubators, accelerators, prizes, and similar programs that support a green economy.

Portfolio Characterization and Impacts

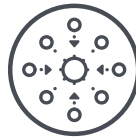
The Innovation and Research portfolio is funded at approximately \$621 million of programmatic funding over the 10-year Clean Energy Fund period and is designed to drive innovation and climatetech business growth across six key opportunity areas:

Through the Innovation and Research portfolio, NYSERDA invests in cutting-edge technologies and businesses that will meet increasing demand for clean energy. NYSERDA funding supports product development, demonstration, business support, ecosystem support, research studies, and information dissemination.

In the first four years of the CEF, a total of \$156 million in I&R funding has been committed to a mix of 272 projects. The largest addition of committed funding and projects across all years was in 2019.



Building Innovation



Grid Modernization



Clean Transportation



Renewables Optimization



**Innovation Capacity
and Business
Development**

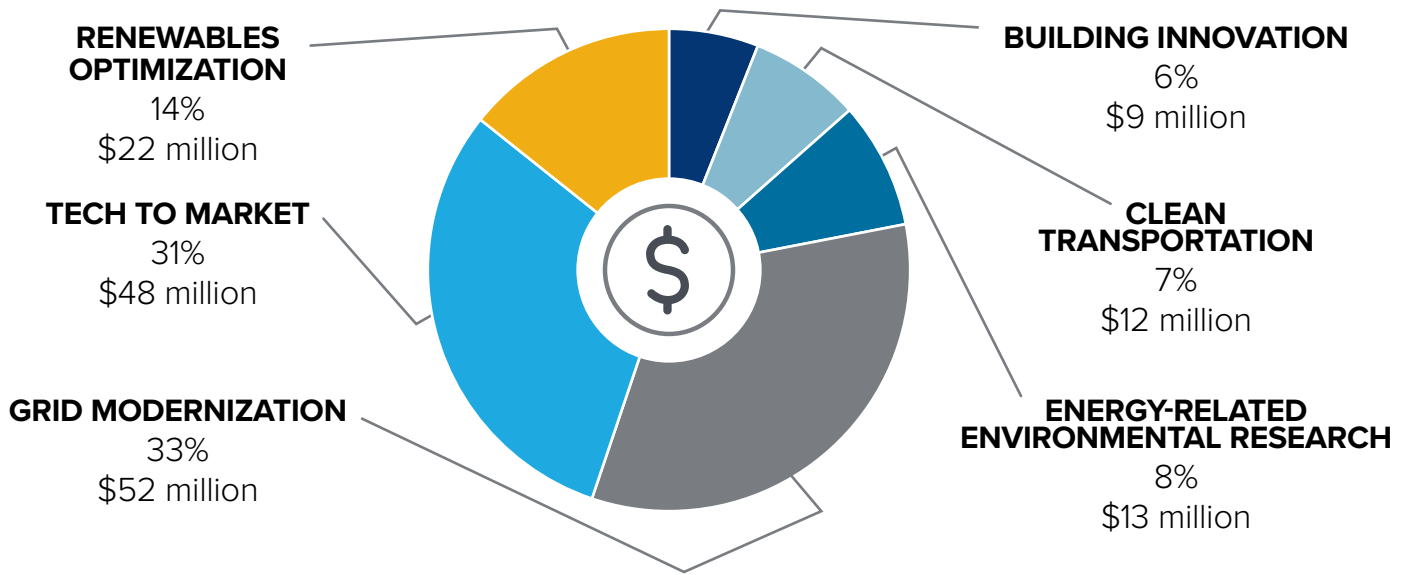


**Energy-Related
Environmental
Research**

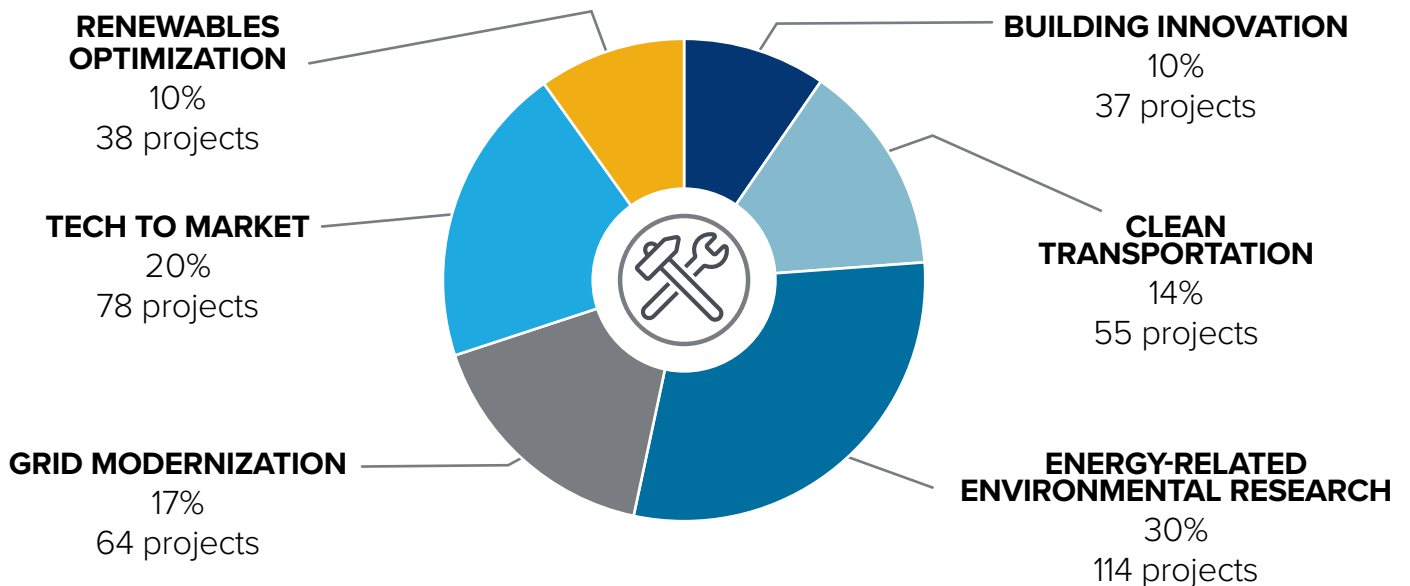
COMMITTED FUNDING AND NUMBER OF PROJECTS BY INVESTMENT AREA THROUGH Q4 2019

The following illustrate the proportion of total CEF Innovation and Research funding committed and number of projects by investment area. The Grid Modernization area currently has the largest amount of approved funding and committed funds. The next largest amount of approved and committed funding is in the Tech to Market area. The Tech to Market program primarily funds incubators, proof-of-concept centers, and other commercialization resources serving early-stage companies in all climatetech market sectors.

FUNDING



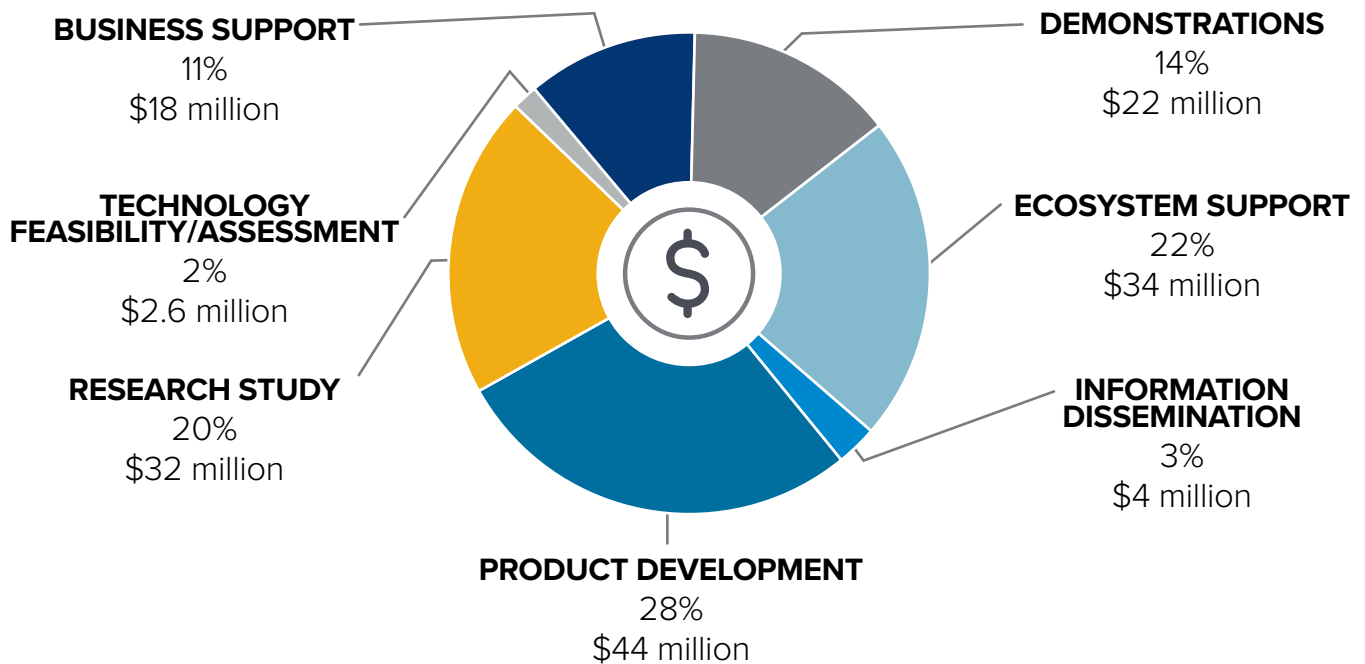
PROJECTS



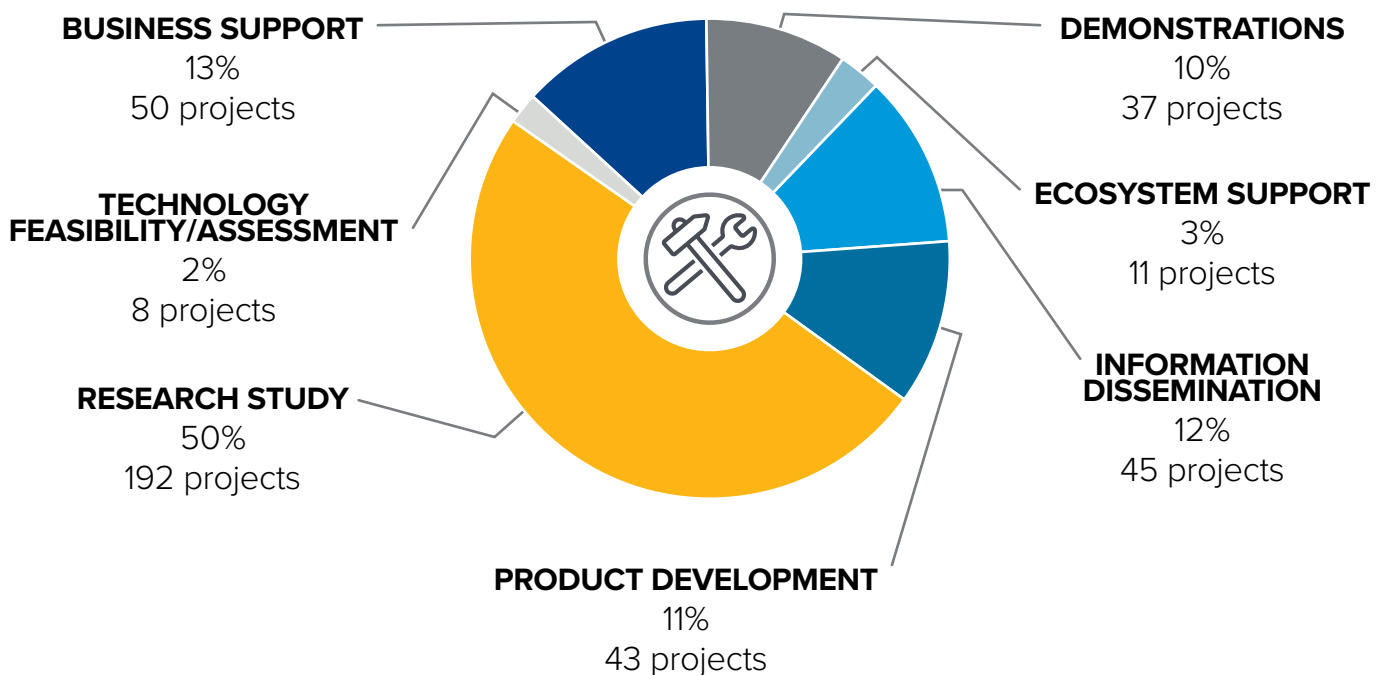
COMMITTED FUNDING AND NUMBER OF PROJECTS **BY PROJECT TYPE** THROUGH Q4 2019

The following presents NYSERDA's I&R committed funding and number of projects by project type. Committed funding is heavily weighted to Product Development at this time, but Ecosystem Support also received a significant portion of committed funds through 2019.

FUNDING



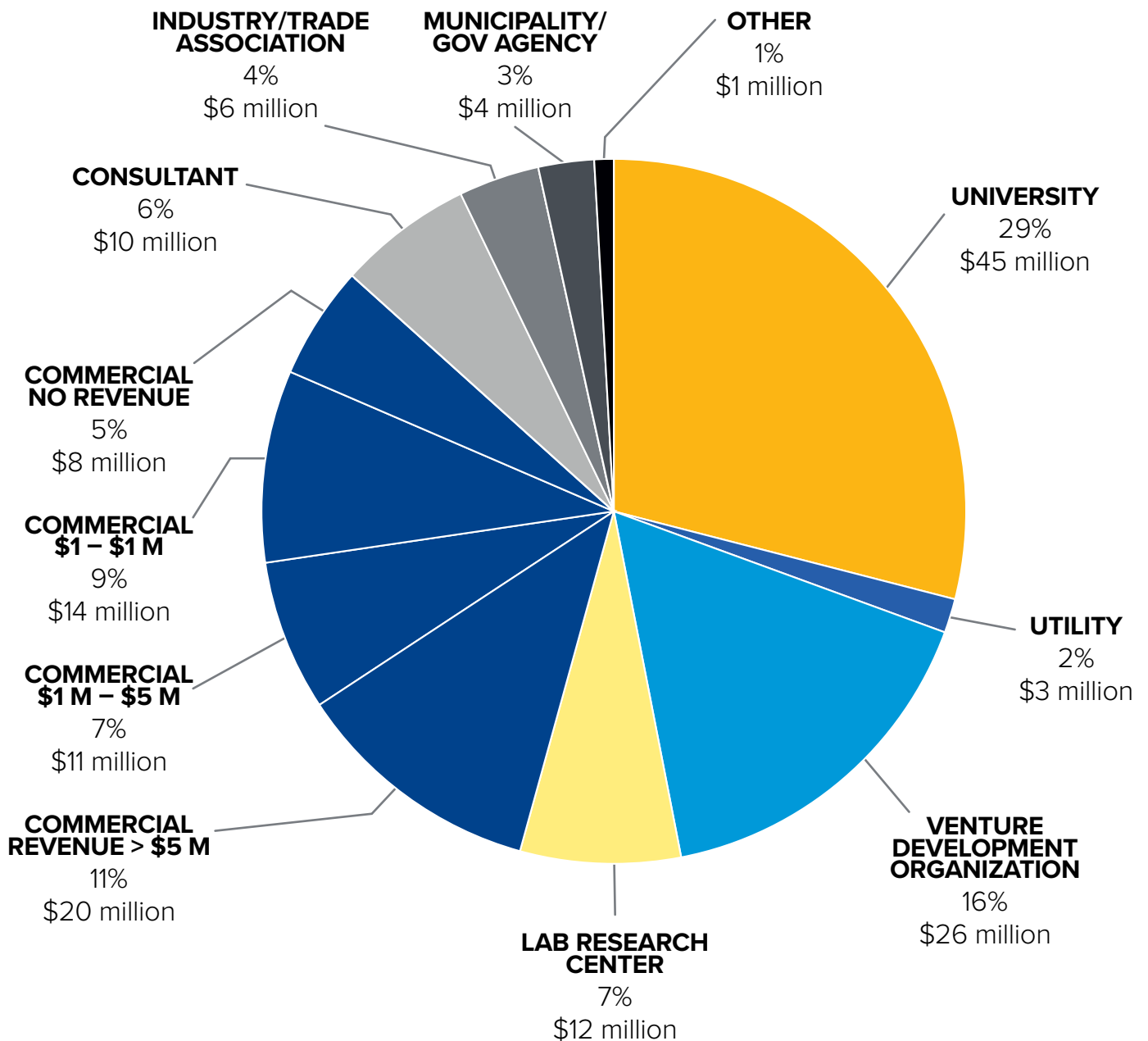
PROJECTS



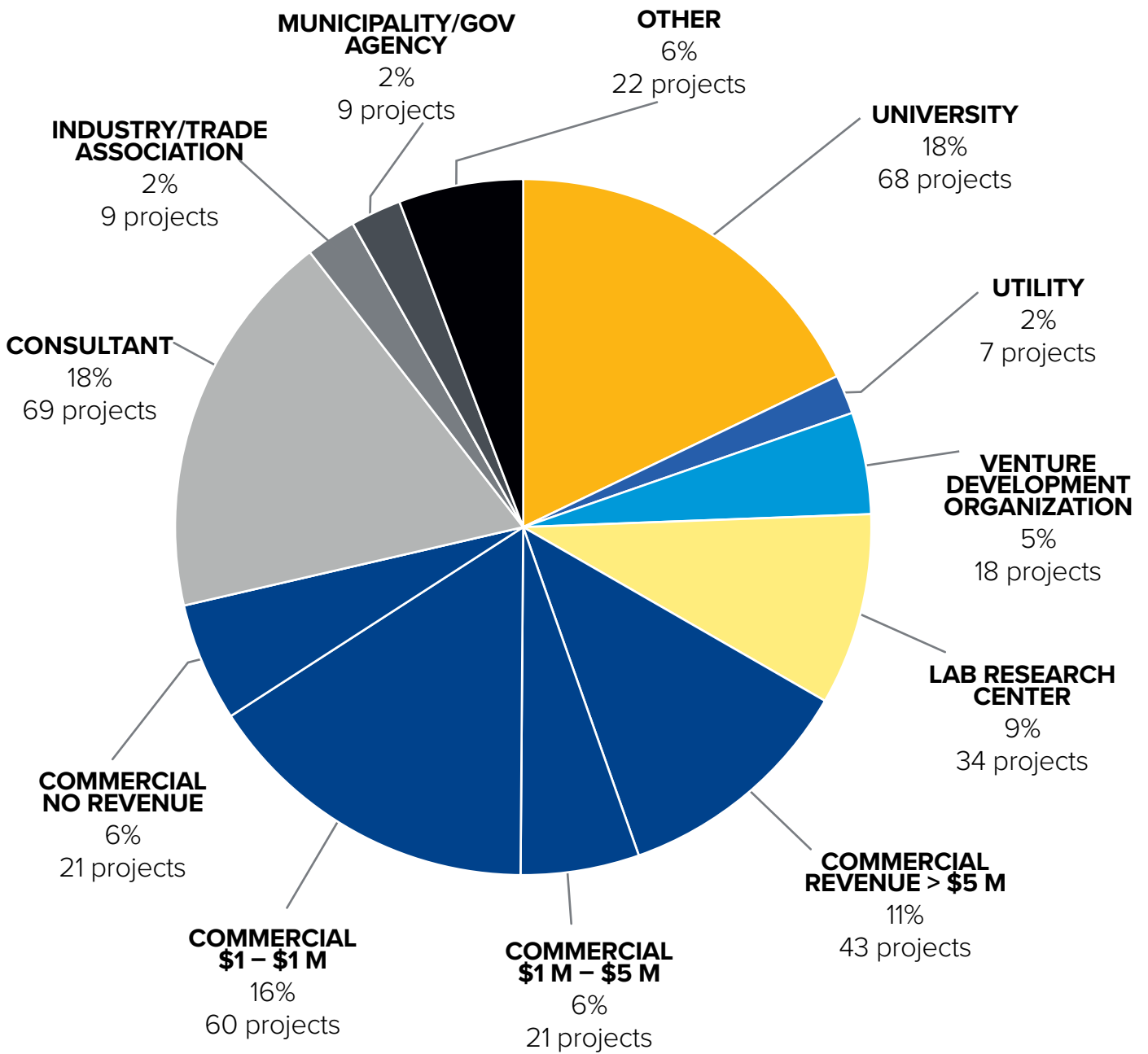
COMMITTED FUNDING AND NUMBER OF PROJECTS **BY CONTRACTOR TYPE** THROUGH Q4 2019

The following shows NYSERDA I&R committed funding by partner type, or the type of entity NYSERDA partnered with on the funded project. By far, the largest dollar value of commitments has gone to University partners. Collectively, small businesses with less than \$5 million in revenue (including those with no revenue) make up the second largest proportion of committed funding. The next largest amount of committed funding has gone to Venture Development Organizations, administering incubators, proof of concept centers, and other commercialization accelerators serving early-stage climatetech companies

FUNDING



PROJECTS





GRID MODERNIZATION

KEY STRATEGIES TO DATE

- Develop, de-risk, and accelerate technologies and applications that improve the grid in alignment with New York State energy goals. Embracing new and emerging technologies to support a broad array of grid functionality enables the Smart Grid program to best support New York State’s climate and energy goals.
- Identify and source projects that increasingly integrate across key functionalities, including flexibility, grid interaction with end-use resources (building-to-grid, vehicle-to-grid, etc.), renewable resource integration, and resilience in addition to more traditional projects, which improve specific aspects of grid operations (system management, loss reduction, outage avoidance, etc.).
- With the Future Grid Challenge, NYSERDA collaborates directly with New York State utilities to identify challenges they face in evolving the electric grid to enable New York’s clean energy and climate goals. This approach fosters collaborative multi-functional teams and partnerships with the New York utilities while directly advancing electric grid evolution.

MAJOR INITIATIVES IN THE MARKET

- DER Interconnection
- High Performing Grid
- Power Electronics Manufacturing Consortium

FUNDING COMMITMENTS AND OUTCOMES THROUGH Q4

FUNDING COMMITTED	COMPANIES ENGAGED	COMPANY REVENUE	PRODUCTS COMMERCIALIZED
\$52 M	36	\$30 M	Gridview* Voltage and Current Sensor–RG235
INTELLECTUAL PROPERTY (PUBLICATIONS AND PATENTS)			Underground Electrical Cable Oil Monitoring System
	23		

*Product of Micatu, Inc. See Grid Modernization highlight later in this document.



CLEAN TRANSPORTATION

KEY STRATEGIES TO DATE

- Funds research, feasibility, product development, and demonstration projects as well as demonstrations of tested products and policies that are underutilized in New York State.

MAJOR INITIATIVES IN THE MARKET

- Electric Vehicles – Innovation
- Public Transportation and Electrified Rail

FUNDING COMMITMENTS AND OUTCOMES THROUGH 2019

FUNDING COMMITTED	COMPANIES ENGAGED	COMPANY REVENUE	PRODUCT COMMERCIALIZED
\$12 M	50	\$16 M	**Metro Guide Light Wireless Module
INTELLECTUAL PROPERTY (PATENTS AND PUBLICATIONS)			
	14		

**Product of ClearVu, a subsidiary of Autronic Plastics, Inc. See Clean Transportation highlight later in this document.

INNOVATION CAPACITY AND BUSINESS DEVELOPMENT



KEY STRATEGIES TO DATE

- Provide support and facilitate access to capital, executive expertise, strategic relationships, and business support, by working directly with NYSERDA's Innovation portfolio companies and fostering an innovation ecosystem that accelerates clean energy and climate tech commercialization.
- Provide funding and access to experts, business training, proof of concept support, mentorship, and ecosystem resources to early stage climate technology innovators.
- Deliver connections, training, and catalytic investment to climate technology companies ramping up manufacturing activities, raising capital, launching product into the market, connecting with in-state customers, and scaling their operations in New York.

MAJOR INITIATIVES IN THE MARKET

- Cleantech Startup Growth
- Manufacturing Corps
- Novel Business Models and Offerings
- 76 West

FUNDING COMMITMENTS AND OUTCOMES THROUGH 2019

FUNDING COMMITTED	COMPANIES ENGAGED	INTELLECTUAL PROPERTY (PATENTS AND PUBLICATIONS)	COMPANY REVENUE	PRODUCTS COMMERCIALIZED
\$48 M	239	30	\$166 M	99

RENEWABLES OPTIMIZATION



KEY STRATEGIES TO DATE

- Improve performance, renewables hosting capacity, and integration while reducing cost with a grid that is distributed energy resources (DER) friendly.
- Improve the economics for renewable and distributed energy resources by addressing technical barriers, as well as advancing renewable technologies that have potential to drive large-scale greenhouse gas reductions, improve grid resiliency, and contribute to New York State's renewable generation and greenhouse gas emission reduction objectives.
- Focus on areas of strategies signature to New York State, including offshore wind and energy storage.

MAJOR INITIATIVES IN THE MARKET

- Energy Storage Technology and Product Development
- National Offshore Wind Research and Development Consortium

FUNDING COMMITMENTS AND OUTCOMES THROUGH 2019

FUNDING COMMITTED	COMPANIES ENGAGED	COMPANY REVENUE	INTELLECTUAL PROPERTY (PATENTS AND PUBLICATIONS)
\$22 M	35	\$2 M	2

ENERGY-RELATED ENVIRONMENTAL RESEARCH



KEY STRATEGIES TO DATE

- The Energy-related Environmental Research program is designed to increase the understanding and awareness of the environmental impacts of energy choices and emerging energy options by providing a strong scientific, technical foundation for formulating effective, equitable energy-related policies and practices. The Program:
 - Informs State and federal energy and environmental policies
 - Examines the health, ecological, and economic co-benefits of renewable energy solutions, and opportunities to avoid, minimize, or mitigate concerns
 - Provides environmental accountability for State and federal policy goals

MAJOR INITIATIVES IN THE MARKET

The Program provides ongoing support for long-term monitoring efforts, recurring competitive solicitations targeting research priorities identified in the Program’s Research Plans, and opportunistic research projects and partnerships, such as with organizations with similar goals who can leverage program funds and enhance scientific and/or policy value.

- Offshore Wind Pre-Development activities including collecting and analyzing field data and other site assessment work that will reduce environmental and developer risks, and lower procurement costs for offshore wind, specifically costs to New York State ratepayers. Three primary activities are taking place that cumulatively exceed \$10 million in pre-development investment. These include geophysical and geotechnical surveys, digital aerial wildlife surveys and the deployment of two Metocean buoys to measure wind speeds and other oceanographic conditions.
- Long-term air quality monitoring, trends analysis, and intensive atmospheric chemistry studies. New York State air quality regulators continue to rely upon these efforts for State Implementation Plan development and tracking progress for fine particles (PM 2.5) and ozone. Additionally, this information is used in litigation against the U.S. Environmental Protection Agency, such as a recent win regarding out-of-state transport of ozone into New York State.

FUNDING COMMITMENTS AND OUTCOMES THROUGH Q4

** See later section of this document on evaluation results*

<p>FUNDING COMMITTED \$13 M</p> <p>WORKSHOPS SPONSORED 29</p>	<p>INTELLECTUAL PROPERTY (PATENTS AND PUBLICATIONS)</p> <p>**More than 1,000 papers in 100+ journals with 6,000+ citations since 1998</p>
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**See section on Energy-Related Environmental Research Citation Analysis for more information.

Overall Impacts of the Innovation & Research Portfolio through 2019

AUTHORIZED FUNDING

\$621 million
over ten years

FUNDING COMMITTED

\$156 million (25%)
of this \$53 million
is expended

For every \$1 of CEF funding invested, I&R projects have leveraged over \$5.5 of other funding.

PROJECT COMMITMENTS SUPPORTED:

LEVERAGED FUNDS

\$851 million

PATENTS

30

COMPANIES ENGAGED

332

PUBLICATIONS

59

COMMERCIALIZED PRODUCTS

104

with a goal of 243 over program lifespan*

REPLICATIONS

134

with a goal of 135
over program lifespan*

COMPANY REVENUE

\$14 million

includes sales associated
with replications

* goals based on total approved funding

Lessons Learned

Given the metrics and evaluations of the portfolio's performance to date, Innovation and Research will consider the following lessons learned:

- Early stage investment in venture development organizations such as incubators and proof-of-concept centers leverages significant additional public and private investment, resulting in outsized market impact. These investments helped drive the overall portfolio to an investment leverage of \$5.8 in external investment for every \$1 of NYSERDA program investment.
- Innovation investments must be deployed more rapidly to developing climate technology markets, sustaining ecosystem partners through the economic disruptions caused by COVID-19 and accelerating progress to meet the aggressive goals of the Climate Act. Increased focus on pilots, demonstrations, regulatory innovations, and other key commercialization barriers is needed to de-risk the market and attract additional, leveraged investment.
- Technology demonstration projects performed well in aggregate, though that performance was driven by a relatively small number of demonstrations having a large number of replications. These results support a broad-based strategy for early stage investment that focus on developing markets and ecosystems rather than seeking an incrementally positive outcome for each individual company or technology.
- The time scale of technology research makes it difficult to quantify in the short-term the long-term effects on the ultimate program goals of reducing greenhouse gas emissions and supporting disadvantaged communities. Available indicators such as investment leverage, replication of technology demonstrations and intellectual property capitalization support the hypothesis that early stage investment in innovation delivers substantial long-term returns. Additional tools and methods are needed to better estimate long-term market impacts and guide portfolio performance.

Future Directions

The Innovation and Research portfolio will accelerate its investments in climate technology and cleantech business growth, expanding and revising its investment strategy to rapidly catalyze investment and promote market growth. This approach will ensure that Innovation's investments will meet the decarbonization and environmental justice objectives of the Climate Act while supporting recovery and growth in an economy experiencing unprecedented disruption due to the effects of COVID-19.

The Innovation and Research portfolio will do this by leveraging New York's competitive advantages, supporting existing industries and seeking opportunities to lead in new industry areas. To achieve the aggressive decarbonization goals of the Climate Act, the portfolio will seek to build and scale up key climate tech markets in the State. Innovation and Research investments will focus on achieving scalable change by removing barriers and de-risking the market, catalyzing additional investment from public and private stakeholders.

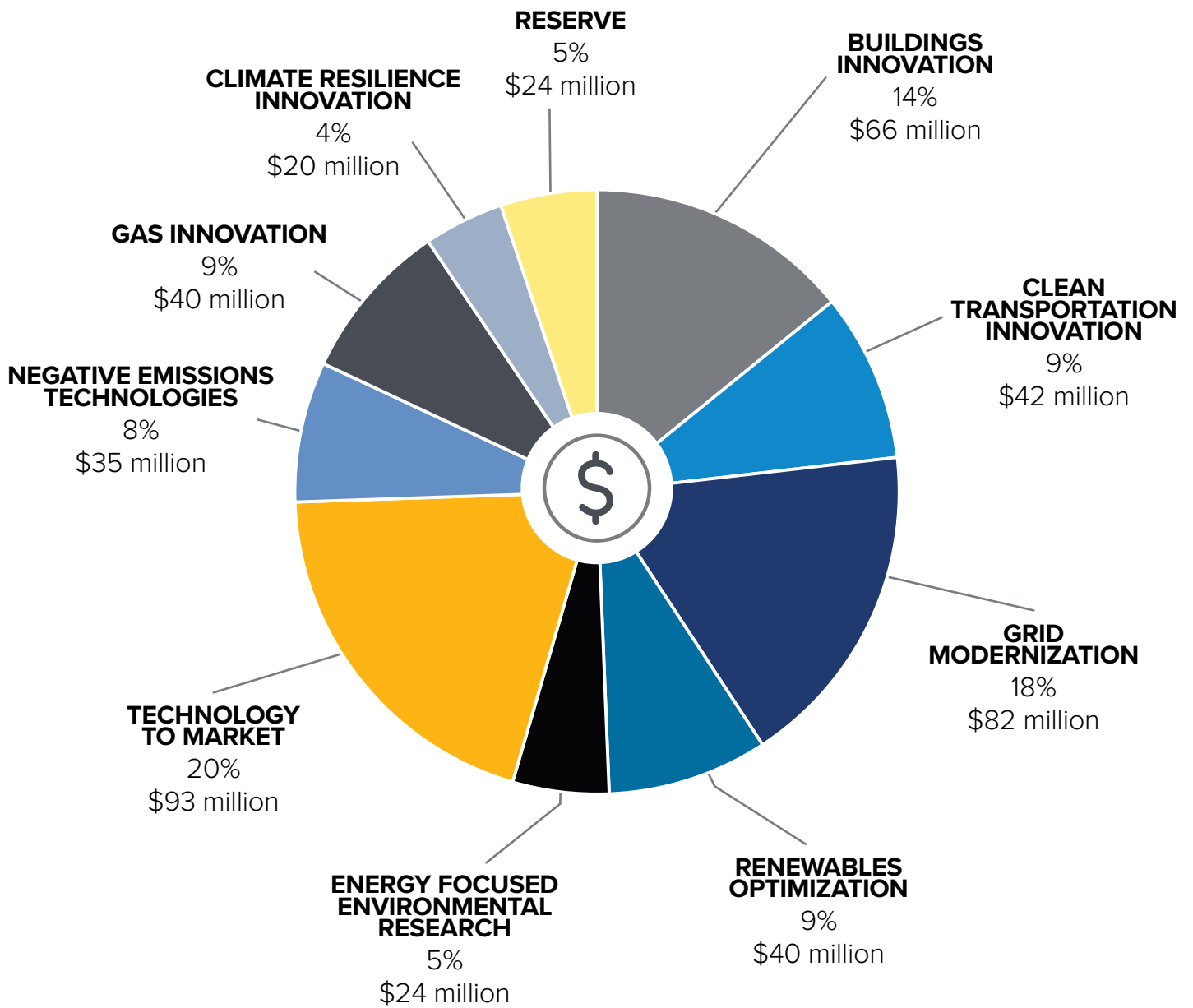
Future technology investments will be focused on helping innovative technologies enter the market more quickly, for example by supporting pilots and demonstrations, disruptive innovations and innovative regulations, processes, and policies. In light of the Climate Act, the Innovation and Research portfolio will also expand technology focus areas to include natural carbon solutions and other direct carbon management innovations, innovations that drive flexibility and affordability for the power grid, building technologies, clean liquid and gaseous fuels, and additional innovation areas prioritized determined by the State's evolving needs.

This strategic approach will require the portfolio to pursue additional factors beyond technology advancement, including innovation in policy, regulatory, and finance models to support rapid growth in decarbonization technologies. Given limited budgetary and human power resources, Innovation will work to expand its network of strategic partnerships, leveraging their support to inform strategy and execute programs. With its investments and investments partners, NYSERDA Innovation will also begin tracking lifecycle emissions and greenhouse gas abatement potential.

INNOVATION AND RESEARCH PRIORITIES AND ESTIMATED FUNDING ALLOCATON (2020-2025)

FOCUS AREA	ESTIMATED CEF FUNDING (2020-2025, \$M)	PORTFOLIO/STRATEGY ADJUSTMENTS
Buildings Innovation	\$66	<ul style="list-style-type: none"> ■ Continue focus on driving down cost and energy use from HVAC systems as well as alternatives to high GHG working fluids. ■ New initiative in building exterior retrofits that drive efficiency and offer comfort/ additional benefits. ■ New initiative in grid interactive buildings and additional electrification solutions for buildings.
Clean Transportation Innovation	\$42	<ul style="list-style-type: none"> ■ New focus on mobility including ebikes and scooters, sharing business models, mobility to ensure jobs access for disadvantaged communities, and solutions that optimize use of the built environment. ■ New focus on enabling transport electrification and grid coordination to facilitate medium and heavy duty electrification and depot charging.
Energy Focused Environmental Research	\$24	<ul style="list-style-type: none"> ■ Continue to coordinate with technical working groups and other stakeholder interactions to inform research needs, adapting the program’s focus as necessary to maximize impact and build stakeholder support.
Grid Modernization	\$82	<ul style="list-style-type: none"> ■ Coordinate with Department of Public Service to prioritize grid needs and support R&D and initial deployments of new grid technologies, business models, and functionalities. ■ New flexibility prizes to drive grid flexibility and optimization with goals of reducing overall grid/power costs and ensuring reliability. ■ Development of grid functional priorities and support of innovation to meet these needs.
Renewables Optimization	\$40	<ul style="list-style-type: none"> ■ Assess the opportunity for clean liquid and gaseous combustion fuels to play a role in meeting Climate Leadership and Community Protection Act goals including Hydrogen. ■ Continue to support the National Offshore Wind R&D Consortium with existing committed funding and staff time.
Technology to Market	\$93	<ul style="list-style-type: none"> ■ Fund commercialization support programs, prize programs, go-to-market training, accelerators, manufacturing training, incubation, customer acquisition programs, and other initiatives that catalyze the innovation ecosystem’s work on NYSERDA priority sectors and increase the number of innovation solutions adopted by customers in the State. ■ Shift focus to support more companies and technologies reaching market deployment stage.
Negative Emissions Technologies	\$35	<ul style="list-style-type: none"> ■ New focus area to support R&D, pilots of best-in-class technologies, and similar initiatives to drive forward direct carbon management solutions to optimally decarbonize the New York State economy.
Gas Innovations	\$40	<ul style="list-style-type: none"> ■ New focus area supporting the transition away from natural gas and natural gas infrastructure. ■ Innovations to support upgraded infrastructure enabling decarbonization technology.
Climate Resilience Innovation	\$60	<ul style="list-style-type: none"> ■ New focus area supporting climate risk framework development and adoption including for resilience of NYSERDA funded assets, and supporting climate risk assessments in the insurance and financial services industries. ■ Analysis and assessments to support actions and programs that will develop innovations required to support regulatory action to control greenhouse gases and other pollutants
Total Innovation and Research	\$466	<p>*Includes ~5% reserve to accommodate emerging needs over the 2020-2025 horizon.</p> <p>New and modified initiatives will be advanced through specific investment plans. See nysERDA.ny.gov/About/Funding/Clean-Energy-Fund for a current listing of investment plans.</p>

ESTIMATED **CEF FUNDING** BY FOCUS AREA, 2020–2025 (\$M)





Highlights

Case studies are an important evaluation method for research and development programs. Due to the nature of R&D investing, it is not uncommon for a very small number of funded projects to carry a disproportionately large amount of the overall benefits or impacts delivered by a portfolio. As might be expected, project success is hard to predict at the outset and research results can take several years to impact the market. Case studies serve to document the program funding and support provided over time as well as the impact it had on development of a product or a business. Highlighted here are selected initiatives that are successful but also exemplary of the type of wins that are expected to continue to come from the I&R investment over time.





Cleantech Innovation

Highlight

Cleantech startups are developing clean energy solutions across New York State.



Innovative clean energy technology plays a significant role in mitigating climate change, protecting the environment, and reshaping New York State’s clean energy future.

“ACRE is the place to be if you’re going to do a cleantech startup in NY.”

– Eric Dahnke, PowerMarket CEO

“The amount of interactions we get with private industry through ACRE is unparalleled.”

– Rimas Gulbinas, Maalka CEO

“Having office space [at ACRE] that we couldn’t have afforded otherwise allowed us to build our business in an affordable way.”

– Kathy Hannun,
President of Dandelion Energy

For more than a decade, NYSERDA has supported six clean energy business incubators to grow New York State’s clean energy economy by providing early stage cleantech companies with access to essential resources that catalyze company growth. **Since 2009, NYSERDA has helped raise \$472 million in private capital and almost \$108 million in non-NYSERDA grant funding for 284 cleantech startups across all six incubators.**

ACRE—New York’s leading incubator for cleantech startups, housed in the Urban Future Lab at New York University—has been a standout NYSERDA partner, accounting for 66% of all incubator-leveraged funds across the six incubators since 2017. Together, NYSERDA and ACRE nurture entrepreneurs who have developed promising innovations designed to save energy or reduce greenhouse gas, by investing in the intellectual as well as financial capital of its clients. This in turn helps New York State further its clean energy goals.

ACRE offers a variety of resources and services to support entrepreneurs as they develop their products, earning an excellent reputation for transforming cleantech startups into viable businesses. Their staff has in-depth knowledge of the clean energy landscape and is constantly monitoring market opportunities and resources to provide guidance and connections to their portfolio companies.

NYSERDA’s support is essential to ACRE’s success. Under its current contract, NYSERDA provided \$2.5 million to ACRE and funding is expected to continue in the future. NYSERDA also directly supports ACRE’s clients by offering expert advisement and providing connections to financial and technical resources or other programs, such as through the Green Innovation Showcase where early stage companies are strategically paired with investors. Since working with NYSERDA, ACRE has hosted 58 client companies and 32 of those have graduated.

Cleantech startups across the State are developing innovative technologies to reduce energy consumption, embrace renewable energy sources, and manage energy waste more effectively.

ACRE offers a variety of resources and services to support entrepreneurs as they develop their product and business. Together, ACRE's client companies have secured:

\$667 million
non-NYSERDA funds, since 2009

With support from NYSERDA and ACRE, these clean energy entrepreneurs are developing promising innovations designed to save energy and reduce emissions while accelerating the market entry of clean energy solutions.

≡ Dandelion Energy — joined ACRE 2018 →

Founded in 2017 and headquartered in NYC, Dandelion Energy is reducing barriers to improve homeowner access to ground source heat pumps (GSHP). Dandelion developed and patented technology for drilling GSHPs in small areas. Using an innovative project financing mechanism as their business model, they offer affordable geothermal heating and cooling installations in Upstate NY for homeowners of all socioeconomic backgrounds.

graduated
October 2018

FULL TIME
NY STAFF

3 ⇒ 91

Hundreds of homeowners who installed ground source heat pumps each expect to **SAVE**

200 TONS OF GHG EMISSIONS OVER THE SYSTEM'S LIFETIME

REDUCED DRILL TIME **FOUR** days ⇒ **ONE** day

≡ PowerMarket — joined ACRE 2014 →

Since 2016, Brooklyn-based PowerMarket has been a trusted community marketplace for people to buy their power from local renewable sources. This helps improve individuals' – particularly renters' – access to renewable energy sources, enables community solar programs to function efficiently, and is a catalyst to help clean energy suppliers and customers embrace the clean energy transition.

graduated
2019

FULL TIME
NY STAFF

1 ⇒ 15

Customers accessing community solar through PowerMarket see a

10% ANNUAL SAVINGS ON ENERGY BILLS

low- to moderate-income
community focus

≡ Maalka — joined ACRE 2014 →

Founded in 2015, Maalka developed an open, scalable, data-driven software platform that allows property managers and cities to manage people, analytics, and communications across data-driven sustainability programs in a way that is easy and affordable.

current
ACRE tenant

FULL TIME
NY STAFF

↑ 2

Depending on building portfolio size
ESTIMATED ENERGY SAVINGS with Maalka

\$76 k ⇒ \$11 M

20+ clients worldwide

On average and dependent on building portfolio size and type, property managers who adopted Maalka's software platform to manage their buildings saw a 25% reduction in their energy use intensity.

Learn more.

Visit nyscrda.ny.gov/innovation or email innovation@nyscrda.ny.gov



Energy Storage

Highlight

Critical to New York’s clean energy future, innovation in energy storage will allow renewable energy, like solar and wind, to be available when and where it is most needed.



Energy storage will play a major role in integrating clean energy into the grid, reducing costs associated with meeting peak electric demands, and increasing energy efficiency while helping the State meet its ambitious climate goals. In addition, energy storage can stabilize supply during peak electric usage and help keep critical systems online during an outage.

“You need some bandwidth to take chances and vet different ideas. We wouldn’t be able to do that strictly with private venture funding ... and so [NYSERDA funding] is very necessary.”

– Gabe Cowles, UEP

“If you need sales help or if you need product development help or marketing or financing, they [NYSERDA] provide very specific experts in those relevant areas.”

– Gabriel Rodriguez-Calero, Ecoelectro

NYSERDA has a long-standing history in supporting energy storage innovation, including launching the NY-BEST (Battery Energy Storage Consortium) and supporting several Energy Frontier Research Centers, as well as Nobel Prize winning work at SUNY Binghamton.

Installing energy storage systems inside buildings will support the State’s commitment to generating 70% of its electricity from renewable energy by 2030. Installation in air-conditioned/heated spaces would increase system performance and reduce costs by maintaining optimal operating temperatures of the batteries.

NYSERDA provided extensive research and development (R&D) funding to Urban Electric Power (UEP) and Ecoelectro to develop new and innovative energy storage technologies. This R&D funding was crucial because private investors are often reluctant to invest in technologies still in the development stage. With nearly \$4 million in awards and other assistance for over a decade, NYSEDA supported these companies in each stage of development (R&D, product demonstration, and product commercialization). Both UEP and Ecoelectro also participated in NYSEDA’s Entrepreneurs-in-Residence program, which guided these early-stage companies through specific projects and barriers.

Supporting companies that can expand the energy storage market will build a more resilient and flexible electric system and significantly increase new job opportunities. Improved energy storage technologies will also benefit the growing New York State solar industry by expanding the range of installation locations, reducing operating costs, and making the availability of solar power less variable by balancing excess production and underproduction.

NYSERDA's Renewable Optimization and Energy Storage Innovation program investment of \$97 million resulted in:

126
solutions
developed

\$643M
follow-on
investments

21
products
commercialized

With support and assistance from NYSERDA, companies like Ecoelectro and UEP are developing breakthrough technology to expand the energy storage market and grow the clean energy economy.

Ecoelectro

Ecoelectro's next generation alkaline exchange polymers are more stable, long lasting, and less expensive. By omitting the use of expensive materials traditionally used in fuel cells and electrolyzers, Ecoelectro can reduce the high cost associated with these clean energy technologies and enable production at scale.

40% POTENTIAL COST REDUCTION

of raw materials used to build hydrogen electrolyzer and fuel cell systems

\$700k NYSERDA funding

\$500k COMPANY cost share

Ecoelectro is working to advance key milestones, by using chemistry to decarbonize the energy, manufacturing, and transportation industries



AVOIDS TITANIUM AND PLATINUM



COST TO MANUFACTURE

enabling lower than \$2-a-kilogram hydrogen

EMPLOYMENT GROWTH 2018-2020

4 ⇒ 8 employees

ECONOMIC IMPACT

\$1M+ 2018-2020

Urban Electric Power (UEP)

Alkaline batteries use zinc and manganese dioxide, materials that are less expensive and safer than those used in other battery types. UEP's batteries can be stacked to power homes and businesses for several days during power outages. They can be recharged hundreds of times from a variety of sources, including solar panels and wind turbines, and can be easily incorporated in micro-grids powered by renewable resources.

Zn-MnO₂ BATTERIES

less toxic than previous technology

\$2.9 M NYSERDA funding

\$2.4 M COMPANY cost share

BATTERY CELL CAPACITY INCREASED by factor of 3

20 amp hours ⇒ 60 amp hours

cheaper to manufacture than Li-ion

enable peak shaving reduce demand charge

ECONOMIC IMPACT

\$4M+ 2019-2020

EMPLOYMENT GROWTH 2018-2020

with 60 employees during full production runs

10 ⇒ 35 full time employees

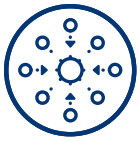
AVERAGE TIME TO MANUFACTURE reduced

200 minutes ⇒ 20 minutes

A 800 kWh UEP battery storage system is planned for installation at City College of NY — when completed it will be the largest indoor-sited battery storage installation in New York City

Learn more.

Visit nyserdera.ny.gov/energy-storage or email energystorage@nyserdera.ny.gov



Grid Modernization

Highlight

Smart grid technologies promote modernization of the electric grid, creating a more resilient and reliable energy system that is less costly to operate and reduces greenhouse gas emissions.



Smart grid tools and technologies aim to improve grid reliability by preventing or responding to outages in real-time. These technologies monitor grid conditions to identify potential problems and automatically reroute power to minimize the number of customers affected.

\$5.9 million
annual reduction
in energy costs associated
with smart grid improvements

— estimated by Central Hudson

75,000+
metric tons

CO₂e
avoided annually
with Micatu's sensors

Smart grid technologies and devices are relatively new and evolving quickly. NYSERDA's Smart Grid program funds research and technology development projects that can be implemented at the utility scale.

NYSERDA played an important role in enabling Central Hudson Gas & Electric's grid modernization efforts. Through NYSERDA's Smart Grid program, Central Hudson received \$6 million that supported eight grid modernization projects. The projects demonstrated an automated distribution management system and helped Central Hudson gain confidence with real-time modeling and automation. The demonstration resulted in significant reliability improvements, economic cost savings, and emission reductions in Central Hudson's service territory. The utility now views microgrids as an effective method of improving reliability in remote locations.

Beginning in 2015, NYSERDA's Smart Grid program provided \$6 million in funding to Micatu, Inc.—an engineering product development firm—to develop its fiber optic Gridview Sensor that will improve grid resiliency, reduce power fluctuations, and help avoid equipment failures. Using real-time data to monitor grid performance and align power supply and demand, the Gridview Sensor eliminates utilities' need for transformers to measure power flow. A large utility installation of Micatu's sensors could potentially avoid more than 75,000 metric tons of CO₂e annually.

Micatu was also awarded a \$1 million grand prize for the inaugural 76West Clean Energy Competition that NYSERDA funds to provide financial and business development support to clean energy technology companies creating jobs in the Southern Tier region. As a result of the award, Micatu was able to grow its business and five of the seven major utilities in New York State are currently piloting Micatu's sensor. The estimated economic benefits and carbon reductions that could result from utilities installing Micatu's sensors system-wide are substantial.

Investments in grid modernization lead to reductions in unnecessary generation, emissions, and system losses.

NYSERDA's Smart Grid program has helped Micatu and Central Hudson make advancements in modernizing the grid with a total investment of



\$12 million

≡ Micatu — Gridview Sensor

NYSERDA's funding helped Micatu develop and demonstrate its Gridview Sensor in NY utility markets. A pilot project with Con Edison demonstrated a new underground application for the sensor and a distribution contract was signed with Eaton, a global distribution company.

\$6 M NYSERDA investment in smart grid enabling tech

A large utility like Con Edison could install Micatu sensors across its grid network and reap significant economic, environmental, and reliability benefits:

13 k SENSORS INSTALLED	 SAFETY FOR electric utility line workers 	
METRIC TONS OF CO ₂ e AVOIDED	75 k annually	2 M over 20 yrs
EMPLOYMENT GROWTH	18 ⇒ 60 expected in 2020	MULTIPLIER EFFECT 78 jobs in NYS economy
\$20M TOTAL VALUE ADDED TO NEW YORK'S ECONOMY		

“Optical sensors have been useful for contactless voltage and current sensing. There are a number of applications we see in this regard. – ConEd”

≡ Central Hudson — Smart Grid

NYSERDA's funding influenced Central Hudson's follow-on smart grid investments and supported knowledge sharing among utilities that influenced other New York State utilities to undertake grid modernization upgrades.

\$6 M NYSERDA investment to modernize grid

\$53 M CENTRAL HUDSON investment

\$8.80 for every NYSERDA \$1

Central Hudson smart grid improvements, using Micatu sensors across its grid network, could have huge potential estimated reductions and savings:

\$6 M REDUCTION in annual energy costs		
MEGAWATT-HOURS OF ELECTRICITY AVOIDED	74 k annually	2 M over 20 yrs
ECONOMIC BENEFITS FROM REDUCED GENERATION AND AVOIDED CAPITAL UPGRADES	\$41 M over 20 yrs	

“We see GIS (Geographic Information Systems) development as a foundational grid modernization effort that ConEd is currently undertaking. – ConEd”

METRIC TONS OF CO ₂ e AVOIDED	741 k over 20 yrs	ENVIRONMENTAL BENEFITS \$34M
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Learn more.

Visit nyserdera.ny.gov/smart-grid or email smartgrid@nyserdera.ny.gov



Clean Transportation

Highlight

Improving methods to build, maintain, and manage transportation infrastructure will enhance energy efficiency, improve mobility and reliability, and reduce congestion.



Transportation accounts for nearly 40% of greenhouse gases generated. NYSERDA is supporting innovative ideas and technologies needed to create more secure, sustainable, and cleaner transportation options for communities across New York State.

Clear-Vu saw NYSERDA's support as essential for them to take risks and develop a new product that could be commercialized

KLD Engineering with help from NYSERDA, was able to develop and demonstrate an adaptive traffic management system that not only improves traffic flow but is also building resiliency

Through the Clean Transportation program, NYSERDA is helping businesses, public agencies, universities, and entrepreneurs develop, test, and launch new technologies, products, and services that help New Yorkers reach their destination safely and efficiently. The program helps take products from prototype to commercialization and wider use.

For more than 35 years, Clear-Vu Lighting* has been a market leader in innovative lighting solutions. With help from NYSERDA, Clear-Vu developed a LED fixture for the New York Metropolitan Transportation Authority (MTA)'s subway tunnels that uses 50% less energy, lasts ten times longer, and requires significantly less maintenance than the legacy CFL fixtures it replaced. The new fixtures include wireless remote monitoring and have a four-hour battery backup that allow lights to function during power outages. **Clear-Vu's product improves lighting quality, extends fixture lifetimes, improves worker and rider safety, reduces train delays, and increases transit system resiliency.**

KLD Engineering, a privately owned business specializing in traffic engineering and Intelligent Transportation Systems, partnered with NYSERDA to develop and demonstrate its Adaptive Control Decision Support System (ACDSS). ACDSS can automatically adjust traffic signal timing across multiple intersections based on an algorithm that detects traffic flow, number of motor vehicles, bicycles, and pedestrians. Operators can override and make adjustments to signal timing based on real time information. **Adaptive management control systems reduce traffic congestion, travel times, fuel consumption, environmental emissions, and improve traffic safety.** These systems lend themselves to emergency management and can adapt quickly to extreme weather events or other emergencies.

* Clear-Vu Lighting is a wholly owned subsidiary of Autronic Plastics, Inc.

NYSERDA is accelerating the commercialization of clean transportation solutions, reducing emissions, and growing the cleantech workforce

Clear-Vu — developed LED fixtures for MTA's subway tunnels

CFL → **LED** Switching from CFL to LED technology leads to substantial benefits and savings

50% LESS ENERGY USED THAN LEGACY LIGHTS

MTA SAVINGS PROJECTED OVER 5 YEARS FROM FIXTURE INSTALLATION

SAVINGS PER FIXTURE

175 kWh per year

LABOR/MATERIAL COSTS AVOIDED

\$1.8M every five years

FIXTURES INSTALLED

1,273

CAPITAL COST SAVINGS

\$483,000

LIFETIME ELECTRICITY SAVINGS (MWH)

1,561

CO₂e AVOIDED (METRIC TONS)

1,104

BENEFITS BEYOND ENERGY SAVINGS

capital cost savings, longer fixture lifetime and reduced downtime, improved worker and rider safety, increased resiliency, fewer train delays and missed days of work, more uniform and brighter lighting, and improved emergency response capabilities

KLD Engineering — developed Adaptive Control Decision Support System, a traffic control system

71 million tons Average annual CO₂e produced 1990–2016 by motor vehicle traffic in New York

PRELIMINARY TESTS AND SIMULATIONS AT 4 STATEN ISLAND INTERSECTIONS

8-40% TRAVEL TIME REDUCTION

varies by jurisdictions & initial intersection conditions

REDUCTION IN VEHICLE STOPS

6%

DECREASE IN VEHICLE DELAYS

7%



REDUCTION IN FUEL CONSUMPTION

6%

3% EMISSION REDUCTIONS

Potential improvements to **traffic safety** for bicycles, pedestrians, and cars



bus transit flow **improved**

congestion **reduced**

transportation time **reduced**

BENEFITS BEYOND ENERGY SAVINGS

Adaptive traffic control systems allow vehicles to clear intersections at uniform speeds, improving predictability of traffic flow and safety for all users.

Learn more.

Visit nyserdera.ny.gov/transportation or email transportation@nyserdera.ny.gov

Innovation & Research Evaluations

DEMONSTRATION

Many of NYSERDA’s innovation investment areas include technology demonstration projects as a means to test the efficacy, performance, and application of new technologies prior to their scale to commercialization. An evaluation of NYSERDA demonstration projects completed between 2014 and 2018 was undertaken to verify and quantify impacts from the funded demonstrations and their associated replication activity.

Data sources for this evaluation study included web-based surveys, in-depth telephone interviews, and project documentation. A standardized set of impact metrics and valuation methods was used across all projects sampled so that the impacts of both the direct demonstration projects and their subsequent replications could be monetized.

Evaluation results indicate that \$47 million in NYSERDA demonstration project funding led to \$155 million of annual monetized benefits from demonstrations and replications, or an annual return of \$3.30 for every NYSERDA dollar invested. Though the lifetime of benefits is somewhat uncertain, a 10-year lifetime would lead to more than \$1.5 billion in monetized benefits. The majority of monetized benefits come from replication projects, specifically “other impacts,” which were mainly driven by operations and maintenance benefits but also include knowledge creation, labor, marketability, and power quality/reliability.

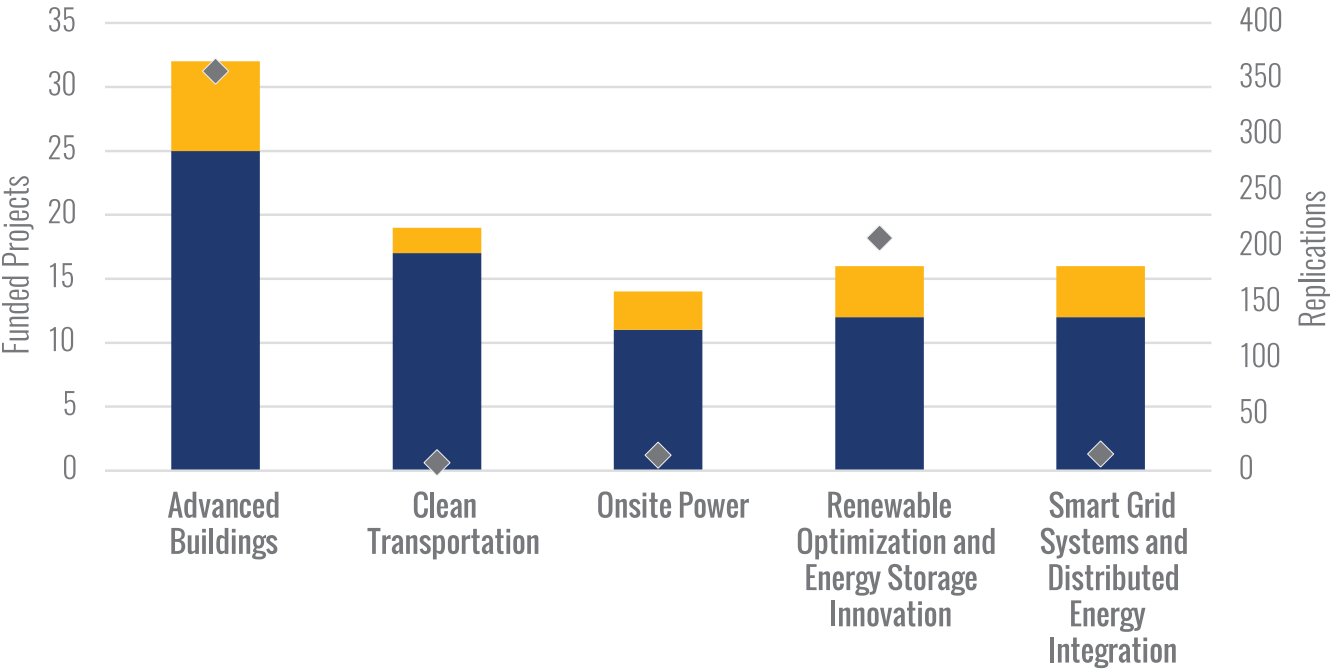
ANNUALIZED MONETIZED IMPACTS FROM INNOVATION DEMONSTRATION AND REPLICATION PROJECTS

Impact Metric Category	Demonstration Project Impacts	Replication Project Impacts	Total Impact
Emissions Reduction	\$307,000	\$573,000	\$880,000
Electricity Impacts	\$582,000	\$1,517,000	\$2,099,000
Financial Impacts	\$2,156,000	\$7,796,000	\$9,952,000
Fuel Impacts	\$497,000	\$385,000	\$882,000
Other Impacts	\$5,390,000	\$133,496,000	\$138,886,000
Power Impacts	\$2,195,000	\$311,000	\$2,506,000
Waste Management	\$210,000		\$210,000
Total annual impacts	\$11,337,000	\$144,077,000	\$155,414,000

The evaluation also examined the frequency of reported replications by innovation programs. The most reported replications come from Advanced Buildings followed by Renewable Optimization and Energy Storage Innovation. In all programs, the replications are coming from a small proportion of funded demonstration projects; out of 150 total demonstration projects, 20 projects (13%) drove the 601 replications that occurred, with replication happening more frequently in the Advanced Building Program.

DEMONSTRATION PROJECTS AND REPLICATIONS

- Respondent Projects without Replications
- Respondent Projects with Replications
- ◆ Number of Replications



INNOVATION CAPACITY AND BUSINESS DEVELOPMENT EVALUATION

A baseline and market evaluation for the Cleantech Startup Growth and Manufacturing Corps (M-Corps) Initiatives was completed in 2018. The evaluation confirmed the need for and identified early successes of these initiatives as well as additional challenges to be addressed.

- NYSERDA's incubator strategy helped accelerate the growth of cleantech startups in New York State.
 - During the baseline period, the participating cleantech companies reported raising a substantial amount of capital, more than \$100 million.
 - There has been a considerable decrease in commercialization time for participating client companies compared to nonparticipating companies.
- Many participants struggle to achieve profitability.
 - About 63% reported no revenues and nearly 40% noted securing financial capital was their main challenge and would like additional help.
- Finding suitable mentors and/or coaches can be a challenge.
 - Staff from three incubators reported difficulties in recruiting mentors or coaches who are effective in leading companies to succeed or willing to devote the time for coaching at no or low cost.

ENERGY-RELATED ENVIRONMENTAL RESEARCH CITATION ANALYSIS

NYSERDA continued its long-standing effort to evaluate the level of citations of energy-related environmental research work in academic journals, completing the latest citation analysis in 2018. Citation analysis supports a key objective of the initiative to provide policymakers and decision-makers with defensible, science-based information to guide and evaluate efforts to improve public health and environmental quality.

Select key findings from the analysis included:

- Between 1998 and 2018, papers attributed to 949 authors were identified 12,244 times in citing papers, which were then cited 318,238 times. The 2018 analysis shows the intellectual reach increased more than four-fold since 2013 when only 76,384 citations resulted from 5,833 citing papers.
- As of 2018, 93% of funded papers had been cited at least once, consistent with prior analyses.
- Funded research is reaching more journals. Since 2009, the number of journals including funded papers increased from 43 journals to 102 in 2018.
- More journals are representing the bulk of citations, suggesting greater diffusion of funded papers in literature. In 2009, nine journals represented two-thirds of all citations; by 2018, this had increased to 21 journals.

End Notes

- 1 <https://www.thesolarfoundation.org/solar-jobs-census/factsheet-2019-ny/>.
- 2 NYSERDA: Statewide Completed Solar Projects, data through December 31, 2019:
<https://www.nysERDA.ny.gov/All-Programs/Programs/NY-Sun/Solar-Data-Maps/Statewide-Projects>.
- 3 The NY-Sun program does not determine the delivery or use of energy (MWh) from projects that receive funding, and NYSERDA makes no claim to the environmental attributes of that energy. Generation from NY-Sun–funded projects may be used by customers for their own voluntary use or used toward meeting state requirements to deliver renewable energy to electricity customers in New York, depending on ownership of the renewable energy certificates from those projects.
- 4 Per the Clean Energy Advisory Council (CEAC) Metrics, Tracking and Performance Assessment (MTPA) Working Group, NYSERDA has adopted a marginal electricity grid emission factor of 1,103 pounds CO₂e/MWh for projects completed after 2015 (<http://documents.dps.ny.gov/public/MatterManagement/MatterFilingItem.aspx?FilingSeq=190731&MatterSeq=50399>). Projects completed prior to 2016 will maintain the 1,160 pounds CO₂e/MWh previously used, based on analysis of grid emissions at that time.
- 5 Note that the megawatt-hours referenced are estimated amounts based on a statewide capacity factor. NYSERDA does not, by filing this report, make any claim to the environmental attributes associated with those megawatt-hours.
- 6 See NYSERDA's CEF Annual Metrics and Financial Report, Appendix A: Program Performance Summaries for initiative level detail.



State of New York

Andrew M. Cuomo, Governor

New York State Energy Research and Development Authority

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