2026-2030 Innovation and Research Proposal

NEW YORK STATE ENERGY RESEARCH AND DEVELOPMENT AUTHORITY (NYSERDA)

12-20-2024

NEW YORK STATE | NYSERDA
New York State Energy Research and Development Authority

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Acronyms and Abbreviations

AGILe	Advanced Grid Innovation Laboratory for Energy
AI	Artificial Intelligence
ATWG	Advanced Technologies Working Group
BIL	Infrastructure Investment and Jobs Act, most known as the Bipartisan Infrastructure Law
Btu	British thermal units
CDFI	Community Development Financial Institutions
CEF	Clean Energy Fund
CEN	ClimateTech Expertise Network
CHIPS	Creating Helpful Incentives to Produce Semiconductors
CIP	Compiled Investment Plan
Climate Act	Climate Leadership and Community Protection Act
ConEd	Consolidated Edison
DACs	Disadvantaged Communities
DER	Distributed Energy Resource
DLR	Dynamic Line Rating
DOE	Department of Energy
DPS	Department of Public Service
EIR	Entrepreneur-in-Residence
EFER	Energy Focused Environmental Research
EM&V	Evaluation, Measurement, and Verification
EPRI	Electric Power Research Institute
EV	Electric Vehicle
GETs	Grid Enhancing Technologies
GHG	Greenhouse Gases
GIS	Geographic Information System
GW	Gigawatt
HVAC	Heating, Ventilation, and Air Conditioning
I&R	Innovation and Research
IRA	Inflation Reduction Act
ITWG	Interconnection Technical Working Group
kWh	Kilowatt-hour
LDES	Long-Duration Energy Storage
M-Corps	Manufacturing Corps
MHDV	Medium- and Heavy-Duty Vehicle
MW	Megawatt
NYC	New York City
NYISO	New York Independent System Operator
NYPA	New York Power Authority
NYS	New York State
NYSERDA	New York State Energy Research and Development Authority
OEM	Original Equipment Manufacturer
OSW	Offshore Wind
OSW Consortium	National Offshore Wind Research and Development Consortium
PEMC	Power Electronics Manufacturing Consortium
PSC	Public Service Commission
PON	Program Opportunity Notice
R&D	Research and Development

RAPID Act	Renewable Action Through Project Interconnection and Deployment Act
RDD&C	Research, Development, Demonstrations, and Commercialization
T2M	Technology to Market
TEN	Thermal Energy Network
TRL	Technology Readiness Level
TWG	Technical Working Group
U.S.	United States
UTEN	Utility Thermal Energy Network
UTENJA	Utility Thermal Energy Network and Jobs Act
ZAPPA	Zip Code Air Pollution Policy Assessment

1. Introduction

On September 15, 2022, the New York State (NYS) Public Service Commission (PSC or the Commission) issued the Order Initiating the New Efficiency: New York Interim Review and Clean Energy Fund Review (hereinafter referred to as the Order Initiating Reviews). The Order Initiating Reviews directed the New York State Energy Research and Development Authority (NYSERDA or the Authority) to file a post-2025 Innovation & Research (I&R) funding proposal by July 1, 2024. On May 31, 2024, NYSERDA filed a request for extension of the proposal due date to December 31, 2024, which the PSC granted on June 12, 2024. This proposal summarizes performance of the Clean Energy Fund (CEF) I&R portfolio from initiation in 2016 through December 2023 (Chapter 2), presents a 2026-2030 I&R funding request (Chapters 3 and 4), and details the performance monitoring and evaluation approach (Chapter 5). The proposed 2026-2030 I&R portfolio includes suggested modifications, improvements, and enhancements informed by past performance and lessons learned from the CEF portfolio and considers emerging needs identified through external research and market analysis. The objective of this 2026-2030 I&R proposal is to optimize NYSERDA's role within the evolving innovation landscape by developing the portfolio to respond to market needs, while maintaining a strong focus on driving affordability and reliability outcomes for ratepayers.

1.1. Background

In 2016, the PSC issued the first CEF Order, establishing the I&R portfolio, and providing direction by distinguishing five focus areas. As part of the triannual review process, NYSERDA submitted a petition assessing the first three years of the CEF in 2020. The PSC responded to NYSERDA's petition in 2021 with the "Order Approving Clean Energy Funding Modifications," outlining a revised set of nine focus areas, and new guidance on how NYSERDA, through the CEF, should drive innovation, engage the market, and align with State policy. Recommendations in this proposal regarding the 2026-2030 I&R portfolio account for the orders and petition in Table 1.

Table 1: Relevant Public Service Commission orders and NYSERDA petition

Name	Date	Description
PSC Order Authorizing the Clean Energy Fund Framework	January 21, 2016	• The CEF Authorizing Order directed NYSERDA to establish four CEF portfolios—New York Green Bank, New York Sun, Market Development, and I&R—with the purposes of advancing clean energy in NYS and delivering positive environmental impact, economic growth, and collaboration among stakeholders. • The Order stated I&R would fund programs in five focus areas: (1) Smart Grid Systems; (2) Renewables and Distributed Energy Resource (DER) Integration; (3) Buildings Innovation; (4) Transportation; and (5) Innovation Capacity and Business Development.
NYSERDA Petition Regarding Clean Energy Fund Triennial Review	December 29, 2020	• NYSERDA submitted a petition to the PSC assessing three years of CEF performance. • The petition noted market evolutions in the NYS energy landscape, such as the transition away from natural gas; deeper decarbonization aspirations; greater emphasis on supporting disadvantaged communities (DACs)[1] and low- and moderate-income customers; elevated focus on green jobs and economic development; and more targeted technology and resource offerings.

[1] Per the Climate Act, "disadvantaged communities" are defined as communities that bear burdens of negative public health effects, environmental pollution, impacts of climate change, and possess certain socioeconomic criteria, or comprise high-concentrations of low- and moderate- income households.

PSC Order Approving Clean Energy Funding Modifications	September 9, 2021	• The Order adjusted CEF's goals and metrics framework to better align with State policy objectives and improve performance.
		• The Order indicated that NYSERDA would drive innovation by providing funding for cutting edge technology development, demonstrations, and early-stage companies through incubators, accelerators, prize competitions, energy-related environmental research studies, and similar programs that enable a green economy.
		• The Order expanded the I&R portfolio to nine focus areas by:
		  ○ Renaming four focus areas (1) Smart Grid Systems to Grid Modernization, (2) Renewables and Distributed Energy Resource (DER) Integration to Renewables Optimization, (4) Transportation to Clean Transportation Innovation and (5) Innovation Capacity and Business Development to Technology to Market.
		  ○ Retaining focus area (3) Buildings Innovation.
		  ○ Adding four new focus areas: (6) Energy Focused Environmental Research (7) Negative Emissions Technologies, (8) Gas Innovation, and (9) Climate Resilience Innovation.
		• In line with the requirements of the Climate Leadership and Community Protection Act (CLCPA or Climate Act), the Order established a commitment for CEF to ensure that DACs receive at least 35% of overall benefits of future spending.[2]

1.2. Summary of Requests and Proposal

In response to the directives set forth in the Order Initiating Reviews, NYSERDA presents this proposal for consideration, including portfolio requests and reaffirmation requests to more effectively advance the State's energy and climate goals.

Portfolio Requests

- NYSERDA proposes a total I&R portfolio funding authorization of **$394.3 million for the 2026 to 2030 period** (Table 2). This proposed total includes $317.6 million in programmatic funds across seven focus areas and a reserve. The remaining $76.7 million is to be used for program administration, including labor, non-labor administrative costs, and external evaluation, measurement, and verification (EM&V) activities. Administrative cost details and a proposed expenditures schedule are in Chapter 3; focus area and activity details are in Chapter 4.
- NYSERDA proposes that the I&R portfolio be subject to the following portfolio level targets realized from the full investment of authorized funding, measured as cumulative benefits: $1.7 billion in leveraged funds; 110 commercialized products; and 570 in demonstration replications. Details and definitions of these proposed targeted are outlined in Chapter 3.
- NYSERDA proposes moving from the current Compiled Investment Plan (CIP) approach to an annual **Operating Plan**, which will provide greater standardization, transparency, and improved operational flexibility. Key changes associated with the Operating Plan include:
  - Standardize output, outcome, and impact metrics across all portfolio activities to reflect both leading and lagging performance indicators.
  - Add an annual review to evaluate progress and forecasts and re-calibrate programmatic approaches.
  - Expand formal portfolio targets beyond leveraged funds to include commercialized products and demonstration replication outcomes.
- Consistent with NYSERDA's overall support for DACs and with the NYS Department of Public Service (DPS) Staff guidance on DAC reporting, **it is proposed that any place-based[3] I&R**

[2] The NYS DPS Office of Markets & Innovation Clean Energy Guidance, issued September 27, 2023. The guidance indicates that for dollars spent through place-based programs or investments, DACs shall receive no less than 35%, with a goal of 40%, of the overall benefits of spending on clean energy and energy efficiency programs. State- or system-wide investments are designed to meet the overall needs of the State's energy infrastructure or other system-wide grid objectives and are not accounted for from a 35% compliance standpoint.

[3] Place-based programs and investments are to be accounted for where initiatives can be prioritized or targeted to individuals, households, businesses, and other entities within specific geographic areas (e.g., census tract or county).

projects be transparently accounted for in terms of their DAC investment and benefits. While the I&R portfolio is largely focused on state- or system-wide investment and benefits, place-based investment may occur through certain types of projects such as demonstrations. Rather than setting a percent DAC investment target for the I&R portfolio, any place-based I&R investments will serve to complement NYSERDA's other portfolios which are better able to target individuals, households, businesses or other entities in specific geographic areas, and are already delivering significant benefits to DACs. I&R programs will also enhance collaboration with local communities to communicate the risks and benefits of new technologies, identify opportunities to site demonstration projects in DACs, and report on these engagement efforts to support the goals of the Climate Act.

Table 2: 2026-2030 Innovation and Research portfolio funding allocation by focus area

2026-2030 Innovation & Research Focus Areas	$ (M)	Total % of Portfolio Funds
Programmatic Funding		
Grid Modernization	66.5	16.9%
Commercialization & Ecosystem	57.5	14.6%
Advanced Buildings & Processes	47.5	12.0%
Power Generation & Storage	39.0	9.9%
Fuels Transition	37.5	9.5%
Clean Transportation Innovation	31.0	7.9%
Energy Focused Environmental Research	23.5	6.0%
Reserve Funds	15.1	3.8%
Total Programmatic Funding	**317.6**	
Administrative Funding		
Labor Costs	53.2	13.5%
Non-Labor Administrative Costs	14.0	3.6%
Evaluation Measurement & Verification (External)	9.5	2.4%
Total Administrative Funding	**76.7**	
Portfolio Total	**394.3**	

Reaffirmation Requests

- Maintain **operational flexibility** in the 2026-2030 I&R portfolio by allowing budget adjustments within +/-20% of the originally authorized amounts, ensuring responsiveness to market needs and transparency through annual report.
- Operate the I&R portfolio on a **fuel neutral basis**.
- Provide **annual briefings to the Commission** on the status of the I&R portfolio.
- File an **annual I&R portfolio cash flow analysis** no later than 60 days after the end of each calendar year.
- Maintain reporting cadence:
    - Quarterly reports which will focus on activity and output metrics
    - In addition to the new proposed operating plan, NYSERDA will continue to submit an **annual report** which provides detailed outcomes and impact of programs and portfolio
- Maintain **EM&V budget** to fund evaluation studies that inform broader program impacts and operational improvements.

1.3. Policy Context

The proposed 2026-2030 I&R portfolio aligns with State policies to advance clean energy solutions that enable system-wide affordability and reliability while driving toward a sustainable and more resilient future. During the timeframe of the CEF, federal policies and programs have provided opportunities that are complementary to the proposed activities to drive innovation and investment in these areas. As federal policies evolve in the 2026-2030 period, NYSERDA seeks to leverage opportunities that are aligned with the State's energy transition goals. Policies and initiatives relevant to the I&R portfolio include those described below which enable a clean energy economy and create opportunities for innovation, including the research, development, demonstration, and commercialization (RDD&C) of technologies.

State Policies

The Climate Act, signed into law on July 18, 2019, complements existing NYS policy including Reforming the Energy Vision and the State Energy Plan. The Climate Act requires NYS to reduce economy-wide greenhouse gas (GHG) emissions from 1990 levels by no less than 85% by 2050. It also requires that 100% of electricity be zero emissions by 2040. To achieve Climate Act requirements, the State set a goal of 185 trillion British thermal units (Btu) in end-use energy reductions. New electricity generation targets include 9 gigawatts (GW) of offshore wind (OSW) energy by 2035, and 3 GW of energy storage by 2030. In June 2024, the PSC expanded the energy storage goal to 6 GW by 2030. Furthermore, the Climate Act requires that at least 35% (with a goal of 40%) of the benefits of place-based clean energy and energy efficiency investments be directed to DACs.

The Climate Act established a Climate Action Council and charged it with development of a Scoping Plan, which it issued on December 19, 2022. The Scoping Plan outlines strategies, specific actions, policies, and investments to achieve the Climate Act's goals. NYSERDA's 2026-2030 I&R portfolio enhances NYS's ability to advance progress towards the established goals by designing specific programs to advance technologies and solutions in electricity, buildings, and transportation–each of which will provide significant ratepayer benefits and require research and development (R&D).

Beyond the Climate Act, the 2026-2030 I&R portfolio will complement State and local policies that enable an equitable clean energy transition. Examples of specific policies include, but are not limited to, the Renewable Action Through Project Interconnection and Deployment Act (RAPID Act) of 2024, which creates a one-stop shop for renewable energy generation and transmission permitting. The RAPID Act has the potential to serve as a force multiplier for commercialization of innovative technologies, accelerating deployments of long-duration energy storage (LDES), and other novel zero emission generation resources. Implementing the All-Electric Buildings Law of 2023, which requires the use of zero emissions heating and appliances starting in 2029 for new buildings that are taller than seven stories,[4] will require innovative electrification solutions geared towards hard-to-electrify, large buildings. As the I&R portfolio evolves, NYSERDA will continue to monitor State and local legislative activities and adjust activities accordingly.

Federal Policies

Nationally, the Inflation Reduction Act (IRA), the Infrastructure Investment and Jobs Act (also known as the Bipartisan Infrastructure Law or BIL), and the Creating Helpful Incentives to Produce Semiconductors (CHIPS) and Science Act of 2022 authorized more than $2 trillion for new investments and programs contributing to the nation's clean energy transition. The United States (U.S.) Department of Energy (DOE) has appropriated approximately $97 billion allocated under the IRA and BIL to deploy clean energy technologies and mitigate commercial risks associated with innovative clean energy projects. The IRA primarily supports clean energy adoption by offering supply and demand-side tax credits for clean energy

[4] The All-Electric Buildings Law, available at: https://www.assembly.ny.gov/all-electric-buildings/

products, reducing market barriers, and enabling large-scale demonstrations. The BIL focuses primarily on supply-side infrastructure development, funding early-stage technologies, and funding RDD&C projects to overcome technical barriers and reduce deployment risks. Additionally, the CHIPS and Science Act promotes domestic manufacturing through public investment, driving job growth in the technology sector and strengthening stable supply chains for clean energy technologies (cleantech).[5] Together, these policies provide significant federal resources to accelerate clean energy innovation and help overcome challenges in both market adoption and technology deployment.

In early 2024, NYSERDA received two federal funding awards—$15 million from the Charging and Fueling Infrastructure program and $24 million from the Grid Resilience State and Tribal Formula Grants program, both established with funding from the BIL. The two awards will enable further deployment of electric vehicle (EV) charging infrastructure, alternative fuel infrastructure, and grid technologies in NYS. NYSERDA also enables in-state innovators to access federal resources by providing letters of support to advocate for the tax credit eligibility of new technologies and by offering co-funding from the Authority to enhance competitiveness when applying for federal funding. An example of this approach is Program Opportunity Notice (PON) 5712 for Clean Hydrogen Innovation, where NYSERDA is providing up to $5 million in co-funding to help proposers meet federal funding award cost-sharing requirements.

In the 2026-2030 I&R portfolio, NYSERDA will continue to leverage federal policies to complement our efforts, amplify funding, and scale solutions within NYS. NYSERDA will work with key federal partners in the energy sector, where appropriate, building on the Authority's 2023 Memorandum of Understanding that establishes a framework for DOE and NYSERDA to collaborate more effectively, including the exchange of information and joint efforts on relevant energy projects.[6]

1.4. Innovation Market Context

As NYS policies encourage movement towards a clean energy economy, the 2026-2030 I&R portfolio will contribute to an innovation ecosystem that accelerates progress toward State goals and objectives.

New York's Innovation Ecosystem

Innovation ecosystems are communities of interacting stakeholders engaged in producing, enhancing, and creating novel methods, products, and processes. These ecosystems provide the necessary infrastructure, resources, and environment to foster RDD&C of novel solutions. Looking ahead, innovation ecosystems will continue to enable the transition to an equitable, clean energy economy through technology innovation.[7]

New York boasts one of the most robust innovation ecosystems in the U.S., ranked third nationally in both clean energy and technology sector jobs after California and Texas based on analysis from DOE's U.S. Energy and Employment Jobs Report and U.S Bureau of Labor Statistics,[8,9,10] and second in total

[5] Cleantech: Innovation that supports decarbonization of the economy through hardware, software, technology-enabled services, data analytics, or processes that broadly reduce energy consumption, increase resource efficiency, reduce greenhouse gas emissions, and/or enable the transition to a sustainable and decarbonized economy.
[6] MOU Announced between DOE and NYSERDA, available at: https://www.nyserda.ny.gov/About/Newsroom/2023-Announcements/2023-09-28-Governor-Hochul-Announces-Partnership-Between-US-Department-of-Energy
[7] Understanding Innovation Ecosystems, 2019, available at: https://d-lab.mit.edu/sites/default/files/inline-files/Understanding_Innovation_Ecosystems_FINAL_JULY2019.pdf
[8] 2024 U.S Energy & Employment Jobs Reports, available at: https://www.energy.gov/policy/us-energy-employment-jobs-report-useer
[9] Renewable Energy World, 2022, available at: https://www.renewableenergyworld.com/solar/u-s-states-ranked-by-clean-energy-jobs-in-2022/#gref
[10] Office of the New York State Comptroller, 2023, available at: https://www.osc.ny.gov/files/reports/osdc/pdf/report-10-2023.pdf

R&D spending after California.[11] The State promotes innovation by providing subject matter expertise, connections, convenings, and financial incentives for small businesses across industries including, but not limited to, life sciences, cleantech, and artificial intelligence (AI). For hardware-based technologies, NYS has developed more than a dozen shovel-ready sites for manufacturing and industry since 2021, incentivizing companies including Wolfspeed and Micron to grow their operations in the State. New York is home to 11 "Research 1" higher education research institutions,[12] tied with California for the most of any U.S. state, underscoring NYS as a critical player in fostering research and innovation.

New York's Cleantech Ecosystem

A holistic innovation ecosystem across the State enables a strong cleantech ecosystem. Innovation and R&D are interconnected and crucial for accelerating technology development and achieving climate goals. New York is home to over 650 cleantech small businesses, making it the second largest hub in the U.S. after California.[13] In 2023, New York City (NYC) ranked as the second most active cleantech venture capital investment ecosystem in the U.S. and the fourth most active globally, with cleantech making up 11.4% of investments.[14] Despite the high ranking, both national and NYS cleantech investments have been recently declining, with 50% lower investment in 2023 relative to the 2021 peak of over $1 billion.[15] Complementary funding sources and technology development funding in the State can help enable continued cleantech ecosystem growth despite this recent decline.

Since the 2016 inception of the CEF, entrepreneurial and technology development support organizations (i.e., incubators and accelerators) have rapidly expanded and diversified NYS's cleantech ecosystem. NYSERDA continues to communicate and collaborate closely with partners to ensure meaningful value-add and avoid duplicative efforts.[16] Table 3 outlines a summary of the New York innovation ecosystem and the purpose of NYSERDA's collaboration across the stakeholder groups.

[11] National Science Foundation R&D Data Surveys: (Commercial – BERD Survey, Federal R&D Funding/Obligations, State – SERD Survey), available at: https://ncses.nsf.gov/surveys/federal-funds-research-development/2022-2023

[12] An institution classified as "R1" indicates the highest level of research activity in the Carnegie Classification of Institutions of Higher Education.

[13] Powerhouse Fund Analysis, 2023, available at: https://www.powerhouse.fund/climate-geography#:~:text=New%20York,-New%20York%20Climate&text=As%20the%20second%20largest%20center,tech%20startups%20in%20New%20York

[14] PWc State of Climate Tech, 2023. https://www.pwc.com/gx/en/issues/esg/state-of-climate-tech-2023-investment.html

[15] Data source: Pitchbook, Clean Energy Vertical Analysis 2016 – 2023.

[16] NYSERDA R&D Partnerships, available at: https://www.nyserda.ny.gov/All-Programs/Innovation-at-NYSERDA/RD-Partnerships

Table 3: NYSERDA's optimized engagement with various stakeholders within New York's innovation ecosystem

STAKEHOLDER GROUP	TYPES OF ORGANIZATIONS	NYSERDA ENGAGEMENT MECHANISMS	PURPOSE
Businesses	Entrepreneurs, early- and growth-stage companies	Provide direct funding through PONs; collaborate through RFIs & RFPs	Drive innovation through RDD&C to achieve state goals.
Government	State and federal agencies, municipalities	Collaborate with agencies to develop new programs; support NYS applications for federal funds; develop policy	Maximize impact of funding and resources for energy transition.
Investors	Angel investors, venture capitalists, private equity firms, banks/CDFIs, public and private utility investors, corporate and strategic partners	PON review committee participation; encourages new investment in businesses	Scale ratepayer dollars and leverage capital.
Research & Education	Academic institutions, national laboratories, accelerators and incubators, venture development organizations.	Provide technical assistance and business support; support research and studies	Strengthen ecosystem by supporting research, development, and training.
Community and Non-Governmental Organizations	Advocacy groups, policy experts	Research and studies to support policy development; stakeholder engagement	Inform and support policy development for climate goals.

1.5. NYSERDA's Role and Place in the NYS Innovation Ecosystem

Through optimized engagement with these stakeholders, NYSERDA creates value and provides benefits to ratepayers by:

- **De-risking technology development and deployment**: NYSERDA provides non-dilutive capital to invest across various sectors, taking risks that traditional investors often avoid. This funding mechanism does not require businesses to give up equity. By reducing barriers to market entry for new technologies—from early R&D to commercialization—NYSERDA can enable aspects of the energy transition that may not otherwise happen in NYS.
- **Speeding and scaling the energy transition**: Through the operation of innovation programs and validation of technology through accelerators, incubators, and RDD&C projects, NYSERDA accelerates the energy transition. This allows NYS to achieve its energy goals sooner while maintaining a reliable system and accomplishing the energy transition on a larger scale than market forces alone could achieve.
- **Improving ultimate ratepayer affordability**: NYSERDA acts as a co-investor with industry partners, providing funding that aligns with long-term goals. This approach helps reduce the overall cost of NYS's energy transition, making technologies available in the market sooner and at lower costs, improving affordability for ratepayers.
- **Enabling greater co-benefits**: NYSERDA's funding for the development and deployment of innovative technologies helps shape the trajectory of the State's energy transition to achieve greater co-benefits. This includes building out the necessary supply chains, robust manufacturing, and encouraging workforce development within the State.
- **Aligning innovation ecosystem to policy goals**: NYSERDA acts as a partner to bring high-risk, high-reward technologies to market and serves as a voice and liaison between regulators and companies. This ensures that emerging technologies align with policy goals and provides funding for companies with technology solutions that have benefits for ratepayers but also carry higher risks.

NYSERDA's Roles in the Ecosystem

The Authority actively funds cleantech R&D and has increasingly focused on demonstration and commercialization. NYSERDA provides value by playing three primary roles:

- **Choreographer** | NYSERDA is a connector, coordinating and convening essential activities and functions to enable innovation in NYS, ensuring they are executed by the most suitable partner(s).
- **Catalyst** | NYSERDA is a market transformer who motivates the private sector to act and invest in products, technologies, and solutions required to meet NYS's decarbonization targets.
- **Actor** | NYSERDA delivers programs and activities directly to the market, providing funding to individuals, entities, projects, and activities to develop and deploy technologies that will enable NYS to meet decarbonization targets.

Program Planning and Development Criteria

For cleantech innovation and research, NYSERDA deploys a range of programs in the market. When designing and implementing programs, NYSERDA validates that programs meet following criteria to ensure appropriate use of ratepayer funds across the portfolio:

(1) **NYS Market Need** | the intervention addresses a proven market need;
(2) **NYSERDA's Role** | NYSERDA is uniquely positioned to or can partner to fill the need;
(3) **Non-Duplication** | there is no duplication of efforts in the market and,
(4) **Ratepayer Suitability** | the work meets the requirements of the funding source and provides benefits to ratepayers, such as improving functionality, reducing cost, lowering energy consumption and costs, and contributing to economic growth and job creation.

Intervention Typologies

In the I&R portfolio, NYSERDA offers services to the market through a set of distinct intervention typologies. In the 2026-2030 I&R portfolio, NYSERDA proposes to consolidate the current eight intervention typologies into four. NYSERDA has organized these proposed intervention typologies to align with its broader activities and reflect technology readiness levels (TRLs), a metric describing a technology's maturity. They range from early-stage research (TRL 1-3), through development (TRL 4-6), demonstration (TRL 7-8), and commercialization and deployment (TRL 9). Table 4 defines the 2026-2030 I&R intervention typologies, illustrates alignment with the current ones, and provides examples of services offered under each. This proposal uses the simplified, 2026-2030 intervention typologies for continuity when describing both past and future programs.

Table 4: Innovation and Research portfolio intervention typologies and services provided

2026-2030 I&R Intervention Typology	Current Intervention Typology	Definition and Relevant TRLs	Example Services Covered Under Typology 2026-2030
Research and studies	• Technology Feasibility Assessment • Information Dissemination • Research Study • Policy Development Support	*TRL 1-9* • Studies relevant to the development and deployment of clean energy technologies. • Policy research and guidance. • Regulatory research and guidance.	Feasibility studies, engineering studies, simulation modeling, technoeconomic analyses, benefit-cost assessments, policy research reports, roadmaps.
Development and lab-scale prototyping (development)	• Product Development	*TRL 3-6* • Technical assistance relevant to creating or improving new energy technologies.	Technical assistance with prototyping, testing, and manufacturing products to optimize design, product engineering and design, manufacturing support, lab-scale testing, and assessments.

Pilots, sub- and full-scale demonstrations (demonstrations)	• Demonstration Projects	*TRL 7-8* • Testing technologies in a real-world setting.	Site selection, permitting and regulatory compliance, measurement and verification financial assistance, engineering, procurement, and construction, measurement and verification, third-party validation, and assessments.
Commercialization services	• Business Support • Ecosystem Support	*TRL 3-9* • Business support relevant to developing and deploying new clean energy technologies.	General services to companies include assembling management teams, grant writing assistance, investor pitch improvement, business structure advice, financial strategy formulation, scaling and manufacturing roadmaps, and customer discovery. Additional assistance to the entrepreneurial support organizations to benefit the ecosystem.

Building on these foundational roles and criteria, Chapter 2 presents specific accomplishments and outcomes NYSERDA's investments have yielded in cleantech and innovation ecosystem growth through the I&R portfolio.

1.6. Provision of Benefits to Disadvantaged Communities

NYSERDA will track and report on place-based I&R activities, such as demonstration projects, to support Climate Act goals. Where feasible, demonstration projects will be sited in DACs to deliver meaningful benefits. For state- or system-wide I&R investments, NYSERDA will identify and characterize potential DAC benefits where possible, such as those related to energy system resilience and environmental justice. NYSERDA will ensure alignment with DPS CLCPA-Disadvantaged Communities Investment and Benefits Reporting Guidance as part of its statewide reporting efforts.

2. Performance of the I&R Portfolio to Date

2.1. Portfolio Summary

NYSERDA conducted a quantitative and qualitative assessment of the CEF I&R portfolio from 2016 through 2023[17] to shape recommendations for the 2026-2030 I&R portfolio. The assessment consists of a review of all focus areas and initiatives, considering financial metrics (commitments and expenditures), performance metrics (outputs and outcomes), and findings from relevant evaluations.[18] The subsequent sections summarize the key accomplishments and challenges for the portfolio and by focus area and offer implications for the proposed future portfolio.

2.2. Funding Allocations & Investments to Date by Focus Area

The $623 million CEF I&R programmatic budget is allocated as represented in

*Table 1*5. As of December 2023, $490 million had been committed, including nearly $254 million which has been expended, across the nine portfolio focus areas.

[17] The data extends through calendar year 2023, as it is the most recent complete year available at the time NYSERDA developed this proposal.

[18] Additional metrics can be found via the Clean Energy Fund Compiled Investment Plans, Case Number 14-M-0094, Filed February 28, 2024, available at: https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={206FF18D-0000-C15B-B29D-8E1A3BCE0AE6}

Table 1: Innovation and Research portfolio budget, commitments, and expenditures as of December 2023

I&R Focus Area	Focus Area Budget ($M)*	Total Planned Funding ($M)*	Funding Committed ($M)	Funding Expended ($M)	% Committed	% Expended
Technology to Market	$141.0	$131.1	$130.5	$89.1	99.5%	67.9%
Grid Modernization	$134.0	$133.5	$116.7	$68.6	87.4%	51.4%
Buildings Innovation	$75.0	$75.0	$68.0	$14.6	90.7%	19.5%
Renewables Optimization	$62.0	$62.0	$57.7	$29.5	93.1%	47.6%
Clean Transportation Innovation	$54.4	$54.4	$31.2	$16.1	57.5%	29.7%
Energy Focused Environmental Research	$47.8	$47.8	$41.1	$29.8	85.9%	62.4%
Gas Innovation	$40.0	$40.0	$24.4	$1.2	61.0%	3.0%
Negative Emissions Technologies	$32.0	$17.6	$17.0	$3.5	96.5%	19.6%
Climate Resilience Innovation	$20.0	$8.8	$3.3	$1.3	38.3%	14.4%
Reserve	$16.8	-	-	-	-	-
Total	**$623.0**	**$570.2**	**$490.0**	**$253.6**	**85.9%**	**44.5%**

*Budget and Planned Funding values are from the CEF CIPs, Case Number 14-M-0094, Filed August 1, 2023, page 426. Totals may not sum due to rounding.

2.2.1. CEF I&R Performance Monitoring and Metrics

NYSERDA tracks and evaluates a range of data on outputs, outcomes, and impacts to understand the performance of the I&R portfolio programs. This process also ensures compliance with the CEF Authorizing Order, which directs NYSERDA to file quarterly and annual progress and performance reports.

Leveraged Funding Target

One of the targets set by the CEF Authorizing Order is to "mobilize clean energy investment of $20 billion." This target applies to the combined CEF portfolios (New York Green Bank, New York Sun, Market Development, and I&R), and NYSERDA tracks and reports this as acquired leveraged funding. As of December 2023, the I&R portfolio had contributed $3.5 billion in cumulative acquired leveraged funding towards this overarching CEF target. This achievement represents 87% of the I&R plan to deliver $4.1 billion in cumulative acquired leverage by 2023.

Achievement of Outputs and Outcomes

The CEF CIP outlines detailed expectations for the initiatives within each focus area. Table 6 summarizes by focus area the outcome metrics for these initiatives. Actuals represent reported values from NYSERDA's CEF Annual Report through December 31, 2023, unless noted in parenthesis which are updated December 2023 actuals available from additional/lagged data collection or as reported for certain metrics that did not have an associated target.

The I&R portfolio aggregate achievement has exceeded targets for all six metrics based on the most complete data available, and for five out of six metrics based on data previously reported in NYSERDA's CEF Annual Report for 2023. Total values represent substantial activity undertaken by the I&R portfolio through hundreds of projects and thousands of engaged organizations. This activity and engagement resulted in more than 200 commercialized products, 985 replications of demonstrated technologies, and $20 million in product revenue. Intellectual property and reach are reflected in nearly 250 publications.

At the focus area level, Grid Modernization, Renewables Optimization, Technology to Market (T2M), Gas Innovation, and Energy Focused Environmental Research (EFER) have exceeded all their targets, whereas Buildings Innovation, Negative Emissions Technologies, and Climate Resilience Innovation made progress in many areas but fell short of meeting all targets.

Achievement of Impact

NYSERDA has undertaken several evaluations to further explain outcomes and understand the broader impact of the I&R portfolio. NYSERDA examined replications of demonstrations to further quantify impacts in an evaluation of projects completed in 2014-2018, largely before the CEF time period but indicative of expectations, nonetheless. This evaluation found that NYSERDA investment of $47 million in demonstration projects led to benefits from those demonstrations and their associated replications of greater than $155 million, giving an annual return of $3.32 per NYSERDA dollar invested.[19]

NYSERDA's evaluations have provided insights into these outcomes and broader commercialization and economic impacts. A recent product development evaluation found that from 2016-2020, NYSERDA invested $109 million in product development, leading to the successful commercialization of 38 products. Beyond sales and revenues, 18 of these products supported nearly 1.4 trillion Btus of annual energy savings through 2021.[20] Due to the lag in commercialization benefits, this evaluation included projects that pre-date CEF, but results are representative of the outcome and impact associated with NYSERDA's investment in product development.

A macroeconomic modeling evaluation of Buildings Innovation, Grid Modernization, and Clean Transportation Innovation focus area investments and leveraged funding estimated significant economic benefits from early CEF investments, including generating 664 average annual jobs, $2.5 billion in gross state product and $1.3 billion in disposable personal income.[21] These impacts are expected to grow as NYSERDA continues to evaluate I&R program results.

[19] NYSERDA Innovation & Research Demonstration Project Impact Evaluation, 2020, available at: https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Publications/PPSER/Program-Evaluation/2020-Innovation-Research-Impact-Evaluation-Final-Report.pdf

[20] NYSERDA Product Development Impact Evaluation Final Report, 2024, available at: https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Publications/PPSER/Program-Evaluation/Transportation/Matter-No-1602180NYSERDA-Product-Development-Impact-Evaluation-Report-Dec-2024.pdf

[21] ICF Economic Impacts from NYSERDA's Innovation & Research Portfolio 2022, available at: https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Publications/PPSER/Program-Evaluation/2022-Innovation-and-Research-Portfolio-Economic-Impact-Analysis.pdf

Table 6: Innovation and Research outcome targets and actual values by focus area.

	Committed Projects		Organizations Engaged		Products Commercialized		Product Revenue		Replications		Publications	
Focus Area	*CIP Target*	*Actual*	*CIP Target*	*Actual*	*CIP Target*	*Actual*	*CIP Target*	*Actual*	*CIP Target*	*Actual*	*CIP Target*	*Actual*
Technology to Market	46	105	1,070	1,582	88	186		(3)				
Grid Modernization	120	128	111	117		(8)		(13)		(186)		
Buildings Innovation	95	73 (78)	126	90	11	8	32	19	310	985		
Renewables Optimization	98	117	77	131		7 (11)		1				
Clean Transportation Innovation	35	27 (65)	76	71		(6)		(3)	6	(598)	4	2
Energy Focused Env. Research		(99)									90	245
Gas Innovation	2	13	12	13								
Negative Emissions Technologies	5	4 (5)	609	516	1							
Climate Resilience Innovation			1									
Total	401	467 (610)	2,082	2,520	100	201 (219)	32	20 (39)	316	985 (1,769)	94	247

Parenthetical values are additional, lagged progress data through December 2023 that became available after the close of the reporting period, or available data collected from NYSERDA award recipients for which a target did not exist in the CIP. Totals may not sum due to rounding.

2.3. Technology to Market Performance

Under the T2M focus area, NYSERDA enhances cleantech innovation ecosystem that enables the maturation and scale of new startup ventures and innovative solutions designed for decarbonization outcomes that benefit NYS. The activities in this focus area benefit a range of ecosystem actors, with an emphasis on early-to-mid stage companies, investors, manufacturers, entrepreneurs, solution adopters, and policy makers and regulators. Under CEF, T2M is the second-largest focus area in terms of total funding allocated. Through T2M, NYSERDA has provided funding for **commercialization services** across six initiatives, resulting in the outcomes in Figure 1.

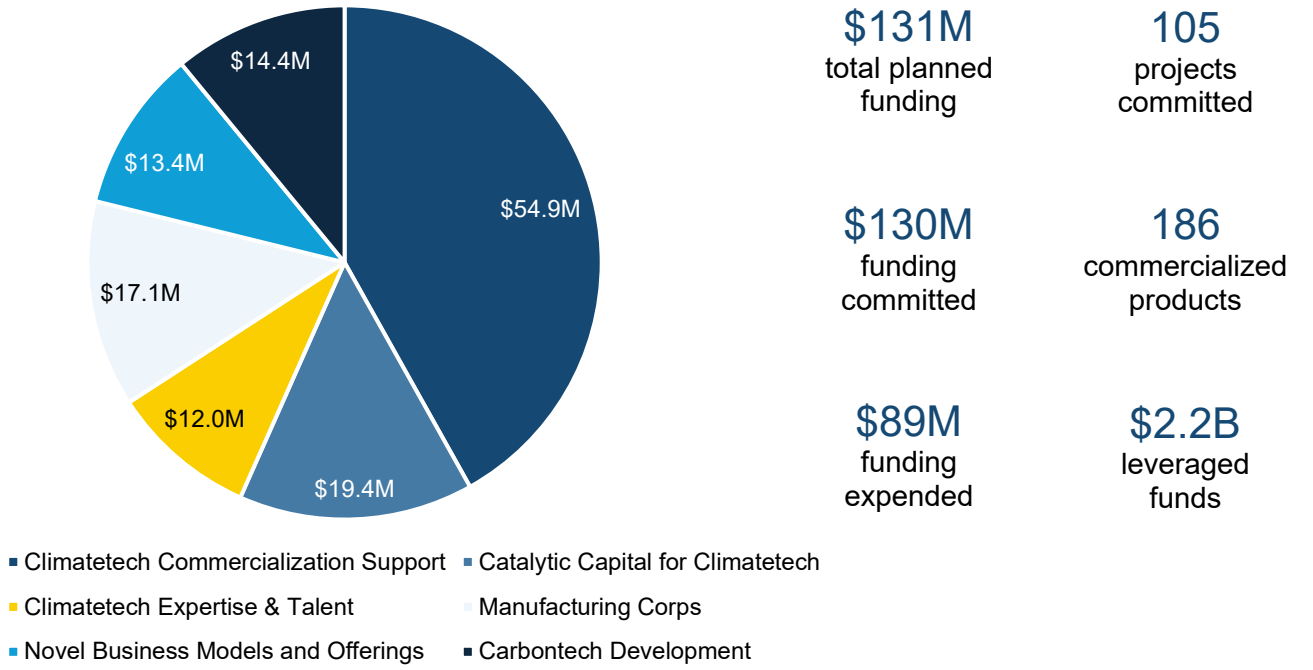


Figure 1: Technology to Market initiatives by portion of focus area budget and summary of funding and outcomes

Focus Area Background

Since T2M's inception, NYSERDA has transitioned focus from funding regional incubators to statewide programs and a range of accelerator services. Table 7 highlights this trajectory by summarizing key milestones under the T2M focus area.

Table 7: Key Technology to Market program milestones

Key Milestones	
2016 Commencement	NYSERDA launched T2M efforts with the Clean Tech Startup Growth initiative, providing funding to six regional incubators for expanded or new programming to include cleantech.
2017 Expansion	NYSERDA expanded T2M efforts by establishing the Manufacturing Corps (M-Corps) initiative, which is an accelerator program to help hard-tech cleantech start-ups establish manufacturing operations, and the Novel Business Models and Offerings initiative, which promotes innovative business models.
2019 Expansion	NYSERDA further expanded the Clean Tech Startup Growth initiative by launching Ignition Grants and a Geographic Coverage program to serve the Southern Tier of NYS. Additionally, NYSERDA provided funding to sustain the Entrepreneur-in-Residence (EIR) and Proof-of-Concept Center programs which NYSERDA initiated under Systems Benefit Charge program.

2021 Restructure	NYSERDA restructured the Clean Tech Startup Growth initiative into three initiatives to better distinguish services and target offerings to early- and growth-stage companies. The first initiative, ClimateTech Commercialization Support, absorbed incubator and accelerator work. The second initiative, Catalytic Capital for ClimateTech initiative, focused on providing direct funding and commercialization services to cleantech start-ups. The third initiative, Carbon Tech Development initiative, focused on establishing NYS as the global hub for carbon-to-value research, technology transfer, and commercialization.

Over the past six years, New York has more than doubled the number of climate-tech incubators and accelerators based in the state.[22] These organizations have been instrumental in nurturing startups by providing structured curricula and a comprehensive suite of product and business development services, including access to industry experts, partner networks, investor networks, product development facilities, and talent pools. These services enable small business growth and accelerate time to market for innovative technologies, but they require NYSERDA to be flexible in adjusting to market needs and avoiding duplication.

As of December 2023, T2M consists of six initiatives: (1) ClimateTech Commercialization Support; (2) Catalytic Capital for ClimateTech; (3) ClimateTech Expertise and Talent; (4) M-Corps; (5) Novel Business Models and Offerings; and (6) Carbon Tech Development. Appendix A.2.1 provides further information on each initiative and the programs within them.

2.3.1. Accomplishments

Under T2M, NYSERDA investments provided value to ratepayers by collaborating with regional ecosystems, enabling in-state manufacturing, and removing commercialization barriers. As of December 2023, NYSERDA realized several accomplishments, including a subset highlighted below:

Successfully built out regional cleantech innovation ecosystems and accelerated growth of these startups in NYS. NYSERDA funded more than 12 regional clean energy business incubators, fostering their growth toward financial sustainability through revenue generation and follow-on funding from Empire State Development and other sources. Participating client companies brought products to market four times faster than non-participants, representing a significant decrease in commercialization time due to NYSERDA's incubator strategy. [23] Under the ClimateTech Commercialization Support initiative, NYSERDA directed funding to the Southern Tier of New York, which lacked entrepreneurial support and expertise prior to the CEF period. According to Saoradh Enterprise Partners, the Southern Tier region ranks first in per capita employment across cleantech Innovation Hubs, just ahead of the San Francisco Bay Area.[24] NYSERDA's designs programs to align with regional market needs, providing expertise for innovative approaches to solving unique urban and rural challenges. This approach ensures product-market fit and highlights NYSERDA's role in driving economic growth and positioning NYS as a leader in the clean energy sector. With NYSERDA collaboration, the New Energy New York's partnership successfully secured $223.7 million in funding from the U.S. Economic Development Administration's Tech Hub and the National Science Foundation.

[22] NYSERDA market research
[23] Opinion Dynamics, Cleantech Startup Growth Initiative and Manufacturing Corps Study, revised April 2022, available at: https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Publications/PPSER/Program-Evaluation/2022-04-NYSERDA-Cleantech-Startup-Growth-and-Manufacturing-Corps-Report.pdf
[24] 2021 Cleantech Innovation Hubs Survey Whitepaper, available at: https://static1.squarespace.com/static/609ee19574fe1c1a16bd9fd9/t/632a0528ddb4c45b028b1237/1663698244589/SEP_2021+Cleantech+Innovation+Hubs+Survey_Whitepaper_Final.pdf

Developed an effective "voucher" program for expertise via the ClimateTech Expertise Network (CEN) and EIR programs. Through mentorship and expert advice services, the ClimateTech Expertise & Talent initiative executed 875 engagements with entrepreneurs throughout NYS. The companies in the program went on to raise $1.6 billion in follow-on funding from 2018-2023. For example, Hydronic Shell Technologies, an integrated building heating, ventilation, and air conditioning (HVAC) façade company, won $3 million in funding from Enterprise Community Partners and Wells Fargo Foundation for a pilot project with the Syracuse Housing Authority after receiving services through the CEN.

Developed an effective accelerator program to enable in-state manufacturing. With NYSERDA collaboration through the M-Corps initiative, the number of manufacturing partnership agreements executed exceeded targets by 29%.[25] M-Corps participants brought products to the manufacturing stage four times faster and generated 16 times more revenue compared to non-participants.[26] The program supported Amogy in establishing contact manufacturing agreements with PEKO Precision Products, a NYS manufacturer and provided funding for design optimization of their proprietary ammonia-to-power platform. Amogy is actively scaling their technology for use in maritime vessels, with a recent successful demonstration of an ammonia-powered tugboat in the Hudson River and raised $150 million in Series B funding.

2.3.2. Challenges, Lessons Learned, and Implications for Future Efforts

NYSERDA identified three key challenges in implementation of the T2M focus area:

Importance of maintaining flexibility to address market needs while streamlining and clarifying offerings. With the parallel development of the Incubators Program, Proof-of-Concept Centers, and Corporate Challenges Program, NYSERDA began providing similar services under multiple programs. NYSERDA will continue to streamline and differentiate offerings so that entrepreneurs and start-ups can more easily identify programs that suit their needs.

Difficulty in achieving in-state manufacturing. Startups involving manufacturing require significant capital and substantial time to mature. The program faced challenges in achieving in-state manufacturing, as companies often developed products outside of NYS and had longer lead times than anticipated. To address this, NYSERDA is aligning new program activities with supply chain partners based in NYS.

Need to achieve optimal balance between sector-agnostic and sector-specific commercialization services within the I&R portfolio. NYSERDA identified this need and recognizes that T2M was traditionally a hub for sector-agnostic services but now has an opportunity to integrate more closely with sector-specific programs to provide them with commercialization expertise that is specific to their sector. For example, The Clean Fight has offered two sector-specific cohort programs, one focused on energy storage and another on buildings, that help companies address commercialization challenges specific to each market.

2026-2030 I&R activities will build on strengths in the T2M focus area, including successful innovation and manufacturing relationships, to assist both sector-specific commercialization and the general clean energy technology ecosystem. NYSERDA also proposes adjusting the portfolio to streamline and clarify offerings. Table 8 demonstrates how NYSERDA will continue T2M implementation. For more details on 2026-2030 I&R T2M activities, refer to Section 4.2.

[25] Opinion Dynamics, Cleantech Startup Growth Initiative and Manufacturing Corps Study, revised April 2022, available at: https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Publications/PPSER/Program-Evaluation/2022-04-NYSERDA-Cleantech-Startup-Growth-and-Manufacturing-Corps-Report.pdf
[26] Ibid 25

Table 8: Proposed changes to Technology to Market focus area in 2026-2030 Innovation and Research portfolio.

Initiatives	Change to Offering	High-Level Proposed Modifications
ClimateTech Commercialization Support	**Continue** with modifications	Based on lessons learned, (1) provide funding for accelerator programs that address sector-specific challenges faced by cleantech entities; (2) given need to streamline offerings, consolidate accelerator and incubator funding under one initiative; and (3) no longer fund the Geographic Coverage offerings that provide similar benefits to the New Energy New York's Tech Hub.
CarbonTech Development	**Continue** with modifications	Based on need to streamline offerings, consolidate relevant activities under a single initiative with other incubator and accelerator programs.
ClimateTech Expertise & Talent	**Continue** with modifications	Based on success of voucher-based program, (1) maintain the CEN program as an affordable low-cost voucher system, allowing companies to access expertise they might not otherwise be able to afford and enabling better decision making; (2) expand voucher offerings to include business and technical assistance focused on addressing commercialization challenges in NYS.
Manufacturing Corps	**Continue** with modifications	Based on challenges around manufacturing, modify approach to focus on matching innovators with NYS-based supply chain partners and providing contract manufacturers with assistance to enable them to engage in more manufacturing work from cleantech-focused entities.
Novel Business Models & Offerings	**Sunset**	Based on lessons learned around streamlining offerings, no longer fund initiative and incorporate business model innovation work into accelerator program offerings, where appropriate.
Catalytic Capital for ClimateTech	**Already sunset**	• Ignition Grants and Investor, Corporate, & Customer Engagement Program have been sunset. • NY Climate Progress is in the process of closing. • Leverage lessons learned to provide (a) a voucher program for assistance to entities from specific pre-approved vendors or (b) cost-share coverage for cost-share gap from other state and federal funding requirements contingent on successful application.

2.4. Grid Modernization Performance

Under the Grid Modernization focus area, NYSERDA invests in technologies, tools, and processes that accelerate realization of a reliable, resilient, and equitable electric grid. Grid programs provide funding for innovations including technology and business model solutions to enhance existing grid infrastructure, standardized modeling and forecasting tools, and improving the interconnection and dynamic management of buildings, vehicles, and DERs. Through Grid Modernization, NYSERDA has provided funding for **research and studies**, **development**, and **demonstrations** across four initiatives, resulting in the outcomes in Figure 2.

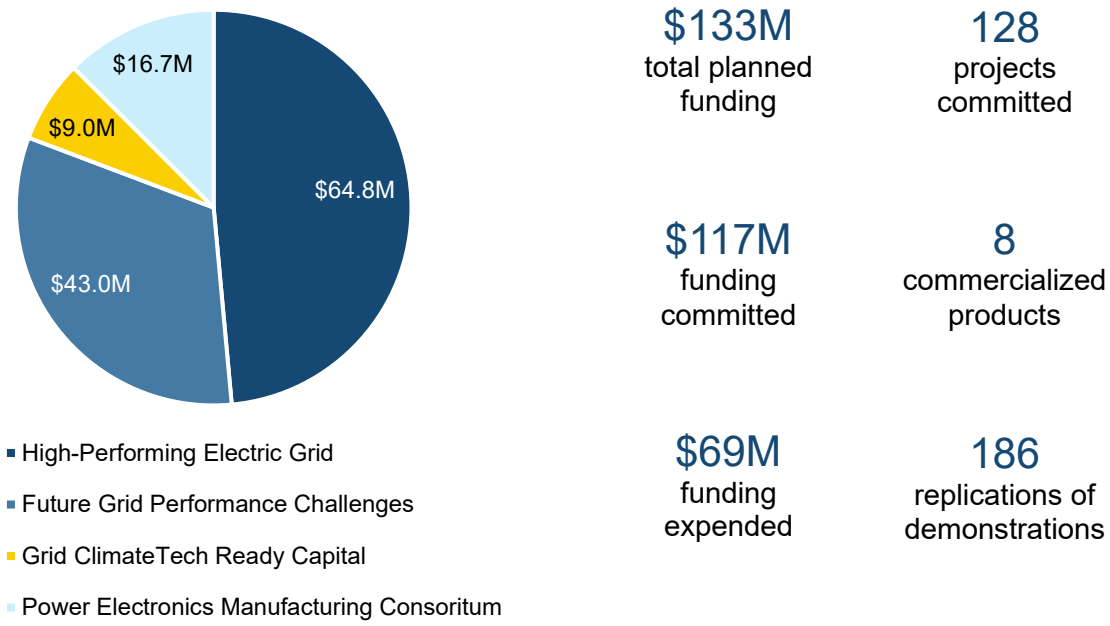


Figure 2: Grid Modernization initiatives by portion of focus area budget and summary of funding and outcomes

Focus Area Background
In 2016, Grid Modernization began with a single initiative focused on DER interconnection, which funded technologies that enable energy resources to export power to the electrical grid. This initiative evolved into the High-Performing Electric Grid initiative, which focuses on de-risking and accelerating the development of technologies that contribute to a digitally enhanced, dynamically managed NYS power grid. In 2017, NYSERDA launched the Power Electronics Manufacturing Consortium (PEMC) initiative, which funded development and manufacturing of next generation materials for use in semiconductors. Following the passage of the Climate Act, NYSERDA established two additional initiatives: Future Grid Performance Challenge, which focuses on forecasting and assessing the impact of increasing electrification on the electric grid, and Grid ClimateTech Ready Capital, which focused on enhancing grid flexibility and integration with grid-edge devices. Appendix A.2.2 provides further information on each initiative.

2.4.1. Accomplishments

Under Grid Modernization, NYSERDA investments provided value to ratepayers by driving technical performance improvements for grid enhancing technologies (GETs), enabling adoption of innovative technologies through small businesses collaboration, and enhancing performance across the system. As of December 2023, NYSERDA's success realized several accomplishments, including the subset highlighted below:

Catalyzed collaboration with stakeholders across the grid ecosystem. Through the CEF, NYSERDA provides approximately $75,000 of funding per year for key grid technical working groups (TWGs) and helps lead the Interconnection TWG (ITWG) and Advanced Technologies Working Group (ATWG). NYSERDA worked with TWG members to co-develop three demonstration projects for advanced transmission technologies including dynamic line ratings (DLR); NYSERDA subsequently provided $10 million for DLR project execution. The ITWG's analysis and recommendations have also resulted in a decision to increase the maximum standard interconnection from 2 to 5 megawatts (MW), which has the potential to reduce interconnection costs for battery energy storage and solar. Moving forward,

NYSERDA will continue to collaborate with TWGs to guide innovation efforts, ensuring that future demonstration projects have the potential for statewide scalability, and maximize benefits to ratepayers.

Evaluation efforts have also identified NYSERDA's strong relationships with utilities in the State, and ability to facilitate connections to enable product demonstrations on a broader scale. Beginning in 2015 and continuing into the CEF period, NYSERDA provided a series of awards to Micatu, Inc., an engineering product development firm focused on developing technologies to monitor power conditions on electricity lines. Micatu noted that, through connections facilitated by NYSERDA, they established pilot projects with five State utilities on an accelerated timeline.[27]

Evolved over time to a statewide "problem statement" approach to address solutions that are scalable and responsive to changing market needs. NYSERDA Grid Modernization programs initially focused on utility-specific challenges. Following the passage of the Climate Act, the Authority adopted a statewide "problem statement" approach. By defining core challenges through clear problem statements, NYSERDA provides clear market signals to innovators developing new technologies and helps investors and utilities understand emerging technologies, increasing the potential for widespread commercialization. For example, NYSERDA worked closely with Consolidated Edison (ConEd), the Electric Power Research Institute (EPRI), and ConnectDER to investigate specific problems in tracking solar contributions to load forecasts. This collaboration resulted in demonstration of 2,400 new meter collar devices that provided ConEd with solar forecasts in 15-minute intervals, improving load forecasting abilities across timescales and commercializing a new technology that is scalable across utility service territories.

2.4.2. Challenges, Lessons Learned, and Implications for Future Efforts

NYSERDA identified one key challenge in implementation of Grid Modernization activities:

Replications for grid technologies face unique non-technical barriers. Pathways to replication and commercialization must consider utility risk profiles and business models to ensure adoption of technologies that improve reliability and reduce costs. NYSERDA's 2020 Demonstration Evaluation Study[28] reported fewer replications for Grid Modernization technologies compared to other I&R portfolio areas, suggesting that grid technologies may need additional collaboration and funding to navigate the unique complexities of utility business model integration. To encourage greater deployment, NYSERDA's grid-focused demonstration projects must now include a business case analysis for multi-utility adoption and further validation of technical capabilities.

2026-2030 I&R activities will build on strengths in the Grid Modernization focus area, including extensive market engagement and collaboration with critical stakeholders, and use of the "problem statement" approach. NYSERDA proposes adjusting the portfolio to continue focusing on navigating the complexities of jurisdictional authority, non-technical barriers that arise during projects, and commercialization of technology solutions that have the potential for statewide scalability. Table 9 demonstrates how NYSERDA will continue Grid Modernization implementation. For more details on 2026-2030 I&R Grid Modernization activities, refer to Section 4.1.

[27] Industrial Economics, Inc. NYSERDA Smart Grid Evaluation Case Study: Micatu's Real-Time Voltage Sensors 2020, available at: https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Publications/Case-Studies/Micatu-Evaluation-Case-Study.pdf

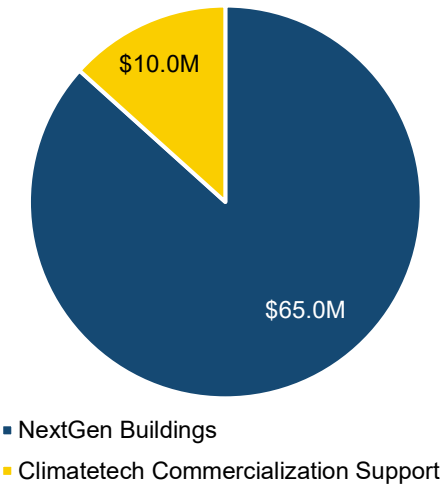
[28] NYSERDA's 2020 Demonstration Evaluation Study, available at: https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Publications/PPSER/Program-Evaluation/2020-Innovation-Research-Impact-Evaluation-Final-Report.pdf

Table 9: Proposed changes to the Grid Modernization focus area in the 2026-2030 Innovation and Research portfolio

Initiatives	Change to Offering	High-Level Proposed Modifications
Future Grid Performance Challenge	**Continue** with modifications	(1) Build on accomplishments around problem statements and statewide solutions, focus on interventions that result in commercialized products scaling in the market; (2) integrate commercialization services to address past challenges related to replicability; and (3) focus on larger-scale demonstrations to drive market adoption to maximize scalability across NYS.
High-Performing Electric Grid	**Continue** with modifications	(1) Build on strengths around utility stakeholder engagement, streamline initiative by focusing on standardization of modeling and analysis tools to; and (2) separate product development and early-stage demonstrations, moving them into other initiatives.
Grid ClimateTech Ready Capital	**Continue** with modifications	(1) Focus initiative on addressing grid flexibility needs that have statewide scalability; and (2) expand funding for grid edge device interoperability work, engaging with stakeholders to identify solutions.
Power Electronics Manufacturing Consortium	**Sunset**	Sunset funding; NYSERDA completed successful PEMC implementation and scale-up in 2019. Wolfspeed, Inc. acquired the PEMC facility in 2019, and it no longer operates as a CEF Initiative.

2.5. Buildings Innovation Performance

Under the Buildings Innovation focus area, NYSERDA focuses on accelerating the development and commercialization of innovative solutions that enable building decarbonization–buildings that are highly energy efficient and capable of interacting with the current and future electric and thermal energy grids–in NYS. The focus area addresses both existing and new buildings. Through Buildings Innovation, NYSERDA has provided funding for **research and studies**, **development**, **demonstrations,** and **commercialization services** across two initiatives, resulting in the outcomes in Figure 3.



$75M
total planned funding

78
projects committed

$68M
funding committed

8
commercialized products

$15M
funding expended

985
replications of demonstrations

Figure 3: Buildings Innovation initiatives by portion of focus area budget and summary of funding and outcomes

Focus Area Background

Under Buildings Innovation, NYSERDA has pursued two initiatives: Next Generation Buildings, which focuses on developing energy-efficient building technologies, and ClimateTech Commercialization Support via the Empire Technology Prize, which is a competitive prize program designed to develop and demonstrate clean heating solutions for tall buildings. Appendix A.2.3 provides further information on

each initiative. Since Buildings Innovation's inception in 2017, NYSERDA has evolved its work from a singular concentration on HVAC solutions that improve building performance to a comprehensive approach that considers the whole building envelope, electrification, thermal storage, improved load management, intelligent controls, and use of DERs.

2.5.1. Accomplishments

Under Buildings Innovation, NYSERDA investments provided value to ratepayers by funding early-stage demonstrations and product development, driving improved performance and cost compression of new technologies. As of December 2023, NYSERDA realized several accomplishments, including a subset highlighted below:

Catalyzed technology transfer of commercially available products to NYS, maximizing ratepayer benefit by avoiding duplicative technology development. NYSERDA strategically pursued technology transfer and motivated firms to bring high-performing technologies to NYS by providing direct funding and open access to relevant customers and demonstration sites. NYSERDA provided funding to Feedback Solutions, a Canadian company, to help them complete an early-stage dynamic ventilation control demonstration in NYS. The demonstration resulted in replications that serviced more than 15 buildings, $2 million in external follow-on funds, and increased availability of a solution that reduces HVAC energy demand in service of NYS Climate Act goals.

Identified and funded development of novel technologies focused on NYS-specific building needs. NYSERDA engaged the market to pursue innovation problems that are especially relevant to NYS's climate, building typologies, and market. NYSERDA provided product development funding to Ice Air for a first-of-its-kind Northeast Energy Efficiency Partnership cold-climate package-terminal heat pump. Ice Air is projecting to scale and sell up to 10,000 of these units in NYS over the next two years. NYSERDA also provided funding for Gradient to develop and scale its plug-in, cold climate packaged window unit heat pump that is uniquely suited for multifamily building stock. In 2022, Gradient was awarded a seven-year contract with the NYC Housing Authority to install 10,000 units in public multifamily buildings. In November 2023, the DOE selected Ice Air ($17.6 million) and Gradient ($17.5 million) to receive Defense Production Act grants to scale up domestic manufacturing of their products.

Delivered solutions that achieved cost compression for emerging products. NYSERDA's solicitations required applicants commit to and be measured against technical performance, functionality, and/or cost compression targets. Once NYSERDA selected awardees, the team created specific performance requirements in each statement of work; NYSERDA measured achievement against the targets at the completion of each project. For example, NYSERDA's work with Kilfrost, a company using antifreeze fluid for geothermal systems, found that ground loops could be shortened by up to 27%, decreasing the total cost of a geothermal system by up to one third.

Effectively managed risk and funded solutions by deploying stage-gate and prize funding approaches. While NYSERDA accepts solutions at all stages, NextGen Buildings solicitations (1) require proposers to identify upfront activities and resources necessary to achieve commercialization, and (2) provide funding through stage-gate reviews to measure the progress of, and incrementally de-risk projects. The stage-gate approach also positioned solution providers to secure additional private funding, as investors may be more likely to fund projects with other financial commitments and reduced risks. Additionally, through the Empire Technology Prize competition, funds are awarded once the applicant has achieved a specific requirement leading to the commercialization of the product.

2.5.2. Challenges, Lessons Learned, and Implications for Future Efforts

NYSERDA identified one key challenge in implementation of the Buildings Innovation focus area:

Establishment of reliable, scalable pathways for timely identification and securing of demonstration sites. NYSERDA experienced challenges identifying sites for early-stage pilots and demonstrations due to incompatibility with existing building infrastructure or security, as well as risk aversion from building owners and operators. To overcome this difficulty, NYSERDA has integrated building owners and off-takers into the solicitation development process to ensure that emerging technologies are compatible with their buildings' needs. In 2023, NYSERDA launched the Empire Technology Prize, integrating nine demonstration partners into the selection process to maximize future offtake and scale-up opportunities. NYSERDA also refined the award process to ensure that projects funded by NYSERDA have a clear pipeline of potential demonstration sites before they are awarded.

2026-2030 I&R activities will build on strengths in the Buildings Innovation focus area. NYSERDA intends to build on the successful commercialization of technologies for NYS-specific problems, the transfer of commercially available technology to new areas, and solutions for cost compression. The 2026-2030 I&R portfolio will expand the focus area to include end-use applications[29] into the residential, commercial, and industrial sectors. Table 10 demonstrates how NYSERDA will continue Buildings Innovation implementation. For more details on 2026-2030 I&R Buildings Innovation activities, refer to Section 4.3.

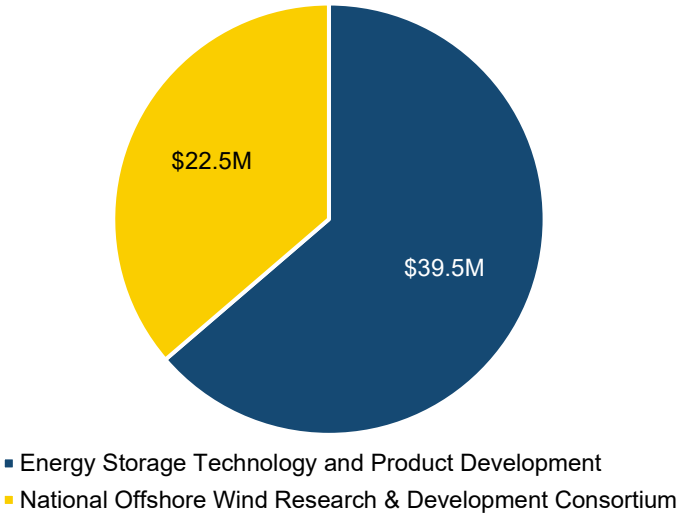
Table 10: Proposed changes to the Buildings Innovation focus area in the 2026-2030 Innovation and Research portfolio

Initiatives	Change to Offering	High-Level Proposed Modifications
NextGen Buildings	**Continue** with modifications	(1) Differentiate core market problems (i.e., energy efficiency and electrification, and building-grid interconnection); (2) based on accomplishments, integrate commercialization services for cost compression, market adoption, and scaling; and (3) prioritize integrating offtaker relationships into early-stage demonstrations and product development, based on lesson learned about need to identify demonstration sites.
ClimateTech Commercialization Support	**Continue** with modifications	Integrate challenges and prizes across initiatives, in addition to traditional solicitations. Building on lessons learned, future challenge and prize activities will focus on technology transfer to New York, addressing NYS-specific problems in the buildings sector, and demonstration site identification.

2.6. Renewables Optimization Performance

Under the Renewables Optimization focus area, NYSERDA has focused on work to understand, advance, and deploy innovative technologies and approaches to expand deployment of energy storage and large-scale renewable energy generation. Renewables Optimization initiatives aim to improve the economics for renewables and DERs by addressing technical barriers, as well as advancing renewable technologies that have potential to drive large-scale GHG reductions, improve grid resiliency, and contribute to NYS's renewable generation and decarbonization objectives. Through Renewables Optimization, NYSERDA has provided funding for **research and studies**, **development**, and **demonstrations** across two initiatives, resulting in the outcomes in Figure 4.

[29] End-use refers to how energy is utilized in various sectors to perform specific functions (e.g., powering electronic devices, industrial processes, etc.), core sectors include residential, commercial, industrial, transportation, and agriculture. This focus area will concentrate on buildings and their processes, as transportation and agriculture are addressed by the Clean Transportation Innovation focus area and Industrial & Agricultural team, respectively.



$62M
total planned funding

117
projects committed

$58M
funding committed

11
commercialized products

$30M
funding expended

131
organizations engaged

Figure 4: Renewables Optimization initiatives by portion of focus area budget and summary of funding and outcomes

Focus Area Background

Under Renewables Optimization, NYSERDA has pursued two initiatives: Energy Storage Technology and Product Development, which advances various energy storage technologies integration into NYS's grid; and the National Offshore Wind Research & Development Consortium (the OSW Consortium), an industry-focused R&D effort to maximize OSW benefits. Appendix A.2.4 provides further information on each initiative. Since its inception in 2017, NYSERDA has evolved its work under Renewables Optimization from funding product development and demonstration of energy storage technologies, expanding to OSW innovation, and now prioritizing LDES.

2.6.1. Accomplishments

Under Renewables Optimization, NYSERDA investments provided value to ratepayers by driving reductions in the cost of deploying OSW technologies, funding energy storage startups, and removing adoption barriers. As of December 2023, NYSERDA realized several accomplishments, including a subset highlighted below:

Engaged with the market to navigate a changing policy and regulatory environment by aggregating and conveying original equipment manufacturer (OEM) and developer feedback back to regulators. By offering technical expertise, funding, and insights, NYSERDA helped entities understand and adapt to evolving regulatory and policy landscapes. For example, NYSERDA advocated for changes to the preliminary IRA 45X tax credit terms (a credit that incentivizes domestic manufacturing of key energy technology components), making components in non-traditional LDES solutions eligible and more accessible. Leveraging ecosystem relationships, NYSERDA has also assisted early-stage energy storage entities in securing follow-on funding and growing their companies, while de-risking technologies and demonstrating solution readiness through connections to the DOE, National Laboratories, and other State agencies.

Established the OSW Consortium and guided it to expected financial and operational self-sufficiency by 2025. NYSERDA helped the OSW Consortium raise $23.4 million in cost-share funding, in addition to $41 million[30] from CEF and DOE. The OSW Consortium has issued four rounds of solicitations and is now approving awards for its first independent solicitation, fully funded outside of NYSERDA or DOE. The OSW Consortium will continue investing in technologies that drive future levelized cost of electricity reductions for OSW.

2.6.2. Challenges, Lessons Learned, and Implications for Future Efforts

NYSERDA identified two key challenges in implementation of the Renewables Optimization focus area:

External market and policy conditions, both domestic and international, create barriers to scaling the OSW industry. Despite NYSERDA's success with the OSW Consortium, supply chain and inflation challenges persisted during and after the pandemic, impacting growth of nascent U.S. OSW industry. Additionally, policies such as the Jones Act increase the costs and complexity of transporting OSW components between locations within the U.S, creating challenges for engineering and construction.

Difficulty of scaling NYSERDA demonstration projects to replication while facing a lack of stable, long-term wholesale market signals for LDES. Developers, even with NYSERDA assistance, faced hurdles in building economically viable LDES projects in NYS due to the absence of clear market signals and the presence of low-cost, dispatchable fossil fuel capacity on the grid. Despite broader market conditions such as the COVID-19 pandemic, supply chain challenges, and labor shortages impacting overall costs, NYSERDA investment contributed to opportunities for cost compression in energy storage specialized components. For example, alpha-En, a company working with NYSERDA, developed a proprietary process to produce lithium at room temperature, which is projected to reduce the cost of lithium metal batteries by 50-70% compared to current prices. While NYSERDA has made progress, continued funding over the next five years is essential to further these demonstrations and overcome existing challenges.

2026-2030 I&R activities will build on strengths in the Renewables Optimization focus area. For the 2026-2030 I&R portfolio NYSERDA intends to build on the success in policy and regulatory changes and continue to leverage relationships to help energy businesses secure follow-on funding. NYSERDA will adjust the portfolio to leverage federal funding for energy storage projects and navigate market and policy conditions. Table 11 demonstrates how NYSERDA will continue Renewables Optimization implementation. For more details on 2026-2030 I&R Renewables Optimization activities, refer to Section 4.4.

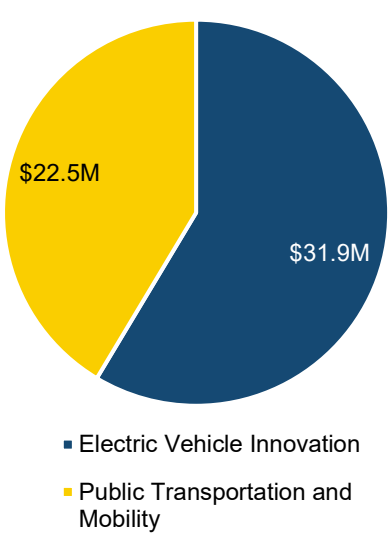
Table 11: Proposed changes to the Renewables Optimization focus area in the 2026-2030 Innovation and Research portfolio

Initiatives	Change to Offering	High-Level Proposed Modifications
Energy Storage Technology and Product Development	**Continue** with modifications	Consolidate existing energy storage-related initiatives into a single initiative focused on LDES and Li-ion battery alternatives; build on successes by continuing to provide demonstration project data to regulators and other stakeholders to inform decision-making.
National Offshore Wind Research & Development Consortium	**Continue** with modifications	Continue involvement in the OSW Consortium focused on execution of cooperative agreement, managing projects to completion, and fulfilling commitments to award new projects and engage in stakeholder engagement to ensure self-sufficiency.

[30] National Offshore Win R&D Consortium Announces Projects Totaling $8 Million, available at: https://www.energy.gov/eere/wind/articles/national-offshore-wind-rd-consortium-announces-projects-totaling-8-million

2.7. Clean Transportation Innovation Performance

Under the Clean Transportation Innovation focus area, NYSERDA has focused on work to accelerate development, demonstration, and deployment of innovative technologies and approaches that enable clean and reliable modes of transportation. Activities are designed to harness stakeholders' creative solutions to transportation sector energy challenges, facilitate the development of these solutions into products or services that are commercially viable, demonstrate their benefits to critical stakeholders, and identify solutions to resolve any barriers to adoption. Through Clean Transportation Innovation, NYSERDA has provided funding for **research and studies**, **development**, and **demonstrations** across two initiatives, resulting in the outcomes in Figure 5.



$54M
total planned funding

65
projects committed

$31M
funding committed

6
commercialized products

$16M
funding expended

598
replications of demonstrations

Figure 5: Clean Transportation Innovation initiatives by portion of focus area budget and summary of funding and outcomes

Focus Area Background

Under Clean Transportation Innovation, NYSERDA has pursued two initiatives: Electric Vehicle Innovation, which develops and demonstrates solutions that advance EV adoption, and Public Transportation and Mobility, which funds public transportation solutions through infrastructure and community partnerships. Appendix A.2.5 provides further information on each initiative. Since Clean Transportation Innovation's inception in 2017, NYSERDA has evolved the work from an initial single initiative focused on EVs to a broader set of work inclusive of public transportation.

2.7.1. Accomplishments

Under Clean Transportation Innovation, NYSERDA investments provided value to ratepayers by enhancing the economics of electric transit buses, improving technology performance and functionality, and reducing adoption barriers. As of December 2023, NYSERDA realized several accomplishments, including a subset highlighted below:

Achieved significant cross-sector innovation by integrating transportation and grid solutions to advance managed charging solutions. NYSERDA strategically prioritized development and demonstration of technologies that optimize vehicle-grid interactions through both passive and active managed charging. This deliberate effort underscores NYSERDA's commitment to connecting transportation and grid initiatives, recognizing the critical importance of cross-sector solutions. NYSERDA collaborated with Siemens to integrate higher-fidelity metrology into their home EV charging stations, enabling more cost-effective managed charging participation. In another collaboration, NYSERDA

supported bp pulse in showcasing their managed charging capabilities in some of the first electric school buses in NYS.

Played a pivotal role in advancing transit bus electrification by providing essential early funding and expertise for planning and demonstrations. NYSERDA paved the way for broader deployment and bolstered NYS's efforts to secure additional funding for medium- and heavy-duty vehicles (MHDVs). By collaborating with transit operators, the New York Power Authority (NYPA), and private companies, NYSERDA effectively identified and addressed challenges to electrifying transit buses. NYSERDA, in partnership with NYPA, funded development of detailed charging and fleet conversion plans for five major transit operations in NYS. Additionally, NYSERDA investigated opportunities to use existing utility infrastructure that powers the subways to charge Metropolitan Transportation Authority electric buses. These studies shaped the direction of these transit fleets, served as the basis for new charging infrastructure at multiple transit bus depots, and enabled transit operators to secure tens of millions of dollars in federal and state funds for transit bus electrification. This strategic funding and expertise is enhancing the economics of electric transit buses, facilitating continued investment in electric equipment by transit operators.

Successfully pioneered innovative approaches to expanding transit and providing new mobility solutions, which significantly increased transportation options for NYS's underserved populations. NYSERDA funded 17 projects that demonstrated new approaches to make cleaner modes of transportation accessible to more people. Key projects included the redesign of NYC bus networks, expanding smaller transit operators to offer carsharing and micro-transit, and demonstrating clean mobility hubs offering a variety of clean transportation options and facilitating connections between transit, bikes, and other micro-mobility options.

Delivered comprehensive analyses and strategic recommendations based on CEF-funded studies, guiding critical State transportation policies.

- Developed a clean transportation roadmap, which identified critical policy gaps needed to achieve NYS's transportation-related GHG reduction targets
- Conducted advanced modeling and forecasting of EV charging demand, which informed the Make-Ready Program, which is designed for the development of EV infrastructure across NYS
- Developed and shared best practices for EV charging station permitting with municipalities to expedite the installation of charging infrastructure, and
- Provided analysis that informed the proceeding on alternative tariff structures for EVs in NYS that will enable tariffs that better reflect EV charging station usage and encourage greater EV market expansion.

These strategic contributions have been instrumental in shaping effective transportation policies and advancing NYS's clean transportation goals.

2.7.2. Challenges, Lessons Learned, and Implications for Future Efforts

NYSERDA identified the two key challenges in implementing the Clean Transportation Innovation focus area:

End-users are often reluctant to get involved with early-stage projects, including demonstration projects. NYSERDA found that RDD&C projects are most successful when end-users help inform design and facilitate deployment. Future efforts will incorporate end-user participation earlier in the process to improve offtake.

Demonstration projects are difficult to replicate because of unique fleet requirements. In many market segments, multiple demonstrations—both across segments and within a single market—are needed to achieve buy-in from industry stakeholders that the products are viable. Awardees will benefit from NYSERDA collaboration in navigating customer demands for a replicable product.

Additionally, DAC efforts presented several key takeaways. Small businesses and low-to-moderate income populations, who depend heavily on their vehicles for work, cannot afford to test unproven technologies. While they can offer valuable input on future needs, they are not ideal candidates for initial demonstrations. Demonstrations are essential for identifying market barriers and challenges that need resolution, as evidenced by the NY Clean Transportation Innovation Prizes. Additionally, it is crucial to provide coaching for technology providers on effectively engaging with community-based organizations (CBOs) and disadvantaged populations, as well as for CBOs on collaborating with RDD&C projects.

The future Clean Transportation Innovation portfolio is influenced by other proceedings that are highly relevant to transportation efforts funded under the CEF. For example, in 2018, the Commission initiated its Proceeding on EV Supply Equipment and Infrastructure to consider the role of electric utilities in providing infrastructure and rate design to meet the needs and electricity demand of EVs and EV supply equipment. Several years later, the Commission established the light-duty EV Make-Ready Program within that proceeding to incentivize development of a statewide network of Level 2 and direct current fast chargers. In 2023, the Commission began a proceeding to address the electrification needs of the State's MHDV sector. Moving forward, certain transportation activities funded by the CEF, such as research or policy and regulatory studies, may be better pursued through transportation-focused proceedings. This presents an opportunity to realign some CEF activities.

2026-2030 I&R activities will build on strengths in the Clean Transportation Innovation focus area. NYSERDA intends to build on engagement with industry, improvements in mobility options for underserved communities, and dissemination of information to agencies and lawmakers for informed decision-making. NYSERDA plans to adjust the portfolio to connect R&D projects with end-users and provide expertise in navigating customer requirements. Table 12 demonstrates how NYSERDA will continue Clean Transportation Innovation implementation. For more details on 2026-2030 I&R Clean Transportation Innovation activities, refer to Section 4.6.

Table 12: Proposed changes to the Clean Transportation Innovation focus area in the 2026-2030 Innovation and Research portfolio

Initiatives	Change to Offering	High-Level Proposed Modifications
Electric Vehicle Innovation	**Continue** with modifications	• (1) Continue R&D efforts around hard-to-electrify market segments and vehicle-grid interconnections, with emphasis on developing durable end-user relationships and navigating unique customer requirements; (2) modify approach to leverage additional funding streams for EV policy research, data collection, and permitting standardization.
Public Transportation and Mobility	**Continue** with modifications	• Build on accomplishments around funding projects in underserved communities, modifying approach to (1) develop and demonstrate new products and business models for transit and mobility; (2) remove focus on electric rail efficiency and electric bus and charging improvements; and (3) fund Electric School Buses through Bond Act funds. • Transit bus electrification planning is complete.

2.8. Energy Focused Environmental Research Performance

Through the EFER focus area, NYSERDA has focused on providing sound, current scientific research to inform decision-making relevant to energy-related environmental policies and goals. Research, analysis, and coordination continues to be needed to meet current and emerging energy and environmental goals. Through EFER, NYSERDA has provided funding for **research and studies** across one initiative, resulting in the outcomes in Figure 6. For clarity, EFER has focused on cross-sector environmental research, sectoral focus areas have conducted sector-specific innovation or technology research.

$48M	$41M	$30M	99	245	249
total planned funding	funding committed	funding expended	projects committed	publications/ reports	workshops/ events

Figure 6: Energy Focused Environmental Research initiatives by portion of focus area budget and summary of funding and outcomes

Focus Area Background

Under the EFER focus area, NYSERDA launched the Energy-Related Environmental Research initiative in 2017 to continue work initiated in 1998 for air and atmospheric monitoring, analyses, and studies. NYSERDA undertook subsequent strategic expansions of EFER to include OSW research efforts, with a focus on reducing siting and environmental risks for projects and lowering development costs for OSW projects. Expansion efforts also included solar energy research efforts, with a focus on better characterizing impacts, mitigation options, and dual-use opportunities to address regulatory, industry, and community concerns, and methane emissions research from the energy sector, with a focus on better characterizing emissions sources and informing the State GHG inventory and mitigation. Appendix A.2.6 provides further information on each initiative and the research priorities.

2.8.1. Accomplishments

Under EFER, NYSERDA investments provided value to ratepayers by supporting key policymaking activities and using open-source data to remove adoption barriers for key solutions. As of December 2023, NYSERDA realized several accomplishments, including a subset highlighted below:

Foundational research completed to better understand the potential for and NYS impacts of OSW. NYSERDA conducted pre-development surveys and data collection to (1) characterize OSW resources and (2) assess the fish and wildlife presence in areas potentially conducive to OSW development.[31] OSW developers used the open-source data to optimize wind siting and mitigation proposals. In addition, the data helped lower the "price of entry" for OSW development through risk reduction strategies.

Delivered research and analysis for policymaking activities, including development and revision of NYS-specific energy and environmental policies. NYSERDA's projects included development of NYS-specific climate change projections that utilities and the PSC have used for utility climate change planning; development of the Zip Code Air Pollution Policy Assessment (ZAPPA) model that enables zip-code level predictions of air quality and public health effects from energy policy options—which NYSERDA and NYS Department of Environmental Conservation used to inform the recent New York Cap and Invest health analysis; and completion of monitoring studies that provided the scientific basis for NYS engagement in federal Clean Air Act proceedings for National Ambient Air Quality Standards.

[31] NYSERDA Environmental Research Program Plan, Research Area 4: Marine Wind and Wildlife Report, available at: https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Publications/Research/Environmental/NYSERDA-Environmental-Research-Program-Research-Area-4-Marine-Wind-Wildlife.pdf

For illustration, there is a representative projects table in Appendix Table A-3 that summarizes key projects that NYSERDA conducted under this focus area.

Continued expansion of influential research and analysis. NYSERDA's evaluation of the citation of EFER papers indicates that intellectual reach increased ten-fold from 2013 to 2022. As of 2022, 97% of EFER papers have been cited at least once. EFER papers are also cited at a higher rate than is typical, as indicated by a C-Index value of 1.3 (a C-Index value of 1.0 would mean EFER papers are cited at the same rate as other papers in the Web of Science database).[32]

2.8.2. Challenges, Lessons Learned, & Implications for Future Efforts

NYSERDA identified two key challenges in implementation of the EFER focus area:

Evolving energy policy and technology landscape creates new priorities, information needs, and policy conflicts. The complex, changing policy landscape requires NYSERDA to remain flexible in research planning and capable of expanding into new areas. To track these shifts, NYSERDA continues to form and engage with stakeholder networks, such as TWGs, and participate in regional and national consortia and advisory networks.

Continued high demand for concentrated stakeholder engagement. Maintaining constructive stakeholder engagement with commercial fishers and agricultural stakeholders was challenging during periods of rapid policy and market change. Information exchange with these stakeholders is critical to avoiding and minimizing conflicts and advancing more responsible renewable energy development that benefits ratepayers.

2026-2030 I&R activities will build on strengths in the EFER focus area including successful delivery of research and analysis projects for policymaking. However, NYSERDA will adjust the portfolio to maintain flexibility in a changing landscape and ensure continued high touch engagement with key stakeholders. Table 13 demonstrates how NYSERDA will continue EFER implementation. For more details on 2026-2030 I&R EFER activities, refer to Section 4.7.

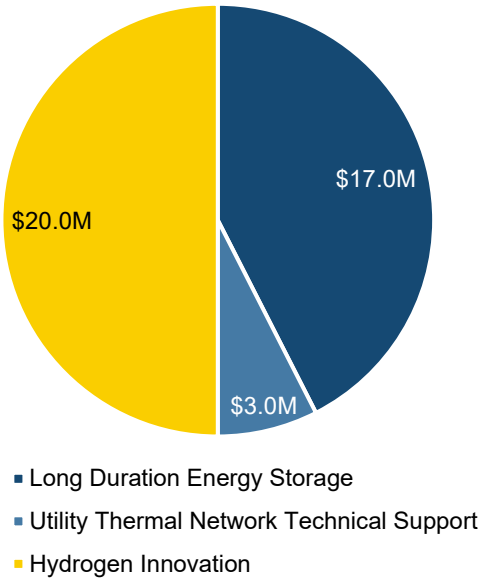
Table 13: Proposed changes to the Energy Focused Environmental Research focus area in the 2026-2030 Innovation and Research portfolio

Initiatives	Change to Offering	High-Level Proposed Modifications
Energy-Related Environmental Research	**Continue** with modifications	Based on accomplishments publishing meaningful research and engaging stakeholders, (1) maintain the Program Planning and Stakeholder Discovery research priority, continuing stakeholder engagement to inform policy-relevant research; (2) consolidate TWG activities under the Clean Energy Standard; (3) maintain the Monitoring and Accountability Studies priority, renaming it for clarity, and continue evaluating energy-related policy effectiveness; (4) maintain Pre-Development Assessments, shifting focus to informing OSW transmission (e.g., the NYC Public Policy Transmission Need); and (5) maintain the Focused Research priority on: • Developing new climate parameters for utility vulnerability assessments. • Conducting methane emissions research and supporting GHG inventory in the energy and buildings sector. • Demonstrating new monitoring technologies and methods. • Studying zero emissions energy impacts and mitigation.

[32] NYSERDA 2022 Energy-Related Environmental Research (ERER) Citation Analysis Final Report, 2023, available at: https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Publications/PPSER/Program-Evaluation/Matter-No-1602180NYSERDAEnvironmental-ResearchCitation-Analysis-ReportSeptember2023.pdf

2.9. Gas Innovation Performance

NYSERDA established the Gas Innovation focus area to better understand the State's gas infrastructure and characterize technologies that may be required to ensure an optimized, zero emissions future system. Under the Gas Innovation focus area, NYSERDA primarily has advanced work related to hydrogen, energy storage, and thermal energy networks (TENs). Through Gas Innovation, NYSERDA has provided funding for **research and studies**, **development**, and **demonstrations** across three initiatives, resulting in the outcomes in Figure 7.



$40M
total planned funding

$24M
funding committed

$1.2M
funding expended

13
projects committed*

**Gas innovation projects have not yet achieved leveraged funding, commercialized products, or replications in current reporting, given it is a newer focus area.*

Figure 7: Gas Innovation initiatives by portion of focus area budget and summary of funding and outcomes

Focus Area Background

Under Gas Innovation, NYSERDA has pursued three distinct initiatives. The Hydrogen Innovation initiative focuses on hydrogen applications for hard-to electrify sectors. Initially, NYSERDA funded energy storage activities under Renewables Optimization. As the portfolio evolved, NYSERDA identified a need for LDES solutions to balance grid supply and demand during peak periods to reduce reliance on fossil fuels. Therefore, NYSERDA developed the LDES initiative to demonstrate solutions to increase grid reliability. Additionally, the Utility Thermal Energy Network (UTEN) Support initiative provides technical expertise to UTEN pilot projects. Appendix A.2.7 provides further information on each initiative. Since Gas Innovation's inception in 2021, NYSERDA has evolved from an initial focus on overall gas system transition activities to now encompass hydrogen innovation activities and a more granular focus on 10-100+ hour energy storage solutions.

2.9.1. Accomplishments

Under Gas Innovation, NYSERDA investments provided value to ratepayers by creating a cost-savings technologies roadmap and rapidly launching a hydrogen innovation solicitation. As mentioned, NYSERDA funded energy storage work under both the Renewables Optimization and Gas Innovation focus areas. To avoid duplication, energy storage accomplishments are described in the Renewables Optimization section 2.6.1. As of December 2023, NYSERDA realized several accomplishments, including a subset highlighted below:

Establish a deep understanding of potential NYS hydrogen economy for targeted interventions. NYSERDA conducted key studies necessary to understand the NYS market and allow for strategic interventions. For example, NYSERDA conducted a statewide hydrogen market study that included an R&D gap analysis to assess (1) costs of clean hydrogen production from renewable resources; (2) storage and distribution infrastructure in NYS; (3) IRA tax credit impacts; and (4) temporal and regional supply and demand. This comprehensive understanding will allow NYSERDA to make informed decisions and implement effective strategies to advance the hydrogen economy in NYS.

Effective engagement of hydrogen ecosystem stakeholders to create targeted solicitations. NYSERDA orchestrated multiple engagements with hydrogen ecosystem stakeholders to inform the approach to hydrogen-focused solicitations, the State hydrogen roadmap, and other analyses. Specific engagements with stakeholders included a hydrogen workshop, as well as individual meetings with over 80 external stakeholders including OEMs, developers, private businesses, and academic institutions to develop key partner relationships. This engagement resulted in NYSERDA's first ever hydrogen innovation solicitation released in May 2023.

2.9.2. Challenges, Lessons Learned, and Implications for Future Efforts

For simplicity, energy storage challenges and lessons learned are described in the Renewables Optimization section 2.6.2. NYSERDA identified two key challenges in implementation of the Gas Innovation focus area:

Given the magnitude of NYS's hydrogen needs, continued regional and national partnerships are required for shared learning and access to funding. The nascent NYS hydrogen market is contingent on regional and national partnership to create production, transportation, and storage capacity. If NYS decides to pursue hydrogen infrastructure development, it will have large capital requirements, and collaboration with regional and national partners is critical to modifying and building shared resources (e.g., pipelines). NYSERDA will continue to engage with ecosystem stakeholders to enhance the formation of partnerships required to scale projects, reduce technology risks, and inform policy.

Continued progress on hydrogen policy, regulation, and funding in NYS is needed to attract industry. To date, the development of State hydrogen policy and resolution of policy and regulatory barriers have lagged related needs, hindering NYS's ability to attract national players. For example, the existing regulatory landscape in NYC prohibits hydrogen transport through certain bridges and tunnels and the storage of liquid fuel. NYSERDA needs critical, continued engagement with regulatory bodies for policy and regulatory changes that are more favorable to the growth of statewide hydrogen and alternatives fuel transport and storage infrastructure.

2026-2030 I&R activities will build on strengths in the Gas Innovation focus area including a deep understanding of the NYS hydrogen economy and engagement with stakeholders to ensure quick turnaround on projects and development of impactful solicitations. NYSERDA will adjust the portfolio to continue to cultivate regional and national relationships to improve progress on hydrogen policy and regulations and increase the leverage of federal funding. Table 14 demonstrates how NYSERDA will continue Gas Innovation implementation. For more details on 2026-2030 I&R Gas Innovation activities, refer to Section 4.5.

Table 14: Proposed changes to the Gas Innovation focus area in the 2026-2030 Innovation and Research portfolio

Initiatives	Change to Offering	High-Level Proposed Modifications

Hydrogen Innovation	**Continue** with modifications	Building on accomplishments, continue to engage market stakeholders and grow the ecosystem, but modify approach to be more targeted, focusing on specific use cases where hydrogen is potentially the optimal resource (fuel cells for power generation back-up at critical facilities and hard-to-electrify end use applications)
Long-Duration Energy Storage	**Continue** with modifications	Modify approach to consolidate under the Energy Storage Initiative as part of the new Power Generation & Storage focus area. Based on lessons learned, continue to provide demonstration project data to stakeholders to inform electricity market opportunities for LDES.
Utility Thermal Network Technical Support	**Continue** with modifications	Expand on the technical support for implementation of the UTEN and Jobs Act (UTENJA) pilot projects by further exploring regulatory and market frameworks for thermal energy in NYS.

2.10. Negative Emissions Technologies Performance

Under the Negative Emissions Technology focus area, NYSERDA has concentrated on accelerating the development of both nature-based and engineered solutions to reduce or remove carbon dioxide from materials or the environment. This focus area provides funding to researchers and entrepreneurs, lowering barriers to deployment of technologies, attracting new technologies to NYS, and de-risking certain lower-maturity technologies. NYSERDA has not focused on non-fossil fuel point source capture, such as natural gas through Negative Emissions Technology. Through Negative Emissions Technology, NYSERDA has provided funding for **development**, **demonstrations**, and **commercialization** across two initiatives, resulting in the outcomes in Figure 8.

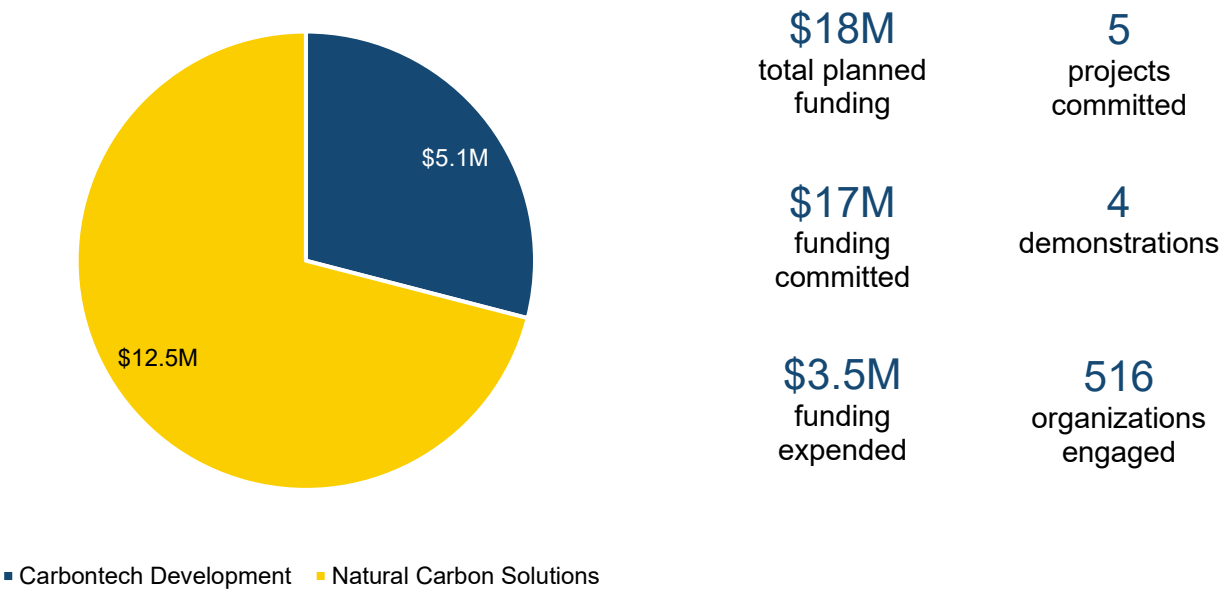


Figure 8: Negative Emissions Technologies initiatives by portion of focus area budget and summary of funding and outcomes

Focus Area Background
NYSERDA has pursued two Negative Emissions Technology initiatives: Natural Carbon Solutions, which targets innovative solutions to lower emissions and sequester carbon, and Carbon Tech Development, which aims to accelerate the scale of carbon tech products. Carbon Tech Development initially launched under T2M, and NYSERDA redistributed a portion (the Carbon Foundry Initiative) to Negative Emissions Technology in 2021 based on its alignment and focus. Appendix A.2.8 provides further information on each initiative.

Initially, NYSERDA's Negative Emissions Technology efforts provided funding for research into low-carbon solutions across a range of sectors. More recently, the focus has shifted to low-carbon and carbon-sequestering building materials that offer opportunities to improve energy efficiency. For example, under the solicitation associated with the Natural Carbon Solutions Program (PON 5180), NYSERDA has awarded projects for bio-based building materials including an aerogel that reduce costs and improve energy efficiency by providing triple pane window performance in the existing double pane window infrastructure (SunThru), and architectural tiles that sequester carbon from agricultural residue and improve insulation (Phytosone).

2.10.1. Accomplishments

Under Negative Emissions Technology, NYSERDA investments provided value to ratepayers by designing programs responsive to State policy to encourage market adoption and catalyzing technology transfer to NYS. As of December 2023, NYSERDA realized several accomplishments, including a subset highlighted below:

Encourage market adoption of low-embodied carbon materials despite lack of statewide policy on lifecycle emissions. Although NYS has several initiatives for low-embodied carbon materials (e.g., concrete, public buildings), the Climate Act only accounts for embodied carbon and lifecycle emissions for hydrofluorocarbons in insulating foams and other building equipment. NYSERDA addressed this limitation by designing programs that align with broader State policies and needs for low embodied carbon materials.

Catalyzed technology transfer to NYS to take leverage products that are commercially available elsewhere and established NYS-based manufacturing to expand supply. NYSERDA identified technologies available outside NYS and the U.S. that aid in achieving NYS's negative emissions goals and reducing building thermal demand in both retrofit and new construction. NYSERDA strategically pursued technology transfer by focusing funding on first-of-a-kind and late-stage demonstrations with lower risk. These demonstrations can be manufactured in NYS using under-utilized raw materials, such as those from the Fort Drum Biomass plant closure.

2.10.2. Challenges, Lessons Learned, and Implications for Future Efforts

NYSERDA identified one key challenge in implementation of the Negative Emissions Technology focus area:

Need to scale replicable demonstration projects while still de-risking emerging technologies to drive market and policy. NYSERDA is instrumental in helping solution providers overcome the product development "valley of death," where providers pilot and demonstrate technologies, but do not reach scale. Early engagement with offtakers benefited solution providers by aiding in developing strategic commercialization plans and understanding the next steps for at-scale manufacturing and product sales. However, there is a lack of consensus on accounting procedures and the distinction between negative emissions and zero emissions. It is essential for NYSERDA to continue assisting companies in navigating

barriers in the NYS market and helping solution partners identify and collaborate with offtakers earlier in the solicitation process.

2026-2030 I&R activities will build on strengths in the Negative Emissions Technology focus area including engagement with stakeholders to design needed products and continue catalyzing technology transfer. Table 15 demonstrates how NYSERDA will continue Negative Emissions Technology implementation.

Table 15: Proposed changes to the Negative Emissions Technologies focus area in the 2026-2030 Innovation and Research portfolio

Initiatives	Change to Offering	High-Level Proposed Modifications
Carbon Tech Development	**Continue** with modifications	Based on challenges around market signals for embodied carbon products, Carbon Tech will not be a standalone initiative; NYSERDA proposes exploring opportunities to integrate carbon tech into other focus areas including low-embodied carbon building materials, demand side reductions in manufacturing, alternative fuels, and firm capacity.
Natural Carbon Solutions	**Continue** with modifications	Natural Carbon Solutions will not be a standalone initiative; modify approach to integrate low-embodied carbon building materials work into the Advanced Buildings & Processes Energy Efficiency & Electrification initiative.

2.11. Climate Resilience Innovation Performance

Under the Climate Resilience Innovation focus area, NYSERDA has focused on understanding the potential impacts of climate change on NYS's clean energy assets, devising approaches that systematically consider risk and resilience in program design, operations, governance, and investments, and establishing innovation pathways to greater climate resilience in NYS. Through Climate Resilience Innovation, NYSERDA has provided funding for **research and studies** and **development** across three initiatives, resulting in the outcomes in Figure 9.

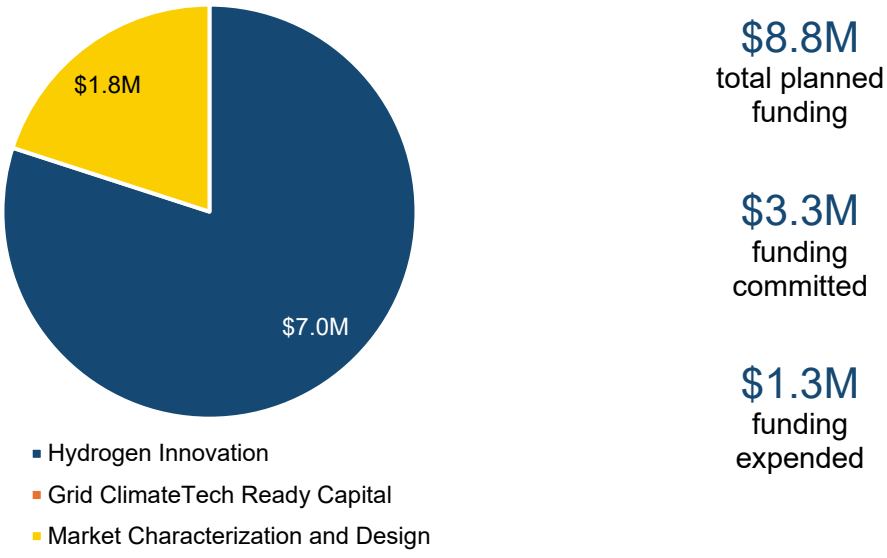


Figure 9: Climate Resilience Innovation initiatives by portion of total focus area budget and summary of funding

Focus Area Background
Under the Climate Resilience Innovation, NYSERDA has pursued three initiatives: Market Characterization & Design which targets market characterization, strategy, and planning activities to guide NYSERDA investments; Hydrogen Innovation which focuses on areas with the highest strategic importance to NYS and with greatest potential for leveraged investment related to hydrogen to improve grid resilience; and Grid ClimateTech Ready Capital which has not yet been committed but addresses grid resilience. Since Climate Resilience Innovation's inception in 2022, NYSERDA has evolved the work from an initial singular concentration on market characterization and design to a more comprehensive approach that includes grid and hydrogen technologies to enhance energy resilience. Appendix A.2.9 provides further information on each initiative. NYSERDA is working to complete contracting and execution of selected projects.

It is important to note that resilience work has not been limited to the Climate Resilience Innovation focus area; it also has occurred under the EFER focus area, reflecting the progressive build of the portfolio. The EFER resiliency work has been focused on completing updates to the NYS Climate Impact Assessment.

2.11.1. Accomplishments
Under Climate Resilience Innovation, NYSERDA provided value to ratepayers by understanding the potential impacts of climate change on NYS's clean energy assets; devising approaches that systematically consider risk and resilience in program design, operations, governance, and investments; and establishing innovation pathways to greater climate resilience in the State. As of December 2023, NYSERDA realized several accomplishments, including a subset highlighted below:

Strategic advancement of new funding activities through market characterization and design. By engaging hydrogen technology and market experts, NYSERDA developed strategic plans for the creation of the Hydrogen Innovation initiative. NYSERDA also created an internal program to gather real-time market intelligence across all Innovation focus areas, facilitating timely program launches. Additionally, a project analyzed the impact of Innovation's investments on cleantech markets, aiming to lower costs, reduce deployment risks, and accelerate adoption for utility ratepayers. These efforts led to ongoing market intelligence gathering, enhanced stakeholder engagement, and preliminary analysis results assessing ratepayer value outcomes. Funding in this focus area has effectively informed potential Innovation investments and market characterization.

2.11.2. Challenges, Lessons Learned, & Implications for Future Efforts
NYSERDA proposes to sunset the Climate Resilience Innovation focus area, merging each of its initiatives into the appropriate proposed focus area. NYSERDA will continue to advance the Climate Impacts Assessment work under the EFER future focus area. I&R will continue to work toward increasing the resiliency of all its programs, where applicable, and other NYSERDA teams will lead efforts to provide Authority-wide guidance on this approach. Table 16 demonstrates how NYSERDA will continue to implement Climate Resilience Innovation-related initiatives.

Table 16: Proposed changes to the Climate Resilience Innovation focus area in the 2026-2030 Innovation and Research portfolio

Initiatives	Change to Offering	High-Level Proposed Modifications
Market Characterization & Design	**Continue** with modifications	Build on successes of targeted market characterization and design studies, continue funding but include this initiative under the Commercialization & Ecosystem focus area.
Hydrogen Innovation	**Continue** with modifications	Based on overarching goal of streamlining offerings, modify approach to consolidate hydrogen work under the new Fuels Transition focus area.
Grid ClimateTech Ready Capital	**Continue** with modifications	Based on overarching goal of streamlining offerings, modify approach to consolidate grid work under the Grid Modernization focus area.

3. Funding Request for 2026-2030 I&R Portfolio

3.1. 2026-2030 I&R Portfolio Modifications

In the 2026-2030 I&R portfolio, NYSERDA will continue to facilitate deployment and market adoption of innovative technologies that provide ratepayer affordability and reliability while also further aligning with the Climate Act. NYSERDA's proposed 2026-2030 I&R portfolio will build upon prior successes and focus on the following set of core principles, Table 17, to improve the overall effectiveness of the portfolio:

Table 17: 2026-2030 Innovation and Research core portfolio principles

I&R Principle	How to Achieve
Thoughtful consideration of NYSERDA'S role: Value in NYSERDA serving not only as an actor, but also as a choreographer, with particular attention to NYSERDA's role in bringing innovation stakeholders together to gather market insights and pursue funding on behalf of the State.	Recognize the importance of NYSERDA performing and investing in the role of choreographer within the NYS energy ecosystem. Strategically consider co-funding to maximize the reach of innovation activities and increase benefits to ratepayers.
Portfolio simplicity: Enhance market signals and stakeholder engagement by striving for simplicity of offerings.	Simplify the structure of the portfolio and the program offerings so that they are easier for stakeholders to understand and navigate. Provide greater market clarity and certainty via fewer focus areas, fewer initiatives, fewer programs, with a transition to standardized intervention typologies with associated standardized metrics.
Portfolio flexibility balanced with transparency: Provide flexibility given the uncertain nature of the I&R portfolio's work, but balance with appropriate transparency.	Maintain flexibility to respond to changes and evolving needs in technology, the policy landscape, and the market. NYSERDA will maintain flexibility via a reserve pool of funding and the continued capacity to move funding between focus areas. Transparency will be increased through use of problem statements to define market challenges to be addressed by NYSERDA.
Commercialization services: Expand Innovation's mandate to include commercialization across all programs in addition to research, development and demonstration.	Expand Innovation's charge to achieve RDD&C by fully embedding technology commercialization and end user adoption considerations across the entirety of the portfolio.
Greater ecosystem engagement and support: Recognize that commercialization services and general ecosystem support are distinct, but both are needed.	Expand and increase connectivity of the State innovation ecosystem and work with partners to ensure that a diverse range of technologies are available in the market.

3.2. Proposed Focus Areas

NYSERDA proposes realigning from nine to seven focus areas for the 2026-2030 I&R portfolio (Figure 10). Chapter 4 provides detail into each focus area. Guided by the core principles, NYSERDA proposes to simplify the portfolio structure and program offerings by sunsetting the Negative Emissions Technologies and Climate Resilience Innovation focus areas. NYSERDA is also including a reserve fund that enables flexibility and the ability to respond to changes in technology, policy landscape, and the market. These proposed changes are the result of a comprehensive review of past performance outlined in Chapter 2 and extensive engagement with the market during the proposal process.

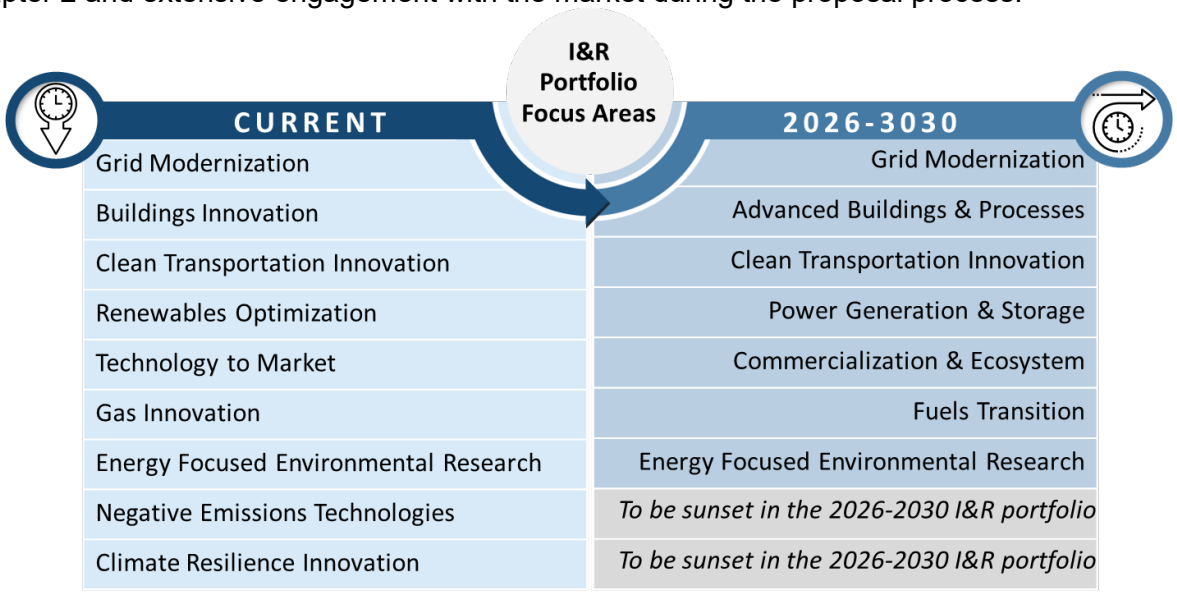


Figure 10: Changes to proposed 2026-2030 Innovation and Research portfolio focus areas

3.3. Portfolio Structure

In the 2026-2030 I&R portfolio, NYSERDA will implement a standardized structure consisting of focus areas, initiatives, problem statements, and intervention typologies. Focus areas are market themes that define a broad bundle of services NYSERDA will deliver. Within each focus area, there are initiatives, which are more specific sets of priorities. For each initiative, NYSERDA articulates market problems as "problem statements," which outline an individual challenge NYSERDA aims to address in the market. To address problem statements, NYSERDA provides funding across a set of four standard intervention typologies, which are mechanisms for delivering services to the market. These typologies (defined in Chapter 1) include research and studies, development and lab-scale prototyping, pilots, sub- and full-scale demonstrations, and commercialization services. Figure 11 shows the portfolio structure components from the focus area level down to the individual typologies.

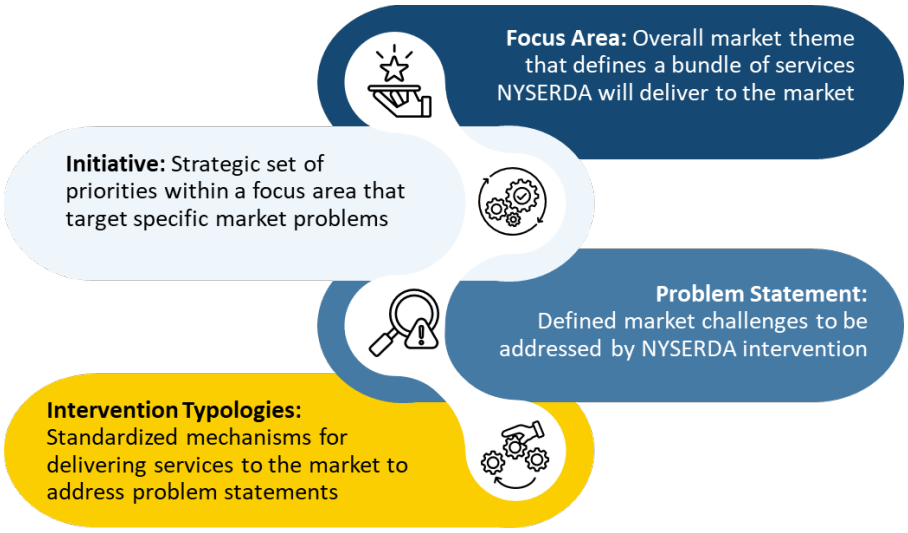


Figure 11: Innovation and Research portfolio structure components

3.4. Proposed Funding Allocations and Portfolio Modifications

Stakeholder Engagement

As outlined in Chapter 2, NYSERDA evaluated current performance of focus areas to determine which initiatives will either (1) continue with modifications or (2) be sunset in the 2026-2030 I&R portfolio. In addition to reviewing existing programs, NYSERDA conducted market research and engaged with innovation ecosystem stakeholders through a series of three roundtable discussions in the summer of 2024 to better understand NYSERDA's optimal role and identify enhancements to the 2026-2030 I&R portfolio. NYSERDA also held a series of one-on-one discussions with peer State government program offices and federal government innovation agencies to inform the proposal.

Through the roundtable discussions, NYSERDA received feedback and input from a range of innovation ecosystem stakeholders including start-ups, investors, academia, entrepreneurial support organizations (i.e. organizations that run incubator & accelerator programs), utilities, other NYSERDA offices, and DPS. Roundtables and stakeholder interviews focused on a set of core discussion topics:

1. NYS innovation challenges and landscape:
   - Technical challenges
   - Commercialization challenges
   - Critical solutions to develop and scale

2. NYSERDA's optimal role in the cleantech ecosystem:
   - Highest-value problems for NYSERDA to address
   - NYSERDA's specific service offerings in the market
   - NYSERDA role in commercialization

Based on feedback from the roundtable discussions, one-on-one interviews, market research, and other engagements, NYSERDA identified a set of stakeholder themes for the future portfolio, outlined in Table 18. The proposed 2026-2030 I&R portfolio incorporates these themes, driving further alignment with innovation needs in the market, Climate Act goals, and maximizing benefits to ratepayers. Chapter 4 presents supporting information and detail about the themes and I&R's future activities.

Table 18: Innovation and Research future portfolio stakeholder engagement themes and modifications

Stakeholder Engagement Takeaway	**Proposed Modifications** *(responsive to stakeholder suggestions and market needs)*
#1) Need for grid flexibility solutions: Even though DERs are widely available in the market, stakeholders identified a market need for improved asset control, interoperable communications, and greater standardization across these resources.	The I&R portfolio will put a greater focus on technologies that enable grid flexibility, targeting accelerated integration of DER assets into the electric system: • **Grid Modernization focus area:** NYSERDA's Grid Flexibility initiative will address gaps in the standardization and interoperability of DERs, enabling market participants to optimize revenues and provide grid reliability benefits. • **Advanced Buildings & Processes focus area**: NYSERDA will invest in technologies that help building owners manage and reduce electric loads, enabling buildings to be more reliable grid stability resources and generating greater ratepayer savings. • **Clean Transportation Innovation focus area**: NYSERDA will invest in technologies to design, install, manage, and test EV charging to increase ratepayer savings and EV adoption.
#2) Innovation ecosystem cohesion and growth: Stakeholders consistently shared that a high-value role for NYSERDA is as a large-scale convener and ombudsperson for information flow across the ecosystem. Stakeholders also identified significant value in targeted in-kind services for start-ups and a continuation of cohort-based programs.	The I&R portfolio will create a strong network of stakeholders, including industry, academia, and government, to foster collaboration and drive innovation: • **Innovation Ecosystem Sponsorships**: The Authority will sponsor industry events, competitions, and conferences to promote flow of information across the ecosystem and connect startups with potential investors, partners, and customers. • **Commercialization Vouchers**: To enhance overall ecosystem growth, NYSERDA's will provide in-kind vouchers to early-stage companies, helping cover the costs of accessing specialized expertise, services, facilities, and equipment, enabling startups to accelerate their development and commercialization efforts. • **Cohort-based Programs**: NYSERDA will also continue to provide funding for cohort-based programs that bring together groups of startups and innovators to participate in structured programs.
#3) Hard-to-electrify end uses: Through stakeholder engagement, NYSERDA identified a targeted set of applications and sectors where electrification is particularly challenging due to technical and economic barriers, including high-temperature heat pumps for buildings, medium- and heavy-duty transportation applications, and TENs.	I&R will provide funding for hard-to-electrify end use solutions across the portfolio: • **Advanced Buildings & Processes focus area**: NYSERDA's Energy Efficiency & Electrification initiative includes scope to focus on high-temperature heat pumps for steam or hydronic distribution and potentially industrial use cases. • **Fuels Transition focus area**: NYSERDA's Large Scale Hydrogen initiative on developing hydrogen fuel cells for power generation uses cases such as providing back-up power to critical facilities, and potentially other hard-to-electrify areas including high-temperature industrial processes, and transportation. The TENs initiative will focus on development of market and regulatory structures for thermal energy. • **Clean Transportation Innovation focus area**: The Hard-to-Electrify Transportation Applications initiative will focus on early-stage MHDV transportation demonstrations including early-stage, first-in-NYS, and unique-context demonstrations with active on-road and off-road MHDV fleets.
#4) Statewide modeling and planning: Across the electric and gas systems, stakeholders identified a need for greater standardization of modeling approaches to inform effective statewide grid modernization, gas system decommissioning efforts, and to accurately assess the environmental impacts of the energy system.	The I&R portfolio will focus on standardization of modeling and analytical approaches to inform decision-making and that helps achieve Climate Act goals and assess potential impacts on ratepayers: • **Grid Modernization focus area**: NYSERDA's Grid Modeling & Analysis Tools initiative will create standardized modeling approaches for statewide interconnection studies, reliability assessments, and power quality analyses. • **Fuels Transition focus area**: NYSERDA's Gas System Transition initiative will focus on collaborating with the PSC and utilities to standardize gas system mapping and modeling approaches, providing greater visibility into the long-term system risks including pipeline leaks and environmental impacts. • **Energy Focused Environmental Research focus area**: NYSERDA will focus on integrated studies to evaluate the environmental and public health implications and opportunities associated with energy-related policies including the Climate Act. NYSREDA will also fund source identification studies to better characterize, inform and optimize methane emissions reduction opportunities from the energy and buildings sectors.

#5) Zero emissions dispatchable power generation and storage: To address the Climate Act goal of zero emissions electricity by 2040, the Climate Action Council estimates that the State needs ~20 to 30 GW of zero emission dispatchable generation capacity to ensure there are no system reliability gaps.	The I&R portfolio will focus on addressing the need for new power generation and storage technologies with the potential to provide this capacity: • **Power Generation & Storage focus area**: NYSERDA Energy Storage initiative will fund pilot and full-scale demonstrations to prove out the potential for at-scale operation and economic viability of 10- to 100-hour storage solutions. NYSERDA's Power Generation R&D initiative will focus on assessing the technical potential for nuclear and OSW to provide safe, affordable, and reliable power to address generation needs.

Overall Funding Allocations

To determine budget modifications, NYSERDA created a funding reallocation pool aggregating funds from all sunset and modified initiatives, and then assigned funding to the 2026-2030 I&R portfolio focus areas based on past performance and market need. NYSERDA proposes a total I&R portfolio funding authorization of $394.3 million from 2026 to 2030. Of this total budget authorization, $317.6 million will fund seven focus areas and a reserve budget. This budget also includes funding for program administration, external EM&V, and the State Cost Recovery Fee. NYSERDA expects these funds to be committed between 2026 and 2030 and expended between 2026 and 2034. Table 19 shows expected I&R portfolio expenditures through 2034. NYSERDA recommends the Commission consider this annual expenditure forecast in establishing collections from ratepayers.

Table 19: Innovation and Research portfolio expected expenditures in millions by year

I&R Expenditure Plan ($M)	2026	2027	2028	2029	2030	2031	2032	2033	2034	Total
Programmatic Totals by Focus Area	**9.8**	**15.1**	**51.0**	**69.1**	**70.5**	**41.7**	**31.0**	**18.9**	**10.5**	**317.6**
Grid Modernization	2.0	3.8	12.0	16.4	16.5	8.1	3.7	2.7	1.3	66.5
Commercialization & Ecosystem	1.7	1.8	7.7	8.5	10.1	7.8	10.1	6.9	2.9	57.5
Advanced Buildings & Processes	1.4	2.6	7.5	10.4	11.4	7.5	4.6	0.7	1.4	47.5
Power Generation & Storage	2.0	3.3	6.7	9.1	8.6	4.7	2.3	1.3	1.0	39.0
Fuels Transition	1.1	1.0	7.7	11.2	9.3	2.7	1.9	1.5	1.1	37.5
Clean Transportation Innovation	0.9	0.8	5.1	7.5	8.5	4.2	1.8	1.2	1.0	31.0
Energy Focused Environmental Research	0.7	1.8	4.3	5.6	4.1	3.0	2.0	1.6	0.4	23.5
Reserve Funds	0.0	0.0	0.0	0.4	2.0	3.7	4.6	3.0	1.4	15.1
Other Costs	**5.4**	**8.8**	**13.6**	**14.1**	**15.1**	**9.5**	**5.7**	**2.9**	**1.6**	**76.7**
Labor Costs	4.8	7.4	10.1	10.4	10.7	5.6	3.0	0.8	0.4	53.2
Non-Labor Administrative Costs	0.6	1.4	2.5	2.7	3.0	2.0	0.9	0.6	0.3	14.0
External EM&V Costs	0.0	0.0	1.0	1.0	1.4	1.9	1.8	1.5	0.9	9.5
Total										**394.3**

Across the I&R portfolio, NYSERDA remains committed to maximizing "money out the door," providing direct funding for innovators and ecosystem stakeholders across the State through its programs. During the CEF period, NYSERDA operated with total program administration budget of approximately 13%, including labor costs, non-labor administrative costs, and external EM&V. However, this cost level has become increasingly challenging to maintain due to economic trends including persistently elevated inflation from late 2021 through 2023, which resulted in higher spending across the Authority's administrative cost structure including information technology services, facilities, contractor support, and other areas. As noted in NYSERDA's Energy Efficiency / Building Electrification (EE/BE) proposal,

between fiscal year 2016 and 2023, the New York "Management/Confidential" pay scale increased at a higher average rate than the five years leading up to the first CEF Order, resulting in a salary baseline that is on average 19% higher than at the start of the CEF.

In addition to economic trends around inflation and labor costs, the unique services NYSERDA offers through the I&R portfolio require more administrative costs relative to other programs. Most I&R projects require hands-on, active project management and close coordination with funding recipients to ensure successful technology commercialization. The I&R portfolio also requires staff with highly specialized expertise across a broad range of sectors and technologies to enable successful execution. As a result, more staff are required to manage funding relative to other NYSERDA programs.

With these realities in mind, NYSERDA developed a "bottom-up" budget for program administrative costs during the 2026-2030 period, accounting for inflationary and labor market changes across three standardized categories:

- **$53.2 million in labor costs (13.5% of total)**: Includes the cost of salaries and benefits of full-time NYSERDA employees and the cost of contracted staff needed for program implementation. This includes internal labor costs associated with EM&V.
- **$14.0 million in non-labor administrative costs (3.6% of total)**: Includes administrative overhead, system development costs, and NYS Cost Recovery Fees. NYSERDA proposes maintaining a consistent Cost Recovery Fee of 1.2% ($4.7 million), with remaining overhead costs of $9.3 million.
- **$9.5 million in External EM&V costs (2.4% of total)**: Includes the cost of hiring contractors, procuring data, and analysis done by third parties to perform evaluation studies of I&R programs.

Portfolio Expenditures

The I&R proposal includes expenditures projections that show the spend plan for 2026-2030 funds, including both programmatic and administrative funds. To create projections, NYSERDA developed a forecast model that incorporates assumptions about NYSERDA's program lifecycle, including how long it takes to develop funding solicitations, and move funds through their lifecycle from committed to expended. NYSERDA also included an assumed efficiency improvement of 15% for the 2026-2030 period, meaning that NYSERDA expects I&R funds to move through the program development lifecycle from solicitation to award 15% faster than during the CEF period. Improving efficiency in the solicitation process is a top priority for the future I&R portfolio. NYSERDA aims to achieve this by streamlining the focus areas and programs, standardizing administrative processes across the portfolio, and reducing the number of intervention typologies from eight to a standardized set of four. Based on these assumptions, Table 19 outlines NYSERDA's projected expenditures plan for the portfolio.

Proposed Budget Flexibility

Investing in innovation and research requires greater market responsiveness and adaptability compared to other NYSERDA efforts, such as incentive programs. To maximize ratepayer benefits from the I&R portfolio, operational flexibility will enable NYSERDA to adjust to market needs over the five-year funding period. NYSERDA proposes maintaining this flexibility by continuing the current CEF budget rules and procedures in the 2026-2030 I&R portfolio. Specifically, the budgets for the seven focus areas should be adjustable within +/-20% of the originally authorized amounts, excluding the reserve budget. Any proposed changes to these budgets will be included in NYSERDA's annual Operating Plan, which will provide a full accounting of budget adjustments over time to ensure transparency and adherence to the 20% flexibility rule.

Core Portfolio Outcomes and Targets

To demonstrate value and the anticipated impact of the 2026-2030 I&R portfolio, NYSERDA identified three core outcome metrics. Table 20 summarizes these proposed outcome targets. The proposed

targets are not comparable to the achievements from the 2016 to 2025 CEF period because, in the 2026-2030 I&R portfolio, NYSERDA plans to prioritize a smaller number of projects, which are expected to produce broader impacts from each additional product commercialized or unit replicated. NYSERDA proposes to report core outcome metrics at the portfolio level rather than the initiative or focus area level. Chapter 5 provides an in-depth explanation of this approach, along with a comprehensive list of performance metrics that will be tracked, evaluated, and reported.

Table 20: Proposed core outcome metrics and associated targets for the 2026-2030 portfolio

Core Outcome Metric	Definition	Proposed 2026-2030 I&R Portfolio Target
Leveraged Funding	Sum of private capital raised, external grants, and project cost share provided during or beyond the time of NYSERDA funding.	**$1.7 billion**
Products Commercialized	Commercially available products developed by companies using NYSERDA funds; this includes products that can be sold, leased, or licensed to the public, and/or are available in public marketplaces.	**110 products**
Replications of Demonstrations	Number of unit replications produced as a follow-on to NYSERDA funded demonstration projects. Demonstration replications validate the ability of a new technology to perform consistently under varying conditions and may reduce risks.	**570 replications**

4. Proposal and Funding by Future Focus Area

The 2026-2030 I&R portfolio will drive clean energy innovation and investment in NYS by funding a portfolio of RDD&C projects that fill market needs and enable systemwide affordability and reliability benefits for ratepayers. The portfolio will also focus on demonstrating and commercializing technologies for NYS through its programs. The following sections summarize the 2026-2030 I&R portfolio by proposed focus area. Each area-specific discussion highlights problem statements, outcomes, innovation needs, and interventions NYSERDA will use to accelerate the deployment of clean energy solutions. The 2026-2030 I&R portfolio builds on the accomplishments and lessons learned outlined in Chapter 2, as well as comprehensive market research and stakeholder engagement throughout the proposal process outlined in Chapter 3.

4.1. Grid Modernization

Problem Statements and Budget

The Grid Modernization focus area will fund RDD&C projects across technologies, tools, and processes that accelerate the development of a safe, reliable, and affordable electric grid. NYSERDA's investments focus on commercializing innovative technologies by encouraging statewide adoption across the electric system. **NYSERDA proposes an allocation of $66.5 million for the Grid Modernization focus area to address three problem statements**:

- **#1 [DER Standardization and Interoperability]** The challenges around DER standardization and the lack of available solutions to make them interoperable are hindering greater grid flexibility, slowing the deployment of DERs, and affecting load management efficiency across NYS.
- **#2 [Underutilization of Assets]** New and existing utility transmission and distribution assets are underutilized, which inhibits optimal use of current infrastructure and increases the need for new, costly "poles and wires" system build-out.
- **#3 [Non-Standardized Planning Approaches]** Lack of stakeholder consensus on planning methodologies and reporting metrics results in unscalable modeling approaches that delay generation, transmission, and distribution operations from achieving future reliable, affordable, and safe grid capabilities.

Initiatives and Interventions

Table 21 outlines Grid Modernization's 2026-2030 I&R initiatives, relevant problem statements, and proposed interventions. The sections below outline additional detail on each initiative.

Table 21: Grid Modernization initiatives, relevant problem statements, and interventions typologies

Initiative	Problem Statement	NYSERDA Intervention Approach	Intervention Typologies
Grid Flexibility	#1 [DER Standardization and Interoperability]	Invest in technologies that improve the interoperability of distributed grid assets, increasing the electric system's ability to manage supply and demand.	• Development & lab-scale prototyping • Pilots, sub & full-scale demonstrations • Commercialization services
Grid Enhancing & Future Grid	#2 [Underutilization of Assets]	Invest in GETs that maximize capacity across the existing electric system and enable further renewable energy deployment while reducing the need for new infrastructure.	• Development & lab-scale prototyping • Pilots, sub & full-scale demonstrations • Commercialization services
Grid Modeling & Analysis Tools	#3 [Non-Standardized Planning Approaches]	Invest in statewide modeling, planning, and analysis solutions that will enable the demonstration of innovative grid technologies with *in vitro* capabilities for replication and scalability.	• Research & studies • Development & lab-scale prototyping • Pilots, sub & full-scale demonstrations • Commercialization services

Focus Area Outcomes

While not intended as formal targets, NYSERDA has used the proposed budget, historical data and planned activities to estimate the level of activity and outcomes in each of the proposed focus areas. Investments in the Grid Modernization focus area are expected to fund up to 40 projects, leading to the following estimated outcomes:

- **$200 million in leveraged funding**: Based on historical results and current funding levels, Grid Modernization projects are expected to result in up to $200 million in leveraged funding including private capital investment, non-NYSERDA grants, other external funding. This represents over $3 in leveraged funding for every $1 of NYSERDA investment.
- **3 products commercialized**: Grid Modernization projects are expected to result in up to 3 grid flexibility, enhancement, and/or modeling technologies that are commercially viable and ready for scale-up and utility adoption.
- **50 demonstration replications**: Grid Modernization projects are expected to result in up to 15 demonstration projects and up to 50 replications of these demonstrations.

Beyond these forecasts, other outcomes will be tracked and evaluated as appropriate based on the metrics framework described in Chapter 5.

4.1.1. Grid Flexibility Initiative Overview

Innovation Need and Technology Solutions

The Climate Action Council Scoping Plan suggests that NYS will continue to pursue DER deployment alongside the expansion of large-scale power generation. DERs generate electricity closer to end users, increasing the delivery efficiency compared with other generation facilities, improving grid resiliency, and potentially curtailing the need for costly transmission investments. As more distributed resources come onto the grid, New York is working to integrate DER aggregations into wholesale electric markets through New York Independent System Operator's (NYISO) DER Aggregation Model and continuing to promote

and improve upon the Value Stack compensation mechanism for retail markets. However, DER aggregation markets face challenges with communication protocol standardization, which have the potential to limit the pace and scale of DER adoption. NYSERDA's Grid Flexibility initiative will address gaps in the standardization and interoperability of DERs, enabling market participants to optimize revenues and maximizing DER grid reliability benefits.

To address *problem statement #1* [DER Standardization and Interoperability], NYSERDA will provide funding for technologies that allow for increased adoption of DERs by improving the interoperability of these grid assets. NYSERDA will focus on optimizing the operations of DERs including, but not limited to, small-scale solar, battery energy storage systems, smart home devices, and transportation infrastructure. Technology innovations may include sensors and controllers that monitor and manage energy consumption, edge computing technologies that process data closer to where it is generated to reduce latency, and use of AI to automate communications and improve response times for grid operations. Improved interoperability will increase the electric system's ability to manage supply and demand and enable the grid to meet bulk power system and local distribution needs.

Program Participants & Services Provided
Program participants are expected to be innovative small businesses and established companies that specialize in grid management and interoperability technologies. NYSERDA will provide funding for program participants to create prototypes, assemble hardware, integrate software, and complete lab testing to validate compliance with operational, communication, and cybersecurity standards.[33] For demonstration projects, NYSERDA will fund the installation and integration of DER equipment, including power conversion systems and communication controls, to demonstrate their effectiveness in real-world settings. NYSERDA will facilitate collaborations between participates and utilities to test, demonstrate, and scale their solutions.

Expected Ratepayer Benefits
The Grid Flexibility initiative is expected to provide the following benefits for ratepayers, which NYSERDA will look to assess through technology performance metrics as described in Chapter 5:

1. **Lower DER operating costs**: Enable improved DER interoperability, optimizing energy flow, lowering operational costs, and potentially leading to reduced electricity bills for ratepayers.
2. **Improved grid stability**: At-scale deployment of advanced sensors and controllers will enhance grid stability and has the potential to reduce power outages.
3. **Cyber security enhancements**: Enabling implementation of cybersecurity standards will protect the grid and consumers from cyber threats, ensuring a secure and reliable energy system.
4. **Reduced infrastructure buildout costs**: Enabling standardization of communication protocols between DERs has the potential to accelerate deployment, which would reduce grid infrastructure buildout needs.

4.1.2. Grid Enhancing & Future Grid Initiative Overview

Innovation Need and Technology Solutions
NYS is expecting a significant increase in overall electricity demand in the coming decades, as annual peak demand has the potential to increase from 31 GW in 2023 to between 41 and 55 GW in 2050 across a range of modeled scenarios.[34] However, many existing transmission and distribution system assets are currently underutilized, meaning the existing poles and wires do not accommodate as much electricity

[33] This includes operational standards (e.g., IEEE 1547, UL 1741SB, applicable electrical codes), information model standards (e.g. IEC 61968 and IEC 61970), communications standards (e.g. IEEE 2030.5, DNP3, MODBUS), wireless communications standards (e.g., WirelessHART, ISA100.11a), and cybersecurity standards (e.g. ISA/IEC 62443, NIST 800-82, NIST 800-37).
[34] Climate Action Council Scoping Plan Appendix G (Integration Analysis Annex 2), 2022, available at: https://climate.ny.gov/resources/draft-scoping-plan/

capacity as they potentially could. Emerging GETs, such as DLR, have the potential to increase effective transmission and distribution capacity on existing lines by 10 to 30%. However, DLR deployments have been limited due to a lack of industry standards for testing and certifying performance.
To address *problem statement #2* [Underutilization of Assets], NYSERDA will provide funding to develop and demonstrate technologies that maximize equipment capacity across the existing electric system and enable further renewable energy deployment while reducing the need for new infrastructure. Solutions will focus on GETs including, but not limited to, DLR, power flow control devices, topology optimization, power quality mitigation techniques and devices, and predictive maintenance techniques with advanced monitoring.

Program Participants & Services Provided

NYSERDA will engage innovative small businesses, established companies, and manufacturers focused on developing GETs. NYSERDA will provide funding for product development—including system design, engineering, modeling, and simulation—for GET hardware and software. As part of product development services, NYSERDA will provide funding for prototyping, initial testing, and full lab validation. For pilots and demonstrations, NYSERDA will fund utility feasibility studies to identify suitable sites and fund demonstration projects that assess technology performance and feasibility in real-world settings and confirm regulatory compliance through installation of monitoring sensors. Additionally, NYSERDA will focus on commercialization of these technologies by fostering collaboration with utilities and grid stakeholders to enable scaling of successful demonstrations from individual power lines or sub-sections of the grid to broader utility service territories.

Expected Ratepayer Benefits

The Grid Enhancing & Future Grid initiative is expected to provide the following benefits to ratepayers, which NYSERDA will look to assess through technology performance metrics as described in Chapter 5:

1. **Lower energy costs**: By enabling implementation of DLR rating and power flow control devices at scale, utilities can optimize the use of existing grid infrastructure, reducing the need for costly upgrades and lowering electricity bills.
2. **Increased reliability through predictive maintenance**: Predictive maintenance techniques with advanced monitoring help prevent outages by identifying and addressing potential issues before they cause disruptions, ensuring a more reliable power supply.
3. **Enhanced grid capacity and stability**: Topology optimization and advanced distribution management systems improve the grid's ability to handle more renewable energy sources, increasing overall system capacity and stability.
4. **Improved power quality**: Power quality mitigation techniques and devices ensure a stable and consistent power supply, reducing the risk of damage to consumer electronics and appliances.

4.1.3. Grid Modeling & Analysis Tools Initiative Overview

Innovation Need and Technology Solutions

Through the CEF period, NYSERDA has focused on increased utility coordination (including through TWGs) to encourage standardization modeling and forecasting approaches, driving enhanced data visibility and accessibility for system planners and other stakeholders. To complement other grid initiatives and address *problem statement #3* [Non-Standardized Planning Approaches], NYSERDA will invest in statewide modeling, planning, and analysis solutions that will enable the demonstration of innovative technologies with capabilities for replication and scalability –including from a portion of the grid to statewide transmission and distribution. Where appropriate, NYSERDA will seek opportunities to integrate AI tools to improve the accuracy of forecasts and reduce development costs across models. These standardized approaches will enable improved visibility and accessibility for system planners, and forecasting capabilities to operate the dynamic grid of the future in a safe and reliable manner. This initiative will complement ongoing State initiatives, notably NYPA's Advanced Grid Innovation Laboratory

for Energy (AGILe) lab and its grid digital twin, by enhancing scalability and standardization of solutions across utilities.

Program Participants & Services Provided

NYSERDA plans to guide research activities towards developing the capabilities required for planning, executing, and sustaining the grid of the future. In doing so, we will work directly with critical grid stakeholders, including but not limited to, the New York ITWG, ATWG, ISO, the Joint Utilities, NYPA, municipal utilities, and co-operative utilities. Activities will include creating standardized modeling approaches and advanced simulation capabilities to conduct interconnection studies, reliability assessments, and power quality analyses. NYSERDA will focus on product development services for modeling and simulation, working closely with utilities and other stakeholders including NYISO to develop practical and scalable tools. Additionally, NYSERDA will continue to foster utility collaboration to promote consistent planning practices, enabling scalable and replicable solutions for grid planning and operation. Lastly, NYSERDA proposes continuing to fund and manage the NY Grid Connect platform under this initiative.

Expected Ratepayer Benefits

The Grid Modeling & Analysis Tools initiative is expected to provide the following benefits to ratepayers, which NYSERDA will look to assess through technology performance metrics as described in Chapter 5:

1. **Improved service reliability through forecasting**: Enhanced visibility and forecasting capabilities help prevent outages and ensure a stable power supply, providing more reliable service for ratepayers.
2. **Expanded renewable energy integration abilities**: Standardized planning methodologies and simulation tools enable better integration of renewable energy sources, boosting the grid's capacity to handle more clean energy.

4.2. Commercialization & Ecosystem

Problem Statements and Budget

NYSERDA aims to foster a strong cleantech innovation ecosystem to scale startups and solutions for decarbonization, benefiting NYS. The Commercialization & Ecosystem focus area will provide commercialization services to early- and growth-stage companies, investors, manufacturers, offtakers, and entrepreneurial support organizations by advancing clean energy technologies. **NYSERDA proposes an allocation of $57.5 million for the Commercialization & Ecosystem focus area to address four problem statements**:

- **#1 [Flexible Funding and Expertise]** Resource and logistical barriers prevent small businesses from accessing necessary expertise and services to overcome commercialization challenges and scale their technologies in the market.
- **#2 [Commercialization Services]** Programmatic gaps within the NYS innovation ecosystem that are not being addressed by other ecosystem partners inhibit companies from receiving necessary commercialization support.
- **#3 [Ecosystem Choreographer]** The NYS ecosystem has indicated a need for a choreographer that can provide targeted resources so that partners share information and best practices, avoid duplicative efforts, and collaboratively problem-solve to maximize impact toward NYS's decarbonization goals.

Initiatives and Interventions

Table 22 outlines Commercialization & Ecosystem's 2026-2030 I&R initiatives, relevant problem statements, and proposed interventions. The sections below outline additional detail on each initiative.

Table 22: Commercialization & Ecosystem initiatives, relevant problem statements, and interventions typologies

Initiative	Problem Statement	NYSERDA Intervention Approach	Intervention Typologies
Commercialization Expertise and Voucher	#1 [Flexible Funding and Expertise]	Invest in vouchers to provide targeted technical and commercialization mentorship, advising, and assistance to start-ups across stages.	• Commercialization services
Cohort-based Commercialization	#2 [Commercialization Services]	Provide funding for partners to run cohort-based programs that offer commercialization services and award funding directly to companies.	
Ecosystem Growth	#3 [Ecosystem Choreographer]	Run a channel partner network and conduct convening and coalition-building activities that support continued growth of the cleantech ecosystem.	

Focus Area Outcomes

While not intended as formal targets, NYSERDA has used the proposed budget, historical data and planned activities to estimate the level of activity and outcomes in each of the proposed focus areas. Investments in the Commercialization & Ecosystem focus area will result in funding for targeted small dollar value in-kind vouchers, cohort-based programs, and sponsorships. Unlike sector-specific focus areas that provide direct funding for product development and demonstrations, Commercialization & Ecosystem programs provide more targeted services to address specific commercialization barriers, expanding the number of companies they can engage relative to other focus areas. Lead to the following estimated outcomes:

- **$1 billion in leveraged funding**: Commercialization & Ecosystem projects are expected to result in up to $1 billion in leveraged funding. This represents over $17 in leveraged funding for every $1 of NYSERDA investment.
- **90 products commercialized**: Commercialization & Ecosystem projects are expected to result in up to 90 clean energy technologies that are commercially viable and ready for additional demonstration projects.

Beyond these forecasts, other outcomes will be tracked and evaluated as appropriate based on the metrics framework described in Chapter 5.

4.2.1. Commercialization Expertise and Voucher Initiative Overview

Innovation Need, Participants, and Services Provided

In the technology commercialization context, a voucher is typically exchanged for predefined in-kind services provided to a company to advance their technology towards market readiness. Energy technology vouchers serve as valuable tools to advance clean energy and cleantech adoption by giving small businesses and organizations access to mentors, technical services, testing facilities, and other third-party subject matter expertise to commercialize their technologies. Through the CEN and EIR program, NYSERDA has committed nearly $12 million in voucher funding for cleantech expertise across 875 engagements. DOE has also implemented several voucher programs for the commercialization of cutting-edge technologies. In 2023, DOE's Office of Technology Transitions announced a $27.5 million voucher program in to provide in-kind commercialization services. These are significant investments, but both NYSERDA and DOE programs are expected to end by 2026. Through this initiative, NYSERDA proposes to continue providing services to cleantech startups, small businesses, and manufacturers by providing additional vouchers from 2026 to 2030.

To address *problem statement #1* [Flexible Funding and Expertise], NYSERDA will invest in vouchers to provide technical and commercialization mentorship, advising, and assistance. These vouchers will fund companies at various stages of technological development (TRL 2-7). Early-stage companies will receive

mentorship and advisory services including grant writing, pitch coaching, customer discovery, business plan development, legal services, talent matching, sales development, operations, and commercialization strategy. For more advanced technologies, NYSERDA will provide technical and commercialization assistance to solution providers, developers, and technology adopters including vouchers for certification testing, validation, and services for siting and front-end engineering design studies. Contractors supplying these services are expected to be contracted by a project-specific competitive process or qualified to join a "pool" through a competitive request for qualifications. Voucher funding will fund targeted portions of each project, reducing deployment risk.

Expected Ratepayer Benefits
The Commercialization Expertise and Voucher initiative is expected to provide the following benefits to ratepayers, which NYSERDA will look to assess through technology performance metrics as described in Chapter 5:

1. **Economic development and ecosystem growth**: Programs that drive commercially meaningful demonstrations provide startups with clear objectives for hard tech and quickly validate their solutions. This accelerates company growth and directs investment towards proven solutions that are on progressing towards commercial deployment.
2. **Reduced costs through replicability of demonstrations**: Cost compression and replication may increase with targeted funding for validation and technology transfer.

4.2.2. Cohort-based Commercialization Initiative

Innovation Need, Participants, and Services Provided
According to the International Energy Agency Net Zero Report, by 2050, approximately 48% of the GHG reductions in its net-zero emissions scenario for the energy sector will rely on technologies that are currently in the prototype or demonstration phases. Research shows that participation in accelerators is positively associated with startup performance, leading to increased likelihood of raising venture capital, generating more revenue, hiring more skilled employees, and paying employees higher wages.[35] NYSERDA works closely with the NYS market to identify sector-specific commercialization barriers and design accelerator programs to overcome these barriers (e.g., manufacturing, raising venture funding, and finding offtakers). NYSERDA will build on the success of its existing programs (e.g., Scale for ClimateTech, Venture for ClimateTech, and Activate) and continue to accelerate uptake of new technology.

To address *problem statement #2* [Commercialization Services], NYSERDA proposes to directly run or collaborate with partners running cohort-based programs that offer services and award grants to companies. NYSERDA has a history of funding accelerator programs, including the following six programs: Venture for ClimateTech, CarbonTech Development Initiative, Activate, Scale for ClimateTech, The Clean Fight, and Uptake Alliance. The commercialization services provided are expected to include pre-seed and seed-stage support with funding, curriculum, coaching, and matchmaking to prepare companies for initial customers, product pilots, and venture investment. They also facilitate the transfer of intellectual property from labs to new companies, support early to growth-stage business model development, and provide market analysis for growth-stage innovations. Additionally, NYSERDA focuses on typology-specific services, such as development and lab-scale prototyping (TRL 4-5), which helps early-stage hardware technologies with resources, funding, mentors, and connections to manufacturers to refine product design and scale up manufacturing processes.

[35] Poised for growth: Exploring the relationship between accelerator program design and startup performance, 2024, available at: https://onlinelibrary.wiley.com/doi/10.1002/smj.3581

Expected Ratepayer Benefits
Through the Cohort-Based Commercialization initiative, ratepayers can expect to realize the following benefits, which NYSERDA will look to assess through technology performance metrics as described in Chapter 5:

1. **Economic growth**: Success of New York's small businesses and innovative technologies have the potential to create jobs and stimulate economic growth, driving a more robust local economy and employment opportunities.
2. **Accelerated commercialization and optionality for ratepayers**: By participating in cohort-based accelerators and challenges, new technologies can scale more rapidly, providing more product optionality for ratepayers.

4.2.3. Ecosystem Growth Initiative

Innovation Need, Participants, and Services Provided
Ecosystems are essential for scaling technology solutions, as they create collaborative environments where various stakeholders (e.g., research institutions, entrepreneurs, industry, investors, and government) can tackle complex challenges more effectively than in isolation. Since NYSERDA began funding NYS's cleantech ecosystem in 2016, it has nearly doubled in size.[22] Climate investments in NYS surged to over $1 billion in 2021 but have declined year-over-year, with 2023 seeing over 50% lower investments compared to 2021. This decline has significantly impacted early- and growth-stage startups. While NYS has a top-ranking ecosystem, there is a need for a dedicated choreographer to bring the ecosystem together to share best practices, collaborate on topics of strong collective need, and improve or develop critical programs.

In June and July 2024, NYSERDA held two roundtable discussions with cleantech ecosystem stakeholders to identify ways to optimize NYSERDA's role 2026-2030. Participants overwhelmingly suggested that NYSERDA could add the most value by periodically convening the larger ecosystem to improve the flow of information and resources. Historically, NYSERDA has sponsored ecosystem participants such as Cleantech Open Northeast, Upstate Capital Association of New York, Upstate Venture Connect, and the Business Incubator Association of NYS. These sponsorships have expanded NYSERDA's reach, particularly into upstate New York, resulting in a diverse range of applicants to I&R programs and greater awareness of technology and business opportunities in clean tech across the state.

To address *problem statement #3* [Ecosystem Choreographer], NYSERDA will use funding to run a channel partner network and conduct convening and coalition-building activities for continued growth of the cleantech ecosystem. NYSERDA expects to also provide funding through competitive grants or sponsorships. The intent is to put "tailwinds" behind high-impact programming that other channel partners want to undertake, as distinct from the cohort-based programming, where NYSERDA is providing other entities with funding to administer programs.

Expected Ratepayer Benefits
Through the Ecosystem Growth initiative, NYS can expect to realize the following benefits, which NYSERDA will look to assess through technology performance metrics as described in Chapter 5:

1. **Collaboration and expertise:** Convening the Channel Partner Network brings together diverse stakeholders (geographic and expertise) to identify and solution around specific energy challenges, ensuring solutions developed are practical and effective for NYS applications.
2. **Market access and scaling:** The Network will focus on technology developers navigating the complex energy market, providing them with services needed to scale their innovations and strengthening relationships to further connect small businesses across the State.
3. **Regulatory coordination and advocacy:** The Network would work across regulatory bodies and advocate for policies that enable the adoption of clean technologies, leading to regulatory changes or incentives to enhance cost-effective implementation of new energy solutions.

4.3. Advanced Buildings & Processes

Problem Statements and Budget

Through the Advanced Buildings & Processes focus area, NYSERDA will prioritize energy innovation and grid-interactive building (residential, commercial, and industrial) infrastructure and processes. NYSERDA will target development and performance validation demonstrations to enable electrified, affordable, zero emissions buildings. **NYSERDA proposes an allocation of $47.5 million for the Advanced Buildings & Processes focus area to address three problem statements**:

- **#1 [Envelope Retrofit Solutions]** The lack of cost-effective and easy-to-implement solutions limits the number of building owners conducting envelope retrofits that reduce thermal loads, electricity peak demand, and energy costs for ratepayers.
- **#2 [Scalable Electrification Solutions]** The limited number of scalable electrification solutions available for diverse building typologies in NYS prevents building owners from pursuing electrification and decarbonization in a cost-effective manner.
- **#3 [Electric Load Management]** The complexities associated with integrating building load management solutions and participating in grid flexibility markets makes it more difficult for building owners to effectively manage and reduce electric loads, which impacts ratepayer savings and hampers grid flexibility, reliability, and resiliency.

Initiatives and Interventions

Table 23 outlines Advanced Buildings & Processes' 2026-2030 I&R initiatives, relevant problem statements, and proposed interventions. The sections below outline additional detail on each initiative.

Table 23: Advanced Buildings & Processes initiatives, relevant problem statements, and interventions typologies

Initiative	Problem Statement	NYSERDA Intervention Approach	Intervention Typologies
Energy Efficiency & Electrification	#1 [Envelope Retrofit Solutions] #2 [Scalable Electrification Solutions]	Invest in (1) technologies that drive installation efficiency for envelope retrofits, and (2) heat pump development, demonstration, and commercialization to drive performance improvements, cost-compression, and identify scalable solutions across building typologies.	• Development & lab-scale prototyping • Pilots, sub & full-scale demonstrations • Commercialization services
Intelligent Buildings	#3 [Electric Load Management]	Invest in asset control and automation technologies that help building owners manage and reduce electric loads, enabling buildings to be more reliable grid resources.	• Research & studies • Development & lab-scale prototyping • Pilots, sub & full-scale demonstrations • Commercialization services

Focus Area Outcomes

While not intended as formal targets, NYSERDA has used the proposed budget, historical data and planned activities to estimate the level of activity and outcomes in each of the proposed focus areas. Investments in the Advanced Buildings & Processes focus area are expected to fund up to 40 projects, leading to the following estimated outcomes:

- **$150 million in leveraged funding**: Advanced Buildings & Processes projects are expected to result in up to $150 million in leveraged funding. This represents over $3 in leveraged funding for every $1 of NYSERDA investment.
- **6 products commercialized**: Advanced Buildings & Processes projects are expected to result in up to 6 products commercialized across envelope, electrification, and grid-interactive building technologies.
- **300 demonstration replications**: Advanced Buildings & Processes projects are expected to result in up to 10 demonstration projects and up to 300 replications of these demonstrations. Note,

unit replications are expected to be highest in the Advanced Buildings & Processes focus area due to the potential for scalability of technologies within individual buildings (i.e., the ability to rapidly scale a demonstration from one unit in a multifamily building to all units in that same building).

Beyond these forecasts, other outcomes will be tracked and evaluated as appropriate based on the metrics framework descried in Chapter 5.

4.3.1. Energy Efficiency & Electrification Initiative Overview

Innovation Need and Technology Solutions

The Climate Action Council Scoping Plan analysis suggests that widespread improvements to building envelopes have the potential to reduce overall energy demand from the buildings sector by 30% to 50% by 2050.[36] Envelope retrofits can be expensive for New York building owners due to the construction labor rates, material costs, and regulatory and permitting requirements.[37] To address *problem statement #1* [Envelope Retrofit Solutions], NYSERDA will invest in technologies that drive cost-compression and installation efficiency. This includes high-performance insulation materials (e.g., vacuum insulated panels and aerogels), air and moisture barriers, prefabricated panels, and automation technologies that leverage robotics and advanced analytics to reduce installation costs. There are manufacturers that currently create prefabricated envelope assemblies, but they are primarily for new construction.[38] More low-cost, standardized solutions are needed to target the existing buildings in New York.

Electrification of heating load is currently seen as a key component of advancing decarbonization in the building sector. While many heat pump technologies are commercially available today, technical improvements are needed to drive increased adoption including optimizing performance in cold weather, creating solutions for large buildings and district systems, and advancing high-temperature industrial end uses.

To address *problem statement #2* [Scalable Electrification Solutions], NYSERDA will invest in heat pump product development and demonstrations to drive performance improvements, cost-compression, and identification of scalable solutions across building typologies. This includes water-source heat pumps, cold-climate air-source heat pumps, and high-temperature heat pumps for steam or hydronic distribution and potentially industrial use cases. NYSERDA will address the technical challenges associated with high-temperature heat pumps, including maintaining high operational temperatures and efficiency over extended periods of time.

Program Participants & Services Provided

Through this initiative, NYSERDA will collaborate with innovative small businesses and technology manufacturers to develop, demonstrate, and commercialize solutions that will be adopted by building owners across a broad range of occupancy types—including, but not limited to, single-family, multi-family, commercial, industrial, and data centers. NYSERDA will offer companies funding to perform prototyping and lab-scale testing, focused on developing envelope and electrification technologies in controlled environments to ensure they meet performance and regulatory standards specific to NYS and national guidelines.[39] This includes testing for efficiency, thermal performance, and durability under various conditions, which can help identify ways to reduce manufacturing and installation costs. Demonstrations

[36] NYS Climate Action Council Scoping Plan, 2022, available at: https://climate.ny.gov/resources/scoping-plan/
[37] Occupational Employment and Wage Statistics, Bureau of Labor Statistic, 2023.
[38] Carbon Neutral Buildings Roadmap, NYSERDA, 2022, available at: https://www.nyserda.ny.gov/All-Programs/Carbon-Neutral-Buildings
[39] For heat pumps, this includes U.S. Department of Energy efficiency standards to ensure eligibility for Inflation Reduction Act tax credits (e.g., SEER2, EER2, and HSPF2), and ensuring that new technologies can participate in the New York State Clean Heat Program.

will aim to address the unique adoption challenges in each technology area. For implementing heat pump solutions, this includes optimizing performance in cold climates and addressing the specific needs of high-temperature heat pumps (higher operational temperatures and maintaining efficiency over time). When retrofitting building envelopes, this includes maintaining structural integrity and minimizing disruption to occupants. Commercialization services will focus on small business development, an understanding of and compliance with applicable regulatory frameworks (e.g., permitting, siting, compliance), and scaling efforts to replicate demonstrations across multiple buildings and typologies.

Expected Ratepayer Benefits

The Energy Efficiency & Electrification initiative is expected to provide the following benefits to ratepayers, which NYSERDA will look to assess through technology performance metrics as described in Chapter 5:

1. **Faster and more cost-effective retrofits**: Prefabricated panels and automation technologies (such as robotics and advanced analytics) will speed up the retrofit process, reducing labor costs and minimizing disruption to building occupants.
2. **Lower heating and cooling costs**: The development of high-performance insulation materials (including vacuum insulated panels and aerogels) has the potential to moderate heat loss and gain, leading to lower energy consumption for heating and cooling.
3. **Enhanced grid stability**: Deployment of improved insulation technologies and efficient heat pumps may reduce overall energy consumption, ease grid demand, prevent overloads, and contribute to a more stable and reliable supply—especially during peak usage times.
4. **Consistent indoor temperatures**: High-performance insulation materials and reliable heat pumps lead to consistent indoor temperatures, reducing the need for frequent adjustments and maintaining a stable indoor environment. This reliability in temperature control has the potential to enhance occupant comfort and reduce wear and tear on HVAC systems.
5. **Reliable high-temperature heating**: High-temperature heat pumps for steam or hydronic distribution will offer reliable heating solutions for buildings that require higher operational temperatures. These systems often face challenges in achieving and maintaining high temperatures due to material and design limitations; NYSERDA demonstrations will help identify improvements and reduce risks.

4.3.2. Intelligent Buildings Initiative Overview

Innovation Need and Technology Solutions

Across building typologies, smart controls that enable demand flexibility have demonstrated the potential to reduce total energy costs for building owners by 29% and have the potential to reduce daily peak demand in New York by 30-50%.[40] To spur continued adoption, building owners must be able to verify that their buildings can efficiently respond to price signals using new technologies. They must also be incentivized to consume power during low-cost times of the day. To address *problem statement #3* [Electric Load Management], NYSERDA will invest in technologies that help building owners manage and reduce electric loads, enabling buildings to be more reliable grid stability resources and generating greater ratepayer savings.[41] This initiative will provide funding to develop advanced building device control algorithms, autonomous operational processes, and other intelligent controls that leverage building science and occupant behavior data. Technology solutions will also focus on enabling new, high energy demand end users—including data centers and industrial facilities—to be grid flexibility assets.

[40] Carbon Neutral Buildings Roadmap, NYSERDA, 2022, available at: https://www.nyserda.ny.gov/All-Programs/Carbon-Neutral-Buildings

[41] The building-grid integration initiative is focused on addressing the unique integration challenges associated with buildings, while the grid focus area is doing work around interoperability across all grid edge devices.

Program Participants & Services Provided
NYSERDA will collaborate with companies developing technology solutions that connect and integrate with a building's energy assets and autonomously manage the timing and setpoints of the building's major electric loads to reduce utility costs and drive demand reductions. Lab-scale testing and simulations will evaluate the scalability of building-specific grid-edge devices and validate potential ratepayer savings that can be achieved through automated demand response. Pilots and demonstrations will include testing installation methods, approaches to managing electric loads, and integration with energy storage systems and on-site renewables. These demonstrations will aim to determine the daily load flexibility potential across building typologies while maintaining occupant comfort and critical commercial & industrial operations.

Expected Ratepayer Benefits
The Intelligent Buildings initiative is expected to provide the following benefits to ratepayers, which NYSERDA will look to assess through technology performance metrics as described in Chapter 5:

1. **Increased energy savings and enhanced load management:** Intelligent controls leveraging building science and occupant behavior data can fine-tune energy consumption and manage major electric loads, leading to significant savings and reduced peak demand charges.
2. **Greater reliability and resilience:** Pilot projects with energy storage and on-site renewables enhance reliability and reduce outage risks, ensuring a stable power supply.
3. **Optimized comfort and operations:** Demonstrations can ensure that energy efficiency improvements maintain occupant comfort and critical operations, providing a balanced approach to energy management.

4.4. Power Generation & Storage

Problem Statements and Budget
Through the Power Generation & Storage focus area, NYSERDA will prioritize research, development, and demonstration of energy storage and zero emissions power generation technologies to provide firm, dispatchable capacity and decarbonize hard-to-electrify sectors. **NYSERDA proposes an allocation of $39.0 million for the Power Generation & Storage focus area to address four problem statements**:

- **#1 [LDES Cost and Performance Improvements]** The lack of economically viable 10- to 100-hour energy storage technologies means that NYS does not currently have the solutions necessary to avoid potential future peak season shortfalls, many of which are expected to span multiple days.
- **#2 [Li-ion Alternatives]** Cost and performance issues of non-Li-ion energy storage technologies, combined with the reliance on Li-ion solutions that pose fire safety and adoption challenges, have the potential to hinder deployment of safe, economically viable, and community-accepted energy storage options.
- **#3 [Nuclear Power Feasibility]** Current load growth projections and the expansion of economic activity with high power quality and availability requirements are creating the need for a broad look at technologies that can advance NY's decarbonization goals. As the State looks at the suite of nuclear technologies and potential applications, research and pre-development work will be needed to better understand the technical feasibility of specific applications throughout the grid.
- **#4 [OSW Consortium]** Fund continued operations and R&D projects of the OSW Consortium; focus on needs including deep-water OSW and mesh grid R&D to enable access of currently inaccessible NYS offshore study area and improve transmission to increase reliability and reduced levelized cost of electricity.

Initiatives and Interventions
Table 24 outlines Power Generation & Storage's 2026-2030 I&R initiatives, relevant problem statements, and proposed interventions. The sections below outline additional detail on each initiative.

Table 24: Power Generation & Storage initiatives, relevant problem statements, and interventions typologies

Initiative	Problem Statement	NYSERDA Intervention Approach	Intervention Typologies
Energy Storage	#1 [LDES Cost and Performance Improvements] #2 [Li-Ion Alternatives]	Invest in (1) LDES pilot and full-scale demonstration to prove out the potential for installation, at-scale operation, and economic viability of 10- to 100-hour storage solutions, and (2) invest in development to address the specific cost and performance challenges of non-Li-ion energy storage solutions, such as flow, solid-state, and sodium-ion batteries	• Development & lab-scale prototyping • Pilots, sub & full-scale demonstrations • Commercialization services
Power Generation Research & Development	#3 [Nuclear Power Feasibility]	Given load growth projections and the expansion of economic activity with high power quality and availability requirements, invest in research and pre-development work to better understand the technical feasibility of specific nuclear applications throughout the grid.	• Research & studies
	#4 [OSW Consortium]	Fund continued operations of the OSW Consortium; focus on needs including deep-water OSW and mesh grid R&D to enable connectivity across NYS offshore study area and improve transmission efficiency.	• Research & studies • Development & lab-scale prototyping • Pilots, sub & full-scale demonstrations • Commercialization services

Focus Area Outcomes

While not intended as formal targets, NYSERDA has used the proposed budget, historical data and planned activities to estimate the level of activity and outcomes in each of the proposed focus areas. Investments in the Power Generation & Storage focus area are expected to fund up to 10 projects, leading to the following estimated outcomes:

- **$140 million in leveraged funding**: Power Generation & Storage projects are expected to result in up to $140 million in leveraged funding. This represents over $3 in leveraged funding for every $1 of NYSERDA investment.
- **3 products commercialized**: Power Generation & Storage projects are expected to result in up to 3 energy storage technologies that are commercially viable and ready for additional demonstration projects.
- **5 demonstration replications**: Power Generation & Storage projects are expected to result in up to 2 demonstration projects and up to 5 replications of these demonstrations.

Beyond these forecasts, other outcomes will be tracked and evaluated as appropriate based on the metrics framework described in Chapter 5.

4.4.1. Energy Storage Initiative Overview

Innovation Need and Technology Solutions

The NYS Energy Storage Roadmap analysis suggests that, by 2040, the State's higher expected peak load, coupled with intermittent periods of low renewable energy output, will create risks of loss-of-load events that short-duration storage solutions (4-8 hours) cannot satisfy. Without continued operation of conventional resources or a new solution, the median loss-of-load event is expected to be ~23 hours, and many events could last multiple days. To bridge this gap and reduce the risk of future blackout events,

the roadmap identifies a need for 24 GW of LDES with 50% round-trip efficiency.[42] The Energy Storage Roadmap further recommends that the I&R portfolio examine funding needs within the existing framework with a focus on enabling large-scale LDES demonstration projects between 50-100 MWs. These projects are intended to provide insight into use cases for LDES and information for utilities, DPS, and NYISO to integrate into their planning and operational procedures.

To address *problem statement #1* [LDES Cost and Performance Improvements], NYSERDA will fund pilot and full-scale demonstrations to prove out the potential for installation, at-scale operation, and economic viability of 10- to 100-hour storage solutions. Potential technical pathways may include thermal storage, pumped hydropower, compressed air, flow batteries, and non-lithium-ion chemistries. NYSERDA will fund pilot and demonstration projects expected to be in the 1-10 MW range, based on available funding. For this initiative, NYSERDA is especially focused on thermal storage technologies that can be integrated into existing steam distribution infrastructure, making them scalable in densely populated load centers (NYISO zones J and K) where there is over 8 GW of fossil fuel peaking capacity currently in operation.[43]

For intraday grid balancing, the Energy Storage Roadmap Order suggests that NY will need 12 GW of short-duration storage by 2040 to maintain an affordable and reliable system. The short-duration lithium-ion battery market is growing rapidly in NYS, with almost 400 MW of capacity in operation and nearly 600 MW of additional storage under contract.**Error! Bookmark not defined.** However, lithium-ion battery safety remains a concern for end user adoption after three battery energy storage fires in 2023. While the State is actively developing fire code updates to improve coordination, safety, and emergency preparedness in the planning of storage projects, lithium-ion alternatives such as solid-state batteries and sodium-ion batteries can offer improved safety profiles by eliminating flammable liquid electrolytes, reducing the risk of fires and thermal runaway.

To address *problem statement #2* [Li-ion Alternatives], NYSERDA will address the specific cost and performance challenges of non-Li-ion energy storage solutions, such as flow, solid-state, and sodium-ion batteries. NYSERDA will provide funding for prototyping and lab-scale testing services targeting technology improvements such as enhancing energy density, reducing degradation rates, increasing round-trip efficiency, and improving thermal management. This includes the development of new materials and chemistries, system, and economic modeling to predict performance under various scenarios, and advanced manufacturing processes to reduce costs.

Program Participants & Services Provided
The Energy Storage initiative will primarily provide funding to technology developers and manufacturers specializing in non-Li-ion short- and long-duration storage solutions. NYSERDA would oversee the funding and coordination of lab-scale prototyping and product development, and well as pilots and full-scale demonstration projects to validate the potential and scalability of these technologies. NYSERDA will coordinate with utility companies, grid operators, and community organizations to ensure that the solutions are safe and beneficial to the communities they serve.

Expected Ratepayer Benefits
The Energy Storage initiative is expected to provide the following benefits to ratepayers, which NYSERDA will look to assess through technology performance metrics as described in Chapter 5:

[42] New York State Energy Storage Roadmap, 2024, available at: https://www.nyserda.ny.gov/All-Programs/Energy-Storage-Program
[43] Based on NYISO's 2024 Gold Book report. We define peaking capacity as fossil fuel power plants with a nameplate capacity greater than 10 MW that operated with a capacity factor of 15% or less in 2023.

1. **Enable a reliable zero emission system**: With the deployment of long-duration storage solutions, the grid will be better equipped to handle prolonged periods of low renewable output.
2. **Accelerated renewable integration**: By supporting both short- and long-duration storage solutions, the program facilitates greater integration of renewable energy sources, which can lead to a cleaner energy mix and potentially lower energy costs in the long-term through avoided infrastructure buildout.
3. **Safety improvements**: Addressing the fire safety and adoption challenges of lithium-ion batteries and developing safer alternatives like solid-state and sodium-ion batteries enhances the safety of energy storage systems, protecting ratepayers from potential hazards.

4.4.2. Power Generation Research & Development Initiative Overview

Innovation Need and Technology Solutions

A core requirement of the Climate Act is that NYS must achieve zero emissions electricity by 2040. The Climate Action Council's analyses estimate that the State will require between 20 and 30 GW of zero emissions dispatchable generation capacity to reliably meet the emissions-free electricity goal, and the PSC is in the process of adopting a definition of "zero emissions." Through this initiative, I&R proposes funding research and development projects to position NYS as a leader in OSW and nuclear innovation, attracting investment and fostering technological advancements while meeting the State's goals.

To address *problem statement #3* [Nuclear Power Feasibility], NYSERDA's Power Generation R&D initiative will focus on assessing the potential for nuclear power to provide safe, affordable, and reliable power to address the State's need for firm generation. NYSERDA expects that this initiative will focus on research & studies in four areas:

1. **Evaluation of advanced reactor technology landscape.** NYSERDA research efforts would evaluate and explore emerging technologies in the nuclear space, encompassing both fission and fusion innovations as appropriate. This may include Generation IV reactors, small modular reactor (SMR) designs, molten salt technologies, high-temperature reactors, and cutting-edge fusion systems.
2. **Assess fuel supply chain risks**. The scalability of nuclear in NYS will rely on a steady supply of uranium. This effort would survey ongoing research efforts around creative ways of extracting uranium outside of mining (e.g., extraction of uranium from sea water).
3. **Scalability of high-temperature reactors paired with high-energy-demand applications.** In addition to electricity, high-temperature reactors have the potential to provide high-temperature heat and high-quality steam for industrial processes and high-temperature electrolysis. NYSERDA research would assess the potential for scalability and engage with the industry to determine reactor designs that align with end-user needs.
4. **Potential to increase the capacity of the existing reactor fleet**. In the current U.S. nuclear fleet, steam turbines typically perform at only 30% efficiency. Further turbine efficiency studies would determine the potential for existing sites to increase the efficiency of the current reactor fleet.

To address *problem statement #4* [OSW Consortium], NYSERDA will continue to fund OSW Consortium activities, with a focus on enabling cost reductions for OSW energy deployment in four areas:

1. **Technology transfer.** Coordinating with regional and national actors to disseminate innovative technologies and practices to NYS, continue to attract leveraged funding, and enhance overall efficiency and effectiveness of OSW development.
2. **Core OSW Consortium operations**. Continue to execute project management and operational oversight functions.
3. **Reduce cost of deep-water OSW.** R&D will focus on testing deep-water (>60 meters) technologies in the NY operating environment to inform NYSERDA's future large-scale OSW solicitations, which will enable the achievement of the State's 9 GW OSW goal.

4. **Address grid integration and energy storage.** Ensuring cost-effectiveness of delivering energy to shore through larger, interconnected systems, thereby maximizing transmission efficiency.

Program Participants & Services Provided
In 2025, NYSERDA expects to develop a Nuclear Blueprint focused on research and validation of solutions across New York, including opportunities, costs, risks, and unique R&D needs. NYSERDA will engage with the research community, technical experts, and State partners to determine the optimal entities to lead each proposed research activity. Through these efforts, the Authority will ensure coordination with research organizations, universities, manufacturers, utilities, and potential off-takers.

Since 2018, NYSERDA has led the development and execution of the OSW Consortium, a 501c3 that represents members across federal and state agencies, most global developers, major industry OEMs, and researchers. The 2026-2030 I&R portfolio will continue to foster collaboration and community amongst these members to fund research projects that lower the cost of the levelized cost of electricity.

Expected Ratepayer Benefits
The Power Generation R&D initiative is expected to provide the following benefits to ratepayers, which NYSERDA will look to assess through technology performance metrics as described in Chapter 5:
1. **Grid reliability**: By increasing the capacity of the existing reactor fleet and exploring advanced reactor technologies, nuclear can increase system reliability . Additionally, the integration of deep-water OSW and mesh grids will further increase reliability through new generation sources.
2. **Cost savings through modularity**: In evaluating the advanced nuclear landscape, NYSERDA will research and identify modular solutions that have the potential to be built quickly and at lower costs compared to traditional nuclear plants.
3. **Cost savings through increased efficiency**: Improving the efficiency of current reactors and OSW development can lead to lower operational costs. These savings can be passed on to ratepayers through more stable and potentially lower electricity rates.
4. **Risk transparency and safety for communities**: Ensuring that communities have transparent access to information about nuclear safety, potential risks, and benefits.
5. **Economic growth**: Developing and deploying power generation technologies can create jobs and stimulate economic growth in NYS. This includes opportunities in research, manufacturing, and construction sectors.

4.5. Fuels Transition

Problem Statements and Budget
Through the Fuels Transition focus area, NYSERDA will invest in technologies that enable broad availability of low-carbon fuels and other non-electricity energy resources. NYSERDA will focus on catalyzing the development of dispatchable zero emission fuel power generation resources and enhancing or adapting the existing gas system to accommodate new fuels while ensuring affordability and reliability for ratepayers. **NYSERDA proposes an allocation of $37.5 million for the Fuels Transition focus to address five problem statements**:
- **#1 [Alternative Fuel-Based Fuel Cell Resources]** The lack of dispatchable, zero emission power resources, including hydrogen fuel cells, prevents New York's grid from reliably achieving the required zero emissions target. The availability of hydrogen fuel cells is hindered by the need for technological advancements to improve efficiency and durability, high production costs, and limited infrastructure for distribution and storage.
- **#2 [Alternative Fuel Infrastructure]** Alternative fuels that are well-suited for hard-to-electrify applications –including hydrogen—cannot currently be deployed at scale partly due to limitations of current storage infrastructure.

- **#3 [Gas System Modeling and Analysis]** The absence of standardized, transparent, statewide gas system characterization impedes NYS from accelerating policy and regulatory decisions to repurpose and decommission gas infrastructure.
- **#4 [Gas System Enhancements]** Cost and operational inefficiencies associated with identifying and repairing leak-prone pipes lead to higher system upgrade costs which are passed on to ratepayers and increased environmental impacts in the operational gas distribution system.
- **#5 [Thermal Energy Network Market Formation]** The lack of a regulatory framework and clear market signals for thermal energy is currently inhibiting adoption of TEN technology solutions.

Initiatives and Interventions

Table 25 outlines Fuels Transition's 2026-2030 I&R initiatives, relevant problem statements, and proposed interventions. The sections below outline additional detail on each initiative.

Table 25: Fuels Transition initiatives, relevant problem statements, and interventions typologies

Initiative	Problem Statement	NYSERDA Intervention Approach	Intervention Typologies
Large Scale Hydrogen	#1 [Alternative Fuel-Based Fuel Cell Resources] #2 [Alternative Fuel Infrastructure]	Invest in development and demonstration projects that enhance the efficiency, durability, and cost-effectiveness of hydrogen fuel cells for hard-to-electrify end use applications across industrial applications, transportation, and power generation.	• Development & lab-scale prototyping • Pilots, sub & full-scale demonstrations • Commercialization services
Gas System Transition	#3 [Gas System Modeling and Analysis] #4 [Gas System Enhancements]	Enable improved, transparent mapping and characterization of the gas system, and invest in low-cost, accurate leak detection methods and pipeline remediation technologies to enhance the efficiency and safety of NYS gas infrastructure.	• Research & studies • Development & lab-scale prototyping • Pilots, sub & full-scale demonstrations • Commercialization services
Thermal Energy Networks	#5 [Thermal Energy Network Market Formation]	(1) Expand on technical assistance to evaluate and extract results from the utility TENs pilots and to refine a regulatory framework under the UTENJA, and (2) fund development of a TENs Roadmap that identifies what is needed to enable TENs deployment in NYS.	• Research & studies

Focus Area Outcomes

While not intended as formal targets, NYSERDA has used the proposed budget, historical data and planned activities to estimate the level of activity and outcomes in each of the proposed focus areas. Investments in the Fuels Transition focus area are expected to fund up to 15 projects, leading to the following estimated outcomes:

- **$100 million in leveraged funding**: Fuels Transition projects are expected to result in up to $100 million in leveraged funding. This represents $2.7 in leveraged funding for every $1 of NYSERDA investment.
- **3 products commercialized**: Fuels Transition projects are expected to result in up to 3 products commercialized across fuel cell technologies, gas system modeling, and leak-prone pipe repair.
- **15 demonstration replications**: Fuels Transition projects are expected to result in up to 4 demonstration projects and up to 15 replications of these demonstrations.

Beyond these forecasts, other outcomes will be tracked and evaluated as appropriate based on the metrics framework described in Chapter 5.

4.5.1. Large Scale Hydrogen Initiative Overview

Innovation Need and Technology Solutions

Hydrogen fuel cells offer a wide range of hard-to-electrify end use applications, such as providing high-temperature heat and continuous power for industrial users, serving as a reliable backup power source for critical infrastructure currently reliant onuses fossil fuel generators, and being utilized in heavy duty transportation. Based on a 2023 analysis of 100 MW, 100-hour storage options by the Pacific Northwest National Laboratory, hydrogen fuel cells have the potential to provide discharge at a levelized cost of $0.38 per kilowatt-hour (kWh), the *third cheapest option* of the 10 technology pathways analyzed, after only pumped hydropower and compressed air energy storage.[44]

To address *problem statement #1*, [Alternative Fuel-Based Fuel Cell Resources], NYSERDA will focus on enhancing the efficiency, durability, and cost-effectiveness of large-scale hydrogen fuel cells. This includes developing advanced components such as high-performance catalysts, robust membranes, and efficient power electronics. To address *problem statement #2* [Alternative Fuel Infrastructure], NYSERDA will fund complementary hydrogen storage systems that can be scaled for larger applications such as new salt caverns, retrofitting oil and gas reservoirs for hydrogen storage, or standalone hydrogen storage at end use locations in NYS (e.g., at an industrial facility, critical building facility for back-up power, or transportation hub).

Program Participants & Services Provided

Funding is for manufacturers in advancing lab-scale testing to evaluate these technologies' efficiency, longevity, and operational stability under various conditions. Pilot and full-scale demonstrations will fund both manufacturers and end users and address specific needs such as ensuring consistent power output, managing thermal loads, and maintaining safety standards. For commercialization services, NYSERDA will fund demonstration projects to address specific commercialization challenges including durability and longevity issues, efficiency optimization, and manufacturing costs. This will ensure that potential fuel cell deployments can be optimized and scaled across end uses include power generation, industrial applications, and transportation.

Expected Ratepayer Benefits

The Large Scale Hydrogen initiative is expected to provide the following benefits to ratepayers, which NYSERDA will look to assess through technology performance metrics as described in Chapter 5:

1. **Enhanced reliability and grid services**: Fuel cells have the potential to provide valuable grid services including load balancing, frequency regulation, and voltage support. Their ability to quickly ramp up and down in response to grid demand helps stabilize the system, which is particularly beneficial during peak demand periods or when integrating intermittent renewable energy sources.
2. **Industrial applications**: Industries such as steel, cement, and ammonia production require high-temperature heat and continuous power, which hydrogen fuel cells can provide efficiently.

4.5.2. Gas System Transition Initiative Overview

Innovation Need and Technology Solutions

The Climate Action Council Scoping Plan calls for a substantial reduction in natural gas use, strategic downsizing of the gas system, and decarbonization of the gas system where possible. However, there are a wide range of potential scenarios and timelines for gas system decommissioning and reuse

[44] Pacific Northwest National Laboratory Energy Storage Technology and Cost Database, 2023, available at: https://www.pnnl.gov/projects/esgc-cost-performance

depending on the technologies deployed to achieve decarbonization. At present, there is limited utility standardization across modeling approaches, scenario planning, and system mapping, and gas distribution utilities do not provide public maps of distribution pipelines in their territories. To address *problem statement #3* [Gas System Modeling and Analysis], NYSERDA will provide funding for activities that enable improved, transparent mapping and characterization of the gas system that facilitates regulator and stakeholder engagement with system investment decisions.

In addition to modeling, emerging gas leak detection and repair technologies have the potential to enable system monitoring and pipe repair at lower costs to ratepayers than conventional approaches. Although NYS is beginning to transition away from fossil fuels, State gas utilities have spent $5 billion on infrastructure investments since 2019 and are on pace to incur a minimum of $28 billion in capital costs through 2043.[45] Pipeline repair costs are often passed on to ratepayers, resulting in higher gas costs for heating and cooking. New repair technologies have been lab tested and piloted but have not had enough in-field demonstration to drive adoption among utilities and utilities commissions.

For areas of the gas system that have been targeted for continued, longer-term use, accurate pipeline leak detection and monitoring is essential to prevent fugitive emissions from impeding progress toward Climate Act goals. Capturing the benefits of leak-prone pipe repair is predicated on the availability of accurate, rapid, low-cost leak detection. To enable broad deployment of pipeline repair, there is a need for innovation and widespread availability of detection technologies. Many of the current leak detection technologies that exist today use ground-based survey techniques that can be costly and time-intensive due to the labor needed to undertake the surveys. Novel technologies such as drone-based sensors can gather almost 100 times as many samples as ground surveys in the same period of time and at a significantly lower cost per sample.[46]

To address *problem statement #4* [Gas System Enhancements], NYSERDA will advance development and deployment of low-cost, accurate leak detection methods and pipeline remediation technologies. This will enhance the efficiency and safety of NYS gas infrastructure, while reducing repair costs that are passed on to ratepayers. Potential detection technologies include acoustic detection, fiber optic sensing, infrared, and satellite and drone-based monitoring. Potential repair technologies include robotic trenching repair methods and quick-drying pipe repair techniques to reduce service outage times and maintenance costs.

To further complement *problem statement #4* [Gas System Enhancements], NYSERDA may explore the technical feasibility of carbon dioxide capture technologies and applications for power generation. This research would inform strategies to reduce the need for new infrastructure across the gas system, prevent stranding of fossil fuel assets, and reduce costs for ratepayers. Currently, large-scale carbon capture costs remain elevated and technical challenges exist. As the pathways to significant cost reductions remain unclear, future research will evaluate the technical, economic, and environmental challenges of implementing carbon capture solutions.

Program Participants & Services Provided

Initial mapping and modeling activities will focus on creating an inventory of existing mapping tools, models, and data sources such as customer gas usage patterns and electric system usage forecasts. As part of this inventory, NYSERDA will assess data availability gaps and standardization needs by collaborating with utilities and technology vendors. Based on the inventory, NYSERDA will collaborate

[45] The Future of Gas in New York State, 2023, available at: https://buildingdecarb.org/wp-content/uploads/BDC-The-Future-of-Gas-in-NYS.pdf

[46] Quantifying Regional Methane Emissions in the New Mexico Permian Basin with a Comprehensive Aerial Survey, *Environmental Science & Technology*, 2022, available at: https://pubs.acs.org/doi/10.1021/acs.est.1c06458

with DPS and utilities to identify modeling use cases that examine the impacts of near-term decommissioning and infrastructure repurposing. Based on these research activities, NYSERDA suggests developing a publicly available tool that aggregates statewide gas system maps and models across utilities, providing greater visibility into the long-term system investment needs and risks such as pipeline leaks and environmental impacts.

To address leak detection, NYSERDA will research emerging technologies and provide recommendations to the Commission to expand the state's list of approved leak detection instruments (16 New York Codes, Rules, and Regulations Part 255.3) that enable accurate monitoring and leak detection at lower costs. Finally, in the leak repair space, NYSERDA will provide funding to demonstrate technologies in real-world settings in collaboration with technology developers and utilities, targeting robotic trenching repair methods and quick-drying pipe repair techniques to reduce service outage times and maintenance costs.

Expected Ratepayer Benefits
The Gas System Transition initiative is expected to result in the following benefits to ratepayers, which NYSERDA will look to assess through technology performance metrics as described in Chapter 5:

1. **Reduced costs for ratepayers through utility standardization**: By creating standardized tools, NYSERDA can provide utilities with standardized resources and avoid the need for each utility to develop unique models.
2. **Reduce monitoring and repair costs passed on to ratepayers**: Advanced repair technologies reduce the need for extensive excavation and manual labor, leading to lower repair costs. Automated, low-cost leak detection systems can quickly identify and locate leaks, reducing the time and resources needed for repairs.
3. **Enhanced infrastructure reliability**: Advanced repair methods and continuous leak detection systems improve pipeline structural integrity, reduce future leaks, and enable early issue detection and prompt repairs, preventing major disruptions and environmental damages.
4. **Reliable service during decommissioning**: By strategically planning decommissioning activities, utilities can ensure that gas supply interruptions are minimized. This coordination will enable a consistent and reliable gas supply to ratepayers during transitions.

4.5.3. Thermal Energy Networks Initiative Overview

Innovation Need and Technology Solutions
TENs use pipes to connect networks of buildings to thermal sources and sinks (e.g., geothermal, surface water, waste heat, and the air) to provide space heating, cooling, and domestic hot water.[47] TENs have the potential to provide highly efficient heating and cooling, while eliminating emissions and ensuring that communities avoid the volatility of fossil fuel prices. The UTENJA, which passed on July 5, 2022, has been instrumental in setting the policy context for TENs and catalyzing New York's first utility TENs pilot projects in real-world operating environments.

The PSC subsequently issued the Order Adopting Initial UTEN Rules under Case 24-M-0429, which further underscored the need to conduct relevant research. Specifically, the Commission directs staff to conduct further research and learn from the operation of existing district energy systems serving NYS (e.g., including ownership, operational, and oversight structures) and throughout the world. The PSC also calls for exploration of broad policy approaches for thermal market development. NYSERDA recommends the TENs work be included in I&R because TENs represent a space for innovation where further research is needed to understand how to overcome a range of technical, financial, policy, and regulatory barriers for at-scale deployment.

[47] NYSERDA Thermal Energy Networks, available at: https://www.nyserda.ny.gov/All-Programs/Clean-Energy-Communities/High-Impact-Actions/Toolkits/Thermal-Energy-Networks

Program Participants & Services Provided

To address *problem statement #5* [Thermal Energy Network Market Formation], NYSERDA will expand supplemental technical assistance to evaluate and extract results from the UTENJA pilots, support development of a comprehensive regulatory framework for UTENs, and provide specific technical assistance, education, training, and tools to local governments. This initiative will also provide funding for the development of a TENs Deployment Roadmap to holistically identify what is needed for TENs deployment in NYS including policy approaches, business models, workforce development, local enabling strategies, and incentives to motivate commercialization of TEN technologies.

Expected Ratepayer Benefits

The Thermal Energy Network Market Formation initiative is expected to provide the following ratepayer benefits, which NYSERDA will look to assess through technology performance metrics as described in Chapter 5:

1. **Access to reliable, price stable heat**. TENs can provide efficient and reliable space heating and that has the potential to be less reliant on fossil fuel price volatility.
2. **Consumer protections in thermal energy markets**. This effort will provide recommendations around the consumer protections that make sense for different types of TENs systems and inform approaches to price/rate-setting for the NYS market.

4.6. Clean Transportation Innovation

Problem Statements and Budget

The Clean Transportation Innovation focus area aims to develop and demonstrate innovative technologies, inform policy development and strategies to reduce GHG emissions from the transportation sector, and gain market traction. Proposed activities harness stakeholders' creative solutions to NYS's transportation energy challenges, facilitate development of commercially viable products or services, demonstrate their benefits to key stakeholders, and identify and resolve adoption barriers. **NYSERDA proposes an allocation of $31.0 million for the Clean Transportation Innovation focus area to address four problem statements**:

- **#1 [Adoption Barriers for MHDVs]** The lack of availability, in-service data, and experience with EVs in hard-to-electrify transportation market segments prevents NYS from overcoming adoption barriers to consumer use of zero emissions, affordable, and high-performing MHDVs.
- **#2 [EV Charging Solutions]** Technology and business model challenges hinder the controlled charging, charging in urban areas, and integration with the grid, which are essential for accelerating EV adoption.
- **#3 [E-Mobility Battery Safety]** NYS is experiencing waning consumer confidence in the perceived safety of batteries used in electric mobility modes of all types.
- **#4 [Transit and Mobility Services for DACs]** Public transportation and mobility options are limited in DACs.

Initiatives and Interventions

Table 26 outlines Clean Transportation Innovation's 2026-2030 I&R initiatives, relevant problem statements, and proposed interventions. The sections below outline additional detail on each initiative.

Table 26: Clean Transportation Innovation initiatives, relevant problem statements, and interventions typologies

Initiative	Problem Statement	NYSERDA Intervention Approach	Intervention Typologies
Hard-to-Electrify Transportation Applications	#1 [Adoption Barriers for MHDVs]	Invest in developing new products and early-stage demonstrations to increase the availability of data and encourage electrification of lagging MHDV market segments.	• Development & lab-scale prototyping • Pilots, sub & full-scale demonstrations • Commercialization services
Vehicle-to-Grid Integration	#2 [EV Charging Solutions]	Invest in technologies to design, install, manage, and test EV charging to increase ratepayer savings and EV adoption.	• Development & lab-scale prototyping • Pilots, sub & full-scale demonstrations • Commercialization services
Mobility & Public Transit	#3 [E-Mobility Battery Safety] #4 [Transit and Mobility Services for DACs]	Invest in (1) e-mobility battery technologies, with a focus on reducing insurance and fire hazards, and increasing consumer adoption, and (2) software solutions to enhance transit operations, reduce costs, and expand services, particularly in DACs.	• Development & lab-scale prototyping • Pilots, sub & full-scale demonstrations • Commercialization services

Focus Area Outcomes

While not intended as formal targets, NYSERDA has used the proposed budget, historical data and planned activities to estimate the level of activity and outcomes in each of the proposed focus areas. Investments in the Clean Transportation Innovation focus area are expected to fund up to 15 projects, leading to the following estimated outcomes:

- **$115 million in leveraged funding**: Clean Transportation Innovation projects are expected to result in up to $150 million in leveraged funding. This represents nearly $4 in leveraged funding for every $1 of NYSERDA investment.
- **5 products commercialized**: Clean Transportation Innovation projects are expected to result in up to 5 products commercialized across MHDVs, vehicle-to-grid integration, and mobility & public transit.
- **200 demonstration replications**: Clean Transportation Innovation investments are expected to result in up to 5 demonstration projects and up to 200 replications of these demonstrations. Unit replications are expected to come from fleet expansions of individual demonstration projects (i.e., based on the results of a single vehicle demonstration, a large offtaker decides to scale to a 50-vehicle fleet).

Beyond these forecasts, other outcomes will be tracked and evaluated as appropriate based on the metrics framework described in Chapter 5.

4.6.1. Hard-to-Electrify Transportation Applications Initiative Overview

Innovation Need and Technology Solutions

As part of the Climate Act, New York has established a goal of 100% zero emissions MHDVs by 2045. New York has introduced several key programs to accelerate the transition to zero emission MHDVs, including a $24 million prize competition for the Electric Truck and Bus Challenge, a $15 million commitment to the MHDV Make-Ready Pilot Program, and incentives provided through both the New York Truck Voucher Incentive Program and the NYC Clean Trucks Program. While NYSERDA programs are encouraging early adopters, MHDV manufacturers face challenges in making the total cost of

ownership favorable to adoption versus traditional diesel vehicles, including high upfront costs, range and charging times, and limits to economies of scale for specialty vehicle types.[48]

To address *problem statement #1* [Adoption Barriers for MHDVs], NYSERDA will invest in developing new products and early-stage demonstrations to increase the availability of data and encourage electrification of lagging market segments. Projects will further demonstrate technology to gather data and increase fleets' comfort with emerging technologies. Targeted demonstrations will be conducted in areas such as refrigerated trucking, construction, and agriculture, with collaborative efforts involving industry leaders and fleet operators to leverage their expertise and resources.

Program Participants & Services Provided
NYSERDA will foster partnerships with manufacturers to provide fleets with access to the latest vehicle models and technologies for testing and evaluation. The Authority will conduct pre-demonstration conversations with end-users to identify specific needs and concerns, facilitating industry collaboration among government agencies, EV manufacturers, fleet operators, and research institutions. NYSERDA will encourage early-stage, first-in-NYS, and unique-context demonstrations with active on-road and off-road MHDV fleets. NYSERDA proposes using comprehensive monitoring systems installed in vehicles to collect data on performance, energy consumption, maintenance, and operational costs. Case studies and reports will be developed based on this data to highlight the benefits and challenges of using EVs in specific market segments.

Expected Ratepayer Benefits
The Hard-to-Electrify Transportation Applications initiative is expected to provide the following benefits to ratepayers, which NYSERDA will look to assess through technology performance metrics as described in Chapter 5:

1. **Reduced total cost of ownership**: Manufacturers will be able to reduce the total cost of ownership for electric MHDVs, including lower upfront and maintenance costs, resulting economic savings for fleets.
2. **Demonstration project data transparency**: Provide insights into the performance, efficiency, and cost-effectiveness of new technologies, allowing fleet operators, policymakers, and the public to make informed decisions based on real-world evidence.

4.6.2. Vehicle-to-Grid Integration Initiative Overview

Innovation Need and Technology Solutions
NYS has set a goal of 100% zero emission passenger vehicle sales by 2035. EV purchases have increased 660% in the last five years, and there are currently more than 15,000 chargers available at over 4,000 locations across the state.[49] As EV adoption continues to accelerate in the coming years, there is potential to reduce adoption costs for ratepayers through "managed charging," an approach that optimizes the time and rate at which vehicles are charged, lowering electricity costs, reducing strain on the electric grid, and improving energy efficiency. Today, many managed charging technologies are limited by communications issues between cars, charging stations, and utilities. It is also challenging to deploy managed charging solutions in urban environments due to space limitations, electrical infrastructure upgrade needs, and complex permitting processes.

[48] Medium- and Heavy-Duty Vehicle Electrification: Challenges, Policy Solutions, and Open Research Questions, 2023, available at: https://www.rff.org/publications/reports/medium-and-heavy-duty-vehicle-electrification-challenges-policy-solutions-and-open-research-questions/
[49] Governor Hochul Announces More Than 100 New Electric Vehicle Fast Chargers to be Built in New York City, 2024, available at: https://www.governor.ny.gov/news/governor-hochul-announces-more-100-new-electric-vehicle-fast-chargers-be-built-new-york-city

To address *problem statement #2* [EV Charging Solutions], NYSERDA will invest in technologies to design, install, manage, and test EV charging to increase ratepayer savings and EV adoption. NYSERDA will invest in novel, low-cost approaches for EV charging stations, including innovative designs for urban deployment, efficient installation methods leveraging existing power capacity, smart integration with DERs, and advanced vehicle-to-grid communications for managed charging during off-peak hours.

Program Participants & Services Provided
NYSERDA will provide funding to technology developers and manufacturers for demonstrations that test system performance and user behavior. This includes projects that inform utility programs through technical and behavioral data collection, pilot projects to test new charging technologies and business models, and gathering insights on user adoption patterns, charging habits, and satisfaction levels.

Expected Ratepayer Benefits
The Vehicle-to-Grid Integration initiative is expected to provide the following benefits to ratepayers, which NYSERDA will look to assess through technology performance metrics as described in Chapter 5:

1. **Grid reliability that maximizes flexibility benefits of EVs**: By integrating EV charging stations with DERs, the grid can better manage energy loads, reducing the risk of overloads and blackouts. Advanced vehicle-to-grid communications enable real-time data exchange between EVs and the grid, allowing for dynamic load balancing and efficient energy distribution.
2. **Reduced EV infrastructure and charging costs**: By developing low-cost EV charging stations with efficient installation methods that leverage existing power capacity, the need for large-scale and expensive grid upgrades is minimized. Additionally, smart integration with DERs will optimize energy use, allowing EVs to charge during off-peak hours when electricity rates are lower. This managed charging approach reduces overall energy costs for ratepayers.

4.6.3. Mobility & Public Transit Initiative Overview

Innovation Need and Technology Solutions
In NYS, fires caused by lithium-ion batteries in e-mobility devices, such as e-bikes and e-scooters, have been a significant concern over the last three years. In NYC alone, the number of fires involving lithium-ion batteries increased from 44 in 2020 to 267 in 2023.[50] In 2024, 202 lithium-ion batteries fires have occurred as of September 30. City and State officials have made significant efforts to improve safety, and the numbers of deaths and injuries from these incidents has decreased significantly in 2024. However, innovation can play a role in continuing to improve battery safety across e-mobility applications.

To address *problem statement #3* [E-Mobility Battery Safety], NYSERDA will provide funding for companies to develop and demonstrate e-mobility battery technologies, with a focus on reducing insurance costs and fire hazards, and increasing consumer adoption. NYSERDA will provide funding for development and lab-scale prototyping to enable commercially viable, low-cost solutions that mitigate the primary causes of e-bike fires, such as the use of non-UL listed batteries and charging of damaged batteries. This includes designing and engineering battery swapping or charging ecosystems and safety detection systems that meet stringent safety standards. Additionally, NYSERDA will conduct root cause analysis of battery fires in e-mobility products to inform its investments.

Beyond the specific safety needs, this initiative will build on NYSERDA's decade-long efforts to innovate across transit and mobility, especially in underserved areas, with the NYS Department of Transportation and PSC. Program efforts and market engagement to date have revealed barriers to broader adoption of low-carbon mobility, especially in low-income and low-population density communities. To address

[50] E-bike battery fires keep climbing in NYC, 2024, available at: https://gothamist.com/news/e-bike-battery-fires-keep-climbing-in-nyc

problem statement #4 [Transit and Mobility Services for DACs], NYSERDA will provide funding to develop innovative software solutions to enhance transit operations, reduce costs, and expand services, particularly in DACs. NYSERDA will invest in innovative software for route planning, real-time tracking, and passenger information systems, as well as maintenance optimization and resource allocation tools. This includes piloting electric and autonomous vehicles, smart charging infrastructure, and advanced alert and safety detection systems.

Program Participants & Services Provided
To address mobility battery safety challenges, NYSERDA will provide funding for technology developers to validate the performance of safety products under various conditions, identify best practices for EV and micromobility operators, and ensure timely intervention through advanced alert systems. NYSERDA will focus on collecting performance and reliability data, and communication efforts to inform utility programs, manufacturers, and broader market strategies using this data.

To address the transportation needs of DACs, NYSERDA will focus on competitive challenges and prizes to identify successful innovations and areas needing improvement, while community engagement will ensure that solutions are tailored to local needs. Private sector technology and service providers often focus on this market but develop products targeting travelers with a high ability to pay for their services. Smaller communities and low-income travelers would be the focus of NYSERDA's program. Pilot programs will test new technologies and business models in diverse settings (including urban, suburban, and rural DACs) and collect data on performance, cost-effectiveness, and user satisfaction. NYSERDA will focus on scaling of successful demonstrations across NYS, with stakeholder engagement to promote the adoption of effective technologies and business models.

Expected Ratepayer Benefits
The Mobility and Public Transit initiative is expected to result in the following benefits for ratepayers, which NYSERDA will look to assess through technology performance metrics as described in Chapter 5:

1. **Enhanced safety and consumer confidence**: By funding the development and demonstration of advanced e-mobility battery technologies that aim to address the root causes of battery fires and implementing advanced alert systems for early detection, the initiative aims to reduce the risk of fires caused by lithium-ion batteries and increase consumer confidence in e-mobility products. This will lead to fewer incidents, injuries, and fatalities—directly benefiting public safety and increasing adoption rates of e-bikes, e-scooters, electric cars, and trucks.
2. **Cost savings through efficient deployment and reduced premiums**: The initiative focuses on creating low-cost, commercially viable solutions for battery safety. This includes designing efficient battery swapping and charging ecosystems that meet stringent safety standards, which can reduce the overall costs associated with battery-related incidents and insurance premiums.
3. **Market growth driven by data accessibility**: The collection and dissemination of technical data on the performance and reliability of safety products will inform utility programs, manufacturers, and broader market strategies. This can drive innovation and growth in the e-mobility sector, creating new business opportunities and jobs.
4. **Enhanced transit operations and lower operating costs**: By developing innovative software solutions for route planning, real-time tracking, and passenger information systems, transit operations will become more efficient and reliable. Maintenance optimization and resource allocation tools will help reduce operational costs, making transit services more affordable.

4.7. Energy Focused Environmental Research

Problem Statements and Budget

The EFER focus area provides the impartial knowledge necessary to better understand and reduce adverse energy-related impacts and costs on NYS communities, ecosystems, and economy through scientific research, monitoring technology demonstration, and pre-development activities. Additionally, EFER seeks to develop data and modeling to evaluate the effectiveness of energy-related policies and to responsibly guide the State energy transition. **NYSERDA proposes an allocation of $23.5 million for the EFER focus to address four problem statements**:

- **#1 [Policy Accountability]** There is a lack of actionable data on the benefits, costs, avoided costs, and externalities of energy-related policies including at finer, localized spatial scales, which has the potential to limit policymakers' ability to quantify the benefits and avoid potential impacts associated with the State's current and future energy policies.
- **#2 [Future Climate Planning]** There is a gap in forward-looking climate information on the energy sector, which has the potential to inhibit climate risk from being incorporated into long-term planning.
- **#3 [Emissions Tracking]** NYS is currently limited in its ability to characterize methane emissions, which is needed to ensure accuracy of the State GHG inventory and optimize methane emission reduction efforts in the energy and building sectors.
- **#4 [Zero Emissions Electricity Projects]** Electricity generation project developers and regulators are limited in their ability to access environmental information, mitigation and monitoring technologies, which limits transparency into project risks, costs, timelines, and user conflicts, hindering deployment.

Initiatives and Interventions

Table 27 outlines EFER's 2026-2030 I&R initiatives, relevant problem statements, and proposed interventions. The sections below outline additional detail on each initiative.

Table 27: Energy Focused Environmental Research initiative, relevant problem statement, and interventions typology

Initiative	Problem Statement	NYSERDA Intervention Approach	Intervention Typologies
Energy Focused Environmental Research	#1 [Policy Accountability] #2 [Future Climate Planning] #3 [Emissions Tracking] #4 [Zero Emissions Energy Projects]	NYSERDA will perform integrated studies to (1) evaluate and inform the effectiveness of energy-related policies, (2) address the need for New York-specific climate data, (3) enhance characterization of energy-related methane emissions, and (4) evaluate the environmental effects and opportunities associated with new energy-related infrastructure projects.	• Research & studies

Focus Area Outcomes

While not intended as formal targets, NYSERDA has used the proposed budget, historical data and planned activities to estimate the level of activity and outcomes in each of the proposed focus areas. Investments in the EFER focus area are expected to fund up to 40 research and studies projects, leading to the following estimated outcomes of up to 20 publications. Details on the publications are described below. In the EFER focus area, NYSERDA focuses exclusively on research and studies that provide transparent data around policy implementation, as opposed to other parts of the I&R portfolio that primarily provide funding to enable development and demonstrations of innovative technologies. Beyond these forecasts, other outcomes will be tracked and evaluated as appropriate based on the metrics framework described in Chapter 5.

4.7.1. Energy Focused Environmental Research Initiative Overview

Innovation Need and Research Activities

As New York continues to implement the Climate Act, the State must reduce economy-wide GHG emissions by 85% by 2050. As the State moves towards this goal, research and evaluation studies are needed to inform progress and the efficacy of interim policy decisions. The Climate Act tasks the State with quantifying the benefits of policy decisions; identifying necessary adaptation, resilience, and mitigation measures; and identifying high-priority climate information research needs. In alignment with Climate Act implementation, NYSERDA will address the four EFER problem statements through the following activities.

To address *problem statement #1* [Policy Accountability], NYSERDA will perform integrated studies to evaluate the environmental and public health implications and opportunities associated with energy-related policies. This includes collecting technical data on energy consumption, production, costs, benefits, and externalities at various spatial scales. Interdisciplinary approaches will combine insights from economics, environmental science, engineering, and social sciences to create holistic models. Additionally, educational outreach through workshops, seminars, and training sessions will educate stakeholders about the implications of energy policies.

To address *problem statement #2* [Future Climate Planning], NYSERDA will perform research and studies and engage stakeholders to address New York-specific energy sector climate information gaps, needs, and opportunities. This initiative will inform utility climate vulnerability assessments and guide responsible climate resiliency and mitigation actions. Specific solutions include collecting data from sensors and monitoring equipment for comprehensive climate data analysis, sophisticated climate modeling software to project future scenarios, and impact assessment tools to evaluate effects on energy infrastructure. Risk analysis platforms will identify climate-related risks, while partnerships with research institutions will leverage expertise for these studies. NYSERDA will use geographic information system (GIS) and cost-benefit analysis tools to assess the economic feasibility of resilience and mitigation measures. These efforts will provide a robust framework for understanding and addressing the impacts of climate change on NYS energy systems.

To address *problem statement #3* [Emissions Tracking], NYSERDA will focus on research and studies, along with stakeholder engagement, to characterize methane emissions from the energy and buildings sectors. NYSERDA will conduct comprehensive source identification studies to characterize NYS methane emission sources broadly and energy and building sector sources specifically while evaluating the efficacy of emissions monitoring and mitigation technologies and emission reduction strategies. NYSERDA will demonstrate and seek to integrate new monitoring technologies with existing GHG inventory systems to enhance data accuracy. The program will inform best practices for methane reduction, such as regular equipment maintenance, low-emission technologies, and efficient building designs. Additionally, NYSERDA will provide evidence-based recommendations for regulations and incentives aimed at reducing methane emissions in the energy and building sectors.

To address *problem statement #4* [Zero Emissions Energy Projects], NYSERDA will conduct research and studies to fill New York-specific information gaps, evaluate new technologies for resource protection and dual-use, and perform pre-development assessments to identify sensitive resources and users. NYSERDA will address environmental information gaps related to OSW transmission development with a focus on public policy transmission needs. The Authority will evaluate the potential environmental impacts of zero emissions energy projects, including effects on sensitive resources and user groups, and develop avoidance and mitigation strategies to address environmental risks and land use conflicts, such as habitat restoration and co-utilization strategies. Additionally, resource maps will highlight sensitive resources and areas of high ecological or economic value that may be affected by zero emissions energy

projects. Finally, NYSERDA will provide policymakers with evidence-based recommendations for regulations and incentives to promote the responsible use of zero emissions energy.

Program Participants & Services Provided
The EFER initiative focuses on research and studies. NYSERDA is expected to lead research in this area, funding expert consultants to provide inputs and perform analysis. NYSERDA will engage in public consultations to gather input on environmental concerns and priorities and ensure that diverse stakeholder perspectives are considered in each individual study.

Expected Ratepayer Benefits
The EFER initiative is expected to provide the following benefits to ratepayers, which NYSERDA will look to assess through performance metrics as described in Chapter 5:

1. **Enhanced Climate Act implementation**: NYSERDA's integrated studies will evaluate the environmental and public health implications and opportunities associated with energy-related law and policies including the Climate Act. This will provide insights into the effectiveness of energy policies, leading to better outcomes for all ratepayers.
2. **Improved climate resilience**: Research and studies addressing New York-specific climate information gaps will inform utility climate vulnerability assessments and guide responsible climate resiliency and mitigation actions. By collecting data from sensors and monitoring equipment and using sophisticated climate modeling software and spatial analysis tools NYSERDA will inform and enhance utility efforts to assess vulnerabilities and implement resiliency measures. This has the potential to protect energy infrastructure and ensures reliable service to ratepayers.
3. **Reduced emissions and environmental protection**: Comprehensive source identification studies and the development of emission reduction strategies will focus on better characterizing methane emissions from the energy and buildings sectors to inform and optimize NYS methane reduction strategies. By integrating new monitoring technologies with existing GHG inventory systems and informing best practices for methane reduction, NYSERDA will reduce harmful emissions. Additionally, evaluating the potential environmental impacts of zero emissions energy projects and developing risk mitigation strategies will protect natural resources and address resource conflicts.

5. Performance Monitoring, Evaluation, and Reporting

5.1. Background

NYSERDA's overall approach to performance monitoring, evaluation, and reporting focuses on gathering information to aid in decision-making, maximize ratepayer benefits, and maintain transparency and accountability in the use of ratepayer funds. NYSERDA collects information that supports active portfolio management throughout the project lifecycle and communicates the results and benefits as programs mature.

5.1.1. I&R Approach

NYSERDA's approach for the I&R portfolio involves planning, reporting, and evaluating initiatives using a logic model to define relationships between interventions, outputs, and outcomes. Outputs measure program activity levels, such as the number of projects completed and participant counts, while outcomes assess market results, including products commercialized and leveraged funding. Reporting includes annual and quarterly updates on financial status and annual details on initiative progress toward achieving key outcomes. Evaluation focuses on identifying, validating, and understanding outcomes and impacts through various independent studies and analyses. More detail on performance monitoring approaches used for the I&R portfolio can be found in Appendix A.3.

5.1.2. Implications for Future Efforts

Based on a review of I&R activities and benchmarking against peer organizations, NYSERDA identified key performance monitoring, evaluation, and reporting changes moving into the future portfolio:

- **Shift from a CIP model to an Operating Plan**: NYSERDA proposes a new Operating Plan structure that will provide greater transparency, accountability and flexibility to operate programs that meet portfolio targets and deliver maximum benefits. For the 2026-2030 I&R portfolio, NYSERDA proposes publishing an initial operating plan based on this proposal, followed by annual updates following year-end reporting.
- **Simplify logic model framework and connect models to problem statements**: NYSERDA will improve its use of logic models by simplifying the overall template, ensuring a direct link to the problem statements defined in Chapter 4, and promoting standardized metrics across the four typologies of interventions.
- **Implement consistent intervention typology outcome metrics**: Due to the technical diversity of the I&R portfolio, NYSERDA has used a wide range of metrics to capture outcomes. In the future, NYSERDA will use a standardized set of outcome metrics by intervention typology (see Table 30). NYSERDA will ensure these metrics can "roll up" from the problem statements to initiatives to focus areas to enable streamlined performance comparisons across the portfolio.
- **Improve transparency and clarity of the leveraged funding metric**: NYSERDA will continue to measure leveraged funding, improving clarity with added granularity to show the parts of leverage, including company co-funding (cost share), and follow-on funding such as private capital investment, non-NYSERDA grants, and other external sources. NYSERDA will calculate leveraged funding in a way that avoids duplication across focus areas and initiatives in cases where individual companies participate in multiple programs.
- **Utilize technology performance metrics tailored to problem statements and solicitations**: Based on engagement with peer innovation organizations, NYSERDA plans to evolve its approach to setting technical and cost targets for developing new clean energy technologies. NYSERDA will set performance criteria that define specific technology cost compression, functionality, and overall advancement targets aligned with NYS needs. These criteria are intended to send signals to innovators in the market about the innovations needed to drive ratepayer affordability and achieve the State's Climate Act goals. These criteria will also round out the key outcomes of NYSERDA investment described in Section 5.1.1 above.
- **Rethink the nature of quantitative targets of the I&R portfolio**: Portfolio-level targets need to encompass a more meaningful set of metrics beyond leveraged funding to tell a more complete story of the results the portfolio is designed and administered to deliver. At the same time, annual initiative-level outputs and outcomes are too granular to meaningfully assess overall portfolio performance.

5.2. Proposed 2026-2030 I&R Approach

5.2.1. Metrics Framework

NYSERDA's proposed 2026-2030 I&R metrics framework includes three categories of metrics: 1) **Outputs** as an early measure of NYSERDA activity and market engagement; 2) **Outcomes** as a measure of the results by different types of I&R investments and technology advancements; and 3) **Impacts** of I&R investment on the broader market in terms of energy, environmental, and economic benefits. Combining these elements and included metrics will enable effective performance monitoring and evaluation over time, capturing three distinct dimensions of success. Along with the problem statements in Chapter 4, the metrics framework will drive the creation of logic models at the outset of programs. NYSERDA will use logic models to manage programs throughout their lifecycle effectively, guide programs towards desired outcomes and impacts, and provide a foundation for iterative evaluation. This framework is summarized in Figure 12.

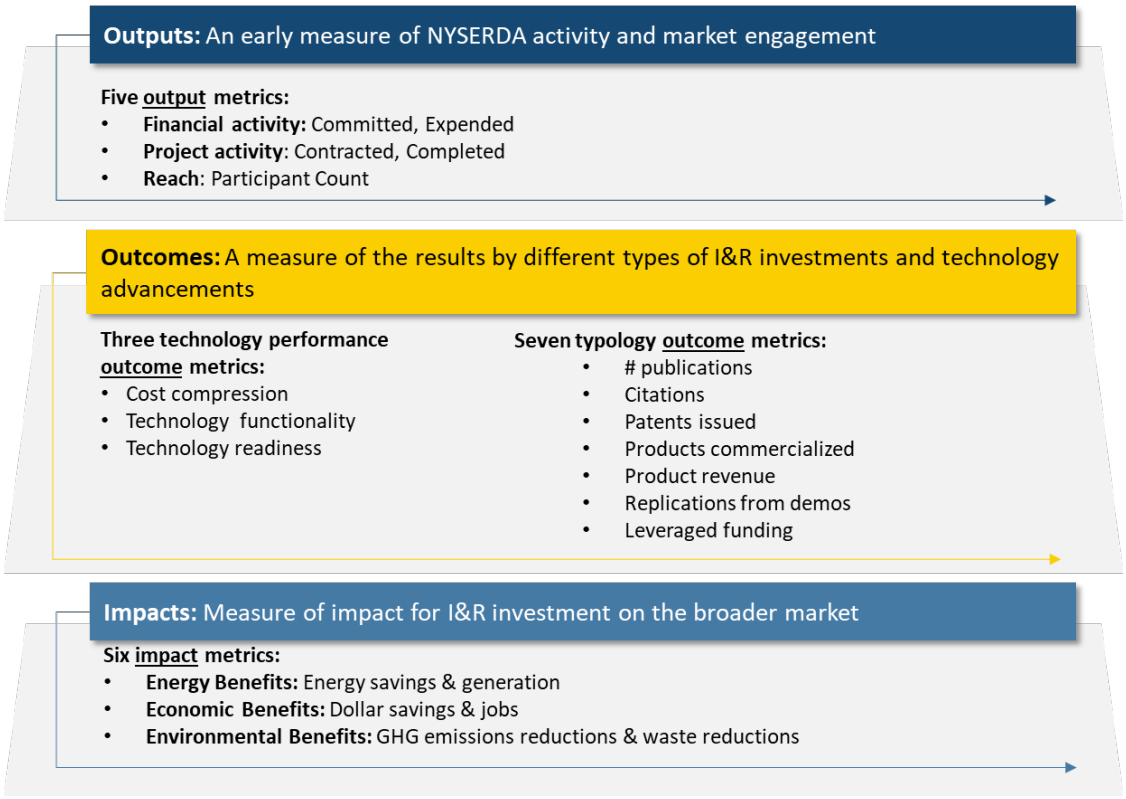


Figure 12: Innovation and Research common metrics framework

Output Metrics

Consistent with the CEF, output metrics represent the level and pace of NYSERDA activity and NYSERDA reach (i.e., how much of the market is engaged). These metrics apply to the entire I&R portfolio and collectively indicate how effectively NYSERDA uses authorized funding to engage with projects and participants, which is a precursor to successful outcomes and impacts. NYSERDA will collect and store data on the following five output metrics, Table 28, in its financial and project management source systems.

Table 28: Output metrics summary

Grouping	Output Metric
Financial Activity Metrics	Committed Dollars
	Expended Dollars
Project Activity Metrics	Contracted Projects
	Completed Projects
Reach Metric	Participant Count

Technology Performance Metrics

NYSERDA I&R efforts are intended to achieve market transformation by focusing on RDD&C across the cleantech industry. NYSERDA will embed technology performance criteria into solicitations for RDD&C services. Entities will be expected to self-report on their performance against these criteria as a condition of receiving funding. Each solicitation will include an evaluation plan that will identify the applicable technology performance metrics and the monitoring approach and requirements to collect data from funded projects.

NYSERDA seeks to advance clean energy technologies in three ways: 1) achieve cost compression by overcoming financial obstacles in technology development; 2) achieve greater functionality by overcoming technical challenges; and 3) measure overall technology readiness improvements including technology advancement and ability to reduce market adoption barriers. For technology-specific focus areas and initiatives, NYSERDA will identify performance criteria that are relevant to each technology based on the problem statements. Technology performance criteria will identify the target improvements.

NYSERDA will use technology performance metrics, Table 29, to evaluate investment strengths and optimize programs to achieve these outcomes. NYSERDA will periodically conduct independent evaluations to further analyze and validate the resultant technology performance improvements and support external reporting and understanding of each outcome.

Table 29: Technology performance outcome metrics

Metric Categories	Definition and Preliminary Examples
Cost compression	Reduction of cost to provide a product or service. For example: - Battery storage solutions available at a cost of < $**XX**/kWh at commercial scale - Hydrogen fuel cell technologies that can discharge electricity at a cost of $**XX**/kWh
Technology functionality	Functionality improvement for the specific technology. For example: - 100-hour duration storage technologies that can achieve round-trip efficiency of **XX**%. - Air source and ground source heat pump technologies that can achieve a coefficient of performance of **XX**. [Coefficient of Performance = heat output / electrical input]
Technology advancement	Movement along the technology readiness continuum from baseline to interim and end state. For example: - TRL advancement from **X** to **Y** - Adoption Readiness Level advancement from **A** to **B**

Standard Typology Outcome Metrics

The typology outcome metrics, Table 30, demonstrate important outcomes of the I&R intervention typologies and portfolio. NYSERDA chose the standard metrics based on prior experience and benchmarking against peer organizations. These standard outcome metrics will be collected from all projects and will receive further validation using public and commercially available sources and evaluation methods.

Table 30: Standard outcome metrics by intervention typology

Typology Outcome Metrics	Applicable Intervention Typology			
	Research & studies	Development & lab-scale prototyping	Pilots, sub & early-stage demos	Commercialization services
# publications	X			
Citations	X			
# patents issued	X	X		X
# products commercialized		X	X	X
$ product revenue		X	X	X
# replications from demonstrations			X	
$ leveraged funding		X	X	X

Impact Metrics

Market impact metrics are periodically evaluated in detail based on invention and technology performance outcomes. When demonstration replications occur, products are commercialized, or technology performance is significantly improved, NYSERDA will evaluate specific projects to better understand the technology's energy, environmental, and economic benefits. Evaluation methods include

engineering analysis of sample projects, case studies, and cost-benefit modeling. In the 2026-2030 I&R portfolio, NYSERDA will assess six impact metrics across three categories:

1. Energy benefits (Energy Savings and Clean Energy Generation)
2. Economic benefits (Dollar Savings and Job Creation)
3. Environmental benefits (GHG Emissions Reductions and Waste Reductions)

5.2.2. Operating Plan and Reporting Plan

Identification and operationalization of the metrics best suited to measure the effectiveness of NYSERDA's investments require a practical structure that can communicate priorities and expectations to all stakeholders. That structure has two components: an **Operating Plan** that conveys intent and routine **Reporting** that conveys progress. Key to this structure is an Annual Performance Review Process that examines progress against expectations to allow for continuous improvement.

NYSERDA proposes a new Operating Plan structure that will balance the need for transparency and accountability with flexibility to operate programs that meet targets and deliver benefits for ratepayers. When combined with a comprehensive Reporting and Annual Performance Review Process, the Operating Plan provides the structure needed to maintain oversight and influence adjustments over time that can lead to stronger performance. For the 2026-2030 I&R portfolio, NYSERDA will publish an initial Operating Plan based on this proposal, which includes modifications to align with the Commission's ultimate Order requirements, with annual updates following year-end reporting.

NYSERDA proposes that the Operating Plan include:

- **Portfolio and focus area budget** accounting, ensuring that NYSERDA administers funding in compliance with Order Authorization. NYSERDA proposes that it maintain the ability to revise focus area budgets within +/-20% of the original allocation and separately allocate reserve funds to meet evolving market needs, including the ability to award reserve funding to successful initiatives.
- **"Core" portfolio-level outcomes** that summarize key results associated with NYSERDA's investments, including (1) commercialized products, (2) replications from demonstrations, and (3) leveraged funding. Initial proposed core outcome targets by focus area are listed in Chapter 4.
- **Additional metrics** that NYSERDA will strategically apply within the portfolio to holistically assess performance, results and the core outcomes. These metrics are represented by the remainder of the output, outcome, and impact metrics described above. They are less readily forecasted, but NYSERDA will evaluate and report on them yearly. The collective view of metrics (Figure 12) represents 21 measures of progress that NYSERDA will determine, where appropriate, consistently across the portfolio.
- **Yearly and total portfolio forecasts** for expenditures and core outcome metrics aligning with portfolio-level targets. These yearly forecasts provide visibility into the portfolio's expected trajectory and represent the working plan that evolves to achieve the portfolio targets.
- **Focus area plans** that convey the problem statements that NYSERDA seeks to address, the intervention strategies, and the relevant program typologies that the Authority will employ to implement those strategies. Each focus area section will contain a forecast of expenditures and "core" outcome metrics that the portfolio-level forecast, providing important clarity around how NYSERDA intends to deliver on the targets through the plan's various components. These plans will detail which output, outcome, and impact metrics are most relevant to measuring the success of investments in that area.

During the 2026-2030 I&R portfolio lifecycle, NYSERDA proposes to incorporate programmatic Operating Plan changes, including budgetary adjustments, more frequently than the annual updates to pivot resources where needed in a timely manner, provided the following:

- Budgetary changes are limited to program costs and remain in compliance with focus area budget limitations established by the Order, with no changes to program administration funding.
- Programmatic changes, including the introduction of new market solutions, remain consistent with the problem statements and strategies described within the affected focus area.
- Quarterly Status Reports detail programmatic changes throughout the year, with any needed plan changes incorporated during the next annual Operating Plan update cycle.

NYSERDA's Reporting plan for the 2026-2030 I&R portfolio carries the current quarterly and annual reporting schedule forward but with some key modifications based on experience to date. Reporting must provide performance visibility that meets oversight needs and is timed according to how and when data will be available. The proposed reporting solution outlined here is designed for that purpose.

- A **Quarterly Status Report** is suited to regularly report on the five output metrics described earlier, providing visibility into how NYSERDA is moving approved funding into the market and advancing project activity and engagement. Output metrics are tracked throughout the portfolio and presented quarterly to illustrate progress for both the current year and cumulatively.
- The **Annual Performance Report** provides a comprehensive, year-end assessment of portfolio progress and performance by (1) highlighting actual progress on the core metrics compared to forecasts and overall targets and (2) expanding to the full view of progress for all 21 output, outcome, and impact metrics, providing a complete story of portfolio investments and benefits for ratepayers.
    - Core outcome metrics will be a key feature of the annual report and the focus of performance measurement dialogue, forming the foundation of a proposed **Annual Performance Review Process** that is intended to tie together a critical review of the original forecast, the current Operating Plan forecast, and the progress reported to date.
- A **Data Scorecard** will allow stakeholders to assess more granular details of the portfolio, focus area, and program progress relative to the full slate of output, outcome, and impact metrics.

5.3. Evaluation

5.3.1. Evaluation Approaches

NYSERDA will continue to conduct evaluation analyses and studies to inform portfolio management and provide credible, robust information on results. Evaluation will characterize the development of technology and markets over time, validate impact, and enable the development of efficient and effective program processes. In the future I&R portfolio, NYSERDA will continue to apply a range of evaluation and cross-cutting study types described in Ch 5.2. Table 31 identifies evaluation approaches that NYSERDA will undertake and its competitively selected independent evaluation contractors. In addition, the table provides details on the information needs these approaches serve. NYSERDA relies on a mix of data sources and tools to conduct its evaluation activities; these components are described further in the table and discussion below.

Table 31: Key NYSERDA evaluation approaches

Evaluation Scope	Information Need Met	Measurement Approach/Tools
Outcome Evaluation	Identification, quantification, and validation of outcomes such as technology performance metrics (e.g., cost compression, technology functionality, technology advancement) and typology metrics (e.g., number of citations, products commercialized, product revenue, replication) to understand the results of NYSERDA investment.	• Analysis of primary data collection (e.g., surveys of participants and nonparticipants) • Analysis of project, company, and market data • Secondary data review, including public and commercially available databases

Impact Evaluation	Quantification and verification of impact metrics (e.g., energy savings and generation, job creation, emissions reductions) which emanate from NYSERDA's direct investments.	• Analysis of primary data (e.g., demonstration results) • Analysis of project tracking data • Input/output modeling • Secondary data review
Process Evaluation	Assess program processes (e.g., administrative processes and steps) and customer experience (e.g., barriers, motivations, satisfaction) to determine program efficiency/effectiveness and opportunities for improvement.	• Collection and analysis of primary data (including surveys, interviews, or focus groups with participants, partial participants, applicants, non-participants, other stakeholders) • Customer journey mapping • Analysis of solicitation and project data • Benchmarking of peer organizations/like programs

Note that while NYSERDA will maintain budgets and track outputs and outcomes specific to the pre-and 2026-2030 I&R periods, evaluation efforts may, in some cases, span across funding cycles given the amount of time necessary for NYSERDA investments to accrue benefits.

In addition to the above-defined study scopes, NYSERDA will assess the progression of products from their nascent, early stages to the ultimate goal of commercialization and may undertake special studies to develop this understanding. NYSERDA will leverage its in-house analytics and independent evaluators to identify a subset of illustrative projects that have demonstrated long-term success along the product development and commercialization continuum. This will include an in-depth assessment of primary and secondary data to highlight key barriers that projects overcame and key opportunities that NYSERDA pursued, resulting in important success stories.

Additionality
Additionality is defined as new market activities spurred by NYSERDA's intervention and a marked change in impact compared to a baseline. NYSERDA seeks to invest public funds in a way that creates additionality. Evaluation provides understanding as to the degree of NYSERDA contribution or influence over the observed change and the nature of the specific impact and role NYSERDA I&R investment played. Each evaluation plan will define how additionality will be assessed using the logic model and a "triangulation" approach with multiple data sources where available.

5.3.2. Evaluation Budget

The Commission previously allocated 3.8% of total authorized funding to the evaluation of the CEF. NYSERDA proposes to maintain this same proportional allocation for evaluation funding in the 2026-2030 I&R portfolio, which equates to approximately $15.7 million. This includes $9.8 million for external EM&V activities (2.4% of the total budget), including funding for contractors to complete the types of studies outlined in Table 31. The remaining $5.9 million supports internal NYSERDA EM&V staff and is distributed across the labor and non-labor administrative cost categories. Evaluation will begin in 2026 but, as I&R investments typically realize results on an elongated time horizon, evaluation funds will be committed and expended beyond 2030 to ensure sufficient assessment, analysis, and reporting of these I&R investments and their associated outcome and impacts. See Chapter 3 for the evaluation budget expenditure timeline.

A. Appendix

A.1 Chapter 1 Supplement

Table A-1: PSC order requirement crosswalk to Innovation and Research 2026-2030 Innovation and Research proposal outline

Order Requirement	Proposal Chapter
-	Chapter 1 – Introduction
Quantitative and qualitative summary of performance of the I&R portfolio to date, overall and by Focus Area	Chapter 2 – Performance of I&R Portfolio to Date
Data trends, lessons learned, and findings from relevant evaluations	Chapter 2 – Performance of I&R Portfolio to Date
Identification of any necessary modifications to further support and align with the Climate Act or otherwise improve the effectiveness of the I&R portfolio	Chapter 2 – Performance of I&R Portfolio to Date Chapter 4 – Proposal and Funding Request 2026-2030 by Focus Area
Funding request for 2026-2030 Innovation & Research initiatives	Chapter 3 – Proposal and Funding Request 2026-2030 I&R Portfolio Chapter 4 – Proposal and Funding Request 2026-2030 by Focus Area
-	Chapter 5 – Performance Monitoring and Evaluation

A.2 Chapter 2 Supplement

The core metrics tracked to measure CEF performance are defined below and include type (leading or lagging). Leading metrics are predictive measure that provide early signals about future performance. Lagging metrics often take several months or years to materialize and reflect outcomes of investments.

Table A-2: Metric definitions and types

Metric	Definition	Type
Signed Projects	Number of projects is defined as the count of projects by date contract signed and it is counted as one project.	Leading
Organizations Engaged	Number of organizations engaged through NYSERDA programs.	Lagging
Products Commercialized	Number of commercially available products developed by companies with funding from NYSERDA.	Lagging
Product Revenue ($M)	The amount of revenue generated from the product supported by NYSERDA funds.	Lagging
Replications	Number of replications reported through demonstration projects.	Lagging
Publications	Number of publications issued (defined by publication type and date).	Lagging
Follow-on Funding ($M)	The amount of funding acquired following NYSERDA support.	Lagging
Cost-Share ($M)	The amount of funding provided by the awardee towards the project.	Lagging

For each focus area, this supplement includes a summary of initiatives outlined below.

A.2.1 Technology to Market Focus Area: Initiatives Summary

Initiative: **Carbon Tech Development*** *Purpose*: *Establish NYS as a world-class hub of carbon-to-value research, technology transfer from laboratories to market, and commercialization.*			
Total Budget Allocation ($M)	Total Budget Committed ($M)	Total Budget Expended ($M)	Year(s) Active
$14.4	$14.1	$6.6	2021 - present
Further Details			
NYSERDA's Carbon Tech Development initiative under T2M originally encompassed two programs. • The Carbon Foundry provides early-stage funding and commercialization support to carbon tech researchers and startups, including helping connect them to sources of investment, potential business partners, and potential employees. The Carbon Foundry also works to attract international carbon tech researchers and startups to NYS to grow the overall carbon tech ecosystem and to inform policy that can help further galvanize the market. • The Activate Carbon Tech Fellowship is a program for NYS-based carbon tech researchers that is delivered by Activate, a US-based international non-profit organization that helps science researchers develop the business skillsets necessary to launch start-ups. The fellow offers carbon tech researchers entrepreneurial training to increase the likelihood of carbon tech R&D innovations making it out of the laboratory and into the market.			
Initiative: **Novel Business Models and Offerings** *Purpose*: *Promote novel business models and tools to galvanize interest from the finance and insurance industries in cleantech and enable deployment of clean energy technologies at scale.*			
Total Budget Allocation ($M)	Total Budget Committed ($M)	Total Budget Expended ($M)	Year(s) Active
$13.4	$13.4	$7.2	2019 – present
Further Details			
NYSERDA's Novel Business Models and Offerings initiative under T2M provides funding for the development of innovative business models (including new commercial service and product offerings) and tools that overcome barriers to deploying clean energy technologies at scale. To date, under the initiative, NYSERDA has run two rounds of competitive solicitations targeted to early- and growth-stage cleantech ventures and stakeholders in the finance and insurance industries for projects that scale and validate novel high-potential business models. Fourteen projects have been awarded, covering novel approaches to performance contracts, power purchase agreements, x-as-a-service, resource sharing, and shared benefits agreements. NYSERDA also has spun one program out of the initiative, which is an Insurance Accelerator program administered by InnSure, a non-profit organization leading the way in insurance innovation for climate-friendly solutions.			
Initiative: **Manufacturing Corps** *Purpose*: *Fills incubation, personnel, and financial gaps and cultivates informed and active investment, industrial, and policy initiatives to support the growth and scale of emerging hardware-focused cleantech companies.*			
Total Budget Allocation ($M)	Total Budget Committed ($M)	Total Budget Expended ($M)	Year(s) Active
$17.1	$16.8	$13.3	2018 – present
Further Details			
NYSERDA's M-Corps initiative under T2M includes the Scale for ClimateTech Program (formerly called the M-Corps Program), which provides cleantech hardware start-ups with support to manufacture their products. The program is designed to reduce the time that it takes for innovative cleantech startups to move from a prototype to a commercial product, including providing training to increase their manufacturing readiness and facilitating connections and agreements between in-State manufacturers and start-ups. The program is administered by SecondMuse, which leads a formal supplier network dedicated to supporting future M-Corps startups.			
Initiative: **Catalytic Capital for ClimateTech** *Purpose*: *Provide direct investments (grants and wrap-around commercialization support) to help advance cleantech innovation by de-risking technology, validating markets, defining customers, and building teams.*			
Total Budget Allocation ($M)	Total Budget Committed ($M)	Total Budget Expended ($M)	Year(s) Active
$19.4	$19.3	$17.5	2017 – present
Further Details			
NYSERDA's Catalytic Capital for ClimateTech initiative under T2M focuses on providing direct investment (grants) and commercialization services to cleantech start-ups. Under the initiative, NYSERDA has run three programs:			

- Ignition Grant Program: Through the Ignition Grant Program, NYSERDA has awarded grants to cleantech start-ups that have been successfully served by NYSERDA-sponsored incubators. NYSERDA designed the Ignition grants to equip startups with seed capital to help them reach near-term technical or commercialization objectives and best position them to attract future investment from other (non-NYSERDA) partners to commercialize their products and accelerate their time to market.
- New York Climate Progress: Through the New York Climate Progress Program, NYSERDA provided "bridge" funding to cleantech start-ups during the COVID pandemic. NYSERDA designed the program to provide bridge funding to early-stage, in market cleantech companies that, while adversely affected by the pandemic and related economic dislocation, have demonstrated potential to rapidly scale their products and services NYS. New York Climate Progress funding is distributed in the form of a loan (i.e., convertible note) to all awardees.
- Investor, Corporate, and Customer Engagement Program: Through this co-investment program, NYSERDA made non-dilutive, matching investments directly into early-stage companies to help match other investor funding that companies bring in.

Initiative: **ClimateTech Commercialization Support***
Purpose: Provide deep, targeted, and customized support (via prizes and collaboration with/sponsorship of incubators, accelerators, and universities) to early-stage and growing cleantech startups and companies

Total Budget Allocation ($M)	Total Budget Committed ($M)	Total Budget Expended ($M)	Year(s) Active
$54.9	$54.9	$37.2	2017 – present

Further Details

The ClimateTech Commercialization Support initiative is the T2M focus area's largest initiative (by funding allocation) and most wide-reaching initiative (by range of programs and activities supported). The initiative includes three programs:

- Cleantech Incubator Program: Under this program, NYSERDA previously sponsored a suite of six incubators distributed across NYS through a region-driven incubator and accelerator strategy. NYSERDA subsequently has taken more of a statewide approach to the incubator and accelerator strategy. This is reflected in the 2023 launch of the Uptake Alliance, a new program administered by ADL Ventures, an innovation consulting group. The Uptake Alliance is a region-agnostic program open to cleantech startups from across NYS.
- Clean Tech Geographic Coverage Program: NYSERDA selected the geographic coverage programs based on the top applicants to an a specific "Accelerate the Southern Tier" PON, vs. a full regional strategy. The PON supported new programs to boost the innovation ecosystem in the Southern Tier, a portion of rural Appalachia that is one of the poorest in the State. Programs offered services to regional entrepreneurs, startups, and manufacturers.
- Clean Tech Proof of Concept Centers Program: NYSERDA established the original Proof-of-Concept Center program in 2013 (pre-CEF). The program targeted technology transfer from universities by providing cohort-based entrepreneurial training and resources (customer discovery, prototypes) to academics. The program then evolved into the Cleantech Accelerators PON in 2019, which resulted in the launch of Venture for ClimateTech and The Clean Fight.
- Corporate Challenges Program: The Corporate Challenges Program evolved out of the POCC Program to provide prize-based programs. NYSERDA shifted to focus on corporate challenges based on recognition of the importance of product-market fit. The Empire Tech Prize spun out of Corporate Challenges.

Initiative: **ClimateTech Expertise & Talent**
Purpose: Provide funding (via a network of highly experienced mentors who provide advisory and consulting on a project basis) to early- and growth-stage cleantech startups.

Total Budget Allocation ($M)	Total Budget Committed ($M)	Total Budget Expended ($M)	Year(s) Active
$12.0	$11.9	$7.3	2017 – present

Further Details

The ClimateTech Expertise Network Initiative consists of one eponymous program. The program was previously known as the EIR Program. The ClimateTech Expertise Network Program is a voucher program for highly targeted and customized support for cleantech start-ups. The program offers access to a network of cleantech entrepreneurship experts, including former CEOs, strategy advisors, business growth experts, and technical experts, who offer mentorship and coaching and provide specific one-off services, such as grant writing, for participating startups.

A.2.2 Grid Modernization Focus Area: Initiatives Summary

Initiative: **High Performing Electric Grid**
Purpose: Fund projects that promote the development of a high-performing smart electric grid that integrates a diverse supply of renewable energy resources, enhances overall grid performance and resilience, and enables customers to reduce their energy costs, consumption, and environmental impacts.

Total Budget Allocation ($M)	Total Budget Committed ($M)	Total Budget Expended ($M)	Year(s) Active

$64.8	$61.1	$42.1	2016 – present
Further Details			
NYSERDA's High Performing Electric Grid initiative is focused on de-risking and accelerating the development of technologies that contribute to the development of a digitally enhanced, dynamically managed NYS power grid. Under the program, NYSERDA has released four solicitations. Early solicitations focused on grid innovation, such as DER integration, energy storage, and transmission/distribution. Later PONs focused on supporting the development of technologies including low-cost communication and smart inverter functions to overcome targeted interconnection issues. The initiative has supported research studies (including feasibility & engineering studies), product development, and demonstration projects.			
Initiative: **Future Grid Performance Challenge** *Purpose: Fund projects that help forecast and assess the impact of increasing electrification on the electric grid—specifically, building electrification, EV charging, heat pump use, and the integration of distributed solar.*			
Total Budget Allocation ($M)	Total Budget Committed ($M)	Total Budget Expended ($M)	Year(s) Active
$43.0	$38.3	$9.7	2021 – present
Further Details			
NYSERDA's Future Grid Challenge initiative is focused on identifying and bridging gaps between current grid performance and the performance needed to achieve NYS's Climate Act goals for a 70% renewable grid by 2030 and a GHG-free electric grid by 2040. Under the program, NYSERDA has issued four rounds of challenges, designing each one in partnership with the Joint Utilities of New York to address specific problems within their respective service territories and to offer grid companies the opportunity to partner with member utilities in executing technology demonstrations. Round 1 focused on funding studies to forecast and assess the impact of increasing electrification on the grid; Round 2, on funding demonstration projects for sensing technologies to enable maximum integration of renewable resources into the existing transmission system; and Round 3, on funding development of advanced technologies to support a reliable, modern energy transmission and distribution system. Round 4, released in August 2023, will build on the themes from Rounds 1-3.			
Initiative: **Grid ClimateTech Ready Capital** *Purpose: Drive grid innovation and grid flexibility outcomes by coordinating with the grid ecosystem to invest in cutting-edge technology development and demonstrations.*			
Total Budget Allocation ($M)	Total Budget Committed ($M)	Total Budget Expended ($M)	Year(s) Active
$9.0	$0.6	$0.1	2021 – present
Further Details			
NYSERDA's Grid ClimateTech Ready Capital initiative provides funding and technical assistance for the development and demonstration of technologies that advance the interoperability of grid edge devices with utility software and hardware at the substation or feeder level. Though the initiative, NYSERDA also provides support for standard-setting and evaluation of opportunities and flexibility solutions beyond simple peak shaving. Under this initiative, NYSERDA has released two rounds (in 2023 and 2024) of the Vehicle-Grid Integration solicitation, which is focused developing new technologies and approaches to help overcome barriers to EV grid integration and increase medium- and heavy-duty EV use.			
Initiative: **Power Electronics Manufacturing Consortium** *Purpose*: *Provide public-private research consortium development and manufacturing support at State-owned R&D facilities for the next generation of silicon carbide and other materials used in semiconductors.*			
Total Budget Allocation ($M)	Total Budget Committed ($M)	Total Budget Expended ($M)	Year(s) Active
$16.7	$16.7	$16.7	2017 – 2020
Further Details			
The PEMC, which was initially founded through a partnership with the State University of New York system, General Electric, and NYSERDA, was a collective of public and private companies that provided support for the establishment of a state-of-the-art production capacity silicon carbide power electronics process line. The intent of PEMC was to enable industry to drive down the costs of technologies implemented with silicon carbide materials and devices and to accelerate the pace at which these technologies reached the market. By 2020, PEMC matured beyond the I&R support need and a collaboration with Empire State Development resulted in a public-private partnership and $1 billion acquisition by CREE, with PEMC transitioning to a self-sustaining commercial entity.			

A.2.3 Buildings Innovation Focus Area: Initiatives Summary

Initiative: **Next Gen Buildings** *Purpose*: *Provide funding for companies that are developing and demonstrating building energy efficiency and decarbonization technologies.*

Total Budget Allocation ($M)	Total Budget Committed ($M)	Total Budget Expended ($M)	Year(s) Active
$65.0	$58.5	$13.5	2017 – present

Further Details

Under the Next Gen Buildings initiative, NYSERDA provides funding for product development, demonstrations, and commercialization services to address NYS building challenges related to HVAC-Refrigeration, intelligent buildings (controls, etc.), envelope, and thermal storage. NYSERDA also helps participating companies advance their products by providing technical assistance and connecting them with partners across the State who can provide technical assistance and demonstration opportunities. As of December 2023, NYSERDA has conducted seven rounds of the NextGen Buildings PON. Participants can enter with solutions at varying TRLs, but all participants must develop commercialization plans and work toward deploying demonstration projects in relevant, real-world environments.

Initiative: **ClimateTech Commercialization Support**
Purpose: *Provide funding (via a competitive prize program) for companies working to commercialize advanced technologies for low-carbon heating system retrofits in tall commercial and multifamily buildings in the NYS market.*

Total Budget Allocation ($M)	Total Budget Committed ($M)	Total Budget Expended ($M)	Year(s) Active
$10.0	$9.5	$1.2	2021 – present

Program/Sub-Initiative Details

ClimateTech Commercialization Support is an initiative that exists under both the Buildings Innovation and the T2M focus area; however, separate work is funded in both places. Under BI, the ClimateTech Commercialization Support initiative is comprised of a single program, the Empire Technology Prize. NYSERDA launched the Empire Technology Prize in October 2023. It is a $10 million competitive prize program focused on incentivizing participating companies to generate solutions for electrifying heating in tall commercial and multifamily buildings.

A.2.4 Renewables Optimization Focus Area: Initiatives Summary

Initiative: **Energy Storage Technology and Product Development**
Purpose: *Provide funding to advance integration of energy storage technologies into NYS's electric grid to provide reliable and affordable power while the State increasingly switches to renewable energy sources and electrifies buildings and transportation systems.*

Total Budget Allocation ($M)	Total Budget Committed ($M)	Total Budget Expended ($M)	Year(s) Active
$39.5	$35.7	$12.9	2017-present

Further Details

NYSERDA's Energy Storage Technology and Product Development initiative provides funding for energy storage product development and demonstrations. The program focuses on energy storage innovations that result in cost compression, improved technical performance and safety, and removal of localized supply chain barriers. Prior to the establishment of the Gas Innovation focus area and the Hydrogen Innovation initiative under such, NYSERDA funded $14 million of hydrogen work under this initiative, consisting of five projects (three research studies – National Renewable Energy Laboratory Hydrogen Study, HyBlend, and a study done by Power to Hydrogen for fuel cells; one product development study by Roccera for hydrogen production; and one demonstration by Constellation for hydrogen use with nuclear power).

Initiative: **National Offshore Wind Research and Development Consortium**
Purpose: *Manage industry-focused R&D of OSW to maximize economic benefits and to reduce levelized cost of electricity.*

Total Budget Allocation ($M)	Total Budget Committed ($M)	Total Budget Expended ($M)	Year(s) Active
$22.5	$22.0	$16.6	2018-present

Program/Sub-Initiative Details

NYSERDA's National Offshore Wind Research and Development Consortium initiative has funded the formation and operation of a 501c3 non-profit consortium that invests in research projects that offer significant opportunity to lower the levelized cost of electricity of OSW. Research projects have concentrated on developing advanced technology solutions that could achieve cost reductions related to installation, operations and maintenance, and supply chain. The OSW Consortium membership consists of key OSW stakeholders including federal and state agencies, most global developers, major industry OEMs, and researchers. The OSW Consortium receives matching grants from both DOE and NYSERDA to address barriers to OSW development.

A.2.5 Clean Transportation Innovation Focus Area: Initiatives Summary

Initiative: **Electric Vehicle Innovation** *Purpose*: *Fund development and demonstration of innovative, replicable solutions that advance EV adoption and the integration of EVs with the electric grid.*			
Total Budget Allocation ($M)	Total Budget Committed ($M)	Total Budget Expended (M)	Year(s) Active
$31.9	$21.6	$8.7	2017-present
Further Details			
Under the Electric Vehicle Innovation initiative, NYSERDA has run two main programs focused on supporting the development of technologies, products, and solutions to advance EV adoption within local communities and successfully integrate EVs into the grid. Fist is the Direct Current Fast Charger Program (PON 4509): This program is intended to accelerate EV adoption in metro areas of upstate New York and the State at large by reducing the cost of purchasing and installing direct current fast chargers fast chargers in New York in Buffalo, Rochester, and Syracuse. Second is the Electric Mobility Challenge Program (PON 4744): This program is intended to advance clean electrified transportation in DACs, with a focus on providing DACs with new or expanded electric mobility options that address community needs, improve quality of life, and demonstrates scalability in other communities. It provides planning support and grant prizes. Beyond these two specific programs, NYSERDA also has advanced work under this initiative associated with development of novel policy approaches to reduce barriers to EV adoption, including through improved consumer awareness and interest, streamlined permitting, and adjusted pricing structures (demand charges). NYSERDA also has provided funding for five demonstrations of emerging hydrogen fuel cell and electric technologies in MHDVs, totaling $8.5 million in funding.			
Initiative: **Public Transportation and Mobility** *Purpose*: *Fund development and deployment of public transportation solutions through partnership with public infrastructure partners and communities.*			
Total Budget Allocation ($M)	Total Budget Committed ($M)	Total Budget Expended ($M)	Year(s) Active
$22.5	$9.6	$7.4	2017-present
Further Details			
Under the Public Transportation and Mobility initiative for Clean Transportation Innovation, NYSERDA has run three programs. The Transit Tech Lab Partnership Program (PON 4448): connected end users such as the Metropolitan Transportation Authority with companies that are developing emerging technology to enhance the public transportation experience and improve efficiency. The Public Transit Technology and Innovation Program (PON 3914): supports the development and implementation of efficient, reliable, and sustainable public transit through the adoption of advance technologies and innovative practices. Lastly, the traditional R&D program focused on conducting research to improve equitable access to clean mobility options and enable first-and-last mile programs that connect people and transit.			

A.2.6 Energy Focused Environmental Research Focus Area: Initiatives Summary

Initiative: **Energy-Related Environmental Research** *Purpose: Increase the understanding and awareness of the environmental impacts of energy choices and emerging energy options by providing a strong scientific foundation for formulating effective and equitable energy-related policies.*			
Total Budget Allocation ($M)	Total Budget Committed ($M)	Total Budget Expended ($M)	Year(s) Active
$47.8	$41.1	$29.8	2017-preset
Further Details			
Under the Energy-Related Environmental Research initiative, NYSERDA has had four main research priorities. 1. Program planning and stakeholder discovery: NYSERDA engages appropriate parties to identify policy-relevant research needs and gaps. 2. Monitoring and accountability studies: NYSERDA conducts studies to evaluate the effectiveness of energy-related policies, including trends analyses and benefits/avoided costs quantification. 3. Focused research: NYSERDA undertakes research focused on understanding and mitigating energy system transition risks, such as understanding impacts of renewable energy siting on surrounding ecosystems and impacts of methane emissions from the energy sector on NYS ecosystems. 4. Pre-development assessments: NYSERDA collects and releases data necessary to reduce renewable energy risks, costs, and timelines.			

Table A-3: Energy Focused Environmental Research project focus and descriptions

Project Focus	Project Description
NYS climate change projections	Developed NYS-specific climate change projections for state and utility climate change planning.
ZAPPA model	Supported the development of the ZAPPA model to enable zip-code level predictions of air quality and public health effects from energy policy options. ZAPPA was used for the recent New York Cap & Invest health analysis.
Monitoring studies	Provided the scientific basis for NYS engagement in federal Clean Air Act proceedings for National Ambient Air Quality Standards.
Solar energy research	Field monitoring studies are evaluating impacts on wildlife and ecosystem services to inform mitigation needs and opportunities toward more responsible and streamlined projects
Renewables co-utilization research	Studies are underway in agricultural and offshore environments to evaluate renewable energy siting and construction designs and enhancement opportunities for dual use
Methane emissions research	Ambient monitoring with targeted characterizations reveals significant inaccuracies in emissions source estimates in NYS
Offshore wind research	Field and technology evaluation of radio telemetry led to issuance of new, standardized federal guidance for bird monitoring

A.2.7 Gas Innovation Focus Area: Initiatives Summary

Initiative: **Hydrogen Innovation***
Purpose: Provide funding for hydrogen research, development, and demonstration for hard-to-electrify sectors to meet Climate Act requirements.

Total Budget Allocation ($M)	Total Budget Committed ($M)	Total Budget Expended ($M)	Year(s) Active
$20.0	$8.5	$0.5	2023-present

Further Details

Hydrogen Innovation is an initiative / program that exists under the Gas Innovation and Climate Resilience Innovation focus areas. Under GI, the Hydrogen Innovation initiative / program focuses on advancing technologies, products, and solutions that facilitate hydrogen deployment, including those related to (a) hydrogen applications for high-temperature industrial manufacturing processes; (b) clean hydrogen production and integration with renewable energy resources, and (c) control, testing, or monitoring of co-pollutants such as nitrogen oxides. Through the program, NYSERDA provides funding for research & studies, product development, and demonstrations.

Initiative: **Long-Duration Energy Storage**
Purpose: Demonstration projects that advance LDES solutions (10 to 100+ hours) that help harness and provide stored renewable energy to New York's electric grid.

Total Budget Allocation ($M)	Total Budget Committed ($M)	Total Budget Expended ($M)	Year(s) Active
$17.0	$14.8	$0.6	2022-present

Further Details

The LDES Innovation initiative under Gas Innovation focuses on advancing technologies, products, and solutions that facilitate LDES deployment. The program encompasses devices, software, controls, and other complementary technologies that decrease energy storage total hardware and installation costs, improve performance, and demonstrate integration with the grid for electrochemical, mechanical, and thermal energy storage. Prior to Hydrogen Innovation being established as a separately funded initiative, NYSERDA also funded $3.1 million in hydrogen-related work under the LDES initiative (product development for Ecolectro and a demonstration project for Standard Hydrogen).

Initiative: **Utility Thermal Network Technical Support**
Purpose: Reduce GHG emissions by creating utility-scale infrastructure projects that connect multiple buildings into a shared thermal network.

Total Budget Allocation ($M)	Total Budget Committed ($M)	Total Budget Expended ($M)	Year(s) Active
$3.0	$1.0	$0.05	2022-present

Further Details

Through the Utility Thermal Network Technical Support, NYSERDA makes available technical expertise for utility-scale TENs as part of the planning and implementation phase of the UTENJA.

A.2.8 Negative Emissions Technologies: Initiatives Summary

Initiative: **Carbon Tech Development* (This initiative also exists under the T2M focus area)** *Purpose*: Enhance the pool of human capital to build a robust ecosystem composed of academic, private sector, and public actors committed to accelerating the scale of carbon tech products and financing them.			
Total Budget Allocation ($M)	Total Budget Committed ($M)	Total Budget Expended ($M)	Year(s) Active
$5.1	$5.0	$3.1	2021-present
Further Details			
Through the Carbon Tech Development initiative, NYSERDA provides funding to promising NYS-based carbon tech researchers and entrepreneurs for research, product development, demonstrations, and commercialization services. This initiative exists under both the Negative Emissions Technologies and theT2M focus areas. Negative Emissions Technologies solely supports the Carbon Foundry, a hub to lead carbon-to-value research and commercialization.			
Initiative: **Natural Carbon Solutions** *Purpose: Provide funding for the development of innovative nature-based solutions to lower emissions and sequester carbon.*			
Total Budget Allocation ($M)	Total Budget Committed ($M)	Total Budget Expended ($M)	Year(s) Active
$12.5	$12.0	$0.3	2022-present
Further Details			
Through the Natural Carbon Solutions initiative, NYSERDA supports solutions from the agriculture, forestry, and waste sectors that offer pathways to low-carbon building products and low carbon fuels for heating and distributed power generation. NYSERDA provides funding for research, product development, and demonstrations. The initiative aims to de-risk technologies and business models, catalyze additional public and private investment, and inform policy and standards.			

A.2.9 Climate Resilience Focus Area: Initiatives Summary

Initiative: **Hydrogen Innovation*** *Purpose: Fund specific studies, product development, pilots, and demonstrations assuring that hydrogen can provide resilience solution to support grid stability and provide emergency solutions under various climate conditions.*			
Total Budget Allocation ($M)	Total Budget Committed ($M)	Total Budget Expended ($M)	Year(s) Active
$7.0	$1.9	$0.2	2023-present
Further Details			
This initiative makes investments primarily through competitive solicitations that support specific studies, product development, pilots, and demonstrations, assuring that hydrogen can provide resilience solution to enable grid stability and provide emergency solutions under various climate conditions. Investments address areas with highest strategic importance to New York and with the greatest potential for leveraged investment. Activities funded include: (a) hydrogen storage technology such as salt caverns, underwater, limited footprint at urban locations; and (b) demonstrations of hydrogen-based systems to provide black start provision, electricity, and heat supply to microgrids and grid firming.			
Initiative: **Grid ClimateTech Ready Capital*** *Purpose: Fund studies, product development, pilots and demonstrations of technologies, and related activities to accelerate adoption of critical technologies that enable a flexible, reliable, and affordable high-performing future grid.*			
Total Budget Allocation ($M)	Total Budget Committed ($M)	Total Budget Expended ($M)	Year(s) Active
$0	$0	$0	2023-present
Further Details			
This initiative will focus on load shifting and flexibility feasibility assessments. The anticipated activities include investment in utility plans to enable the growth of demand flexibility or DER expansion for utilities in NYS. Plans may include large-scale load shifting and flexibility demonstrations and the development of technology roadmaps for enabling technologies that improve the interconnection, market operations, and customer experience with DER integration.			
Initiative: **Market Characterization & Design** *Purpose: Fund the pre-investment activities that form the basis for new Innovation initiatives in the CEF.*			
Total Budget Allocation ($M)	Total Budget Committed ($M)	Total Budget Expended ($M)	Year(s) Active
$1.8	$1.5	$1.1	2018-present

Further Details
Broad categories of work required to initiate and accelerate interventions under the CEF are identified under this framework and refined to support Innovation & Research portfolio interests and strategies, operating across sectors with the goal of having broad applicability and value to other clean energy activities in New York.

*Indicates initiative spans other Focus Area(s)

A.3 Chapter 5 Supplement

The current CEF I&R approach to planning, reporting, and evaluating is briefly summarized below.

Planning (Logic Model, Outputs, and Outcomes): For each initiative, NYSERDA followed best practice for public-good investments and employed a *logic model* approach to guide program planning. The **logic models** define relationships between market/technology barriers, initiative activities, outputs and outcomes that benefit ratepayers. **Outputs** are generally a measure of activity, including project and participant counts.[51] **Outcomes** are generally a measure of the results or impact of the activity such as leveraged funding, replications, patents issued and commercialized products.[52] Portfolio-level leveraged funding was one of the CEF targets during the 2016-2025 period, with the I&R portfolio significantly contributing to these results. The **CIP** provides details on NYSERDA's planned activities for the I&R portfolio, including the expected spending forecast as well as the annual level of outputs and outcomes by each initiative. The CIP included an annual reforecast filing on November 1, and filings as needed to update plans on a quarterly schedule.

Reporting[53]: During the 2016-2025 period, NYSERDA reported on the I&R portfolio both quarterly and annually. The **CEF Quarterly Performance Report** provides detailed financial and benefits status of the portfolio, focus areas and initiatives, including approved plans, committed and expended/acquired results compared to what is planned. A spreadsheet accompanies the formal report with similar, but even more granular details on budgets and benefits plans and progress in quarterly increments which is ultimately used to populate NY's Clean Energy Dashboard. Lastly, the **CEF Annual Report** builds upon the quarterly reporting and adds reporting on the actual progress for individual program-level milestones, outputs, and outcomes metrics to compare against the expectation in the CIP.

Evaluation: The formal evaluation of the 2016-2025 CEF focused on identifying, validating, and understanding the outcomes and impact of the programs through focused and cross-cutting studies that consider a range of output and outcome metrics, including energy savings benefits, improvements in technology performance, and reductions in cost. Some basic process evaluation has also been included where warranted. Table A-6 below presents these study types and example studies that NYSERDA has completed.

Table A-4: Clean Energy Fund Innovation and Research evaluation study summary

Study Type	Study Objectives	Methods	Example Studies
	Identify, validate, and describe outcomes (e.g., replication, technology performance) and	In-depth interviews with key stakeholders, project data review, analysis/use of	Grid Modernization Case Studies: Central Hudson and Micatu (2020) Cleantech Start Up Case Study (2020)

[51] Output metrics progress data comes from NYSERDA's internal tracking and data validation systems, which ensure completeness and accuracy, from data entry through reporting.

[52] Outcome metrics progress data comes from an annual metrics collection process that has become increasingly standardized and automated to collect data from projects NYSERDA has supported over time. Outcome metrics progress data is validated by NYSERDA program staff who manage the projects and by cross-referencing data sources that contain similar information on companies, like investment they receive. Outcome metrics progress data is also derived from third party evaluation studies designed to collect accurate and representative baseline and progress data at key points in time.

[53] All reporting is based on the New York State Department of Public Service *Clean Energy Fund Reporting Guidance*, available at: https://dps.ny.gov/system/files/documents/2023/10/disadvantaged-communities-guidance.pdf

Focused Studies	impacts (e.g., energy savings) of investments in novel, successful projects.	supplemental information such as publicly available performance reports and emissions calculators	Clean Transportation Case Studies: ClearVu and KLD (2020) Shared Mobility Case Study (2023)
	Quantify impact and productivity of NYSERDA-funded research projects through citation analysis.	Analysis of databases housing a repository of science and research journal articles	Environmental Research Citation Analysis (2018) Environmental Research Citation Analysis Update (2022)
Cross-Cutting Studies	Identify and quantify outcomes and impact of product development and demonstration investments (e.g., replication, products commercialized, economic impacts) across initiatives and focus areas	Primary data collection from participants; analysis of project data; secondary data review	Innovation & Research Demonstration Project Impact Evaluation (2020) Innovation & Research Project Development Impact Evaluation (2024)
	Improve understanding of business support results (e.g., time-to-market, partnerships established) across initiatives and focus areas.	Primary data collection from participants and nonparticipant; analysis of project data; secondary data review	Cleantech Start Up Growth Market Baseline Evaluation (2018) Cleantech Startup Grown and M-Corps Market Evaluation Update (2022)
	Assess impacts (e.g., employment, jobs) associated with NYSERDA investments through macroeconomic analysis.	Analysis of project data; application of modeling tools (e.g., REMI Policy Insight Plus); secondary data (e.g., NYS Gross State Product)	Innovation & Research Portfolio Economic Impact Analysis for Buildings Innovation, Clean Transportation and Grid Modernization (2022)

Notes: NYSERDA published evaluation reports can be found at this link: https://www.nyserda.ny.gov/About/Publications/Evaluation-Reports

1. https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Publications/PPSER/Program-Evaluation/NYSERDA-GridModernization-CentralHudson-EvaluationCaseStudyReport-July2020.pdf.
2. https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Publications/Case-Studies/Micatu-Evaluation-Case-Study.pdf
3. https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Publications/PPSER/Program-Evaluation/NYSERDA-Cleantech-Startup-Incubator-EvaluationCaseStudyReport-June2020.pdf
4. ClearVu: https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Publications/PPSER/Program-Evaluation/NYSERDA-CleanTransportation-ClearVu-EvaluationCaseStudyReport-June2020.pdf
5. KLD: https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Publications/PPSER/Program-Evaluation/NYSERDA-CleanTransportation-KLD-EvaluationCaseStudyReport-June2020.pdf
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7. https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Publications/PPSER/Program-Evaluation/2018-Environmental-Research-Citation-Analysis.pdf
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12. https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Publications/PPSER/Program-Evaluation/2022-04-NYSERDA-Cleantech-Startup-Growth-and-Manufacturing-Corps-Report.pdf
13. https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Publications/PPSER/Program-Evaluation/2022-Innovation-and-Research-Portfolio-Economic-Impact-Analysis.pdf