13. Energy Innovation

Draft New York State Energy Plan

July 2025

Key Findings

- **Continued State investments in energy research, development, and demonstration (RD&D) help enable New York's transition to a clean energy economy.** State investments into innovation can accelerate the energy transition by introducing new products and services into the market whose cost and performance benefits far exceed incumbent technologies. Opportunities exist across the entire energy system, including grid modernization and reliability, power generation, energy storage, low-carbon alternative fuels, and heating and cooling technologies. Aligning RD&D investment plans with the needs of the market, ratepayers, and disadvantaged communities (DACs) is important for defining and prioritizing opportunities and improving market adoption.
- **Continued State investments in commercialization can accelerate the deployment of widely beneficial energy technologies.** Commercialization programs help bring beneficial energy technologies and services to market through technical assistance, financing, customer discovery, and further product development. Commercialization programs can provide a draw for manufacturers to develop new products and increase their business activity in New York by introducing and scaling technologies developed in-State or by bringing promising technologies to New York.
- **Strengthening partnerships that leverage New York's innovation ecosystem will foster economic development, create jobs, and provide greater leverage for State investments.** New York is one of the leading clean energy innovation hubs in the country thanks to the strong, mutually beneficial partnerships across State agencies, universities, and the private sector. Coordination among statewide and regional technology partnerships is critical to continue driving innovation, attracting new talent and industry, and meeting the market's energy needs. Continuing to foster synergistic relationships between State agencies, authorities, and other partners can ensure the State's significant research, education, industrial, manufacturing, and finance sectors are leveraged to drive innovation.
- **The State's investments in its education systems provides key talent, leadership, and cutting-edge research and product development needed for the energy transition.** New York's education system serves as the linchpin of the State's clean energy innovation portfolio by driving research, commercialization efforts, and hosting large-scale demonstration projects. Investing in the State's clean energy technology education pipeline can also produce the talent needed to develop and scale emerging energy technologies. Despite robust job growth, New York faces a shortage of highly trained professionals in cutting-edge areas like hydrogen RD&D and advanced grid modeling. Without more targeted education and training programs, critical research and demonstration projects can face prolonged timelines and reduced output.

Key Terms

- **RD&D.** Research, development, and demonstration.
- **Commercialization.** Commercialization programs help bring beneficial energy technologies and services to market through technical assistance, financing, customer discovery, and further product development.
- **Innovation Ecosystem.** Innovation ecosystems are communities of interacting stakeholders engaged in producing, enhancing, and creating novel methods, products, and processes.

1. Background: The Innovation Process

New York's nation-leading clean energy goals have already helped catalyze a robust clean energy industry. The State boasts one of the largest, most mature clean energy workforces, advanced markets for clean energy technologies, and extensive research and innovation hubs. Public and private investment in clean energy companies has been significant between 2021 to 2023, reaching nearly $4 billion, a 71 percent increase over that period. Growth can be expected to continue as New York remains committed to expanding existing markets and fostering the growth of emerging technologies.

Over the course of the Plan's time horizon, New York will need to scale up its existing supply of clean energy technologies to advance ambitious goals and growing energy demands. Innovation will be key to this success. This State Energy Plan should support an investment strategy that ensures that new industries can be reliably powered in the near term while developing and commercializing affordable clean energy technologies to meet future demand, especially as electrification efforts increase demand on the electric system.

Investing in energy innovation programs ensures New York retains the capacity to scale critical technologies necessary for meeting its energy goals as well as expanding New York's position as a leading innovation ecosystem. The State's leadership and commitment to technology innovation will be needed to help counter uncertainty in the federal policy context, including cuts to the US Department of Energy (DOE) technology research and demonstration budgets that risk stalling momentum on advancing new technologies to commercial adoption, tax policy that undermines private-sector confidence and investment in energy systems generally, and risks to the country's global position in leading technology development. In contrast, New York's continued commitment to innovation and market development—such as incentivizing clean energy supply chains to locate within the State—can attract investment, improve supply chain resilience, and drive long-term economic competitiveness for New Yorkers. By acting decisively, the State can retain its role a national anchor for clean energy innovation as well as demonstrate the value to New York's economy and to national security.

The New York State Energy Research & Development Authority (NYSERDA) leads the State's clean energy innovation, research, and deployment programs. Empire State Development (ESD) leads critical efforts to provide support for innovation and business development activities for new and existing New York businesses. The New York Power Authority (NYPA) pilots early-stage technologies, enables simulations to derisk new technologies, and mobilizes new technologies to scale. The State's academic institutions, including the State University of New York (SUNY), play a vital role in fostering New York's research and innovation ecosystem. Together, NYSERDA, ESD, SUNY, and NYPA regularly coordinate activities with other relevant agencies on policy, procurement, and community engagement. As New York welcomes new industry partners, extensive cross-agency collaboration will be needed to ensure that the associated energy demand can be met with clean energy supplies.

1.1. Technology Life Cycle and De-risking

New technologies take time to mature, particularly in energy where various trade-offs, such as cost, performance, land-use, and community benefits must be considered. The life cycle of new energy technologies can be broken down into the following stages: research and product development,

demonstration and validation, commercialization, and market adoption and scale up (see Figure 1). Typically, the public sector—whether state, federal, or otherwise—invests in the earlier stages of this technology life cycle and provides funding to assess the performance and benefits of key technologies; this lowers risk for private investors and enables a given technology, solution, or service to reach a greater scale. This intervention can result in fast-tracking solutions, returning them to research, or eliminating them from consideration.

Figure 1: Innovation Life Cycle

Sustained support throughout the later stages of the lifecycle, such as demonstration, commercialization, and market adoption, also plays an important role. State innovation programs accelerate the transition from lab to market by reducing financial risk, aligning technologies with regulatory frameworks, and facilitating partnerships with private industry. Commercialization programs can also play a role in identifying and importing mature, proven technologies from other markets and scaling their deployment to meet the State's energy needs. If market adoption occurs, scaling up product supply and manufacturing to needed levels must be considered throughout the maturation stages. The ability to manufacture products in New York State to supply the New York market can result in economic growth and in certain cases, cost reductions.

The maturation of clean energy Investments can be tracked by several metrics, such as Technology Readiness Level (TRL), Commercial Readiness Level (CRL), and Adoption Readiness Level (ARL). ARL has more recently been employed as a holistic framework for predicting the deployment and scale-up of energy technology investments. For example, NYSERDA Innovation is transitioning to the use of ARL to account for technical, market, policy, and other ecosystem factors to better predict likelihood of success of new investments and track progress toward stated goals. This evolving and adaptable framework, combined with coordinated RD&D projects and strategic partnerships, is expected to improve success rates and enable more precise tracking of meaningful progress. This includes not only financial outcomes but also measurable energy and non-energy benefits. Additionally, based on historical trends, investments in innovation are projected to yield broader economic growth benefits.[1]

1.2. Innovation and Clean Energy Affordability and Access

Investments into clean energy innovation programs have demonstrable positive effects on the deployment of emerging technologies, lowering energy system costs, increasing energy efficiency, and providing positive environmental impacts. Investments in innovation drive down the cost of more energy-efficient consumer products and equipment, reduce overall costs of the energy system, as well as improve reliability. For example, national investment in energy technology innovation, development, and

[1] Snyder, Bill. 2019. How Innovation Drives Economic Growth. Insights by Stanford Business. https://www.gsb.stanford.edu/insights/how-innovation-drives-economic-growth.

market adoption has led to a substantially lowered cost of wind, solar, large-scale batteries, heating, and cooling technologies.[2,3]

Successful innovation can also unlock advanced grid capabilities such as dynamic line rating, power flow control, and streamlined integration of demand response, virtual power plants, grid interactive buildings, electric vehicles, and flexible industrial processes. These advancements can reduce the need for unnecessary transmission buildouts, lower system costs, and enhance the reliability of the electrical grid as it transitions to a new mix of energy generation sources. Examples of these strategies include:

- **Grid Modernization Cost Savings:** Funding dynamic line ratings enables utilities to optimize electricity flow without costly new transmission lines, reducing congestion-related expenses and stabilizing rates.
- **Technology Cost Compression:** Investments in advanced building envelopes, heat pumps, and geothermal loops help lower upfront costs, eventually curbing overall electricity demand and easing pressure on retail prices.
- **Enhanced Reliability Measures:** Utility-scale long-duration storage and other advanced technologies serve as crucial buffers during power fluctuations or emergencies, mitigating large-scale outages and ensuring a more resilient energy system for all New Yorkers.

These investments, over the long term, result in more affordable energy and a cleaner environment. Strategic innovation investments can ensure that environmental benefits, cost savings, and revenue opportunities accrue to disadvantaged communities (DACs). Additionally, investments in innovation can also de-risk and identify optimal siting locations for microgrids and community-owned power systems, which can lower energy costs and support local job growth.

2. State of the Sector: New York's Innovation Ecosystem

Innovation ecosystems are communities of interacting stakeholders engaged in producing, enhancing, and creating novel methods, products, and processes of energy generation, transmission, and storage. These ecosystems provide the infrastructure, resources, and supportive environment needed to drive RD&D and commercialization of novel solutions. Looking ahead, a strong innovation ecosystem will continue to enable the transition to an equitable clean energy economy.[4]

New York boasts one of the most robust innovation ecosystems in the United States, ranked third nationally (after California and Texas) in both clean energy and technology sector jobs and second (to

[2] American Council on Renewable Energy (ACORE). 2025. "The Latest Statistics & Trends on U.S. Clean Energy." https://acore.org/resources/the-latest-statistics-trends-on-u-s-clean-energy/.

[3] International Energy Agency (IEA). 2020. "Clean energy technology innovation and the vital role of governments ." https://www.iea.org/reports/clean-energy-innovation/clean-energy-technology-innovation-and-the-vital-role-of-governments.

[4] MIT Practical Impact Alliance. 2019. "Understanding Innovation Ecosystems." https://d-lab.mit.edu/sites/default/files/inline-files/Understanding_Innovation_Ecosystems_FINAL_JULY2019.pdf.

California) in total RD&D spending.[5,6,7] New York State promotes innovation by providing subject matter expertise, strategic connections, convening opportunities, and targeted financial incentives to support small businesses across industries including, but not limited to, life sciences, cleantech, and artificial intelligence (AI). For hardware-based technologies, the State has established 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 eleven "Research 1" (R1) higher education research institutions, tied with California for the most of any U.S. state, underscoring New York as a critical player in fostering research and innovation.[8]

A holistic Innovation ecosystem across the State helps enable the maturation of needed energy technologies and businesses. New York is now home to over 650 cleantech small businesses, making it the second-largest hub in the U.S. after California.[9] Despite these high rankings, the number of North American cleantech investment deals has recently declined by 25 percent in 2023 relative to the 2021 peak.[10] Complementary funding sources and technology development funding in the State can help enable continued cleantech ecosystem growth despite this recent decline.

New York is committed to a dynamic clean energy innovation ecosystem to expand the supply of reliable clean energy sources, reduce greenhouse gas (GHG) emissions, and ensure clean energy affordability and accessibility for all New Yorkers. The Scoping Plan for the Climate Act called for expanded investment in innovation essential to "advancing a full portfolio of options and mitigating risk" to meet the 2050 targets set out in the Climate Act. The Scoping Plan also called for targeted innovation in technologies that support decarbonizing buildings, long-duration storage, flexible electric loads, carbon sequestration solutions, low-global-warming-potential (GWP) refrigerants, and alternative fuels from agricultural residues, among others.

Building on the success of past investments, New York continues to support innovation that delivers tangible benefits, including building sensors and controls for more efficient heating and cooling, ground source heat pumps, and grid-responsive technologies. These efforts are helping to scale up high-impact local energy industries for dynamic load management alongside encouraging the growth of key local energy ecosystems including battery storage, offshore wind, and transportation technologies (see insets).

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5 U.S. Department of Energy. 2024. "2024 U.S. Energy and Employment Report (USEER)." https://www.energy.gov/policy/us-energy-employment-jobs-report-useer .

6 Office of the New York State Comptroller. 2022. "The Technology Sector in new York City." New York City. www.osc.ny.gov/files/reports/osdc/pdf/report-10-2023.pdf.

7 National Science Foundation (NSF). 2023. R&D Data Surveys. Washington, DC. https://ncses.nsf.gov/surveys/federal-funds-research-development/2022-2023.

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

9 POWERHOUSE. 2023. *The Geography of Climate Tech: Findings from Powerhouse's Data.* www.powerhouse.fund/climate-geography#:~:text=New%20York,-New%20York%20Climate&text=As%20the%20second%20largest%20center,tech%20startups%20in%20New%20York.

10 PWC. 2024. State of Climate Tech 2024: Seeking an edge as deal-making slows. December. https://www.pwc.com/gx/en/issues/esg/climate-tech-investment-adaptation-ai.html.

New York's leadership on batteries and energy storage innovation has been recognized by major federal awards:

New-York-based coalitions, led by the State University of New York at Binghamton (Binghamton University), were the only entities in the United States to have won all three recent place-based economic development competitions from the U.S. Economic Development Administration (EDA) and the National Science Foundation (NSF). Funding for these initiatives to date exceeds $100 million. Both ESD and NYSERDA provided financial, advisory and letters of support.

The Binghamton University-led "Upstate New York Energy Storage Engine" initiative was awarded up to $160 million over ten years from the NSF to establish an industry hub for energy storage componentry. ESD is providing up to $16 million of additional state match funding for this program.

The Binghamton University-led New Energy New York consortium was awarded an EDA Tech Hub designation for end-to-end battery development and manufacturing. This national designation helps unlock federal funding opportunities and serves as a nationwide highlight of the region as a leader in energy storage technologies.

Awarded EDA Build Back Better Regional Challenge award in 2022.

ESD and NYSERDA Jointly Support Scale-Up of Clean Ammonia-to-Power Technology in New York

Amogy, a Brooklyn-based startup developing ammonia-to-power systems for transportation applications. With NYSERDA and ESD support, Amogy located to the Brooklyn Navy Yard in Kings County, formed a contract manufacturing agreement with Rochester-based PEKO Precision Products and successfully demonstrated an ammonia-powered tugboat on the Hudson River. The company subsequently raised more than $270 million in funding to further scale its technology for maritime use, and more recently, for carbon-free power generation, a capability important to leverage toward New York's goals for a zero-emissions electric grid. Amogy's trajectory highlights how strategic state support can accelerate commercial readiness and attract large-scale investment to New York.

New York's clean energy innovation strategy is supported by programs administered by NYSERDA, ESD, and the Empire State Academic Consortium. Table 1 provides an overview of key New York clean energy innovation programs and investments.

Table 1: Overview of Key Current Statewide Energy Innovation Programs

Agency	Focus Areas	Relevant activities	Initiatives
NYSERDA	Commercialization & Ecosystem Support	Facilitate RD&D and commercialization efforts, business support and training for startups, scale up support for key energy technologies	Carbontech Development Initiative (CDI), Activate New York, The Clean Fight, Scale for ClimateTech; Venture for ClimateTech, ClimateTech Expertise Network (formerly Entrepreneur-In-Residence)
	Grid Modernization	RD&D and commercialization to support a high-performing future grid	High Performance Grid, Future Grid Challenge, Grid Climate Ready Capital; Grid of The Future Study, BIL Grid Resilience Formula Funding
	Power Generation & Storage	Renewable energy and advanced nuclear power RD&D, and commercialization support activities.	National Offshore Wind R&D Consortium (NOSWRDC); Long-Duration Energy Storage; Advanced Battery Innovation Demonstrations
	End-Use Technologies	RD&D and commercialization to improve building energy efficiency, clean modes of transportation	NextGen Buildings, NextGen HVAC, Enabling Innovative Clean Energy Building Solutions, Empire Technology Prize, Clean Transportation Prize Initiative, E-mobility Technologies,
	Energy Focused Environmental Research	Research and studies providing objective, scientific information to guide policy decision-making & investment in technology	Advanced Nuclear Master Plan, New York Hydrogen Assessment, Evaluating Emission-Free Technologies for New York's Energy Future; and technical analyses of Energy Efficiency, Alternative Low-carbon Fuels, Large Scale Renewables, Emissions, and Energy Assurance and Emergency Plans
	Alternative Fuels & Negative Emissions Technologies	RD&D and commercialization of carbon capture, carbon sequestering products, zero-emissions fuels for heat, power and transportation.	Natural Carbon Solutions; Clean Hydrogen Innovation; Utility Thermal Network Technical Support; Low carbon fuels production and application in hard-to-electrify sectors
	Climate Resilience Innovation	RD&D to mitigate impacts of climate change on the energy system.	Market Characterization & Design; Technical Assistance for MUNIs and COOPs for grid resilience.
ESD	Innovation Financing	Provides equity investment capital to pre-seed through Series B innovation start-ups in clean energy. It also has a program where it makes commitments to venture capital fund managers, including those supporting climate and clean energy start-ups.	NY Ventures (various funds).
	Innovation & Commercialization Programs	Administration of innovation centers and hubs, grants support innovation activity, technical assistance for small- and medium-size firms.	Division of Science, Technology and Innovation (NYSTAR), which includes Centers for Advanced Technology, Centers of Excellence, Manufacturing Extension Partnership centers, incubators, hot spots, accelerators and venture competitions.

Agency	Focus Areas	Relevant activities	Initiatives
SUNY	Education and Research Capacity	With 64 campuses, SUNY is the largest comprehensive university system in the US, educating approximately 468,000 students, 7,500 degree and certification programs.	SUNY Climate Research Task Force.
	Research & Commercialization Programs	Numerous ongoing research programs across campuses, including battery storage technology at Binghamton, wind and solar technologies at many schools, and materials for the nuclear industry at Stony Brook. SUNY has launched a climate research task force that build on these efforts to develop a clean energy research strategy.	SUNY Energy Research Centers and Commercialization Hubs; Decarbonization Leadership Program; NENY Battery Tech Hub; Stony Brook Advanced Energy Research and Technology Center, University at Buffalo Renew Institute, and the Binghamton University S3IP Center of Excellence.
	Demonstration of Clean Energy at Scale	SUNY has ambitious plans to decarbonize its campuses to meet Climate Act goals, has clean energy master plans for all campuses, is part of the State's Decarbonization Leadership Program, and has secured over $100 million in Bond Act and other State funding for implementing thermal energy networks.	SUNY-NYSERDA innovation partnership.
	Workforce Development	Offering nearly 2 million workforce and professional development programs.	See the Clean Energy Jobs and a Just Transition chapter of this Plan for additional discussion.
NYPA	Advanced Grid Innovation Lab (AGILe)	Digital twin to derisk new technologies through modeling	Testing of transmission, distribution, DER technologies and cybersecurity under a broad range of scenarios.

2.1. NYSERDA

NYSERDA engages with various stakeholders across the entire New York State innovation ecosystem to develop and expand relevant programming with a focus on accelerating solutions that provide affordable and reliable electricity and energy and benefit the environment, public health, and the economy. Stakeholders include public and investor-owned utilities, businesses (early-stage and established), State, federal and municipal governments, private investors, academic institutions, as well as community groups and non-governmental organizations.

Informed by engagement with these key stakeholders, NYSERDA creates value through programs that accelerate the path to market for key technologies and services through lowered costs and improvements in performance. NYSERDA's programs accomplish this by:

- **De-risking clean energy technology development and deployment** and enabling aspects of the energy transition that appear unlikely to happen otherwise, generally by providing non-dilutive capital with performance-based contracts.
- **Expediting and scaling the energy transition** with validation, adoption, and business support through incubators, customer matching activity, and commercialization training.
- **Improving ultimate ratepayer affordability** by lowering costs and increasing access to beneficial technologies.
- **Enabling greater co-benefits** through supporting needed supply chains, manufacturing and other job growth, while supporting environmental quality.

- **Aligning innovation ecosystem to policy goals** serving as a liaison between regulators and companies, ensuring all supported technologies align with policy goals and ratepayer benefits.

Before any innovation investment or program is approved for implementation, stakeholder engagement as well as a rigorous set of criteria is used to evaluate the potential benefits, and establish a clear market need, a clear role for NYSERDA to add value, non-duplication of existing efforts, and a clear case for potential rate payer benefits. Impacts of these investments are assessed using several indicators, including funding leveraged for every dollar of investment by NYSERDA from co-investment and revenue, as well as energy related impacts after a technology has been deployed. Alongside direct investment that supports new product development and demonstration, NYSERDA supports research that delivers objective information to the public, such as trade-offs in cost, performance, and other attributes of forward-looking energy technologies that helps influence and coordinate other investors and industry.

Between 2016 and 2023, $490 million in funding was committed across focus areas summarized in Table 1.[11] To date, impacts of these investments include commercialization of over 200 products, replication of 985 demonstrated technologies, nearly $20 million in product revenue, and over $3.5 billion in leveraged funds from other sources. In addition, NYSERDA-sponsored research produced nearly 250 peer-reviewed publications to support energy investments, policy initiatives, and general information to be disseminated in the public interest.[12] Specific examples include:

- **The National Offshore Wind Research & Development Consortium (NOWRDC).** Established in 2018 as a not-for-profit public-private partnership, NOWRDC focuses on advancing offshore wind technology in the United States. NYSERDA provided $20.5 million in funding, leveraging an additional $35 million from the DOE, Virginia, Massachusetts, California, Maine, Maryland and New Jersey. Results of impacts to date suggest that deploying innovations supported by NOWRDC lowers the Levelized Cost of Energy (LCOE) by up to 10% and increase annual energy production up to 4% from offshore wind.
- **Grid Modernization**. $6 million awarded to Central Hudson for grid modernization (including sensors, smart inverters, automated transmission and distribution management systems), helped increase grid efficiency, reduce costs and improve reliability by predicting and withstanding power outages. Impacts included $41.7 million in avoided electrical upgrades and $28 million in environmental benefits from 740,000 avoided metric tons of CO_2 (over 20 years), as well as improvements in reliability. NYSERDA's investments de-risked key innovations and leveraged $53 million in investment by Central Hudson, with the total estimated benefits valued at $12.83 for every $1 of NYSERDA investment.

- **RD&D for End-Use** in buildings have catalyzed significant co-investment to replicate and scale up demonstrated technologies, such as drilling equipment and ground source heat pumps by

[11] 2026-2030 Innovation and Research Proposal (NYSERDA 2024).

[12] As an example of energy impacts from new products, a recent product development evaluation found that from 2016–2020, $109 million in investment resulted in successful commercialization of 38 products with 18 of these products supporting nearly 1.4 trillion British thermal units of annual energy savings through 2021.

Dandelion Energy and window mounted heat pumps by Gradient. Together, these two examples leverage over $200 million of additional investment from $2 million of initial NYSERDA investment.

NYSERDA's commercialization programs support the conditions necessary for new technologies to enter and grow in the New York market to enable a greater scale of impact. NYSERDA's commercialization programs fund organizations that provide structured business development services, access to partners and investors, technical assistance, and facilities to accelerate time to market. Over the past six years, the number of incubators and accelerators in New York has more than doubled and companies supported by NYSERDA-backed incubators have reported bringing products to market up to four times faster than those without similar support. Participants in NYSERDA-supported programs reported, on average, 16 times higher revenue than peer companies. Key programs include:

- **ClimateTech Expertise Network & For ClimateTech:** One of the persistent challenges for early-stage climate ventures is access to capital. NYSERDA provides capital and technical assistance to help companies secure follow-on investment and scale their operations. Between 2018 and 2023, companies supported through the ClimateTech Expertise Network and the Venture and Scale for ClimateTech initiatives raised approximately $1.6 billion in follow-on funding. This includes private investment, venture capital, and federal grants. NYSERDA has directly engaged over 800 entrepreneurs across New York through the ClimateTech Expertise Network.
- **M-Corps Initiative:** NYSERDA has emphasized the importance of connecting[13] energy innovation with local manufacturing. NYSERDA's M-Corps initiative supports startups in transitioning from prototyping to production, with a specific emphasis on working with New-York-based manufacturers. M-Corps provides funding and technical support to facilitate design optimization, secure production partnerships, and reduce the time to manufacturing readiness.
- **Carbon Tech Development Initiative:** In 2021, NYSERDA launched the Carbon Tech Development Initiative to leverage the State's academic research base and industrial capabilities to improve the efficiency and cost of capturing CO_2 and converting it into commercially viable products such as fuels, building materials, and industrial inputs. The initiative aims to advance lab-to-market transitions, support early-stage demonstration, and attract commercialization partners. While still in its early stages, the initiative has contributed to placing New York in a leadership role in driving these enabling technologies to market and attracting new businesses and talent.

2.2. ESD

ESD plays a key role in spurring and supporting new clean energy industry growth by providing resources to new and existing New York businesses to develop and scale innovative technologies, including clean energy technologies. Through NYSTAR and NY Ventures (part of the Small Business and Technology

[13] Through the ClimateTech Commercialization Support initiative, NYSERDA targeted commercialization support to the Southern Tier of New York—a region that previously had limited entrepreneurial resources. This support helped expand access to business development services, contributing to significant regional gains. According to analysis by Saoradh Enterprise Partners, the Southern Tier now ranks first in the nation for per capita cleantech employment among innovation hubs.

Development Division), ESD provides grants, technical assistance, equity capital, and other services to support incubators, innovation hubs, and small businesses. Key programs include:

- **Centers of Excellence and Centers for Advanced Technology:** These programs have established University-based centers focused on specific areas of technology. State funding is used to support collaboration between academia and private industry to help companies advance and succeed. There are several centers supporting clean energy development, including the Center for Future Energy Systems at RPI and the Advanced Energy Research and Technology Center at Stony Brook University.
- **State-certified Incubators and Hot Spots**: NYSTAR has twenty certified incubators across New York State, as well as ten certified Hot Spots (one in each economic development region). These aid early-stage startups with everything from space and equipment to curriculum and networking.
- **Accelerators and Venture Competitions:** NYSTAR oversees seven accelerators and venture competitions statewide. These are eligible both to NY-based startups, as well as are an attractor for startups globally that want to set up substantial operations in New York State. These span a number of technology areas, though most have cleantech-relevant companies included in their cohorts each year.
- **NY Ventures**: This program provides direct equity investments, matched to private sector investors, in high-growth innovation start-ups across the State. For example, NY Ventures recently invested $250,000 in the pre-seed financing round for Exodys Energy, a company that is working on recycling used nuclear fuel for a closed-loop nuclear system.
- The **Emerging and Regional Partner Fund** and the **Community and Regional Partner Fund** make investment commitments to venture fund managers including those that support clean energy and climate solutions start-ups.

2.3. SUNY

SUNY is involved in several facets of New York's innovation ecosystem: education, research, development, commercialization, and the demonstration of the adoption of clean energy at scale. As one of the largest university systems in the United States, SUNY serves nearly 1.3 million students in credit-bearing courses and programs and continuing education and community outreach programs.[14] In its Climate and Sustainability Action Plan, SUNY has committed to over 150 climate innovation-focused actions, including:

- **Educating the next generation of change agents.** Just as the higher education sector mobilized for the 1960s Space Race, today's institutions are poised to respond to the climate crisis by expanding both classroom and experiential learning opportunities. These initiatives are designed

[14] State University of New York (SUNY). 2025. What is SUNY? Accessed May 29, 2025. https://www.suny.edu/about/.

to deepen students' understanding of how climate change impacts communities, while highlighting pathways for leadership, innovation, and economic mobility.

- **Doubling investment in climate and clean energy research**. This includes establishing a dedicated research task force and launching at least one new center or innovation hub to advance agricultural technology, clean energy solutions, and resilient food systems.
- **Decarbonizing SUNY's built environment.** With a portfolio encompassing 111 million square feet, about 40% of New York State's public building space, SUNY is pursuing deep decarbonization through early adoption of energy efficiency measures, renewable energy, thermal energy networks, and scalable demonstration projects. The system also seeks to double its on-site renewable energy generation to 66,000 megawatt hours.

Through its multi-campus Clean Energy Consortium, Offshore Wind Training Institute, and other faculty communities of practice, SUNY is developing a number of academic and training programs developed in collaboration with energy employers and other businesses in the clean energy innovation space. Programs range from advanced degrees in engineering, environmental services, and design and innovation, to certificate programs in welding, manufacturing, building management, and offshore wind technology.

2.3.1. Research and Commercialization

SUNY serves as the linchpin of the State's clean energy research and innovation portfolio. As a nationally recognized leader in clean energy research, SUNY holds one of the largest university-owned clean energy patent portfolios in the country. The 64-campus system includes three campuses at the forefront of clean energy advancement: Stony Brook University Advanced Energy Research and Technology Center, the University at Buffalo RENEW Institute, and Binghamton University's S3IP Center of Excellence.

Beyond these flagship centers, SUNY houses other key energy innovation initiatives, such as the Center for Sustainable Materials Management at SUNY ESF, which leads applied research on waste and the circular economy, and the Upstate 2.0 partnership between Cornell and SUNY ESF, which was awarded an NSF Regional Innovation Engines grant to develop fossil fuel replacement, robotics, and agricultural technologies. SUNY is also working with NYPA on a DOE research grant to site a commercial scale energy storage system that uses batteries with alternative materials to rare earths.

SUNY launched a Climate Research Task Force modeled on successful research strategic efforts for Artificial Intelligence (AI), biochemistry, quantum mechanics, and other areas that have provided a roadmap for funding and efforts. The Climate Research Task Force will look at clean energy technology, embodied carbon, and materials used in the advanced energy sector (including nuclear), among other areas of focus.

2.3.2. Demonstration of Clean Energy at Scale

SUNY's extensive facilities—2,833 buildings and 111 million square feet of owned and/or operated space—generate most of SUNY's Scope 1 and 2 GHG emissions. The State-owned facilities at SUNY campuses account for approximately 40 percent of all State-owned and managed buildings that need to

be decarbonized to meet Climate Act and EO22 goals.[15] SUNY has committed to address this challenge and demonstrate decarbonization at scale by transitioning buildings' heating, cooling, lighting, and power systems from fossil fuels to clean electricity. In addition, SUNY is determined to reduce Scope 3 emissions used to create construction materials (embodied carbon) and emissions in the demolition and disposal of buildings after their useful life.

Facilities in the SUNY system are already cleaner and more efficient following successive implementation of projects addressing energy efficiency, building control, lighting, and other areas to meet Executive Order 111 (2004), Executive Order 88 (2012), and the State University Construction Fund's Directive 1B-2, which requires all SUNY projects to meet the NY Stretch Energy Code (2020).[16] Through renovations and new construction that meet the above standards, SUNY has decreased energy use in buildings by 12 percent since 2015, even as it expanded its total footprint by five million square feet. Overall, SUNY has reduced its energy use intensity (EUI) by 16.5 percent in the same period (and by approximately 22 percent between 2005 and 2024).[17] As a result of these initiatives, SUNY has reduced its gross Scope 1 and 2 GHG emissions by over 35 percent compared to 1990 levels, on track to meet the Climate Act's interim goal of a 40 percent reduction by 2030. This progress is continuing under EO22. For example, under the New York Power Authority's (NYPA) BuildSmart 2025 program, SUNY aims to reduce energy use by an additional 4.4 trillion British Thermal Units (tBTUs) by 2025.

Future deep decarbonization will require maintenance of that progress as well as a new approach to developing campus-wide heating and cooling infrastructure. In early 2024, SUNY completed 28 Clean Energy Master Plans for State-operated campuses, with four more in progress. These Clean Energy Master Plans, funded by NYSERDA and other sources, set a pathway to dramatically decarbonize facilities to net zero emissions by implementing geothermal heat pumps, district thermal energy systems, using waste heat from data centers and other sources, and full electrification of building heating and cooling systems. Around the same time, the Governor's Decarbonization Leadership Program was announced, under which NYPA will develop action plans for 15 of the top emitters statewide, which includes seven SUNY campuses.

SUNY is working with NYPA to ensure that the BuildSmart 2025 program builds on prior plans and advances projects for early completion. As a demonstration of support, Governor Hochul announced that SUNY can immediately invest $100 million in funds allocated by the New York State Clean Air, Clean Water, and Green Jobs Bond Act to design and build innovative thermal energy networks, renewable

[15] Signed on September 20, 2022, Executive Order 22 Leading by Example (EO22) directs State agencies to accelerate efforts to make State facilities and State operations more sustainable. A new first-of-its-kind interim design guide for State buildings standardizes recommendations for increasing energy efficiency, designing for zero emissions and climate resiliency in State buildings. This will help ensure that State investments effectively reduce emissions and deliver long-term benefits for New Yorkers, with integration into State projects beginning in 2025.

[16] In 2007, the SUNY Board of Trustees required that all new buildings meet at least a Leadership in Energy and Environmental Design (LEED) Silver standard. Directive 1B-2 has built on that effort and requires all new construction at SUNY to be designed to achieve net zero carbon and be electricity-ready.

[17] This progress was made through energy efficiency, building control, lighting, and other retrofits with short paybacks. In addition, campuses switched out their dirtiest fuels like oil and coal. Binghamton University, for example, converted its central plant boilers from coal to natural gas and biomass.

solar power generation, and other clean energy technologies. In addition, SUNY is eligible for up to $200 million provided in the FY26 budget for thermal energy networks. Finally, SUNY is exploring opportunities to develop energy performance contracts and public-private partnerships with private

Net zero ETEC building at University at Albany

ETEC is UAlbany's newest state-of-the-art and environmentally sustainable facility, a 246,000 square foot building that houses researchers, educators and entrepreneurs under the same roof as some of UAlbany's fastest-growing programs, including atmospheric sciences. ETEC aligns with SUNY's goal to achieve net zero carbon emissions and has received LEED Platinum certification, the highest level awarded by the Green Business Certification Inc. for energy-efficient and sustainable buildings. A geothermal field of 190 wells and solar panels on the Uptown Campus Podium combine to save about 70 percent in energy costs, efficient fixtures reduce water usage by 40 percent, and the site includes green stormwater management including a porous parking lot and a teaching green roof.

SUNY Oneonta Clean Energy Demonstration Site

The SUNY Oneonta campus will serve as the site for long-duration energy storage (LDES) demonstration projects capable of delivering electricity for 10-24 hours. The demonstration will examine the effectiveness of innovative zinc-manganese technologies—from non-rare earth US-sourced abundant minerals—cost-effective in enhancing the resilience of New York's electrical grid and to contribute to the State's climate goals. This site will serve as one of two in support of a project developed by the New York Power Authority (NYPA), Rockland County-based Urban Electric Power (UEP). and Electric Power Research Institute (EPRI). The Project is supported by a $6.5 million from the U.S. Department of Energy, awarded in 2024.

2.4. The Broader Innovation Ecosystem of New York State

In addition to the targeted initiatives led by State agencies identified above (and summarized in Table 1), New York is home to a thriving innovation ecosystem comprised of numerous interconnected public and private entities. State government programs anchor and support this ecosystem with essential funding, expertise, and policy guidance, and play a critical coordinating role in fostering collaboration. This integrated approach helps innovations to transition efficiently from concept to commercialization while balancing economic growth with equitable impacts on all communities. Key elements of the State's innovation ecosystem include:

- **Educational Institutions** that drive clean energy innovation in New York through advanced RD&D, workforce training, and public-private partnerships that accelerate technology development, support decarbonization, and fuel economic growth. In addition to the SUNY

system, this includes Cornell University, Columbia University, New York University (NYU), City University of New York (CUNY) system, University of Rochester, Rensselaer Polytechnic Institute (RPI), Rochester Institute of Technology (RIT), Syracuse University, Clarkson University, and the New York Institute of Technology (NYIT).

- **Laboratories and Research Centers** throughout the State funded by a mix of private and public funds that are or can be applied toward energy innovation. Major facilities include GE Vernova Lab (GE Vernova), AGILe (NYPA), Advanced Energy Research Technology Consortium (AERTC) (Stony Brook University), ETIC (NYIT), Brookhaven National Laboratory, and the IBM Watson Research Laboratory.
- **Research and Technology Consortia** that focus on advancing innovation in a technology sector of interest. These entities unite researchers, developing and mature companies, manufacturers, and supply chains to promote and accelerate new technology to market. Leading examples include the New York Battery and Energy Storage Technology Consortium (NY-BEST), the National Offshore Wind R&D Consortium, and AERTC.
- **Venture-Focused Organizations** throughout the State provide support and funding for startup companies including incubators and accelerators, investor associations, and public-private organizations that foster collaboration and facilitate technology transfer and demonstration. Some leading examples include The Clean Fight, Launch-NY, Columbia Technology Ventures, the New York Climate Exchange, Urban Futures Lab at NYU, National Grid Ventures, the Long Island High Tech Incubator (LIHTI), Newlab, and the RIT Venture Creation Incubator.
- **Economic Development Organizations** in every region of the State that focus on attracting and retaining companies and jobs. These organizations often fund other elements of the innovation ecosystem, such as incubator and accelerator programs. This includes the ten Regional Economic Development Councils and the New York City Economic Development Corporation, in addition to ESD (which works statewide through its NYSTAR and other programs).
- **Military Installations** that can play a collaborative role in piloting advanced energy technologies to ensure resilience in operations as well as efficiency, including Fort Drum, Fort Hamilton, New York Air National Guard, Kings Point, and West Point.
- **Other private industry** includes major advanced manufacturers located in New York, investor-owned utilities with innovation initiatives such as ConEd and National Grid and tailored financial products across various financial institutions.

3. Recommendations

New York State can progress toward its long-term energy and climate goals by continuing to advance its clean energy innovation strategy and supporting a broad range of technologies and applications, including grid modernization, end-use energy applications in buildings, transportation and industry, power generation and energy storage, alternative fuels, carbon capture, and overall resilience and

reliability of the energy system. Investments have the potential to enable a more affordable and reliable energy system, strengthen the State's innovation ecosystem, and support economic growth.

As New York State anticipates emissions targets outlined by the Climate Act, continued investment in refining innovation programs and expanding commercialization capacity—through expanded manufacturing support, deeper capital networks, and public-private partnerships—will remain essential. New York will continue to evaluate emerging markets and identify opportunities where the State can mobilize existing capacity and assist in addressing barriers. The State should pursue the following recommendations over the time horizon of the plan:

- **NYSERDA, PSC, ESD, SUNY, and NYPA should continue to invest in RD&D aligned with key priorities, policies and needs across all energy sectors.** This includes de-risking new technologies by validating them in use cases for cost and performance benefits to accelerate deployment.
- **NYSERDA, SUNY, ESD, along with the broader innovation ecosystem, should continue to support commercialization activities across State innovation investments and beyond.** This includes activities such as supporting local startup growth and bringing market-ready products and businesses to New York State that have demonstrated performance in other states and countries. It further includes coordination and outreach across different states and organizations, as well as improving metrics of success with consideration of energy, financials, economic growth, and local communities.
- **NYSERDA, PSC, SUNY, together with other agencies and authorities, should continue to commission studies and performance evaluations** to provide objective information to the public on the trade-offs in cost, performance, environmental benefits and policy compatibility of emerging technologies important for New York State's future energy portfolio.
- **NYSERDA, ESD, SUNY, and NYPA should work to strengthen and formalize partnerships across the statewide innovation ecosystem.** This includes working with other agencies, private organizations, and universities to accelerate deployment of key enabling technologies, aligning the broader innovation ecosystem, and activities such as developing strategic market roadmaps and matching appropriate demonstration sites (e.g., SUNY campuses, healthcare facilities, and municipalities) with first-of-a-kind demonstrations that have potential for widespread replication.
- **NYSERDA, ESD, and SUNY** should coordinate with other State agencies, universities, municipalities, and community organizations to consider development of a set of effective and feasible best practices for integrating the priorities, needs, and participation of disadvantaged communities (DACs)—including demonstration sites, project participation, and benefits assessments—given that investments in new services and technologies are an opportunity for improvements in energy affordability, reliability and new jobs that can all better serve DACs.

- **NYSERDA, ESD, SUNY, NYPA, and other partners in the NYS Innovation** ecosystem should build upon successful models to leverage economies of scale to accelerate cost reductions and market adoption of key energy technologies. Examples include collaboration between NYSERDA, the New York City Housing Authority (NYCHA), and NYPA on the design and demonstration of window-mounted heat pumps, where multiple stakeholder inputs were used to optimize and establish a strong demand signal, incentivizing manufacturers to invest in facilities needed to scale up a beneficial product for the broader New York market.
- **SUNY should continue to prioritize and expand its clean energy research and education portfolio and continue to identify opportunities to leverage SUNY's expansive physical footprint** (111 million square feet of conditioned space or 40 percent of the state's footprint, including 54,000 acres) to support clean energy demonstration sites, as well as support needed education and training for emerging energy technologies.