11. Economic Development, Industry, and Agriculture

Draft New York State Energy Plan

July 2025

Key Findings

- **Energy use in the industrial sector is expected to have unprecedented growth over the coming years.** New York State agencies and authorities should continue and enhance their collaboration to provide reliable power to the sector. Economic development agencies, energy policymakers, regulators, utilities, power generators, and the system operator should support electric system improvements to maximize economic benefits, while ensuring new developments support local communities, reduce pollution, and align with New York's climate goals.
- **Economic development programs and rate design can drive New York's competitiveness.** Continued investments into programs that lower energy and site interconnection costs for commercial and industrial users, such as NYPA's hydropower programs and POWER UP, are crucial to remaining competitive with other states. New York should maintain or enhance these programs. Rate design strategies can also be implemented to encourage more efficient energy use and reduce peak system needs and capacity investments.
- **System demands from large, energy-intensive industrial users will require investments in the energy system and provide an opportunity to stimulate the development of new, clean, firm generation.** Expanded generation and transmission investments can support the provision of clean, reliable power to new energy-intensive industries and contribute to overall system resiliency. New York should strategically partner with large energy-intensive industrial customers to leverage purchasing power and procure zero emission resources.
- **The clean energy transition is an economic development opportunity for New York industries.** By fostering a domestic clean energy supply chain—attracting and expanding clean energy manufacturers, the companies that supply them, and other clean energy professionals and organizations—New York can generate local economic benefits through job creation and increased tax revenues. Localized clean energy supply chains can reduce procurement lead times, minimize transportation-related emissions, and accelerate the transition across major sectors by facilitating the manufacturing of electric heat pumps, batteries, grid equipment, and low embodied emission construction materials.
- **Cost-effective investments in industrial energy efficiency and electrification can reduce energy use and on-site combustion.** Efficiency measures can deliver cost-effective improvements to industrial facilities in the short term, including but not limited to the insulation of process heating equipment and heat recovery, improvements in motors, turbines, and engines, and improved process control and site management. There are also commercially available electric alternatives for facility heating, ventilation, and air conditioning (HVAC) and low to medium-temperature process heating, through infrared, microwave, or radio frequency heating. State support through technical and financial assistance can help accelerate the deployment of these technologies.
- **Waste heat from industrial processes can be put to productive use.** Waste heat capture leverages existing resources as an effective way to reduce investments in or the expansion of

generation, transmission, and distribution systems to serve thermal energy or electrification loads.

- **In the medium- and long-term, New York can support industrial decarbonization through a diverse Research, Development, and Demonstration (RD&D) portfolio of emerging technologies.** New York will need to leverage a wide array of emerging solutions to achieve emission targets: low-carbon fuels and energy sources, carbon capture utilization and storage (CCUS), electrification of high-temperature processes, and novel production processes. (See the Energy Innovation chapter of this Plan for further discussion).

- **Agricultural operations can leverage energy efficiency, efficient electrification, and on-site energy production.** New York State's agricultural sector can reduce costs, energy use, and carbon emissions through investments in energy efficiency and efficient electrification. Additionally, deploying distributed renewables, or leveraging agricultural waste products for alternative fuels can lower costs and increase the resilience of the energy system.

Key Terms

- The **Industrial sector** includes businesses focused on the mass production of goods, often involving machinery, technology, and a significant workforce.
- The **Manufacturing sector** encompasses firms that transform raw materials into finished goods.
- The **Agricultural sector** grows crops, raises livestock, and harvests plants and animals from their natural habitats.
- **Low-carbon fuels and energy sources** produce significantly fewer greenhouse gas emissions during their lifecycle compared to traditional fossil fuels.
- **Carbon capture utilization and/or storage (CCUS)** technologies capture carbon dioxide (CO_2) emissions from large sources, like power plants and industrial facilities, or directly from the atmosphere, which is then either repurposed or stored.
- **Industrial process emissions** occur when industrial processes cause the release of pollutants and greenhouse gases.
- A **Life cycle analysis (LCA)** evaluates the potential environmental impacts associated with a product, process, or service throughout its entire life cycle.
- **Embodied emissions** refer to the total greenhouse gas emissions generated throughout the entire life cycle of a product, particularly emphasizing the stages before its operational use. This includes the extraction of raw materials, manufacturing, transportation, construction, and disposal at the end of its life.

1. Overview

Over the course of this Plan's time horizon, New York will need to rapidly scale up its supply and diversity of clean energy technologies to meet growing industrial energy demands. New York currently ranks as a top 10 manufacturing state, having generated over $90 billion in manufacturing activity in 2024.[1] New York has received unprecedented new investments for in-state manufacturing, including Micron's planned microchip fabrication plant that would account for $100 billion in new investment, making it the largest semiconductor fabrication facility in the history of the United States.[2] As other new, energy-intensive industries consider New York for their operations, the demand on the State's energy system will be increased. To focus public support, the State has identified a list of strategic industries which provide value to the State's economy, supply chains, and workforce: semiconductors, transportation equipment, agribusiness, and other advanced manufacturing and materials processing—including but not limited to the manufacturing related to clean energy technologies.[3]

The industrial and agricultural sectors rely heavily on energy use to enhance their productivity and competitiveness, while contributing to New York's economy by providing goods and products, infrastructure investments, and local (i.e., in-state) jobs. Today these sectors are at an inflection point, with federal trade policy and State climate policy collectively altering their long-term outlook. Federal trade policy and industrial investments have increased interest in U.S. manufacturing, and State goals call for the electrification of major energy end-uses—including some industry and agriculture. These simultaneous trends will increase demand for clean electricity, power-ready sites, and electric consumer products, while industrial and agricultural facilities are modernized to reduce emissions and on-site combustion.

Industry is expected to see notable energy demand growth from 2025–2040, as new manufacturing projects and other large loads enter service.[4] Planning for this new energy use is key to ensuring continued opportunities for economic growth in the state. New York has an opportunity to modernize existing industries, attract new ones, and increase investments in the energy system to support these industries. Treating the energy transition as an economic development opportunity can help the State meet its climate obligations, reduce local air pollution, and strengthen New York's economy through clean manufacturing and agricultural production. The State's Energy Plan should address the short- and mid-term investment strategies that will ensure existing and new facilities have access to reliable and affordable power, while strategically attracting new industry and minimizing environmental impacts. Ensuring this supply of clean energy, in addition to New York's world class workforce and markets, will position New York to attract strategic industries.

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[1] New York ranks ninth. U.S. Bureau of Economic Analysis, SAGDP2 Gross domestic product (GDP) by state [1](accessed June 3, 2025).

[2] Empire State Development, "Micron Will Invest $100 Billion to Establish Leading-Edge Memory Fab in Central NY," accessed July 3, 2025,https://esd.ny.gov/micron.

[3] Empire State Development, "Industries in the Empire State," accessed June 3, 2025, https://esd.ny.gov/industries.

[4] As described in the Pathways Analysis chapter of this Plan, several large manufacturing and data-center projects are projected to enter service this coming decade, which add roughly 16 TWh of electricity demand, or over 75 percent of total industrial electricity demand today. This assumption follows the NYISO 2025 Load and Capacity Data Report ("Gold Book").

This chapter will review New York's related energy planning objectives, describe the needs of specific industrial subsectors, and consider strategies focused on power supply and more efficient energy usage to support the State's industrial and agricultural output. The chapter includes the following sections:

1. **Meeting the energy needs of industry and other large energy users.** Key considerations include how the State can reliably meet the energy needs of large, energy-intensive users.
2. **Strategies to attract and power new industries.** To attract relevant manufacturers, New York is committed to ensuring competitiveness and providing State support for site selection, incentives, and local connectivity.
3. **Strategies to reduce energy waste and emissions from industrial and agricultural operations.** NYSERDA, ESD, the New York State Department of Public Service (DPS), NYPA, and the Department of Agriculture and Markets (AGM) all work with businesses in the industrial and agricultural sectors to provide technical and financial support to make operations more efficient while reducing pollution and carbon emissions.

2. State of the Sector and Progress Report

2.1. Energy Considerations for Business

The State's affordable power programs for industry have supported New York's competitiveness. While energy costs are an essential component of ensuring continued economic competitiveness, they are one of many factors an operator must juggle when considering siting their business. New York businesses only spend on average 2.1 percent of their total costs on energy.[5] This share is markedly higher for certain energy intensive manufacturing industries, such as asphalt manufacturing, industrial gas manufacturing, fertilizer manufacturing and aluminum manufacturing (38, 22, 18, and 17 percent, respectively). But for many manufacturing industries this share hovers below 10 percent, as is the case for paper mills (9 percent), a roughly $3.3 billion industry in New York.[6] For many consumer goods and services, including essential services like hospitals and educational institutions, energy costs typically make up just a few percent of all costs. This value is just 0.5 percent for hospitals, 1.7 percent for k-12 schools, and 2.1 percent for grocery stores. Energy affordability across all cost categories is important, but energy cost improvements offer only limited benefit in terms of the overall cost picture that non-energy intensive New York businesses face.

Figure 1 below shows the share of energy costs relative to total costs for a sample of economic sectors in New York. Industries in the manufacturing sector have higher energy cost shares, though this share varies considerably based on the industry. Agricultural and consumer goods and services industries

[5] This figure excludes electric power generators and fossil fuel refineries, whose energy expenditures are significantly higher and average roughly 36 percent. Energy costs are defined here as direct expenditures on electricity, natural gas, and petroleum and other fuels, namely refined petroleum products, coal, wholesale services of petroleum and petroleum products, and crude petroleum. Based on analysis conducted for NYSERDA by BW Research. Data is from IMPLAN for calendar year 2023, from the State Industry Balance Sheets, Commodity Demand, and Social Account Matrix.

[6] U.S. Bureau of Economic Analysis, Gross Domestic Product: Paper Manufacturing (322) in New York [NYPAPMANNGSP], retrieved from FRED June 13, 2025, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/NYPAPMANNGSP.

experience much lower cost shares. For many manufacturing and agricultural industries, roughly half of these energy costs are accrued in-state.

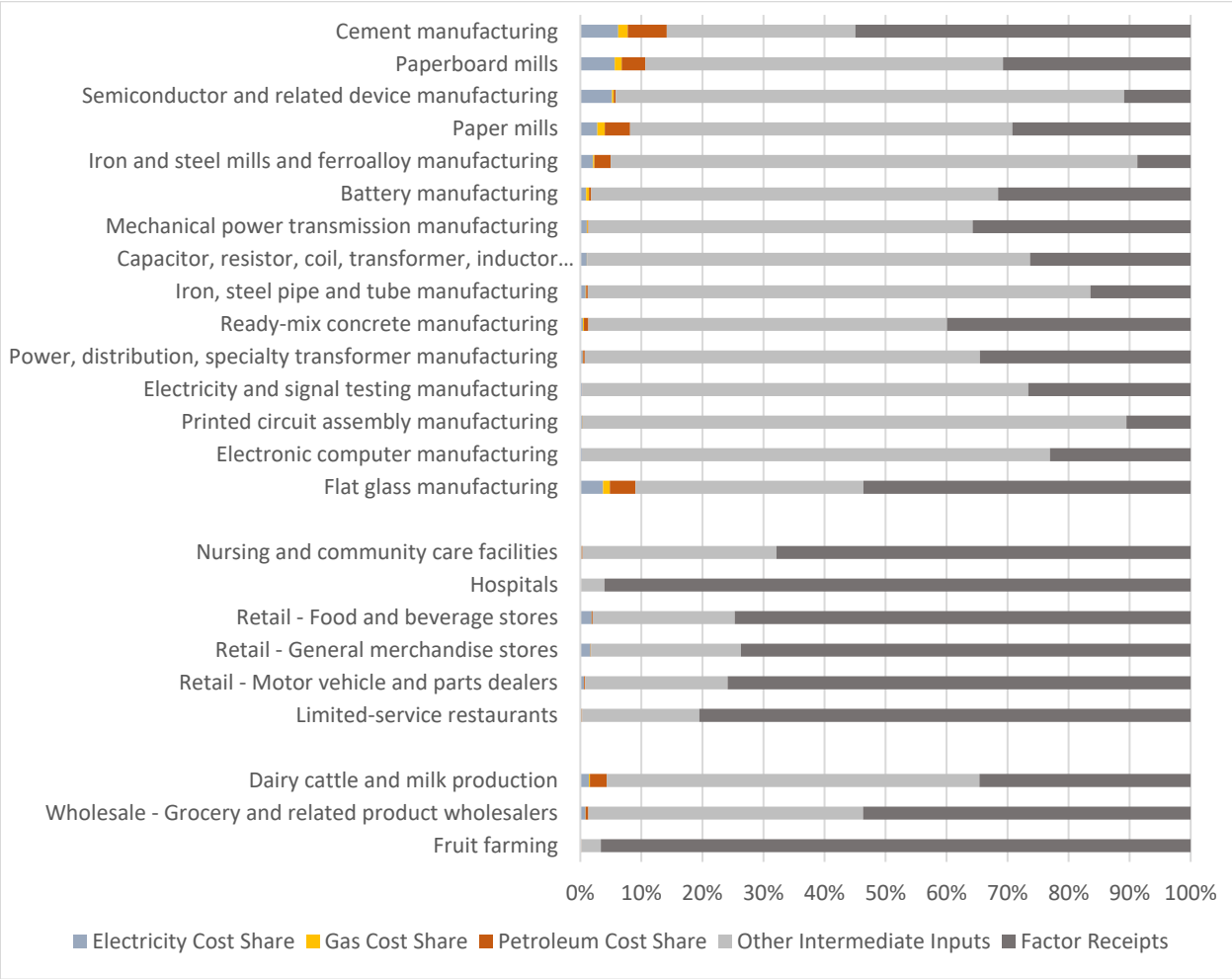


Figure 1: Energy Costs as a share of Total Costs, Select New York Industries (2023)[7]

Consistent with the Climate Act, the State should be attentive to the differing impacts of energy and climate policies for New York businesses. While the State will continue to pursue general energy affordability for all economic sectors, energy-intensive and trade-exposed businesses merit focused attention to safeguard their economic competitiveness. These are generally manufacturing businesses, with certain industrial sectors experiencing greater costs than others.

As noted above, energy costs are just one energy-related input considered by businesses looking to locate in New York. First and foremost, private investors and large manufacturers need a clear path to affordable, reliable power in a reasonable amount of time before the manufacturer will make a site selection and invest in New York State. A NYSERDA-conducted survey of large industrial customers from

[7] Based on analysis conducted for NYSERDA by BW Research. Data is from IMPLAN for calendar year 2023, from the State Industry Balance Sheets, Commodity Demand, and Social Account Matrix.

the Site Selector's Guild indicated that that electric power capacity and the availability of development-ready sites with sufficient infrastructure capacity are the top two drivers of a firm's site selection decision (energy costs did not rank among top survey responses).[8] Energy capacity planning, prioritizing investments into existing site inventory, and identifying new sites will contribute to bolstering New York's competitiveness.

2.2. Economic Development

New York's economic development strategy has led to the rapid scaling of clean energy technologies in New York, ranging from to the development of 130 megawatts (MW) of new offshore wind at the South Fork Wind Farm to Micron's development of the nation's largest semiconductor facility. Since 2019, 45 clean technology manufacturing projects have been announced, totaling nearly $5 billion in investments.[9]

As New York welcomes new industry partners, extensive cross-agency collaboration will be needed to ensure that new loads can be met with clean energy supplies. Cross-agency collaboration is essential to balance the needs for energy supply and reliability while advancing economic development goals, climate goals, and ensuring affordability. Currently DPS, NYPA, NYISO, NYSERDA, and ESD each contribute to efforts to ensure the State can reliably meet the energy needs of large, energy-intensive users. ESD, NYSERDA, and NYPA each contribute to the implementation of New York's economic development strategy. To attract key manufacturers and other high-impact industries, the State provides affordable power, support for site selection, economic incentives, and facilitation of local connectivity.

Table 1: Summary of Key Statewide Economic Development Initiatives

Agency	Focus Areas	Description	Key Programs
DPS		Advancing grid planning and the Clean Energy Zones initiative	
ESD	Strategic Business Development	Tax credits, site management and readiness, technical assistance	Excelsior Jobs Program with Green Project enhancement, FAST NY, Green CHIPs NY, Restore NY, Export Marketing Assistance Service Programs (EMAS), POWER UP
	Small Business Support	Loans for early- to mid-stage small business, business expansion and equity capital for high growth innovation start-ups	Entrepreneurship Assistance Centers (EAC), NYS Contract Reporter, Linked Deposit Program, Capital Project Loan Fund, Job Development Authority (JDA) Direct Loan Program, and other loan and investment programs.
NYPA	Low-cost power programs	Cost competitive, firm, clean power sources for industry.	Industrial Economic Development Program, Preservation Power, ReCharge NY, Expansion Power (EP) and Replacement Power (RP) (aka WNY Hydropower), etc.
	Revolving Loan Funds		Greater Massena Economic Development Fund; North Country Economic Development Fund; Niagara Economic Development Fund
NYSERDA	Site Readiness	Strategic research and program support to identify and attract clean energy industries and promote their competitiveness.	Build it Clean. Build it Here., Build Ready, and strategic market research.
SUNY	Small Business	Small Business Support	Small Business Development, etc.

[8] The Site Selectors Guild is an association of professional site selection consultants who provide location strategy to corporations internationally.

[9] Based on internal NYSERDA tracking of new projects.

To remain competitive, the State should continue to make targeted investments into the energy system as well as into its economic development programs. A range of State-led programs are designed support New York's economic development strategy, summarized in Table , above.[10]

2.2.1. Empire State Development

As New York's lead economic development agency, ESD has ten Regional Offices and a Strategic Business Division to assist new and existing manufacturers through economic assistance in the form of loans, tax credits, and grants, as well as technical assistance.[11] Cleantech and Renewable Energy are among ESD's identified strategic industries, as well as other industries essential to building out the clean energy supply chain—namely semiconductors, industrial systems, and materials processing. ESD's programs are designed to assist manufacturers ready to expand with site selection support, support of infrastructure upgrades and other site readiness, and connectivity to local businesses. Core programs include:

- The **Excelsior Jobs Program**, which provides fully refundable tax credits tied to job creation, including an enhancement for green projects.[12] This program has been successful in attracting 3,400 new jobs and $1.8 billion in investment across 18 green projects.[13]
- The **Green CHIPS Incentive** provides incentives for semiconductor manufacturing and supply chain projects that meet robust job and investment criteria and adopt sustainability measures to mitigate the project's greenhouse gas emissions and other environmental impacts.
- **NY Ventures** provides pre-seed funding to Series B equity investment capital for high-growth innovation start-ups across New York State, as well as managers of funds that invest capital in innovation start-ups.
- **The Division of Science, Technology and Innovation (NYSTAR)** funds over 90 centers and resources across the State, including Centers for Advanced Technology, Centers of Excellence, Incubators, Hot Spots, Accelerators, and Venture Competitions. As New York State's National Institute of Standards and Technology (NIST)-designated Manufacturing Extension Partner (MEP), NYSTAR has designated 11 MEP centers—one in each economic development region and one statewide—to assist manufacturers with any challenges they are facing. This includes assistance with certifications, lean workouts, technology infusion (Industry 4.0), and supply chain development, among other services.

[10] Industrial Development Agencies and Authorities have played a key role in facilitating the development of new renewable energy projects, primarily through tax exemptions. Other regional programs are available through New York's utilities, including but not limited to Central Hudson Gas & Electric Corporation programs to support manufacturers, infrastructure investments from Niagara Mohawk Power Corporation d/b/a National Grid, and industrial efficiency programs through Consolidated Edison Company of New York, Inc.

[11] Technical assistance is provided by ESD's Entrepreneurship Assistance Centers and Manufacturing Extension Partnerships, both of which are funded by NYSTAR.

[12] A green project is generally defined as a project to make products or develop proven technologies that are ready to be commercialized and moved into markets and that are aimed at reducing greenhouse gas emissions or supporting the deployment or adoption of clean energy.

[13] Internal data from ESD.

To meet the need for new manufacturing sites, New York is working to ensure that shovel-ready sites are enhanced with energy infrastructure investments. ESD's **FAST-NY Shovel Ready Grant Program** (FAST-NY) provides funding to prepare and develop sites across New York to jump-start shovel-readiness and capitalize on high-value opportunities. Funds are provided for pre-development activities and general infrastructure investments that will attract many eligible industries in high-tech manufacturing, semiconductor manufacturing, Cleantech and renewable energy, life sciences, agribusiness, optics, transportation equipment, materials processing, industrial machinery manufacturing, and other advanced manufacturing. These sites can also be used for interstate distribution and logistics.

Spotlight: FAST-NY Awardees

City of Rome, Oneida County ($23.6 million grant). The Triangle Site at Griffiss International Airport is adjacent to Wolfspeed and Micron, positioning it to be New York's premier semiconductor supply chain campus, offering up to 50 MW of power. The site is being improved with electrical upgrades, the extension of municipal water, sanitary sewer and natural gas pipelines, transportation and access upgrades, and the completion of general site work. This will unlock up to 2.6 million square feet of new construction and the potential for 3,000 new jobs on this 332-acre site. The campus is in a moderately distressed community and provides accessible workforce amenities, housing, recreation, and transit. Total project cost: $26 million

Town of Coeymans, Albany County ($17 million grant). A new electrical transmission line and two substations will serve the Port of Coeymans. These upgrades will add 50 MW of capacity to the Coeyman's Industrial Park, which is currently power-constrained, with the capacity to provide up to 100 MW for potential future development. Coupled with access to navigable waterways and developable acreage, delivering power to this site will provide the State with a key strategic asset for industrial machinery manufacturing as well as Cleantech and renewable energy manufacturing. Total project cost: $83.8 million.

County of Monroe IDA (COMIDA) ($20 million grant). The site in the Town of Webster is being developed to attract agribusiness and industrial machinery manufacturing. Funding will be used to upgrade the existing electrical infrastructure. Total project cost: $27 million.

Since formally launching in December 2022, FAST-NY has announced four rounds of grant awards, totaling $232 million for 32 projects across the State, transforming over 4,000 acres of previously underutilized land. Over $80 million of the $232 million was for electrical infrastructure upgrades and plans for utility connections. The FY2026 budget allocates an additional $100 million to FAST-NY. Beginning in 2025, the $300 million **POWER UP Fund** will support the proactive development of electric capacity to create power-ready sites and attract new businesses to the State. The POWER UP Fund is discussed in additional detail in Section 4.2.4.

2.2.2. New York Power Authority

NYPA's low-cost power programs are a pillar of the state's economic development strategy. Additionally, its revolving loan and proceeds support a broad variety of relevant regional economic development activities, including funding for electric vehicle (EV) infrastructure and equity for clean energy companies. Since the enactment of the Climate Act, NYPA has prioritized support for the State's priority industries and has launched statewide initiatives in support. These efforts include:[14]

- **Preservation Power.** 490 MW of competitively priced, clean hydropower available to new or expanding projects in St. Lawrence, Franklin, and Jefferson Counties.
- **ReCharge NY.** 910 MW of New York hydro and market power that may be allocated to small and large businesses that support regional and statewide priorities, including climate goals.
- **Western New York Hydropower**. Also known as Expansion Power (EP) and Replacement Power (RP), is comprised of 695 MW generated at NYPA's Niagara Power Project in Lewiston that may be allocated on a competitive basis to qualified businesses within a 30-mile radius of the Niagara Power Project.
- **St. Lawrence County Economic Development Power (SLCEDP)** is comprised of 20 MW of hydropower generated at the St. Lawrence Franklin D. Roosevelt Power Project. This new supply will be available to St. Lawrence County businesses.

NYPA's role will continue to evolve as it builds additional low-carbon energy resources, as discussed in the Electricity chapter of this State Energy Plan.

2.2.3. New York State Energy Research and Development Authority

NYSERDA strategically identifies key clean energy industries and ensures New York remains a competitive market for these firms. NYSERDA catalyzes new clean energy supply chain development in the State through targeted investments, business support, coordination across agencies, marketing the State to the business community, and fostering the clean energy workforce and innovation ecosystem. For example, NYSERDA played a critical role in fostering a local market for offshore wind, including investments to grow the offshore wind supply chain, workforce, port infrastructure, and hosting cross-cutting advisory working groups.

NYSERDA's research informs State policy to best attract and maintain clean energy technology developers and relevant clean energy supply chains. As the State's leader in developing clean energy solutions and informing clean energy policy, NYSERDA is uniquely to positioned to connect the research and market needs related to the clean energy transition to the State's economic development policies. This work informs New York's "Build it Clean. Build it Here." campaign, designed to market the State's competitive positioning as a hub for the clean energy industry.[15]

[14] Preservation Power, Western New York Hydropower, and the St. Lawrence County Economic Development Power are all available to customers adding at least 100 kW of new electric load to their meters, and with a demonstrated long-term commitment to Western New York through job creation and capital investments to local facilities.

[15] New York State, *Build It Clean, Build It Here*, accessed July 5, 2025, https://builditclean.ny.gov/.

NYSERDA also supports ESD in tailoring parts of the State's economic development policies to best meet the needs of clean energy partners. This includes planning and site identification work that informs FAST-NY, as well as the development of targeted business development and marketing. NYSERDA also develops resources designed to be leveraged by regional developers and economic development organizations.

2.3. Industry and Agriculture

The U.S. Energy Information Administration defines the industrial sector as "all facilities and equipment used for producing, processing, or assembling goods," including manufacturing, agriculture, mining, oil and gas extraction, and construction.[16] With such diverse subsectors, industry uses energy in more unique ways and relies on more types of fuels than other sectors. In 2022, New York's industrial sector accounted for roughly 8 percent of the net energy use statewide.[17] Fossil fuels serve most industrial demand, with natural gas and petroleum products accounting for 38 percent and 28 percent of industrial energy use, respectively. Electricity accounts for 23 percent of industrial energy use, and wood meets 10 percent of demand (primarily in the paper sector). Coal, waste energy, and solar thermal constitute the remaining energy sources.

In 2024 NYSERDA published the Phase 2 Industrial Facility Stock Study (Stock Study). A forthcoming follow-up report examining Decarbonization Potential in the Industrial Sector is planned to be released in the summer of 2025.[18] These studies worked to better understand New York's manufacturing sector by taking stock of facilities and major equipment statewide, and subsequently identify opportunities to convert this equipment to low-emission alternatives. The Stock Study found that New York's manufacturing sector accounts for roughly 150 trillion British thermal units (TBtu) of energy use annually,[19] divided between several key subsectors: paper (20 percent), chemicals (17 percent), primary metals (10 percent), food (10 percent), fabricated metals (10 percent), and transportation equipment (8 percent) (Figure 2). Process heating stands out as the major end-use across subsectors, accounting for 55 percent of manufacturing demand in 2023. Manufacturing demand for lighting as well as HVAC is second largest among end-uses (19 percent), while machine is third (15 percent). Proposed strategies throughout this chapter leverage insights from these studies.

[16] U.S. Energy Information Administration, State Energy Data System 2022, Consumption Technical Notes, Page 245. <https://www.eia.gov/state/seds/sep_use/notes/use_technotes.pdf>. The EIA definition also includes forestry, fishing, and hunting, which will not be addressed in this chapter.

[17] Patterns and Trends: New York State Energy Profile Dashboard, Net Consumption of Energy in New York State. https://www.nyserda.ny.gov/About/Publications/Energy-Analysis-Reports-and-Studies/Patterns-and-Trends

[18] For phase 1 of this report, see: Assessment of Energy Efficiency, Electrification, and Decarbonization Potential in the New York State Industrial Sector: Phase One (August 2023). https://www.nyserda.ny.gov/About/Publications/Evaluation-Reports/Building-Stock-and-Potential-Studies

[19] NYSERDA, New York Statewide Industrial Facilities Stock Study – Phase Two Final Report (June 2024). https://www.nyserda.ny.gov/About/Publications/Evaluation-Reports/Building-Stock-and-Potential-Studies

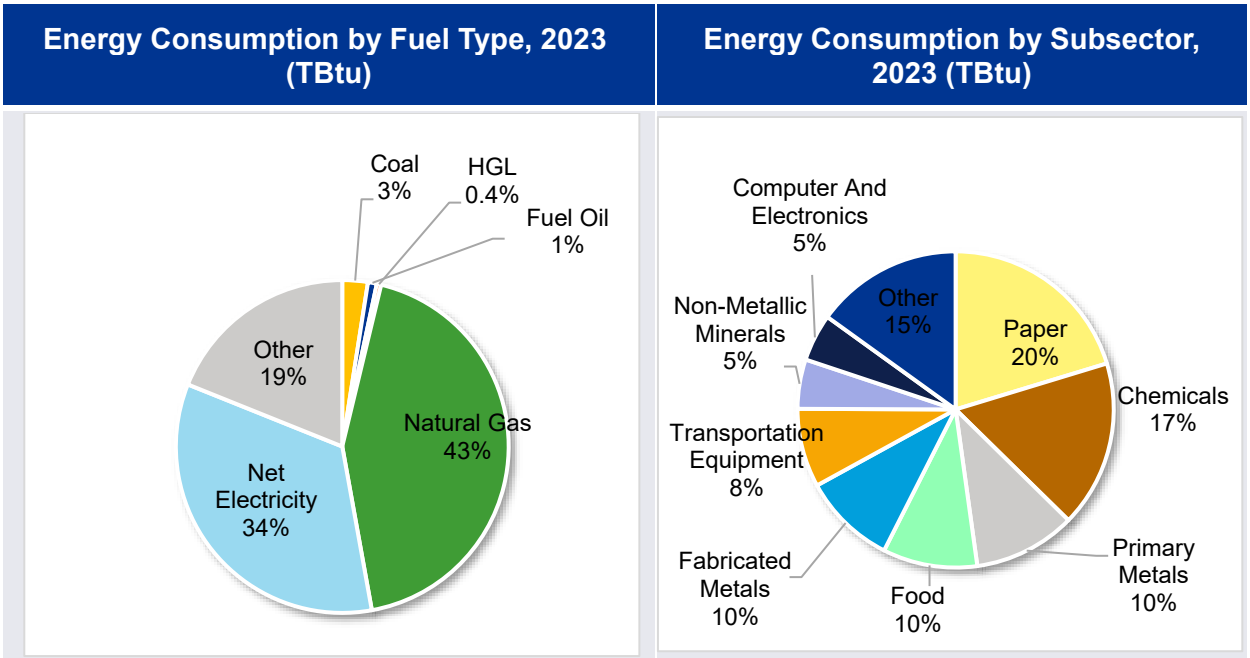


Figure 2: New York's Manufacturing Energy Use by Fuel and Subsector[19]

The agricultural sector is more difficult to track using currently available data; many sources divide agriculture by end-use into buildings, transportation equipment, and industrial equipment, so it is difficult to determine the true scale of agricultural energy use. The U.S. Department of Agriculture (USDA) Agricultural Census does provide some key data points.[20] Between 2017 and 2022, the number of farms contracted by nearly 10 percent: the number of small (i.e., sub-1,000-acre) farms decreased by 9 percent and large (i.e., over-1,000-acre) farms increased by 12 percent; meanwhile, the overall acreage remained largely unchanged, indicating consolidation within the sector. The value of purchased fuels increased from $238 million to $403 million over this same period. Similarly, the value of purchased fertilizers, limes, and chemicals also increased from $354 million up to $568 million. Overall, the cost of these energy and energy-intensive inputs increased 64 percent from 2017–2022. To balance out these inputs, the value of products sold annually increased by over $2.5 billion from 2017–2022, nearly 50 percent growth. This increased output, coupled with a decrease in number of farms statewide, shows that the agricultural sector is consolidating and becoming more reliant on energy inputs for their production.

Key State programs that support energy and climate goals in New York's industrial and agricultural sectors are summarized in Table 2Table 2.

[20] U.S. Department of Agriculture, Census of Agriculture, 2022, National Agricultural Statistics Service. <https://www.nass.usda.gov/Publications/AgCensus/2022/Full_Report/Census_by_State/New_York/>.

Table 2: Key Industrial and Agriculture Programs

Agency	Focus Areas	Description	Key Programs
Agriculture and Markets	Resiliency	Programs to promote agricultural resiliency	Climate Resilient Farming Program
ESD	Strategic Business Development	Tax credits	Green CHIPs NY*
NYPA*	Low-cost power programs	Cost competitive, firm, clean power sources for industry.	Preservation Power; ReCharge NY; Expansion Power (EP) and Replacement Power (RP) (aka WNY Hydropower); etc.
NYSERDA	Industrial Demonstrations	Funding for industrial sector decarbonization projects	Commercial & Industrial Carbon Challenge Program
	Industrial & Ag Technical Assistance	Programs to support engineering, training, and energy management	Ag Energy Audit; FlexTech; On-site Energy Manager; Strategic Energy Management

Note: * See the Section 2.2 for a full description of these initiatives

2.3.1. Department of Agriculture and Markets

AGM has a mission to promote New York State agriculture and its high-quality and diverse products, foster agricultural environmental stewardship, and safeguard the State's food supply, land, and livestock to ensure the viability and growth of New York's agricultural producers. They work to protect and enhance New York State's natural resources and working landscapes[21] and promote sustainable animal production agriculture.

AGM's New York State Climate Resilient Farming Program provides financial assistance to farmers to help them reduce greenhouse gas emissions and increase resilience to climate change. It offers funding for projects related to agricultural waste management, water management, and soil health systems.

2.3.2. NYSERDA

NYSERDA's work in the industrial and agriculture sectors, examples of which are listed below, promotes the adoption of energy-efficient technologies and business practices and seeks to find next-generation solutions for sustainable manufacturing and agriculture. Additionally, NYSERDA's research informs State policy to best attract and maintain clean energy technology developers and companies which would comprise the clean energy supply chains.

- The **Agricultural Energy Audit Program** offers free energy audits to help eligible farms identify ways to save energy and money on utility bills. Reports include recommendations for energy efficiency measures.
- **The Flexible Energy Assistance (FlexTech) Program** offers a wide range of cost-shared technical services to help businesses examine energy usage patterns and make cost-effective clean energy decisions.
- The **On-site Energy Manager Program** offers a cost-share for industrial facilities to hire a dedicated full-time or part-time on-site energy manager. Energy managers help identify energy

[21] A "working landscape" is land actively used for production, such as farming, forestry, or ranching, while also supporting a healthy ecosystem and biodiversity.

projects, including operations and maintenance improvements, energy efficiency upgrades, water saving improvements, and more.

- **The Strategic Energy Management (SEM) Program** is a training program that provides a comprehensive approach to aligning energy efficiency with business practices and goals to achieve long-term benefits. Instead of managing energy saving projects one by one, SEM gives industrial facilities tools to manage energy in a coordinated and strategic manner.
- The **Commercial & Industrial Carbon Challenge** program provides awards to manufacturers that execute large energy and greenhouse gas emission abatement projects at their facilities. The program encourages industrial companies to explore and pilot the next generation of decarbonization technologies and opportunities.

2.3.3. Industrial and Agriculture Policy Developments

Executive Order 22 - Leading by Example, directs State agencies to accelerate efforts to make their facilities and operations more sustainable, with a focus on reducing embodied carbon in construction materials used in State infrastructure projects. It requires the reporting and disclosure of commonly used materials to drive demand for low-embodied carbon options and aims for a 30 percent reduction in carbon emissions from concrete by 2028. In guidance released in January 2025, the Office of General Services (OGS) defined the covered materials as concrete mixes, asphalt mixes, steel products, and glass products.[22]

The Low-Embodied Carbon Concrete Leadership Act (LECCLA) mandates OGS to establish guidelines concerning the procurement of low-embodied carbon concrete. In January 2025 rules took effect setting maximum embodied carbon allowances, and project sizes which must follow these rules.[23] The law requires OGS to reassess and lower these thresholds every two years, with an update due to take effect in January 2027.

3. Outlook (2025 – 2040)

While industry makes up less than ten percent of energy use in New York State, the industrial sector's energy use is expected to grow significantly between 2025–2040. The Pathways Analysis developed for the State Energy Plan forecasts about a 20 percent growth in final energy use (across all fuel types) from the industrial and agricultural sectors by 2040. This growth is driven by large electric loads, which are expected to increase by 50 TBtu between 2025 and 2035.

Emerging and fast-growing, energy-intensive industries (like data centers, AI servers, microchips, and the onshoring of large-scale manufacturing) are all expected to put upward pressure on electric demand. Between 2024 and 2026, New York is expected to see between 1 and 2 gigawatts (GW) in new large-load

[22] New York State Office of General Services, Executive Order 22: Embodied Carbon Guidance (January 2025). <https://ogs.ny.gov/executive-order-22-embodied-carbon-guidance>.

[23] New York State Office of General Services, NYS Buy Clean Concrete Rules (accessed June 2025). <https://ogs.ny.gov/nys-buy-clean-concrete-guidelines-0>.

projects across the state.[24] As discussed in the Electricity chapter of this Plan, growth in electric demand is not unique to industry and is also expected from the electrification of buildings and transportation.

Looking forward, the provision of low-cost bulk energy is important to the growth of the industrial and agricultural sectors. State agencies will need to collaborate and partner with utilities and industry to ensure that this growth uses energy efficiently and is in line with State energy and climate goals. In addition to meeting new demand growth, the industrial and agricultural energy transition will need to modernize existing operations with clean energy alternatives, alternatives for high-heat processes, and enhanced materials management to reduce emissions from other on-site processes.

The State has an opportunity to match industries necessary to the clean energy transition with industrial investments to enhance local economic development and job creation, while supporting the production of equipment vital to transitioning other sectors of the economy. Recent economic disruptions (e.g., COVID labor and supply shocks, inflation, federal trade policy) have also demonstrated the benefits of local and resilient supply chains.

4. Themes and Recommended Actions

4.1. Meeting the Energy Needs of Industrial and Agricultural Energy Users

Industrial and agricultural activity is closely intertwined with the State's energy systems and provides benefits such as economic development and resiliency, as well as local job creation. Existing facilities value and benefit from affordable energy access and rely on a range of energy sources to maintain their production. Aligning economic development and energy policy requires identifying energy system constraints and future needs and taking actions to address these needs.

4.1.1. Electricity

Industrial operations generally require access to the electric grid, and more and more facilities will require bulk electricity. Advancing access to low-cost, low-emission electricity not only provides economic advantages to businesses and consumers in New York State but also offers a pathway to reduce pollution in the sector.

The Electricity chapter of this Plan discusses multiple initiatives underway to ensure that growing demand for power in New York State is met in a timely, coordinated, and cost-effective manner. These include:

- Stepped-up procurements for large-scale renewable generation and improvements to the interconnection process to the bulk power grid.
- The ongoing Coordinated Grid Planning Proceeding, among other planning processes, to identify necessary transmission and distribution investments.

[24] NYISO notes that there is significant uncertainty as the pace at which these projects will proceed and the ultimate electric demand that will need to be served. (New York Independent System Operator (NYISO) 2023)

- Collaboration among several State agencies to develop a Clean Energy Zones initiative that will synchronize the development of new sources of load, and the transmission extensions and clean generation additions needed to serve them.
- The "0x40" Proceeding, led by DPS, to convene stakeholders and collaborate on solutions to achieve the State's Climate Act decarbonization targets.

In addition, through novel industrial rate designs, such as dynamic electricity-pricing models, the State can support cheaper and cleaner electricity generation and avoid costly new infrastructure. Examples of such rate designs could include:

- Differentiating transmission, distribution, and demand charges based upon on-peak and off-peak usage.
- Incentivizing industrial energy managers to participate in on-site energy generation, efficiency measures to reduce demand, or flexible management to reduce system peak.
- Providing sample tariffs to value the storage and/or recycling of thermal energy. Waste heat from industrial processes or data centers can be stored or recycled for reuse on- or off-site. Creating standardized contracts or tariff guidelines for these thermal resources can help create additional revenue streams for industrial facilities and help serve nearby sources of demand.

Beyond energy generation and rates, the State also needs to bolster transmission and distribution investments to help meet rising demand from large energy users. At present, it can take upwards of four years to build new transformers or substations, far too long for a company to wait to begin operations. Transformer supply chain issues must be resolved so that the delivery time for transformers and other transmission equipment can be shortened. It also presents an opportunity for public-private partnerships to expand and improve the State's energy networks. Extending transmission and electrical infrastructure to more sites around the State will help unlock economic growth and significantly enhance the ability to connect New Yorkers with the advanced manufacturing jobs of the future.

4.1.2. Gas

In New York State, industrial end-users account for about 7 percent of natural gas consumption and gas is the largest source of energy in the sector. Gas is used for diverse purposes, ranging from chemical production and process heating to a variety of manufacturing activities. New industrial facilities—small and large—that are being planned and constructed in New York consistently look to use natural gas as an input to their production processes.

While nearly all gas consumers in New York rely on supplies imported from out-of-state through large transmission pipelines, larger industrial gas consumers commonly connect directly to the gas transmission system, rather than relying on Local Distribution Companies (LDCs) which serve smaller industrial consumers. Since large gas consumers contract directly with suppliers, their access to gas depends on cost and transmission pipeline capacity, rather than on the availability of distribution infrastructure. By contrast, smaller industrial customers that access gas via the distribution mains owned

and operated by LDCs are subject to tariffs and the LDC's gas capacity and ability to extend service when and where they are needed.

Part RR of Chapter 56 of the Laws of 2023 requiring zero-emission building and energy codes and the Public Service Commission's (PSC) Gas Planning Proceeding both inform gas system planning, but focus on residential and commercial customers, not industrial facilities. The PSC's planning proceeding, which was established to avoid moratoria and to facilitate planning in light of the Climate Act's emissions reduction targets, relates to LDCs' gas distribution systems. It does not direct LDCs to limit gas access for industrial consumers, today or in the future.

Recommendations

- DPS Staff should continue to convene the Coordinated Grid Planning Proceeding and the Clean Energy Zones initiative detailed in the Electricity chapter of this Plan. These efforts will help to drive investments into the electric grid that improve availability and reliability, while helping to synchronize the development of new sources of load, and the transmission extensions and clean generation additions needed to serve them.
- DPS, NYPA, and NYSERDA should continue to advance integrated planning practices that enable investments necessary for industrial electrification to be coordinated and optimized across the gas and electric systems.
- DPS should continue to engage utilities and stakeholders to pursue new rate designs and demand side programs that provide competitive utility rates, reduce the cost of industrial electrification, and incentivize reduced or flexible usage of energy from on-site energy generation, demand management, and/or storage or recycling of thermal energy.
- DPS, ESD, NYPA, and NYSERDA should examine opportunities and challenges presented by emerging energy-intensive subsectors to best accommodate new load while balancing State policy goals and targeting support to strategic industries that create wider community, economic, and workforce benefits.

4.2. Attracting New Industrial Development

Attracting new industry can create economic opportunities for New Yorkers through job creation, increased tax revenue, increased consumer spending, community development and revitalization, and if done strategically, can accelerate the clean energy transition by attracting clean energy supply chains.

State and federal support is already rapidly transforming upstate New York into a global hub for advanced manufacturing—particularly in semiconductors,[25] clean tech,[26] and agribusiness.[27]

To continue attracting new—and maintain existing—industry, the State must balance several important priorities including ensuring that firms have access to: sufficient shovel-ready and power-ready sites; reliable, affordable, and clean power; the necessary skilled workforce and expertise; and tailored State support. Comprehensive energy planning is a critical piece to ensure that these users have access to affordable, clean power, while balancing the existing energy needs of the State.

4.2.1. Site Readiness and Energy Infrastructure

Large-scale manufacturing and industrial firms require sufficient shovel-ready and power-ready sites, or enhanced power-connectivity to electrify existing facilities. ESD routinely receives requests for more than 50 MW of power from companies interested in locating to or expanding in New York, but sites of at least 200 acres and 50 MW or more of capacity are in high demand and short supply. Many Cleantech manufacturers that produce solar panels, wind turbines, EVs, and batteries do not proceed beyond the site selection stage to even consider the incentives offered by the State, and as a result, New York is losing these investments to the "Battery Belt" emerging in the Midwest and the South. Sites must be open and ready for business and locating at a power-ready site can shave years off the timeline between site selection and a plant's opening day.

As mentioned above, the State must also invest in transmission, distribution, and clean generation infrastructure to ensure that the State can provide reliable and ample power. Reliability of clean power across the life of the plant is a critical factor for new industry in considering a site, as it supports the many firms who have independently established decarbonization goals.

The ability to develop on-site generation or co-location with firm power sites may also be considered to address reliability concerns. The Department of State's **Brownfield Opportunity Area (BOA) Program** works to maximize the value of previous industrial and commercial sites, leveraging existing infrastructure including connections to the electric grid and pipelines. Through this program, local governments and community-based organizations can apply for funding to collaborate on area-wide redevelopment planning in areas with a legacy of contamination. The BOA Program works to revitalize economically distressed areas through redevelopment of brownfields and other vacant, abandoned, or underutilized properties into productive uses, meeting the needs of today's communities.

[25] New York Office of the Governor, $10 Billion Partnership to Bring Next Generation R&D Center to NY CREATES' Albany Nanotech Complex. December 11, 2023. https://www.governor.ny.gov/news/governor-hochul-announces-10-billion-partnership-bring-next-generation-research-and

[26] New York Office of the Governor, $160 Million Federal Investment from NSF to New Energy New York Storage Engine. January 29, 2024. https://www.governor.ny.gov/news/governor-hochul-announces-160-million-federal-investment-national-science-foundation-new

[27] New York Office of the Governor, Groundbreaking of the New Fairlife Production Facility – the Largest Dairy Production Facility in the Northeast. April 12, 2024. https://www.governor.ny.gov/news/governor-hochul-and-coca-cola-company-celebrate-groundbreaking-new-fairlifer-production

4.2.2. Clean Energy Supply Chains

One of the key strategic priorities of the Scoping Plan for the Climate Act is to build out a robust, export-oriented supply chain for clean energy technologies that provides high-quality jobs and creates opportunities for businesses and entrepreneurs statewide.[28] By treating the energy transition as an economic development opportunity, New York can capture opportunities for new investments, drive the transition to a clean energy economy, support manufacturers in developing local production and new clean energy products, and build out local clean energy supply chains. The Scoping Plan calls for the need to identify "specific businesses and technologies that could benefit, in part through incentives for private investment" from the work New York is undertaking toward the Climate Act targets and "include an enhanced marketing strategy to attract these manufacturing and clean-tech businesses to New York, with a specific focus on in legacy/rust belt cities and Disadvantaged Communities."[29]

Fostering these supply chains will be crucial for the provision of a wide array of goods and services necessary for the clean energy transition, including but not limited to battery and storage technologies, grid and generation equipment, low-embodied emission materials, heat pumps, and renewable energy system components. In-state supply chains offer numerous benefits, including resilience against potential supply disruptions, reduction of transportation-related environmental harms, economic growth opportunities, and leadership in innovation. New York State can support supply chain development and new clean energy business growth by inducing demand for the next generation of products, regulating the environmental attributes of the key products in the built environment, and strategically investing in new technologies in partnership with private sector stakeholders.

Since 2019, New York has announced 45 Cleantech manufacturing projects totaling more than $4.8 billion in investments and approximately 8,500 jobs created or retained.[30] The State can build on this momentum by continuing to proactively identify opportunities, invest in strategies to attract firms, and build a coalition of partners statewide to help catalyze and align public and private investments to accelerate clean industry growth in New York. The State can leverage this work to address gaps in New York's clean energy market and to target priority needs to support the energy transition.

To attract and expand in-state clean energy supply chains, including technologies critical to scaling renewable energy, New York must continue to establish itself as a competitive business destination for industry. Analysis has shown that other states are drawing a higher number of more substantial projects, usually through bundled incentives, with incentive-to-capital investment ratios reaching as high as 28 percent.[31] Currently, New York offers limited programs outside of offshore wind that are specifically targeted for clean energy manufacturing.

[28] New York State Climate Action Council, New York State Climate Action Council Scoping Plan: Chapter 22 (2022), climate.ny.gov/resources/scoping-plan/ScopingPlan
[29] *Id*., pg. 428
[30] Based on internal NYSERDA tracking of new projects.
[31] Based on NYSERDA analysis of several different data sources.

4.2.3. State Support for New Industries

Policymakers can provide a variety of incentives to manufacturers or other industry to locate in their state. For example, ESD's Excelsior Jobs Program offers refundable tax credits to qualifying businesses operating predominantly in specified strategic industries, encouraging them to expand and invest in New York State. However, the State could increase the competitiveness of these credits by layering on additional tailored incentives, especially for target industries. New York has adopted this strategy to successfully attract offshore wind supply chains through targeted investments and initiatives that foster partnerships between wind developers and manufacturers. The State has identified microchip processing, agribusiness, materials processing, and transportation equipment among its key strategic industries.

Firms also benefit from State support into site identification, site development, business development, and financial support that helps to mitigate early-stage financial risk. While New York is competitive on utility costs, taxes, and expertise, New York does not have long-standing programs that offer direct financial assistance. Particularly in cases where firms are providing new technologies that are capital-investment-sensitive, these firms prefer cash incentives—such as assistance for higher acquisition cost and construction costs. Flexible incentive funds, such as discretionary closing funds, can help offset upfront costs and provide more flexibility for new technologies looking to locate in the State, which should be managed by ESD to provide businesses with the ease of engagement with one NYS point of contact.

In designing programs to build up industry, the State can promote the development of underutilized areas, promote Minority/Women-owned Business Enterprises (MWBE) to fulfill State contracts, and ensure that benefits accrue to Disadvantaged Communities (DACs). For example, NYSERDA's Build Ready Program partners with local communities to identify opportunities for and support the development of revenue-generating clean energy projects on underutilized land.

Continued investments in workforce development and RD&D also play a role in attracting key industries. As noted in the Clean Energy Jobs and Just Transition chapter of this Plan, fully realizing the potential of the impending energy transition will necessitate growth in the State's workforce as well as skills development to operate emerging technologies. In the industrial sector, this requires training the next generation of workers with an understanding of the business value of energy efficiency, the necessary training to leverage emerging decarbonization methods and technologies, and the ability to innovate and grow new ventures in clean energy. Likewise, investments into RD&D can maintain and expand manufacturing excellence in the State and advance the attainment of our emissions goals while meeting the energy needs of new and growing industries and improving affordability.

4.2.4. Policy and Program Initiatives Underway

The Fiscal Year 2025–2026 Enacted Budget contains critical tools to help New York develop and improve sites to attract more investment and create opportunities for New Yorkers. This budget increases the initial $300 million provided for the FAST-NY program to develop shovel-ready sites by an additional $100 million. The program prioritizes sites that can accommodate advanced manufacturing, including

semiconductors, supply chain projects, Cleantech, and green economy projects. This new funding will continue to focus on equipping sites with utility access (including renewable, clean energy).

The Fiscal Year 2025–2026 Enacted Budget funds $100 million for the new POWER UP program, as a part of a $300 million appropriation over three years, to fund the proactive development of the electric infrastructure for power-ready sites. POWER UP funds can be used to alleviate bottlenecks to connect businesses to power and proactively upgrade electrical infrastructure at sites to rapidly accommodate future commercial and industrial investment opportunities. By injecting State funding into the needed energy infrastructure improvements, POWER UP can help defray electric rate increases for regional ratepayers.

POWER UP will facilitate collaboration between ESD and DPS to address economic development challenges involving power. ESD will provide economic development expertise to ensure the fund focuses on the preparation of sites that are strongly positioned to host manufacturing operations and create jobs. DPS will provide expertise in utility capital planning and will identify opportunities for project sites that can bundle multiple clean energy resources.

The State is active in promoting regional supply chains for critical areas of the clean energy economy. As an example, the Governor has announced a $500 million investment in the establishment of port infrastructure, manufacturing, and other supply chain infrastructure to advance the offshore wind industry. To support these investments, a consortium of State actors works in concert to spur and showcase regional supply chain opportunities, including NYSERDA, the Center for Economic Growth, ESD Hudson Valley Economic Development Corporation (HVEDC), Nassau County Industrial Development Agency (IDA), New York City Economic Development Corporation (NYCEDC), the Orange County Partnership, and the Suffolk County Industrial Development Agency (IDA).

The State has also instituted policies and regulations to create conditions that will spur the demand for products in the clean energy economy. Executive Order 22 and LECCLA both aim to promote low-embodied carbon materials and improve the sustainability of construction practices in the State. This benefits industry and industrial decarbonization by creating new market demand for construction materials produced efficiently with regards to energy and emissions.

Recommendations

- New York should **continue and enhance interagency coordination** to meet the energy needs of new, large customers. Expanded collaboration between NYSERDA, DPS, ESD, NYPA, and DEC will be essential to driving New York's competitiveness.
- ESD, in collaboration with NYSERDA, should continue to **invest in site readiness**. New York needs more large sites with access to competitive and adequate electricity supply. Without these sites, the State will not be positioned to accommodate the coming demand from advanced manufacturing and technology companies, putting the State at risk of missing out on potentially tens of thousands of jobs and potentially billions of dollars in new investments. When possible, these efforts should prioritize brownfield redevelopment to leverage existing, underutilized sites.

- NYSERDA and NYPA, in coordination with ESD, should identify and attract **key in-state clean energy supply chain opportunities**, including the development of marketing campaigns and other targeted programs. Attracting these industries could further amplify the benefits of clean energy development, including through job creation, added tax revenue, and more resilient supply chains.
- New York should **leverage opportunities to stimulate the development of clean, firm energy supply**, developing partnerships with energy intensive industry to explore the development of clean energy resources.
- ESD, in coordination with NYSERDA, DPS, and DOS should continue to ensure consideration of **disadvantaged communities** and **MWBEs** when making economic development investments, as applicable.

4.3. Energy Efficiency and Electrification in the Manufacturing Sector

The industrial manufacturing sector provides strong opportunities to reduce energy use and emissions, as energy consumption is centralized into key equipment, and facilities often have dedicated energy managers. On the other hand, manufacturers place a high value on equipment reliability and availability, and usually require a faster return on investment than other sectors of the economy. Currently, low-emission technologies struggle to compete with entrenched fossil fuel technologies, which are more widely available, making them less expensive and facility managers reluctant to switch to emerging technologies. Additionally, as discussed above, expanded power capacity to electrify facilities can be a long and expensive process. In the short-term, energy efficiency and electrification offer strong options to transition to low-emission industrial equipment, but deployment will require State support, both technical and financial.

Process heating accounts for most of the manufacturing sector's energy demand, but most of its uses are for low (<140°C) and medium (140°C–300°C) temperature processes which can be electrified through technologies like infrared, microwave, or radio frequency heating. The most impactful sectors to target vis a vis process heating would be the State's food, chemicals, metals, and transportation equipment sectors. Some high-heat processes are starting to use electric technologies to preheat materials, and then fossil fuels to achieve the final required temperatures.

Beyond electrification of process heating, there are strong opportunities to capture and recycle waste heat, treating it as a thermal resource to recycle into useful forms. This could be internal to industrial facilities, recycling heat to be reused on later processes. Thermal storage processes, such as boilers to store hot water, can be useful to store this heat until it is needed or prices from other sources increase. Thermal storage has the advantage of being the lowest cost source of energy storage.[32,33] Additionally, waste heat can be connected to nearby sources of heat demand via a Thermal Energy Network. This can

[32] Odukomaiya et al., 2021, *Addressing Energy Storage Needs at Lower Cost via On-Site Thermal Energy Storage in Buildings.* Energy & Environmental Science, https://pubs.rsc.org/en/content/articlepdf/2021/ee/d1ee01992a

[33] Cole, Wesley and Akash Karmakar, 2023, *Cost Projections for Utility-Scale Battery Storage: 2023 Update*, National Renewable Energy Laboratory, NREL/TP-6A40-85332, https://docs.nrel.gov/docs/fy23osti/85332.pdf

leverage the waste heat to displace other sources of thermal generation, and potentially add another revenue stream to industrial facilities who are able to provide a steady supply of waste heat. After process heating, boilers and motors provide the most opportunity for energy and carbon savings in the sector, followed by general building efficiency measures for industrial sites, such as HVAC and lighting upgrades.

These manufacturing investments would have additional benefits to the State. New York's manufacturing sector is already one of the cleanest and most efficient, using far less energy per units produced than the nationwide average.[34] Continued investments would help extend this advantage and support local industries. Using less energy while enhancing energy networks to serve manufacturers also brings resiliency benefits to the State. The industrial sector relies heavily on large amounts of energy; therefore, securing a stable supply creates a more stable economy in New York and hedges against potential disruptions. Finally, industrial plants, especially those combusting fuel on-site, tend to be highly polluting. With over 60 percent of industrial facilities in New York located either in or near a DAC,[35] reducing energy use and converting facilities from fuel to electric power would reduce pollution in these communities, improving air quality and public health.

4.3.1. Policy and Program Initiatives Underway

Recent State and federal studies have examined the potential to reduce energy use and greenhouse gas (GHG) emissions in the industrial sector. NYSERDA's Industrial Stock and Decarbonization Potential studies were discussed above. Separately, the U.S. Department of Energy (DOE) produced a Commercial Liftoff Series,[36] examining decarbonization potential in industry as well as subsector specific reports on cement production, chemicals and refining, and carbon management. These studies found the most short-term potential in energy efficiency investments, followed by electrification, whereas carbon capture, utilization, and storage (CCUS) was most impactful in the long-term. (For a more detailed description of CCUS, see Section 4.4.2.)

Spotlight: Industrial Energy Management

Byrne Dairy, located in East Syracuse, NY, participated in the NYSERDA's On-site Energy Manager Program. They tapped CHA Consulting, Inc. to provide a full-time staff energy manager for a 13-month period. In that time, the energy manager worked with staff to identify energy savings opportunities, promoted continuous improvement, and developed implementation strategies for energy management.

A total of 41 energy projects were identified, with 11 projects selected for implementation. They exceeded their goal of a 5.5 percent reduction in site energy use, with a simple investment payback of 2.5 years. In addition, several projects had ancillary benefits such as product, O&M, water, and boiler chemical savings.

[34] NYSERDA, Patterns and Trends: New York State Energy Profiles: 2007-2021 (November 2023), Table 2-16a and Table 2-16b. <https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Publications/Energy-Analysis/PatternsandTrendsEAA.pdf>.

[35] See, Phase 1 Industrial Stock Study. Page 60.

[36] U.S. Department of Energy (DOE), Pathways to Commercial Liftoff, <https://liftoff.energy.gov/about-the-liftoff-reports/>.

NYSERDA also supports more efficient energy use at industrial facilities through various programs. As noted in Section 2.3.2, The **FlexTech** and **SEM** programs offer technical and engineering support for companies and facilities to improve their energy efficiency, while the **On-Site Energy Manager Program** offers to share 75 percent of the salary cost of a dedicated energy manager for a minimum term of 12 months to manage energy use and enhance productivity. Two programs also provide matching funds to invest in energy upgrades. The **Commercial and Industrial Carbon Challenge** program (also described in Section 2.3.2) provides awards to facility investments, including electrifying of steam production, electrifying mining equipment, CCUS, biofuel production, and low-carbon inputs for cement production. The **Heat Recovery Program** also provides financial support for facilities to capture and recycle their waste heat, reducing their heating needs and energy demand.

Recommendations

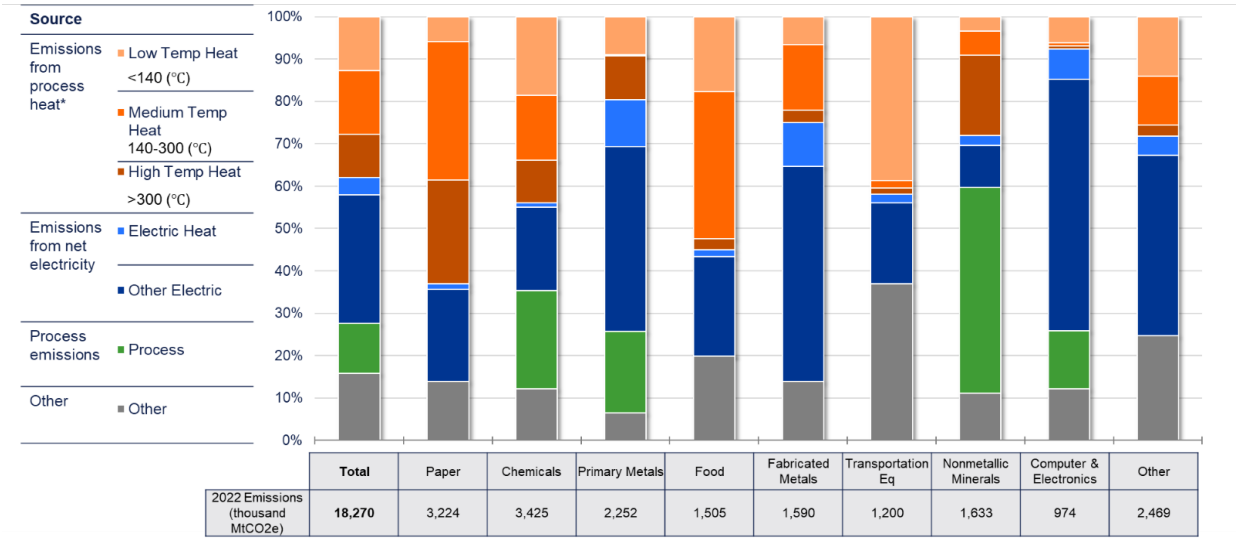
- **NYSERDA should continue to provide technical assistance to energy-intensive industrial facilities** to facilitate cost-effective energy efficiency and decarbonization upgrades. NYSERDA should also provide financial support to help these facilities implement deeper energy efficiency and decarbonization projects, as funding is available.
- In the near- to medium-term, **NYSERDA and the PSC should prioritize high-efficiency and electric process heating**. Increased insulation, electric boilers, electric pre-heating, and infrared, microwave, and radio frequency heating can all reduce energy use and on-site combustion in the industrial sector. Recycled waste heat can also power additional processes or be resold as a valuable resource into Thermal Energy Networks.
- **NYSERDA, in coordination with ESD, should help facilities maximize the value of energy used in process heating.** On-site equipment, thermal energy networks, and heat sharing agreements can help recycle heat in facilities or capture heat as an energy supply for nearby thermal needs.
- **DEC, in coordination with NYSERDA, should examine the benefits of clean energy investments in industrial facilities**, including the public health benefits of reduced pollution.

4.4. Additional Approaches to Industrial Sector Decarbonization

The NYSERDA Industrial Potential Study (forthcoming, Phase 2) indicates that energy efficiency and electrification of thermal loads can account for the majority of short-term decarbonization in the manufacturing sector, and as such, should remain the primary solutions for this goal. However, in their current state of development, these efforts alone will be insufficient to reduce the sector's energy emissions in line with the State's Climate Act targets in the medium- and long-term. This is most acutely due to process temperature requirements and manufacturing process integration challenges. In many cases, there are no electric alternatives for providing the medium and high operating temperatures (>140°C) required in certain manufacturing processes (Figure 3). While high-temperature electric alternatives are under development, it may be several years before they are available for many manufacturing processes.

This presents a need for additional solutions that can be met with the utilization of low-carbon fuels and energy sources, CCUS technologies, and novel process innovations. These solutions are varied both in

technical detail and market readiness and will require financial support for continued research, development, and demonstration.



	Total	Paper	Chemicals	Primary Metals	Food	Fabricated Metals	Transportation Eq	Nonmetallic Minerals	Computer & Electronics	Other
2022 Emissions (thousand MtCO2e)	**18,270**	3,224	3,425	2,252	1,505	1,590	1,200	1,633	974	2,469

Figure 3: NY Manufacturing Sector 2023 Emissions by energy end-use.

4.4.1. Low-Carbon Fuels and Energy Sources

Low-carbon fuels and energy sources provide a solution for decarbonizing manufacturing for those subsectors and businesses that cannot electrify operations due to their inability to reach higher operating temperatures. These solutions can include, but are not limited to:

- Biomass fuels – the direct combustion of biomass material or fuels derived from process and/or refining biomass material.
- Hydrogen – the direct combustion of hydrogen blends or the combustion of hydrogen derived fuels like ammonia or methanol.
- Geothermal heat – sourcing heat from geologic formations.
- Nuclear-derived heat – sourcing heat from fissile material, particularly from micro- and small modular reactors for industrial heat.
- Solar Thermal – using solar arrays to heat water directly rather than producing electricity.

In addition to their beneficial temperature capacities, low-carbon fuels and energy sources can also carry other benefits. The complexity of reconfiguring manufacturing to accommodate electrified equipment can present barriers related to operations and maintenance, workforce training, and quality control.[37] For example, a site may be configured such that excess heat from a fossil-fuel-driven manufacturing process is collected and used to drive a separate process at the facility. Replacing the gas-fired equipment with electric equipment will eliminate the useful excess heat, requiring reengineering of the secondary process as well. This can have cascading effects that impact multiple systems across a plant.

[37] DOE, *Industrial Decarbonization Roadmap*, September 2022, https://www.osti.gov/servlets/purl/1961393.

Replacing fossil fuels with alternative, low-carbon fuels and energy sources can reduce or eliminate the need for process reengineering.

Spotlight: Biomass Fuels

Cascades is one of the largest paper packaging and hygiene product manufacturers in North America. In 2021, the company's Containerboard Packaging plant in Niagara Falls, NY was awarded just over $2 million from NYSERDA's Commercial and Industrial Carbon Challenge program to execute a biogas project. The plant is in the process of upgrading their waste biodigester system to efficiently capture methane streams that would otherwise be flared. The methane will be processed through a newly installed purification process so that it can be directly combusted in the plant's boilers. This system will yield an estimated 400 MMBtu of low-carbon gas per day and reduce the plant's reliance on delivered fossil gas.

Utilization of alternative fuels is particularly attractive in certain subsectors capable of generating such fuels onsite. For example, manufacturing pulp and paper products involves the processing of large quantities of biomass. This leads to significant biomass waste streams. These waste streams can be further processed or refined to provide fuel, as happens in anaerobic digester systems.

As noted in the Low-Carbon Alternative Fuels chapter of this Plan, these solutions should be carefully managed to realize fuel-cycle GHG reductions and avoid other environmental or health impacts. In addition, the supply of alternative fuels will be limited due to a limited supply of available feedstocks and competition from other end-uses and other states or provinces in the region with similar decarbonization goals. As additionally discussed in the Low-Carbon Alternative Fuels chapter, the State prefers waste-based feedstocks sourced in-state for alternative fuel production. Industrial and agricultural facilities with significant biomass-based waste streams could leverage these waste streams for their own use, such as an on-site production and use of biogas. As the alternative fuels market develops, there may be further interest from producers in the available waste streams within the state.

Advanced nuclear energy systems are capable of generating heat at temperatures above 700°C that can be used in industrial applications. As noted in the Nuclear chapter of this Plan, these solutions present a complex series of challenges related to technology feasibility and cost, regulatory needs, safety, and waste management. Moreover, there are siting concerns regarding the co-location of nuclear reactors with industrial facilities that will require the thoughtful development of frameworks for community engagement and information sharing.

Full utilization of hydrogen fuel in industry poses operational barriers that will need to be addressed. While New York is not pursuing gas-hydrogen blending in the gas transportation network, industrial sites producing hydrogen on-site can explore gas-hydrogen blends in combustion infrastructure. These blends can more easily integrate into existing gas equipment at lower blend rates. However, replacement or modifications of existing industrial equipment are needed to combust blends with higher concentrations of hydrogen. This is due to differences in the required composition and characteristics of hydrogen

versus natural gas. New safety systems are also necessary to account for increased flammability and differences in hydrogen flame characteristics.[38]

4.4.2. Carbon Capture, Utilization, and Storage

CCUS is the application of a system to capture Carbon Dioxide (CO_2) and other emissions from a point source, like an industrial flue stack, before the emissions are released into the atmosphere. The captured CO_2 can then be utilized for other purposes or stored in a long-term geological reservoir.[39] CO_2 is already utilized in the production of a wide variety of goods and efforts are underway to find additional innovative uses (see "Spotlight: Carbon Utilization").

Spotlight: Carbon Utilization

AIRCO, based in Brooklyn, NY, is an innovative startup working to create synthetic fuels from CO_2 captured from industrial point sources and green hydrogen. They currently have commercial partnerships with JetBlue and Virgin Airways related to their sustainable aviation fuel, AIRMADE SAF. Displacing traditional, fossil-derived jet fuel with their SAF alternative helps recycle waste CO_2 with beneficial global warming impacts.

AIRCO participated in the Year 1 Cohort of the Carbon2Value Initiative, a collaborative venture for CCUS startups administered by the Urban Future Lab, Greentown Labs, and the Fraunhaufer USA with support from NYSERDA. This support encourages new business growth in the State's clean energy economy while simultaneously aiding in the decarbonization of the industrial sector.

CCUS, like alternative fuels and energy sources, can help overcome the challenges posed by high temperature requirements in manufacturing, but the technology has other unique benefits as well. The processes used to manufacture certain products can generate GHG emissions that are not related to energy consumption. Rather, the emissions result directly from chemical reactions or physical transformations of materials. For example, the production of aluminum most often involves an electrolysis process where carbon anodes react with oxygen or fluorides to produce CO_2 and perfluorocarbons (PFC), very potent greenhouse gases. Other sources of manufacturing process emissions in New York State include cement, chemicals, glass, semiconductor, iron and steel, hydrogen, and lead production. Solutions like CCUS will be needed to eliminate these types of manufacturing process emissions.

CCUS offers near-term benefits apart from process emission mitigation solutions that make it likely to be utilized by manufacturers working to reduce emissions. There are certain applications of CCUS that are

[38] Rissman, Jeffrey, *Zero-Carbon Industry*, New York City, Columbia University Press, 2024.

[39] In order for CCUS to have beneficial impacts, care must be taken to ensure that utilization and storage does not simply delay the ultimate release of the CO_2 into the atmosphere in a short period of time. Utilization pathways should be subject to robust Lifecycle Analyses and storage sites should be continuously monitored to verify there are no leaks.

already mature and widely available, whereas many electrified solutions for replacing fossil fuel-based equipment are in earlier stages of development with more limited market availability. Given the limitations on supply for alternative fuels discussed in the chapter on that subject, CCUS may prove preferable to certain subsectors for addressing high-temperature manufacturing processes.[40]

While CCUS offers benefits, there are important limitations to its use. CCUS systems impose an additional energy load in the facilities in which they are deployed. The magnitude of this energy load is correlated to the concentration of CO_2 in the waste gas stream: the more diffuse the CO_2, the more energy required to remove it. These concentrations are highly variable across different manufacturing subsectors.[41] Employing CCUS in facilities with less concentrated gas streams is not currently economically feasible. Application in these facilities would depend on the development of breakthrough approaches.

Optimal CCUS use demands that there are options for durable, long-term storage of the captured emissions. This requires well-tested and robust utilization pathways or storage media. While pathways for carbon utilization are very actively under development in the market, the technical and economic feasibility for many remain uncertain. While many aspects of long-term storage in geologic media are well understood, with technology readily available to facilitate it, the cost of such operations are likely to be prohibitive in the short- and medium-term. Moreover, there are additional regulatory, safety, and cost barriers to building out a CO_2 transportation and storage system in New York.

4.4.3. Novel Manufacturing Processes

Process innovation is a general term for novel methods of manufacturing products with more favorable energy or emissions characteristics. Given the heterogenous nature of manufacturing subsectors and their unique processes, providing a comprehensive overview of the methods and technologies under consideration is impracticable (see “Spotlight: Industrial Energy Management,” for an illustrative example).

These novel methods can include new physical or chemical conversion pathways for raw materials. These conversion pathways often work by leveraging electricity rather than heat to drive processes, remaking the process to manufacturing a good that typically requires medium-to-high heat to be produced (>140°C). However, this will result in additional demand being imposed on the electric grid from industrial efforts to decarbonize.

The technologies and processes being developed to alter manufacturing processes are at very early technical readiness levels and will face both known and unknown technical hurdles in order to reach maturity. Furthermore, developing, scaling, and ultimately deploying these technologies will require significant investments.

[40] Rissman, Jeffrey, *Zero-Carbon Industry*, New York City, Columbia University Press, 2024.
[41] NYSERDA, Potential for Carbon Capture, Utilization, and Storage Technologies in New York State (July 2020), https://www.nyserda.ny.gov/-/media/Project/Nyserda/files/Publications/Research/Environmental/20-13-Carbon-Capture-Utilization-and-Storage-Technologies.pdf

4.4.4. Initiatives underway: policy processes and programs

NYSERDA is actively researching the characteristics and potential of multiple alternative fuels, low carbon energy sources, and CCUS opportunities, with an acknowledgement of utilization in industry. The following research efforts have been recently completed or are underway to better inform the State's industrial strategy:

- New York State Hydrogen Assessment (2025)
- Analysis of the Potential Scale and Impacts from the Use of Anaerobic Digester Gas and Renewable Natural Gas for Hard-to-Decarbonize Energy Uses in New York State (Forthcoming)
- Blueprint for Consideration of Advanced Nuclear Energy Technologies (2025)
- Potential for Renewable Natural Gas in New York State (2022)
- Advanced Nuclear Request for Information (2025)
- Potential for Carbon Capture, Utilization, and Storage Technologies in New York State (2018)

NYSERDA offers many programs to research, develop, and demonstrate the capacity of these many solutions. Technical assistance programs can offer support for companies and facilities to identify opportunities to generate or utilize low-carbon fuels and energy sources, innovate processes, or deploy CCUS technologies. The Commercial and Industrial Carbon Challenge program provides capital awards for facility investments aimed at reducing the emissions in industrial facilities, welcoming all types of technology applications for doing so (see "Spotlight: Biomass Fuels"). Additional capital support has been made available for development and demonstration projects through the NYSERDA Innovation team's portfolio of programs.

The federal government has likewise been active in supporting alternative fuels and energy sources of importance to energy, though federal policy priorities are uncertain at present.

Recommendations

- NYSERDA, in coordination with researchers in the state university systems and non-academic institutions, should continue to support research, development, and demonstration activities for promising industrial decarbonization solutions in high-temperature electrified heat, low-carbon fuels and energy sources, CCUS, and novel process development.
- NYSERDA should continue to provide technical assistance and capital support for manufacturing facilities for cost-effective decarbonization upgrades.
- NYSERDA, DPS, and AGM should prioritize strategies, policies, and programs that support the use of low-carbon fuels and energy sources in:
    - Subsectors with limited capacity for decarbonization through electrification and efficiency.

    - Close proximity to the energy or fuel source to reduce midstream transportation complications (e.g., fugitive emissions, pipeline costs) and to promote offtake clustering.

- As offtake potential for alternative fuel and energy sources in industry materializes, NYSERDA and ESD should increase efforts to provide market intelligence to industrial sector stakeholders to ensure awareness of opportunities.
- NYSERDA, ESD, and DOS should pursue risk-sharing mechanisms with the federal government, other states, and/or industry to reduce the potential barriers of any novel decarbonization strategies or methods, including:
    - Advanced Nuclear siting partnerships,
    - Demand-clusters for alternative fuels, and
    - Novel process pilots.
- When opportunities for CCUS deployment arise, DEC and NYSERDA, along with local development authorities, should work to connect potential sources of captured carbon with facilities that can leverage carbon for productive utilization or with geologic sequestration sites.

4.5. Agricultural Energy Use, Energy Efficiency, and Electrification

Agriculture is a vital industry in New York State, which ranks among the top-producing states for dairy, fruits, and several other commodities. As agriculture depends on the weather and specific climatic conditions, this sector faces extraordinary challenges from climate change.[42] Farms are adapting by using more energy, whether it is barn cooling and ventilation on dairy farms, frost protection on vineyards and orchards, more energy-intensive inputs like fertilizers or chemicals, or incorporating more controlled environment agriculture (e.g., greenhouses, container farming, and indoor farming).

Energy efficiency measures and best practices can be utilized on farms now even while farms continue to adapt to a changing climate.[43] Numerous programs, at both the federal and State level, have been set up to provide grants or low-interest loans to adopt best energy efficiency practices on farms. NYSERDA has compiled tools and resources to help New York farms make informed energy decisions that will save money, boost productivity, and improve operations.[44] NYSERDA also offers programs for farms to conduct energy audits, which uncover opportunities to reduce and conserve energy through the deployment of energy efficiency best practices.[45] The State would benefit from additional data to measure the energy

[42] New York State Climate Impacts Assessment, *Understanding and Preparing for Our Changing Climate*, accessed July 3, 2025, https://nysclimateimpacts.org/.

[43] New York State Energy Research and Development Authority (NYSERDA), *Energy Best Practices for Agriculture*, accessed July 5, 2025, https://www.nyserda.ny.gov/All-Programs/Agriculture-Energy-Assistance/Energy-Best-Practices-for-Agriculture.

[44] NYSERDA, *The Inflation Reduction Act is Expanding Clean Energy Access and Agriculture Investment*, accessed July 3, 2025, https://www.nyserda.ny.gov/All-Programs/Agriculture-Energy-Assistance#:~:text=The%20Inflation%20Reduction%20Act%20is,incentives%20for%20additional%20cost%20savings.&text=provide%20opportunities%20for%20farms%20to,that%20reduce%20greenhouse%20gas%20emissions.

[45] NYSERDA, *Energy Best Practices for Agriculture*, accessed July 5, 2025, https://www.nyserda.ny.gov/All-Programs/Agriculture-Energy-Assistance/Energy-Best-Practices-for-Agriculture.

use on farms and increased use due to climate change. New York State should invest in research that better quantifies on-farm energy uses across major commodities agricultural production systems.

Efficient electrification is defined as the process of replacing fossil fuels with electricity to reduce emissions and energy costs. Many agricultural applications can be converted to high-efficiency electricity use. As climate change continues to add stress to agricultural output (e.g., drought conditions for growing crops, and heat stress on livestock), demand for energy will increase. By converting appropriate applications to electrification using variable speed pumps, cooling fans, frost protection, etc., less fossil fuels will be needed. Much of this electrification requires utility upgrades, such as three-phased power. This comes at a high upfront cost to the farm and community and can be cost-prohibitive.

4.5.1. Policy Process, Program Initiatives, and Market Adoption Underway

NYSERDA and AGM can develop new programs and enhance existing ones to support the utility upgrade costs for three-phased power enabling increased adoption of electric equipment. The existing NYS Climate Resilient Farming (CRF) Program has helped farms adapt by providing cost-share funding to boost irrigation capacity by replacing diesel powered water pumps with high-efficiency electric pumping. The CRF Program could help cover costs to upgrade facilities to three-phase power if it is required for a climate adaptation/resiliency measure such as irrigation or frost protection.

Some common agricultural best management practices implemented to protect water quality or lower agricultural emissions also have energy savings when adopted. Practices such as reduced tillage on fields not only boosts soil health and quality but also requires fewer tractor passes over the field. This energy savings can be quantified by measuring the reduction in gallons of fossil fuels needed to grow crops.[46] Furthermore, helping farms to manage nutrient applications can reduce the amount of synthetic fertilizer. These fertilizers are fossil-fuel-intensive to produce so reductions in their use reduces emissions and conserves energy resources.[47] Other best management practices such as prescribed rotational grazing and the use of cover crops may promote reductions in fossil fuel use of farm machinery and/or increase soil health and nutrient crop use efficiency.

CRF together with agricultural water quality programming provides technical and cost-share assistance for the adoption of conservation practices. Administered by the NYS Department of Agriculture and Markets and the NYS Soil and Water Conservation Committee and locally led by County Soil and Water Conservation Districts, these programs assist farmers to protect water quality, reduce agricultural greenhouse gas emissions and adapt to a changing climate.[48] Many of these conservation practice systems can reduce energy inputs on farms. However, more information and data are needed to better quantify energy efficiency benefits.

[46] Helsel, Zane, Robert Grisso, and Vern Grubinger, "Reducing Tillage to Save Fuel," April 3, 2019, https://farm-energy.extension.org/reducing-tillage-to-save-fuel/.

[47] United States Department of Agriculture (USDA), *Learn More About Nutrient Management*, accessed July 3, 2025, https://www.farmers.gov/conservation/nutrient-management#:~:text=Nutrient%20management%20is%20an%20important,cost%2Deffective%20role%20to%20play.

[48] New York State Department of Agriculture and Markets, *Soil & Water Conservation Committee*, accessed July 3, 2025, https://agriculture.ny.gov/soil-and-water/soil-water-conservation-committee.

Recommendations

- AGM, in coordination with NYSERDA, should support efficient electrification systems on farms including three-phased power upgrades.
- AGM should expand the NYS Climate Resilient Farming Program to support adaptation projects that also reduce GHG emissions or at least do not increase emissions.
- AGM, in coordination with DEC, should support the measurement, monitoring, and verification of energy use in the agricultural sector, as well as efficiency co-benefits associated with the adoption of conservation management best practices.

4.6. Agricultural Renewable Energy Production

Agriculture is a very energy-intensive industry, and some end uses cannot currently be electrified or are challenging to electrify with considerable upfront costs. For these applications it is important to consider low-carbon fuels as a dispatchable resource that could be used now and into the future or serve as a bridge to technological advances in energy and electrification. Biodiesel could be produced and refined on site for use in agricultural equipment.

New York State can support farmers and help meet state clean energy and environmental goals through planning for the continued reduction of methane through alternative manure management systems.[49] Manure storage is the largest source of agricultural emissions since the 1990 baseline. The storage of manure is an important practice to facilitate nutrient management, reducing the need for synthetic fertilizers and mitigating runoff for the improvement of water quality. However, the treatment and storage of livestock manure can produce methane through the anaerobic decomposition of the manure and be used as a productive fuel.

The alternative manure management strategies (detailed in the Climate Act Scoping Plan) can reduce methane emissions through on-site investments designed for each farm, such as methane destruction systems, anaerobic digester systems, composting, and other innovative systems that collect, capture, destroy, or utilize methane from manure storage. This biogas can be used as a fuel on-site or shipped to supply other sectors. The limited supply of biogas or RNG produced from manure management or other waste streams should be targeted to strategic uses such as locations where it can provide electric system capacity for buildings and transportation electrification by alleviating system constraints or RNG for industrial processes including food production such as fluid milk processing. Though biogas may be used on-site, RNG and other alternative fuels will need to be produced, transported, stored, and used at scale to meaningfully contribute to the decarbonization of the energy system.

New York State should expand support for the advancement of energy production and methane mitigation following full life cycle analyses, including measurement and abatement of methane leakage, consideration for avoided emissions, and future innovations. Programs that incentivize or permits to build anaerobic digestion should require systems be built (or retrofitted) for maximum methane

[49] Climate Act Scoping Plan, *Chapter 15. Agriculture and Forestry*, accessed July 3, 2025, https://climate.ny.gov/resources/scoping-plan/-/media/project/climate/files/Chapter15AgricultureandForestry.pdf

mitigation to ensure development of well-managed, low-emission biogas or RNG production such as utilizing emissions minimizing technologies and techniques, minimizing fossil fuel use in biogas or RNG production, minimizing emissions from biosolids/digestate, and consideration of a regulatory framework to ensure best practices.

The State should develop and apply standards for leak detection and repair from energy production systems. These standards will also include monitoring to guide management to minimize losses and optimize GHG emissions reduction benefit. New technologies such as drones make leak detection much simpler and affordable.

The State should align manure management systems designed for energy production, organic waste management, and methane mitigation with markets and private-sector investments (e.g., clean transportation standard, industry net zero initiatives, and others). NYSERDA and DPS, along with utilities and energy market participants, should identify energy pricing models and conduct a market-based study for waste-generated biogas. When on-site use of this fuel is not possible, improved connections between markets and farms can help match this new supply with market demand biomethane and other organic co-products generated by such on-farm systems, such as electricity, heat, gas, and organic soil amendments.[50]

4.6.1. Challenges and Barriers

One challenge to this strategy is in the size and scale needed for system efficiency and cost effectiveness. Typically, anaerobic digesters are used on a large-scale dairy farm as a manure treatment and handling method where the project scale is sufficient to achieve economic feasibility. However, smaller-scale anaerobic digestion systems may provide an option for small- to medium-sized farms but would need to be coupled with strong incentives and perhaps new technology demonstration for large-scale adoption. Small-scale digesters may intake manure along with food waste to produce energy at the farm. Benefits of these systems include reduced odor, pathogen reduction, processing of food wastes and substantially reduced methane emissions. The addition of food wastes boosts biogas production and helps institutions comply with the State's Food Donation and Food Scraps Recycling Law that took effect in January 2022.[51]

Notably, food waste may have two to three times more energy potential per unit mass than manure, making co-digestion an effective method to increase energy output while reducing methane emissions from the degradation of food wastes. This biogas output may also be used in a combined heat and power (CHP) system to generate electricity and heat energy for the grid and farm. In most cases, the onsite electricity generation from anaerobic digestion systems will exceed the farm's usage. Currently, the value structure for excess power production to be supplied to the grid is not sufficient for farms to make investments in anaerobic digestion/CHP systems.

[50] Climate Act Scoping Plan, *Chapter 15. Agriculture and Forestry*, accessed July 3, 2025, https://climate.ny.gov/resources/scoping-plan/-/media/project/climate/files/Chapter15AgricultureandForestry.pdf

[51] New York State Department of Environmental Conservation, *Food Donation and Food Scraps Recycling Law*, accessed July 3, 2025, https://dec.ny.gov/environmental-protection/recycling-composting/organic-materials-management/food-donation-scraps-recycling-law.

Biogas may be upgraded to biomethane or RNG through carbon capture and removal. However, small scale digesters generally cannot connect to the natural gas pipeline grid for RNG injection as it is not cost-effective to upgrade to pipeline quality and cover grid interconnection costs at a small scale. Biomethane can potentially be used for vehicle fueling, boiler fueling, or other equipment that require a lower percentage of methane in the gas.[52] Still there are significant challenges in matching variable energy use needs with a constant and continuous production of gas as well as higher relative capital and on-going costs associated with small-scale biomethane production.

4.6.2. Current Policies, Program Initiatives, and Market Drivers

In recent years, the California Low Carbon Fuel Standard (LCFS) and federal Renewable Fuel Standard (RFS) have been the primary market force for RNG development of large-scale anaerobic digestion systems on dairy farms in New York State.

The LCFS provides payment to farms by allowing them to generate and sell credits for capturing methane gas produced from animal manure, incentivizing the reduction of GHG emissions by converting waste into a usable fuel source, which can then be sold to energy companies required to meet the LCFS carbon intensity standards. This also incentivizes energy developers to invest in biogas capture technology on farms.[53]

The RFS is a federal program that mandates the incorporation of renewable fuels into the nation's transportation fuel supply. Each year, the U.S. Environmental Protection Agency (EPA) issues RFS rulemakings with volume requirements for certain renewable fuel categories and sets those volumes through annual renewable volume obligations (RVO). RVOs are the volumetric biofuel targets for obligated parties, such as refiners and importers of petroleum-based gasoline or diesel fuel. A Renewable Identification Number (RIN) is a unique number that tracks each gallon of renewable fuel in the United States. RINs are used to ensure compliance with the federal RFS.[54] Because of feedstock requirements for RINs, use of food waste for RNG production is discouraged. There is also uncertainty with the value for LCFS and RINs due to the potential for changes in California and federal policy.

With support and incentives from the State, this market uncertainty and the under-utilized potential of food waste could potentially drive interest of RNG developers to consider new RNG projects that take both manure and food waste and produce RNG for use on-site or regionally located to supply hard-to-electrify/decarbonize industrial customers, including dairy processing facilities, via low-risk long-term purchase agreements. A similar approach might be possible for bringing food waste and manure from other farms to existing digesters with spare capacity or an ability to expand capacity.

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[52] Vafiadis, Sarah and Lauren Ray, "Small-scale anaerobic digestion system technology," October 13, 2024, https://ecommons.cornell.edu/server/api/core/bitstreams/2cbfe405-a09e-4df9-b46f-9b5808e39617/content

[53] California Air Resources Board, "Overview of Low Carbon Fuel Standard & Dairy/Swine Manure Fuel Pathways," March 29, 2022, https://ww2.arb.ca.gov/sites/default/files/2022-04/dairy-ws-session-9-CARB.pdf.

[54] DOE, *Alternative Fuels Data Center: Renewable Identification Numbers,* accessed July 3, 2025, https://afdc.energy.gov/laws/RIN.html.

4.6.3. Opportunities for State Action

New York State could create programs to facilitate both pilot projects for small-scale systems that incorporate new and innovative technologies for electricity or RNG generation, as well as large-scale community anaerobic digestion projects for multiple farms and food waste feedstocks. A program for small-scale anaerobic digestion could pilot and demonstrate new and innovative technologies for the use of biogas and RNG. For example, linear generator systems could potentially be used in small to large scale systems to cost effectively produce electricity from dairy anaerobic digestion.[55] Large-scale community digestion projects may allow many smaller facilities to participate in a digestion project. These centralized anaerobic digestion systems could be co-located with hard to electrify/decarbonize industrial/food processing campuses. Many of these facilities currently require natural gas for sustained high-temperature process heating or treating raw materials. Much of this natural gas usage could potentially be replaced by lower carbon RNG**.**

Most recently, digesters built in New York State were driven mainly by market-based incentives from the California LCFS or the federal RFS RINs value. These systems do not intake food waste but could do so—with an appropriate incentive structure. A program could be created to spur a market for RNG in New York State. Industrial facilities could purchase this RNG to ensure a predictable pricing structure in the long term. Due to New York State's methane goals and the Food Donation and Food Scraps Recycling Law, a program could encourage the addition of food waste. These systems could create a steadier supply of biogas, farmers could receive tipping fees, and energy developers could enter into a long-term contract with an industrial facility in the same region.

Recommendations

- **NYSERDA, in coordination with AGM, should continue to support research, development, demonstration, and deployment of RNG, electricity, and biogas production from on-farm waste sources**, such as co-digestion of anaerobic manure and food waste for strategic and limited use.
- **NYSERDA, in coordination with AGM and DPS, should facilitate pilot projects for small-scale digestion systems** that incorporate innovative technologies that maximize production of electricity, biogas, or RNG, while also maximizing emissions reductions.
- **NYSERDA, in coordination with AGM, should support applied research and demonstration projects for community anaerobic digestion for multiple farms and food waste supplies** for use locally or regionally for difficult-to-electrify end uses.

[55] Simpson Adam and Keith Davidson, *High-efficiency and Ultra-low Emissions Linear Generator Demonstration Project in Southern California*, California Energy Commission, May 2024, https://www.energy.ca.gov/publications/2024/high-efficiency-and-ultra-low-emissions-linear-generator-demonstration-project.