

Chapter 12. Buildings

12.1 State of the Sector

Overview

New York’s residential and commercial buildings sector encompasses over 6 million buildings, which are home to 7.4 million households and include over 5 billion square feet of commercial and institutional space where New Yorkers work, learn, gather, and access essential services. The State’s large geography, varied climate, and vibrant economy drives a diverse buildings mix, as discussed further below.

Statewide, New York’s residential and commercial buildings are older than the national average, pointing to opportunities for upgrading buildings in ways that improve both quality of life and energy performance. In addition, nearly half (48%) of households statewide are low- to moderate-income (LMI) households, underscoring the importance of careful attention to housing and energy affordability.

Residential and commercial buildings use energy for heating, ventilation, and air conditioning (HVAC), water heating, lighting, refrigeration, cooking, computer and office equipment, and other small appliances. Direct greenhouse gas (GHG) emissions from the buildings sector come from burning fossil fuels onsite in residential and commercial buildings, primarily for space and water heating, and associated upstream emissions. This chapter addresses strategies for reducing GHG emissions attributable to residential and commercial buildings, whereas strategies for mitigating emissions attributable to industrial facilities are addressed in *Chapter 14. Industry*.

Emissions Overview

The buildings sector was the largest source of emissions in 2019, responsible for 32% of emissions statewide, which includes the combustion of fossil fuels in residential (34%) and commercial buildings (19%), emissions from imported fuels (33%), and hydrofluorocarbons released from building equipment and foam insulation (14%). The fuels used in buildings today include fossil natural gas, distillate fuel (e.g., heating fuel oil #2), wood, propane, kerosene, and residual fuel.

Decarbonizing building operations describes the reduction or elimination of GHG emissions from building end uses through energy efficiency improvements to reduce energy demand and through switching from equipment and systems powered by burning gas, oil, or other fossil fuels to highly efficient equipment and systems powered by zero-emission energy sources. In addition, embodied carbon associated with building construction can be reduced through building reuse and through using lower-carbon materials or carbon-sequestering products.

The integration analysis indicates that energy efficiency and managed electrification in buildings will be critical to meet New York State’s GHG emissions limits under the Climate Act. All scenarios modeled in the integration analysis include rapid adoption of high-efficiency heat pumps so that one to two million energy-efficient homes use heat pumps by 2030, and by 2050, the large majority of buildings statewide use electric heat pumps for heating, cooling, and hot water. Switching from fossil fuels to heat pumps for heating and hot water will immediately and significantly reduce GHG emissions and criteria pollutants from buildings (as powered by the State’s electric grid today). As the State advances toward a zero-emission electricity sector by 2040, electrification will enable buildings to operate with virtually zero emissions. To manage the impacts of widespread electrification on the State’s electric grid, it also will be essential that buildings make significant investments in energy efficiency, install a diverse mix of heat pump technologies, and adopt smart controls, energy storage, and other load flexibility measures. As modeled in the integration analysis scenarios, widespread improvements to building envelopes (air sealing, insulation, and replacing poorly performing windows) will reduce energy demand from the buildings sector by 30% to 50% by 2050. The adoption of ground-source (or geothermal) heat pumps (GSHPs) and installation of heat pumps with fuel backup further reduce the amount of electricity needed on the coldest days of the year, relative to air-source heat pumps (ASHPs) with electric resistance backup. The integration analysis finds that rapid and widespread building efficiency and electrification is needed and supported by the strategic utilization of alternative fuels.²¹⁰

Electrification of space and water heating with high-efficiency heat pumps is a viable approach to decarbonizing operations for nearly all types of buildings in New York. Modern heat pumps that work in very cold weather are commercially available and able to keep homes and businesses safe and comfortable year-round, as long as they are properly chosen, sized, installed by appropriately trained workers, and paired with an energy-efficient building envelope and HVAC system design. Electrically powered heat pumps circulate refrigerant to move heat from one place to another – typically between indoors and the air, ground, or water outside. GSHPs perform well in extreme temperatures without the need for electric resistance or fuel backup since heat is exchanged between the building and stable ground temperatures via an underground piping system. Cold climate ASHPs also work efficiently in New

²¹⁰ See Appendix G: Integration Analysis Technical Supplement. Scenario 2 (called “Strategic Use of Low-Carbon Fuels”) modeled in the integration analysis projects that 20% of installed heat pumps are GSHP and 80% are cold climate ASHP, of which one in 10 air source heat pumps (ASHPs) are modeled to use fuel backup to meet heating demands during the coldest 5% of hours. In this scenario, renewable natural gas (RNG) is used in the buildings sector, assuming a 9% RNG blend in gas pipelines by 2030 and 100% RNG to meet dramatically reduced gas demand in buildings by 2050. Green hydrogen use is limited mostly to transportation, industrial purposes, and electricity reliability in this scenario, though a small amount of hydrogen is used to power the Con Ed district system by 2050, with steam demand reduced by about 66% as many existing customers electrify in whole or in part.

York's climate, but in very cold outdoor conditions both their heating capacity (output) and efficiency (coefficient of performance) are reduced, and supplemental heat may be used. At a district or community-scale, underground pipes can be installed alongside other infrastructure to distribute thermal energy among multiple buildings; these thermal energy networks can recycle waste heat among diverse building types, provide load smoothing, and drive economies of scale. Compared with fossil fuel or electric resistance heating systems, ASHPs are two to three times more efficient, and GSHPs are three to five times more efficient on a seasonal basis; even higher efficiencies are possible through heat recovery and thermal energy networks.

Cold climate ASHP systems, GSHP systems, and thermal energy networks have different upfront costs, operational costs, seasonal efficiency performance, and impacts on electric peak load during the coldest hours. The integration analysis modeled a high ground source/district loop heat pump system sensitivity to examine how more widespread use of ground source heat pumps and district geothermal thermal energy networks could help reduce electric grid system impacts from electrified space heating, while reducing GHG emissions by substituting clean thermal energy sources for fossil fuel heating systems. It showed that if energy efficiency upgrades lag and ASHP installations perform poorly during very cold hours, then energy use and electric system costs would increase; or alternatively in this scenario, more GSHPs/thermal energy networks could be installed at a higher cost that is approximately balanced out by electric system savings.²¹¹ Lower demand from the buildings sector with more GSHPs and thermal energy networks would lead to lower electric system investments in firm capacity, battery storage, renewables, and the distribution grid. Ongoing analysis is warranted to monitor the relative cost trajectories of GSHP and district thermal energy networks versus electric peak costs.

Regional differences in New York also warrant ongoing consideration as technologies, markets, and policies evolve to enable the transition to an efficient, electrified building stock. New York's downstate region (Long Island, New York City, and Westchester County) is characterized by dense urban areas and a mixed climate (Climate Zone 4A, mixed humid). These cities and towns often have higher costs for construction and real estate, more multifamily housing and leased space, and taller buildings with denser occupancy. Median household incomes are typically higher in downstate counties than in upstate New York; however, Bronx County has the lowest median household income and the highest poverty rate of any county in the state (U.S. Census Bureau, American Community Survey 5-Year Estimate, 2016-2020).

²¹¹ See Appendix G: Integration Analysis Technical Supplement.

Inequality is high in New York City, where nearly one in five residents lives in poverty and over 40% of the population lives in poverty or near poverty.²¹²

Challenges to installing heat pumps in downstate New York are high installation costs, high electricity costs, the provision of gas service lines and extensions of gas mains at no or low cost to individual new customers, and uncertainty on how to design systems for existing high-rise buildings. This milder climate downstate allows for smaller heating systems, and single-family homes can use heat pumps as a whole-home solution without supplemental heat. Larger multifamily, mixed-use, or complex commercial buildings may have logistical constraints (e.g., limited roof area) that result in heat pump systems needing supplemental heat (e.g., electric resistance or pre-existing gas-fired system) on the coldest days. However, it is anticipated that supplemental heat will be phased out as envelopes are improved and heat pump technology advances to meet the needs of existing high-rises. Large buildings in New York City that purchase Con Edison's district steam for heating and hot water may prioritize system optimization, energy recovery, and partial electrification to minimize steam consumption in advance of the potential decarbonization of the district steam system.

The upstate region is characterized by suburban and rural communities, as well as small and moderate-sized cities, with cooler climates (Climate Zones 5, cool-humid and Zone 6, cold-humid). These smaller cities, towns, and villages have lower cost real estate and more single-family homes and low-rise buildings. Median incomes are typically lower than in downstate New York, with those in the Southern Tier being among the lowest in the state. In the Southern Tier and in the mostly rural and suburban counties in the Mohawk Valley and the North Country regions, low-income households are more likely to live outside census tracts that are geographically designated as Disadvantaged Communities.²¹³

Challenges to installing heat pumps in upstate New York are high installation costs, the provision of gas service lines and extensions of gas mains at no or low cost to individual new customers, limited availability of equipment and trained installers and contractors, and uncertainty on how to design efficient systems that can handle sub-zero temperatures without supplemental heat. In addition, rural areas with above-ground electric wires are more vulnerable to prolonged power outages in winter storms; while

²¹² The Mayor's Office for Economic Opportunity. 2021. New York City Government Poverty Measure 2019. Available at <https://www1.nyc.gov/site/opportunity/poverty-in-nyc/poverty-measure.page>

²¹³ Based on New York State's Draft Disadvantaged Communities Criteria. December 2021. See the "Draft Disadvantaged Communities Criteria Overview Fact Sheet" available at <https://climate.ny.gov/disadvantaged-communities-criteria/>.

furnaces and boilers also require electricity to operate, a heat pump system requires significantly more power (watts) to run, pointing to the need for resilience solutions that go beyond a portable generator. However, the upstate region also has certain advantages that may help transition these homes and businesses to heat pumps. First, homes and buildings upstate are likely to have ample outdoor space for ASHP outdoor units or GSHP ground loops. Second, where gas infrastructure is less developed, as in many rural areas and on Long Island, New Yorkers heating with delivered fuel oil or propane can benefit from significant energy bill savings by switching to an energy-efficient heat pump. Third, New York's upstate region has the cleanest electricity in the country.²¹⁴

In New York's coldest northern and mountainous regions, some homes that install cold climate ASHPs may need supplemental heat (wood, home heating oil, propane, or gas) for the coldest days to maintain comfort, avoid oversized heat pumps that lead to inefficient operation, and offer a backup source of heat during a power outage (paired with a generator as needed). Counties in the North Country, Mohawk Valley, and Capital regions are the coldest in New York.²¹⁵ Heating systems there need to keep buildings warm in winter temperatures that fall below zero (0°F), a design temperature at which available cold climate ASHP products tend to be installed with supplemental heat. The U.S. Department of Energy's ongoing Residential Cold Climate Heat Pump Technology Challenge is working in partnership with the U.S. Environmental Protection Agency, Natural Resources Canada, heat pump manufacturers, and other stakeholders to accelerate the development and commercialization of next-generation cold climate ASHPs, including products that are optimized for -15°F (-26°C) operation, which like GSHPs would meet consumer comfort, safety, and efficiency needs in even the coldest New York regions.

Vision for 2030

By 2030, one to two million energy-efficient homes should be electrified with heat pumps, and heat pumps should provide space heating and cooling for 10% to 20% of commercial space statewide. Heat pumps should become the majority of new purchases for space and water heating by the late 2020s. From 2030 onward, more than 250,000 New York homes and thousands more commercial buildings each year are expected to be retrofitted or constructed to be energy-efficient and to install heat pumps for primary

²¹⁴ Carbon dioxide equivalent emissions on a 100-year basis in the eGrid region NPCC Upstate New York (NYUP) were 234.5 pounds of CO₂e per megawatt hour of electricity produced in 2020. Emissions from the next cleanest eGrid region California (CAMX) were 515.5 pounds of CO₂e per megawatt hour that year. U.S. Environmental Protection Agency. https://www.epa.gov/system/files/documents/2022-01/egrid2020_summary_tables.pdf

²¹⁵ Based on the 99% Heating Design Temperature (°F) by county in the ASHRAE 2013 Manual J Design Conditions 8th Edition.

heating, cooling, and hot water, which is more than a tenfold increase from annual adoption today. This rapid market growth is projected to generate more than 100,000 new jobs in energy-efficient construction and clean heating and cooling. Public support for job growth and training in electrification and energy efficiency services will provide both new and incumbent workers with opportunities in the clean energy economy (see Table 10 and Strategy B8), while in-state engineering companies and manufacturers expand innovation and capacity to serve the growing New York and regional markets.

To achieve this dramatic growth, New York should invest in a significant scale-up of financial support for energy-efficient building envelope upgrades and electric heat pump systems, with priorities afforded to Disadvantaged Communities. State codes should require new construction to be highly efficient, zero-emission, and resilient to the effects of climate change. State regulations should be in place to phase out fossil fuel use in existing buildings by requiring zero-emission equipment and appliances at the time of replacement and by setting energy efficiency performance standards for large existing buildings. These regulations will send a clear policy signal, with compliance dates that allow regulated entities to plan and build capacity while regulators protect households from cost burdens. Utility price signals and technological innovation also should support expansion of grid-interactive buildings, energy storage, and other demand-side solutions for load shifting, reducing the need to operate peaker power plants and to build additional grid capacity. Throughout this transformation and through the strategies in this Scoping Plan, LMI households and frontline communities will need to be protected from displacement and threats to affordability.

Vision for 2050

By 2050, 85% of homes and commercial building space statewide should be electrified with energy-efficient heat pumps and thermal energy networks. New York should have advanced a managed, phased, and just transition from reliance on fossil natural gas in buildings to a clean energy system (see *Chapter 18. Gas System Transition*). Embedded subsidies for fossil fuels will have been eliminated, and energy-efficient, zero-emission buildings will have become the most cost-effective option in a clean energy economy that supports secure jobs and demonstrates leadership in innovation. Investments in research and development will have brought affordable batteries and thermal storage, grid-interactivity, ultra-low global warming potential (GWP) refrigerants, and advanced technical solutions for the hardest-to-electrify building types to market. All New Yorkers will benefit from a just transition that supports vibrant, healthy communities and repairs structural inequalities in access to housing, credit, employment, economic opportunities, environmental resources, and a clean and healthy environment.

Table 10. Sector Spotlight: Timelines for a Just Transition in the Buildings Sector

- The JTWG Jobs Study found that residential HVAC, residential shell, commercial HVAC, and commercial shell subsectors will experience the most growth in clean energy jobs, with installation and repair jobs comprising almost two-thirds of all jobs added by 2030. Activities like heat pump installation and weatherization work will employ construction laborers, HVAC workers, electricians, plumbers, pipefitters, and insulation workers in local communities statewide.
- In scenarios modeled in the integration analysis, fuel consumption in the buildings sector is modeled to decline by roughly 33% by 2030 and 58% by 2035. Electric heat pumps are modeled to grow rapidly from a niche market to comprise the majority share of heating and hot water system sales from 2028 onward, and nearly all heating and hot water system sales by 2035. As compared with business-as-usual, energy-efficient building shell installations are modeled to more than triple by 2025 and to be six times higher by 2030.
- The 2020s thus represents a key period for job growth and training for workers who are doing energy efficiency and electrification work in the buildings sector. Gas distribution jobs are modeled to roughly stay flat through 2030, before declining in the 2030s, whereas heating oil jobs will decrease sooner.
- With legislation passed and a new regulatory regime under development, gas distribution workers will have the remainder of the decade to learn about and get trained on community and utility thermal energy network systems at-scale before gas distribution employment is projected to drop-off – as one pathway to utilize transferrable skills.
- As described in *Chapter 7. Just Transition*, the State should conduct prospective market assessments and analyses on the detailed occupations that will support job growth across the residential and commercial buildings sectors. Market analysis on these occupations should include an assessment of wraparound service needs, career pathways, and skills transferability for new and existing buildings workers, and should inform the scale-up of workforce development and training.
- Coordination across the New York State Energy Research and Development Authority (NYSERDA), New York State Department of Labor (DOL), and the Office of Just Transition, as well as direct engagement with labor unions and Registered Apprentice programs, is a vital part of understanding and responding to these market needs and to ensuring trained installers.

Existing clean energy jobs:	165,200	Potential job growth by 2030:	+135,700
		2040:	+197,600
Existing fuels jobs:	13,600	Potential job loss by 2030:	-2,600
		2040:	-8,000
		Potential net job creation by 2030:	+133,100
		2040:	+189,600

Note: Job impact data from JTWG Jobs Study (Scenario 2 Initial Employment Outputs), rounded to the nearest hundred. Jobs figures here may be partial due to differences in sectoral breakdown between Scoping Plan Chapters and Jobs Study; additional analysis found in the Jobs Study.

Existing Sectoral Mitigation Strategies

Catalyzing energy efficiency and electrification of space and water heating in buildings is a pillar of New York’s climate and equity agenda. The New Efficiency: New York strategy demonstrates the State’s commitment to reducing energy waste, fossil fuel use, and GHG emissions in the buildings sector, and doing so in a manner that advances equity, creates, and transitions to clean energy jobs in communities statewide, supports energy affordability, prioritizes benefits to Disadvantaged Communities, and expands access to comfortable, healthy, and energy-efficient homes and businesses. New York invests over \$1 billion in public funds annually for State- and utility-administered grant and market development programs focused on energy-efficient buildings. This includes a coordinated, statewide framework to

benefit LMI New Yorkers and the launch of the NYS Clean Heat initiative. The State's clean energy workforce training initiative helps to equip the current and future workforce while increasing industry diversity and job opportunities in line with a just transition. Another long-standing priority is catalyzing innovation and bringing leading technologies and companies to New York, for example, through public-private partnerships that spur scalable demonstration projects for visionary, low-carbon buildings.

New York's 2022–2023 State Budget includes a \$25 billion, five-year housing plan that will create or preserve 100,000 affordable homes across New York with a focus on economic recovery, social justice, improved digital connectivity, and climate action. The plan also provides for electrification and energy efficiency work to be ready for electrification in an additional 50,000 homes. Under the plan and its Sustainability Guidelines issued in 2022, New York State Homes and Community Renewal (HCR) is working to produce high quality affordable housing with improved building envelope performance and significantly lower or zero on-site GHG emissions from fossil fuel burning appliances. As noted in the Barriers and Opportunities Report, addressing the climate and housing crises in tandem will be more effective than addressing them separately.

The Advanced Building Codes, Appliance and Equipment Efficiency Standards Act of 2022 bolsters New York's regulatory and policy environment to support energy efficiency and GHG reduction strategies in buildings along with expanded appliance standards. Additionally, the Utility Thermal Energy Network and Jobs Act requires the Public Service Commission (PSC) to develop a regulatory structure for utility thermal energy networks for heating and cooling homes, and utilities to launch pilot projects. The New York State Department of Environmental Conservation (DEC) also has adopted regulations that prohibit certain hydrofluorocarbons (HFCs) in specified uses (such as commercial refrigeration and large air-conditioning equipment) (6 NYCRR Part 494). Executive Order Number 22 builds upon progress and sets new goals for the State's lead-by-example sustainability and climate directives for State agencies.

Even as New York demonstrates leadership, the speed and scale of action to decarbonize buildings must accelerate dramatically. Meeting New York's ambitious climate requirements and goals in the residential and commercial buildings sector requires multi-pronged policy action, including new regulations and a major scale-up of public investments, to break through thorny market barriers and to manage significant risks to achieving the necessary equity and emissions reduction outcomes. The strategies recommended for the buildings sector work to achieve the Climate Act's energy efficiency requirement for 2025, and critically, to spur more rapid and widespread end-use efficiency and electrification in buildings.

Key Stakeholders

Collaboration is critical among multiple State agencies, local governments, the federal government, consumers, nongovernmental organizations (NGOs), New York’s electric and gas utilities, affected workers and unions, and industry actors including the construction and building improvement industry, real estate actors, and clean energy businesses. Stakeholder engagement must include meaningful involvement of households, businesses, and community-based organizations from frontline communities, LMI households, public housing authorities and residents, environmental justice organizations, and affordable housing groups.

12.2 Key Sector Strategies

The key strategies within this sector are organized into four themes, as shown in Table 11. As described there in greater detail, the labor standards discussed in *Chapter 7. Just Transition* are intended to apply throughout this Scoping Plan, including for the buildings sector, as a means of promoting good, family-sustaining, union jobs accessible to all New Yorkers and achieving a true just transition.

Table 11. Buildings Sector Key Strategies by Theme

Theme	Strategies
Adopt Zero-Emission Codes and Standards and Require Energy Benchmarking for Buildings	<ul style="list-style-type: none"> B1. Adopt Advanced Codes for Highly Efficient, Zero-Emission, and Resilient New Construction B2. Adopt Standards for Zero-Emission Equipment and the Energy Performance of Existing Buildings B3. Require Energy Benchmarking and Disclosure
Scale Up Public Financial Incentives and Expand Access to Public and Private Low-Cost Financing for Building Decarbonization	<ul style="list-style-type: none"> B4. Scale Up Public Financial Incentives B5. Expand Access to Public and Private Low-Cost Financing B6. Support Development of Thermal Energy Networks B7. Align Energy Price Signals with Policy Goals
Expand New York’s Commitment to Market Development, Innovation, and Leading-by-Example in State Projects	<ul style="list-style-type: none"> B8. Invest in Workforce Development B9. Scale Up Public Awareness and Consumer Education B10. Support Innovation B11. Reduce Embodied Carbon from Building Construction
Transition from Hydrofluorocarbons	<ul style="list-style-type: none"> B12. Advance a Managed and Just Transition from Reliance on Hydrofluorocarbon Use

As a cross-cutting strategy, New York should establish a 2030 target for the buildings sector that is commensurate with the level of electrification and efficiency needed to achieve the State’s climate goals and should then monitor progress to ensure that policies and programs are in place to achieve this target.

Adopt Zero-Emission Codes and Standards and Require Energy Benchmarking for Buildings

When new buildings are constructed, clear and cost-effective opportunities exist for decarbonizing building operations and reducing embodied carbon emissions. Fulfilling these opportunities will have long-term impacts throughout the construction market. Advanced codes will minimize the near-term installation of additional fossil fuel equipment and ensure that new buildings going forward are resilient to the impacts of climate change. State entities will lead by example in this regard pursuant to Executive Order 22, which requires sustainable procurement specifications and that from 2024 onward all new construction submitted for permitting by affected State entities shall avoid building systems or equipment that can be used for the combustion of fossil fuels (to the fullest extent feasible with allowance for necessary use for backup emergency generation and process loads).

In existing buildings, the best opportunity for energy improvements is during routine home and capital improvements and when HVAC equipment is retired from service. Since the useful life of HVAC equipment ranges from 15 to 30 years, seizing the opportunities to electrify New York's over 6 million buildings by 2050 requires near-term action.

Electrification and efficiency improvements in existing buildings present a larger challenge of sheer scale. The New York State Energy Research and Development Authority (NYSERDA), DEC, and New York State Department of State (DOS) should work together to adopt regulatory requirements that will bring about the end of fossil fuel combustion in buildings by prohibiting replacement of fossil fuel equipment at end of useful life, coordinated with action taken by the PSC and New York State Department of Public Service (DPS) to regulate gas utilities and with New York State Department of Labor (DOL) and the Office of Just Transition to promote workforce development. Building performance standards also will compel efficient operation of buildings and capital investments in high-performance building envelopes and efficient HVAC systems.

These regulations and complementary market support must be thoughtfully designed to drive adoption of highly efficient heat pump systems that are coupled with measures that reduce thermal energy demand, rather than uptake of inefficient alternatives such as electric furnaces or boilers. If not managed, there is a risk that consumers could install inefficient electric equipment in inefficient buildings; this would result in higher ongoing electric bills for building occupants and, if widespread, excessive system peak electricity demands that would be extremely costly to meet. Put simply, policy action to decarbonize buildings must address both energy efficiency and electrification.

Advancing equitable outcomes for lower-income households and Disadvantaged Communities also demands careful design of regulatory actions and complementary strategies. The Climate Justice Working Group (CJWG) expressed support for regulatory sunset dates for combustion equipment in buildings provided that these regulatory actions are coupled with additional goals and public investments to benefit Disadvantaged Communities. This Scoping Plan endorses this condition for regulatory action and proposes complementary strategies to minimize the risk of negative impacts on lower-income and vulnerable households while prioritizing investments that benefit affordable housing and Disadvantaged Communities.

For buildings, resilience is the ability of the building systems to be prepared for, withstand, adapt, and quickly recover from disruptions such as severe weather, power outages, and chronic changes to the climate. Given the increased frequency of extreme weather events, which also increase the probability and scale of electric grid outages, it is critical to consider and manage risks to resilience when electrifying the heating systems of buildings. Flexible technologies and grid-interactive appliances that actively manage building energy consumption can contribute to improved grid reliability and resilience. At the building level, high-performance building envelope features prolong passive survivability. Additional resilience strategies include on-site renewable energy that is able to operate independent of the grid, energy storage, and electric vehicle (EV) battery-interactive capabilities. The resilience of building and energy systems is a priority area for public investment in research, solution development, and demonstration projects.

B1. Adopt Advanced Codes for Highly Efficient, Zero-Emission, and Resilient New Construction

This Scoping Plan recommends adopting zero-emission State codes as an important policy lever that can contribute to the rapid transformation presented in the integration analysis. New York City's Local Law 154 of 2021 sets carbon dioxide (CO₂) emission limits that effectively prohibit fossil fuel combustion equipment for heating, hot water, and most appliances in new construction, beginning in 2024 for lower-rise residential, and by 2027 for commercial and large multifamily. The State should adopt comparable codes, applicable to all municipalities, to prohibit fossil fuel combustion systems and fossil fuel combustion equipment in new construction.

Components of the Strategy

The Advanced Building Codes, Appliance and Equipment Efficiency Standards Act of 2022 requires the New York State Energy Conservation Construction Code (Energy Code) to be updated to achieve energy efficiency and GHG emission reductions in support of the Climate Act. DOS and the New York State Fire

Prevention and Building Code Council (Code Council) – in consultation with DEC, NYSERDA, other State entities including the Office of Just Transition and other Climate Action Council (Council) agencies, local governments, and interested stakeholders – should adopt codes and standards for new construction (and additions and alterations as applicable) of residential and commercial buildings to be built to a highly efficient, zero-emission standard, and incorporate requirements for building resilience. In coordination, the PSC and DPS should work with New York’s electric and gas utilities to account for updates to building codes and standards in their distribution system planning and infrastructure investments and with regard to relevant occupational licensing requirements, while continuing to enhance the associated tools and data available to customers and stakeholders.

- **Update regulations to improve energy efficiency and building resilience:**
 - 2025: Adopt highly efficient State Energy Code for new construction (and additions and alterations as applicable) of residential and commercial buildings to require highly insulated thermal performance and air tightness; electric readiness for space conditioning, hot water, cooking, and dryers; EV readiness where parking is provided; and solar wherever the opportunity exists and is feasible (with allowances for green roofs and other uses of rooftop space).²¹⁶ These requirements should apply to construction of buildings that file for a building permit starting in 2025.
 - 2025: Adopt additional building resilience features into State codes for new construction (and additions and alterations as applicable) to require energy storage or on-site renewable generation that is able to operate independent of the grid, with specifications for sizing to meet resilience demands.²¹⁷ Also require grid-interactive electrical appliances as feasible (such as batteries and hot water heaters) to support grid reliability and eliminate barriers to residential adoption of GSHPs. These requirements should apply to construction of buildings that file for a building permit starting in 2025.
- **Adopt regulations to end on-site emissions:** DOS, NYSERDA, and the Code Council should advance code provisions that prohibit fossil fuel combustion equipment for space conditioning,

²¹⁶ In the context of building energy codes and standards, residential buildings include one- and two-family attached or detached dwellings, and multifamily buildings three or fewer stories above grade. Commercial buildings are all buildings other than low-rise residential buildings, including multifamily high-rise residential buildings over three stories in height above grade. Buildings containing both residential and commercial spaces are generally considered separately with respect to compliance with model energy codes.

²¹⁷ NYSERDA is conducting research to understand building load profiles for thermal comfort/safety in order to recommend standards for battery or thermal storage in instances of power outages.

hot water, cooking, and appliances. Until such codes are adopted statewide, NYSERDA should encourage local governments to adopt NYStretch Energy Code.

- 2025: Adopt State codes that prohibit building systems or equipment used for the combustion of fossil fuels in new construction statewide of single-family and low-rise multifamily residential buildings having three stories or less (and additions and alterations as applicable). These requirements should apply to construction of buildings subject to residential codes and standards that file for a building permit starting in 2025.
- 2028: Adopt State codes that prohibit building systems or equipment used for the combustion of fossil fuels in new construction statewide of multifamily residential buildings having four stories or more and commercial buildings (and additions and alterations as applicable). These requirements should apply to construction of buildings subject to commercial codes and standards that file for a building permit starting in 2028.
- **Support local code enforcement and facilitate clear permitting processes for building decarbonization technologies:** The State also should provide additional funding for local code enforcement (staff, training, materials) and a credentialing program for Energy Code inspectors. NYSERDA should continue to offer training and resources to help local Authorities Having Jurisdiction and the building industry, including frontline installers, understand and meet energy code requirements. For battery energy storage systems, geothermal wells for GSHP and thermal energy networks, and other building decarbonization technologies that may experience permitting processes and challenges that vary by locality, NYSERDA, other relevant State agencies, and partners should work to facilitate clear permitting processes, for example by providing resources and tools, facilitating peer-to-peer sharing of good practices, and helping to reduce the learning curve for Authorities Having Jurisdiction and the building industry.

B2. Adopt Standards for Zero-Emission Equipment and the Energy Performance of Existing Buildings

Among the 6.1 million existing buildings in New York, single-family homes and other low-rise residential buildings (up to three stories) are relatively straightforward to upgrade and convert to zero-emission heating and hot water systems using residential-sized GSHPs or ASHPs that are suited to heat efficiently in cold climates. Larger, complex building typologies may necessitate more flexibility in both timing and technological solutions, and affordable housing will need compliance paths that protect tenants.

Technical solutions to retrofit high-rise multifamily and commercial buildings are advancing rapidly. New York is supporting research, development, and demonstration (RD&D) activity that ranges from demonstrating heat pump solutions to maintain centralized heating and hot water systems in large buildings (transferring technology now in use in Northern Europe and Canada) to fostering the development of small, cold climate packaged/window heat pumps that will be affordable for high-rise multifamily buildings. In large and complex commercial and institutional buildings, phased electrification retrofits also offer a feasible, resource-efficient path. Steps include integrating electrification with near- and long-term capital planning (including tenant lease turnover), reducing space conditioning loads and recovering waste heat, and converting steam to hydronic distribution to accommodate the lower temperature hot water produced by heat pumps. For central plant equipment, feasible heat pump installations may meet the large majority of the building's heating load while maintaining a supplemental fuel heat source for peak conditions, with a plan to phase it out over time if possible.

For existing buildings, New York should require the sale and installation of energy-efficient and zero-emission new equipment for space heating and hot water, when replaced at the equipment's end of useful life in residential and commercial buildings.²¹⁸ The State should further require efficiency upgrades for large buildings through a building performance standard. The development of codes, standards, and regulations should include further analysis of societal and consumer benefits and costs, as well as provide for compliance pathways for existing buildings to account for extenuating circumstances (including, but not limited to, housing affordability-related matters and health and safety/emergency needs).

Components of the Strategy

NYSERDA, DEC, and DOS should work together to implement standards for building performance, appliances, and equipment. These regulations should be coordinated with action taken by the PSC and DPS to regulate gas utilities and in consultation with DOL and the Office of Just Transition to support workforce development actions in a manner that is responsive to industry needs and consistent with *Chapter 7. Just Transition*. As identified below, the State should enact legislation to enable these regulatory actions.

- **Regulations to improve energy efficiency in existing buildings:** New York's Advanced Building Codes, Appliance and Equipment Efficiency Standards Act of 2022 enables

²¹⁸ The Integration Analysis assumes that the average useful life for hot water and space heating equipment in residential and commercial buildings ranges from 15 to 18 years. In practice, equipment may be kept in service for significantly longer timeframes.

NYSERDA, with DOS, to establish and enforce efficiency standards for appliances and equipment that are sold, leased, or installed in New York in order to promote energy reduction, water conservation, GHG reduction, and/or increased demand flexibility. As soon as possible, the State should further enact legislation that enables the establishment and enforcement of energy efficiency standards for buildings, in coordination with NYSERDA, DOS, and local code officials for development and enforcement.

- As soon as possible: Adopt energy efficiency standards for appliances that are exempt from federal preemption (such as computers, monitors, fluorescent and LED light bulbs, and air purifiers).
 - 2027: Require existing properties larger than 25,000 square feet (sq. ft.) to upgrade to energy-efficient lighting in all commercial spaces and common areas.
 - 2030: Adopt an energy efficiency performance standard for existing commercial and multifamily properties larger than 25,000 sq. ft. (with distinct accounting for the electrification of heating and other end uses). Compliance standards should be informed by statewide benchmarking data and align with New York City's Local Law 97 and across State and local government requirements where appropriate. A phased-in building performance standard could become effective starting in 2027.
- **Zero-emission standards to phase out fossil fuel combustion equipment:** NYSERDA and DEC should collaborate on developing and setting zero-emission standards for building equipment, in coordination with DOS for enforcement. DEC should set and enforce zero-emission standards tied to the operation of large fuel burning equipment. In addition to the considerations required by the Climate Act and the State Administrative Procedures Act (SAPA), for a full public engagement and comment process that considers consumer costs and benefits as well as technical and industry readiness and the ability of the electric system (generation, transmission, and distribution) to meet electricity demand with widespread electrification, building-level resilience and potential for future connection to a clean thermal energy network will also be considered in the development of these emission standards. Relevant considerations are also outlined in the Gas System Transition Plan Framework (Table 18). Such standards shall ensure that compliance will not disproportionately burden Disadvantaged Communities. These zero-emission standards across a range of equipment types should apply starting in the years noted below.
 - 2025: The State should review and consider modifications to existing statutory provisions that relate to utilities providing new gas service to existing buildings as part of a

- comprehensive plan to end investments in new gas infrastructure in coordination with municipalities.
- 2030: Adopt zero-emission standards that prohibit replacements (at end of useful life) of residential-sized equipment used for the combustion of fossil fuels for heating and cooling and hot water. The standards beginning in 2030 should regulate equipment sized to typically serve single-family homes and low-rise residential buildings with up to 49 housing units.
 - 2035: Adopt zero-emission standards that prohibit replacements (at end of useful life) of large and commercial-sized equipment used for the combustion of fossil fuels for heating, cooling, and hot water. The standards beginning in 2035 should regulate equipment sized to typically serve larger multifamily buildings (having four stories or more or 50 or more housing units) and commercial buildings.
 - 2035: Adopt zero-emission standards that prohibit replacements (at end of useful life) of fossil fuel appliances for cooking and clothes drying.
 - 2035: DEC should adopt zero-emission standards that prohibit fossil fuel use in large fuel burning equipment for heating and domestic hot water. The standards should be enforced under a new emissions enforcement regime of large combustion equipment sized to typically heat buildings 50,000 sq. ft. or more in floor area, thereby requiring early retirement.

B3. Require Energy Benchmarking and Disclosure

Energy consumption benchmarking provides building decision-makers with information to improve building operations and investment decisions, and the data collected statewide will inform building performance standards. Lack of awareness in the market may limit the effective use of benchmarking data. Education will be needed for consumers, brokers, and building owners on how to use the energy usage and benchmarking information.

The State must also mitigate against and monitor for potential harm to Disadvantaged Communities. Disinvestment could occur if disclosure or labeling of energy performance makes properties less attractive to potential renters and buyers, or conversely, demand for efficient buildings could price people out of the market for healthy housing in their community. Adequate technical and financial assistance for LMI homeowners and building owners will be needed in Disadvantaged Communities to scope and finance energy upgrades. As was emphasized by the CJWG, energy affordability is a challenge for many LMI households and required energy disclosure provides important information when buying or renting a home, including ongoing energy costs, which informs decision-making and budgeting. The State should

ensure consistency and alignment across State and local government requirements (such as New York City local laws), including in reporting templates and timeframes.

Components of the Strategy

NYSERDA, DOS, the New York State Department of Taxation and Finance, and the New York State Office of the Attorney General should work together to implement and enforce energy benchmarking and disclosure requirements, in coordination with PSC direction to utilities under its jurisdiction. The State should enact legislation to enable these regulatory actions.

- **Require energy consumption information and disclosures:**
 - 2024: Commence a statewide energy benchmarking and disclosure program that requires owners of multifamily and commercial properties larger than 10,000 sq. ft. to annually report whole-building energy and water consumption data to NYSERDA for public disclosure. NYSERDA should lead implementation, with support from the Department of Taxation and Finance and the Attorney General’s office. Also, the PSC should require electric, gas, and water utilities to provide automatic aggregated whole-building uploads of utility customer data directly to the U.S. Environmental Protection Agency’s (EPA) ENERGY STAR Portfolio Manager.
 - 2025: Require multifamily and commercial properties larger than 25,000 sq. ft. to undertake a comprehensive building energy assessment (audit), to be conducted by appropriately trained workers, at least once every 10 years that evaluates the building’s systems and identifies opportunities to invest in energy efficiency upgrades, electrification or electrification-readiness for building systems, and climate risk with resilience measures. Filing an assessment report with NYSERDA would be required on a cycle established by the State or at the time that a building permit is needed for specified work that must conform to Code, whichever comes first. NYSERDA should lead implementation, in close coordination with DOS and local code officials for development and enforcement.
 - 2025: Require owners of all single-family and multifamily residential and commercial buildings to obtain and publicly disclose, as part of sale or lease listing of a building, housing unit, or commercial space, the prior-year energy consumption of the building, unit, or space (at least 12 consecutive months of energy bill data).
 - 2027: Require owners of single-family buildings to obtain and disclose an energy performance rating (such as a Home Energy Rating System index) as part of sale listing.

Scale Up Public Financial Incentives and Expand Access to Public and Private Low-Cost Financing for Building Decarbonization

A substantial infusion of both public resources and private capital will be needed to pay for the building upgrades necessary to decarbonize buildings, while also expanding access to safe and healthy housing and bolstering resilience to climate impacts. The integration analysis indicates that to meet the Climate Act’s GHG emission reduction requirements, more than 250,000 housing units each year will need to adopt electric heat pumps and energy efficiency measures from around 2030 onward – more than a tenfold increase from current market activity – with a comparable pace of transformation in the commercial sector. Across the residential and commercial buildings sectors, annual investment costs for these upgrades are projected to grow over time from roughly \$5 billion in 2030 to \$30 billion in 2050, based on the incremental cost of building electrification and shell improvements made in each year. This investment will expand jobs in energy efficiency and building electrification in communities statewide and is projected to add 100,000 new clean energy jobs by 2030. This investment remains a fraction of other building-related expenditures in New York, which annually include approximately \$60 billion in buildings investments and over \$30 billion on energy costs across the residential and commercial buildings sectors. Significant opportunity exists to redirect existing spending toward a more sustainable buildings sector.

B4. Scale Up Public Financial Incentives

Financial incentive programs will need to scale up dramatically to motivate millions of homeowners and building owners to install high-efficiency electric heat pumps and make energy efficiency improvements such as sealing air leaks, adding insulation, and using building controls. Building envelope sealing and weatherization measures improve comfort (reducing drafts, cold surfaces, and noise pollution) and reduce risk of pests and mold; moreover, to promote healthy homes, weatherization needs to include appropriate ventilation systems and must take place after any pre-existing safety and health issues (such as mold, mustiness, or high levels of formaldehyde and other air pollutants) are addressed. Replacing an existing heating system with a high-efficiency electric heat pump system that also provides air conditioning and filtration can meet formerly unaddressed or inadequate cooling needs. Although many energy efficiency upgrades improve housing quality and are cost-effective, these projects can be disruptive for occupants or simply not a priority for owners. For most existing homes and buildings, moreover, the current upfront costs of building electrification and related energy efficiency upgrades such as air sealing, insulation, and building controls can be significantly higher than costs for replacing fossil fuel equipment.

For example, for an older single-family home that is otherwise in good condition, the average installed cost for a heat pump for whole-home space heating and cooling paired with an air sealing and insulation upgrade is estimated to be about \$21,000 for a cold climate ASHP and \$40,000 for a GSHP system (before available rebates and tax credits), as compared with roughly \$10,000 or less to replace a fossil fuel boiler/furnace and air conditioner (with no envelope work).²¹⁹ A homeowner who switches from home heating oil to an electric heat pump will see substantial energy bill savings, so that with currently available incentives through NYS Clean Heat and the federal geothermal tax credit, the project payback could be between five to eight years. For many customers now heating with low-cost gas, however, bill savings do not currently offer a clear economic return on investment for adopting a whole-home heat pump. Because of the diversity of stock and pre-existing conditions in multifamily buildings, potential costs vary widely to convert existing apartments to heating and cooling with efficient heat pumps. The average cost of investing in an efficient heat pump is estimated to range from about \$14,000 per apartment unit for an ASHP retrofit in a small multifamily building to \$50,000 per apartment unit for an ASHP paired with a moderate shell efficiency package (including air sealing, roof insulation and double pane windows) in a large multifamily building (before available rebates and tax credits); corresponding incremental costs range from roughly \$10,000 to \$40,000 per unit.²²⁰ In considering consumer benefit-cost and equity impacts, it is further important to recognize that some housing is unsafe and unhealthy due to years of underinvestment, such that costly repairs are needed before making energy improvements.

Given the scale of the challenge, public funding must be used strategically to accelerate market adoption, help LMI consumers, promote transitioning the existing workforce and workforce development that expands skills and job placement, and advance equity. Expansion of financial incentive programs to motivate early adoption in market-rate housing and commercial buildings will be needed for at least the coming decade. This support should target existing buildings more so than new construction and eventually phase out (once efficient, zero-emission codes and standards go into effect), with a longer

²¹⁹ Installed equipment costs reflect weighted average statewide costs sourced from Appendix G: Integration Analysis Technical Supplement Annex 1: Inputs and Assumptions (updated November 18, 2021). Energy cost savings modeled separately, finding that a modest single-family home that switches from oil heating to a heat pump (paired with basic air sealing/insulation) annually saves \$1,200 (NYC) to \$1,700 (upstate) with a ccASHP, or \$1,700 (NYC) to \$2,100 (upstate) with a GSHP. The same home that switches from gas heating (but maintains gas service) sees only a modest annual cost decrease (NYC) or cost increase (upstate) with a ccASHP, or \$700 (NYC) to zero (upstate) annual cost savings with a GSHP.

²²⁰ Installed equipment costs reflect weighted average statewide costs sourced from the Integration Analysis – Inputs and Assumptions Workbook, comparing an air source heat pump to gas heating equipment and room air conditioner (AC); the moderate shell efficiency package is referenced as “basic shell” in the source data and is compared to the “reference shell” cost estimate. The source data also includes installed costs for ground source heat pumps which if paired with a moderate or deep shell efficiency package would sum to a higher range of costs than that provided in the text for air source heat pumps.

timeframe for support for low-income households and, as appropriate, for next-generation technologies as they emerge.

Dedicated financial support programs for LMI households, affordable and public housing, and Disadvantaged Communities are essential to enable these households to make and benefit from energy upgrades that improve housing quality and comfort, with careful attention to impacts on housing and energy affordability. For these households and buildings, grant funding will need to cover most or all the near-term cost premium for building electrification and efficiency upgrades, considering economic realities and to remedy unjust patterns of redlining and underinvestment in Disadvantaged Communities. A major investment of public funding, at a scale and along a timeframe that aligns with the adoption of zero-emission codes and standards, will be needed to decarbonize and improve the quality of housing for LMI households, affordable and public housing, and in Disadvantaged Communities.

It also is critical to ensure that the phase out of fossil fuel equipment in buildings does not increase low-income residents' cost of housing, nor create undue energy burden. In New York, the Home Energy Fair Practices Act and PSC regulations provide comprehensive consumer protections for both residential and non-residential utility customers, including applications for service, service terminations, customer billing, and payment and complaint procedures.²²¹ New York has also established an Energy Affordability Policy that sets the goal of limiting energy costs for low-income households to no more than 6% of their income. The existing low-income energy bill discount programs administered by the major electric and gas utilities should be expanded, and current or future public utility bill assistance programs will need to recognize and adjust for both increased cooling needs as the climate warms and the shift from traditional forms of heating to efficient electrification (using heat pumps that provide both heating and air conditioning). Electrifying rental housing can lead to changes in how energy services such as heating, cooling, and cooking are metered, resulting in transfers of utility costs between building owners and occupants. Over the longer term, regulatory requirements must be coupled with ongoing public financial support for poor and working-class households. Thoughtful policy and programmatic design and coordination of funding sources will be essential to support affordability, safe and healthy housing, consumer protections, and economic opportunities that benefit Disadvantaged Communities.

A salient challenge is marshalling additional public funding, across State, ratepayer, and federal funding and tax credits, at the needed scale, alongside animating the flow of private capital to low-carbon building

²²¹ 16 NYCRR Part 11 (HEFPA) governs residential service and Part 13 governs non-residential service.

construction and improvements. At present, charges levied on electric and gas ratepayers provide the largest source of funding for New York’s energy efficiency incentive programs, with heat pump incentives funded by electric ratepayers specifically. This funding source has the benefit of established precedent and regulatory oversight, which as major new policy initiatives are considered, includes public process and assessment of ratepayer impacts. While there is scope for strategic re-direction and some potential expansion of ratepayer-funded programs, the scale of investment will require a leveraging of multiple sources of funding including other State, federal, and private funding sources. Moreover, the PSC should direct utilities to continue to assess and place priority on investments in clean, distributed energy resources (DERs) (including weatherization and energy efficiency, storage, and electrification of heating) that are comparatively cost-effective ways to reduce peak electric or peak gas demand. Even as these avenues are explored, though, new funding sources beyond ratepayer charges will need to be identified.

In 2022, New York enacted a State Geothermal Income Tax Credit equal to 25% of geothermal system expenditures up to \$5,000 for owner-occupied homes, which helps position New York to take advantage of federal geothermal tax credits. State tax credits could be expanded to further encourage GSHP systems and building decarbonization in multifamily and rental housing, commercial buildings, and thermal energy networks. Two potential economywide State policy mechanisms, cap-and-invest and carbon tax/fee, are discussed in *Chapter 17. Economywide Strategies*. If either policy is implemented and provides a new source of funding for policy actions identified in this Scoping Plan, the housing sector should be a priority area for investing that funding to support both equity and emissions reductions.

Critical opportunities exist to leverage federal funding made available under the federal Inflation Reduction Act of 2022. Long-term tax credits will provide market certainty and make it more affordable for New Yorkers to install decarbonization technologies including energy efficiency upgrades, high-efficiency electric appliances, solar panels, and battery storage systems. Notably, federal tax credits for geothermal heat pump system installations extend through 2032 at rates of 30% of the installed cost, with an additional 10% domestic content bonus credit, stepping down in 2033 and 2034. Additional grants for LMI households for home energy performance-based whole-house rebates (the HOMES Rebate) and for High-Efficiency Electric Home Rebates will support broader adoption and further increase benefits. In the integration analysis work, modeling of these tax credits and LMI formula grants specifically for energy efficiency and heat pumps found that this federal funding could reduce New York’s cost of the transition to an efficient, electrified building stock by \$7 billion or more.

The recommendations below also identify specific opportunities to leverage existing and potentially expanded federal funding, in particular for affordable housing and low-income households. For example, the EmPower New York program and the federal Weatherization Assistance Program both provide no-cost energy efficiency solutions to income-eligible New Yorkers; these programs can help improve the conditions in existing homes, make homes electrification-ready in some instances, and provide a network of contractors and nonprofit community-based organizations to support low-income communities. Scaling up funding and revising the Weatherization Assistance Program guidelines to allow for electrification could better serve Disadvantaged Communities through existing program infrastructure. In addition, around 10,000 multifamily units are built or preserved each year with a combination of federal tax credits and subsidy programs provided by HCR, which has a goal to increase subsidies for the full electrification of that unit production over time.

The CJWG emphasized that regulatory action to phase out fossil fuel equipment in buildings is inadequate without added policy goals and public investments to benefit low-income households and Disadvantaged Communities. The strategies proposed here are consistent with the CJWG’s call to front-load and prioritize public investments in efficient appliances and zero-emission heating, cooling, and cooking equipment in Disadvantaged Communities so that poor and working-class households are not left behind, while safeguarding that building electrification does not increase the housing or energy cost burden on low-income residents. Informed by input from the CJWG, the proposed strategy components include attention to New York’s existing energy affordability goal, the needs of public housing, and the health benefits associated with building decarbonization. The CJWG further called for “clawback provisions” as part of public subsidies to private landlords to defend against rate increases, gentrification, and displacement. This specific recommendation is not reflected in the proposed strategy because such provisions merit careful consideration in program design.

Components of the Strategy

Significant coordination will be needed among State and local agencies and utilities, notably to support low-income households and Disadvantaged Communities, with State leadership from the PSC and DPS, NYSERDA, HCR, New York Power Authority (NYPA), and New York State Office of Temporary and Disability Assistance (OTDA).

- **Scale up incentives for building decarbonization:** The State should scale up direct incentives for weatherization (including sealing of cracks and holes, insulation of attics and walls, replacement or repair of windows and outside doors, and mitigation of energy-related health and

safety issues), additional energy efficiency upgrades, electrification-readiness, and electrification with highly efficient heat pumps and resiliency measures in residential and commercial buildings. In incentive program design, it is important to place emphasis on ease of access to available and relevant resources for consumers and installers, particularly for LMI households and buildings in Disadvantaged Communities that may access resources from multiple programs. Electrification incentives need to be structured and marketed in a manner that motivates replacement of fossil fuel combustion heating systems before equipment failure in order to allow time for good-practice sizing and specification of a heat pump system paired with weatherization and other thermal efficiency measures as appropriate and needed to keep operating costs affordable. Where incentives are offered through utility companies, the State should develop a coordinated statewide program to provide a consistent experience and incentive structure that helps installers reach more customers, with a priority to LMI households and Disadvantaged Communities. Incentives also could include expanded State tax credits, such as the recently enacted Geothermal Income Tax Credit.

- **Align regulatory frameworks:** The State should identify and pursue modifications to regulatory frameworks for energy efficiency, building electrification, and resiliency programs to further align the programs with Climate Act goals and requirements. This includes, but is not limited to, attention to accounting holistically for the societal costs and benefits of building energy upgrades, including health impacts associated with outdoor and indoor air quality and thermal comfort. Additionally, as discussed in *Chapter 18. Gas System Transition*, the State should review and as appropriate bring into alignment with the Climate Act statutory provisions regarding gas service, such as reviewing the provision of gas service lines and extensions of gas mains at no cost to new customers (known as the “100-foot rule”).
- **Design incentive levels and programs to align with value to the energy system and consumers:** While the upfront cost to install GSHP systems and thermal energy networks is higher, geothermal heating and cooling systems are less expensive to operate (lower annual energy bills and maintenance costs), have a longer lifespan compared other types of HVAC equipment, and require less electricity to operate during the coldest peak times compared with ASHP systems. Zero-emission new construction and comprehensive building decarbonization retrofits that include on-site renewable generation plus energy storage likewise will minimize electric grid impact and increase energy bill savings, and will improve building resilience. The value provided to both the energy system and consumers, in particular to low-income and vulnerable households, should be considered in setting incentives. Substantially higher adoption of GSHP systems, thermal energy networks, and on-site energy storage solutions will require

both appropriate State incentives that leverage generous federal tax credits and novel financing and coordination solutions.

- **Prioritize LMI households, affordable housing, and Disadvantaged Communities:** The State should expand dedicated direct incentives and financial support mechanisms for weatherization, energy efficiency, and electrification for LMI households, affordable housing, public housing, and Disadvantaged Communities. This includes developing new partnerships to effectively deliver programs (such as through housing agencies, community development financial institutions, and local community-based organizations), streamlining program enrollment models, and establishing people-centered policies, programs, and funding across local, State, and federal governments, consistent with recommendations and opportunities described in the Barriers and Opportunities Report. It likewise involves adopting inclusive engagement processes that incorporate Disadvantaged Communities and LMI households in program co-design processes, including co-design with and for the most vulnerable New Yorkers. These strategies should account for New York's existing Energy Affordability Policy, which seeks to limit energy costs for low-income households to no more than 6% of their income, as well as a household's cumulative cost burden related to housing, energy, transportation, and healthcare when assessing affordability impacts. Pursuant to Executive Order 22, State entities should prioritize State facilities located in Disadvantaged Communities for energy efficiency and electrification upgrades, which will lower environmental impacts on these communities.
- **Prioritize energy upgrades and pilot new resilience strategies in public housing:** The State should support and accelerate efficiency, electrification, and resilience in public housing, particularly in New York City Housing Authority buildings and in other Public Housing Authority developments statewide, with attention to the special needs of and jurisdictional issues that affect the State's public housing stock. The State should pilot a range of resilience solutions in public housing and housing for vulnerable populations, with learnings shared to inform broader community- and building-level resilience strategies. In doing this, the State should leverage federal and other available funding sources to support community resilience, deeper retrofits, and electrification. Specifically, the State should support resilience centers (or resilience hubs) in public housing developments that meet community needs and gathering space in non-emergencies (childcare and after school programming space) and provide safety and comfort in acute situations, including during power outages. Such centers should include backup power (including solar-storage pilots) for multi-day outages, a basic livable space that is thermally safe while also providing access to sufficient electricity to meet critical needs (e.g., refrigeration for

medications, power for in-home medical processes/equipment, air filters for critical conditions), and community space to coordinate disaster relief.

- **Expand access to community solar:** Under the State’s Solar Energy Equity Framework, NYSERDA will implement a strategy for community solar projects that provide electric bill savings to income-eligible households and/or that benefit affordable housing or public buildings in Disadvantaged Communities, with program rules that direct benefits to low-income residents.
- **Fund non-energy improvements when necessary:** As described in the Barriers and Opportunities Report, building stock that is old and in disrepair can limit the reach of building decarbonization and resiliency programs, due to challenges such as increased cost to make upgrades, the need to address more critical priorities (e.g., roof repair), or structural deficiencies or health and safety issues that lead to homes being deferred from energy efficiency and weatherization program participation until such issues are addressed. For example, moisture and mold-creating conditions in a home need to be addressed before weatherization in order to protect the health of occupants; but severe mold issues require deferral from the federally funded Weatherization Assistance Program since mold testing and remediation is not an allowable cost. Lack of maintenance and upgrades can also negatively impact occupant health (via indoor air quality and temperature comfort), economic security, and increased stress and anxiety. The State should create a new Retrofit and Electrification Readiness Fund for LMI households, affordable housing, rent regulated housing, public housing, and residential buildings in Disadvantaged Communities to cover costs of non-energy building improvements that are necessary to install energy measures and broadband installation costs when funding energy projects.
- **Leverage funding for healthy homes and community development:** The State should leverage services, resources, and funding across housing, health, community/economic development, and energy improvements for low-income households to fund decarbonized, resilient, and healthy housing retrofits. Near-term actions can expand use and coordination of both State and federal funding (such as use of Weatherization Assistance Program funds for health and safety improvements), build on the ongoing pilot to leverage New York Medicaid’s Value-Based Payment program for Managed Care Organizations to contribute to healthy housing services and home energy efficiency improvements, and engage with nonprofit hospitals in community health needs assessments. Expanding relationships with local housing agencies offers further opportunities to leverage federal resources such as through Community Development Block Grant and U.S. Department of Agriculture (USDA) Home Repair funds.
- **Support community-scale solutions and community thermal systems:** The State should develop, pilot, and, where successful, scale up financial support for portfolio- and community-

scale solutions, where hundreds of homes and businesses are contracted for energy upgrades to boost project delivery efficiency, reduce unit costs, incorporate place-based strategies, and drive scale and momentum (as compared with one-off projects). A strategy to support development of clean thermal energy networks is discussed in this chapter. Another opportunity is for State, federal, and local government entities that support disaster and flood recovery needs to integrate resources both for long-term resilience and to equip damaged homes, businesses, and community facilities to make highly efficient repairs with electrified equipment (for example, replacing a damaged water heater with a heat pump water heater).

- **Increase market transparency on project costs:** For projects that receive State or utility incentives for heat pumps and other building decarbonization upgrades, the State should routinely collect and publish (in an anonymized and aggregated format) data on the installed project cost to increase market transparency on cost.

B5. Expand Access to Public and Private Low-Cost Financing

Mobilizing and focusing private capital at scale will be essential to construct, upgrade, and operate highly efficient, electrified buildings. Modernizing codes and standards to require electrification and efficient construction will drive such investment via existing market activity and the cycle of routine building improvements. Low-cost financing products for energy efficiency, electrification, electrification readiness, solar photovoltaics (PV), energy/thermal storage, resiliency measures, and related improvements are also needed so that single-family, multifamily, and commercial and institutional building owners can access low-cost capital at the scale needed to pay for the building upgrades necessary for decarbonization.

At present, there is a general lack of lender interest and awareness around financing building electrification and energy efficiency projects, as well as perceptions of risk in underwriting based on energy performance. New York should help to address this barrier through lender education and outreach, and by making available case studies and modeling tools so that lenders can appropriately underwrite to energy performance standards and applicable regulatory requirements. The largest sources of capital for building investments are in the mortgage industry. NYSERDA and HCR plan to continue to convene the financial industry to explore ways to bring capital to building decarbonization in compliance with the Climate Act. This will build upon roundtables that the Federal Reserve Bank of New York, NYSERDA, and the Community Preservation Corporation held in 2022 with housing developers and lenders to explore climate adaptation risks to their portfolios and to identify public and private public financing options for decarbonizing New York's affordable housing; the resulting white paper included

recommendations for property tax abatements for electrified buildings and longer amortization for loans used to decarbonize buildings.²²²

Another important role for the State is to provide for consumer protection in connection with financial products and services, particularly for products that target LMI consumers. In addition, the NY Green Bank, HCR, State and local revolving loan funds, and possibly electric/gas utilities offer important mechanisms to strategically deploy public financial resources in ways that can leverage private capital and accelerate the transition to a decarbonized, resilient building stock.

Reflecting on input from the CJWG, the proposed strategy places priority on consumer financing made available by community development financial institutions and credit unions.

Components of the Strategy

Action and coordination across a range of State agencies and stakeholders is likewise important to expand access to low-cost financing for building electrification and efficiency upgrades, with leadership from HCR, the NY Green Bank and NYSERDA, the New York State Department of Financial Services (DFS), Dormitory Authority of the State of New York (DASNY), and NYPA.

- **Integrate energy requirements and resources into affordable housing deals:** The State should continue to scale up energy and green requirements in affordable housing deals while ensuring that sufficient resources are available to maintain, preserve and produce housing that is clean, safe, and affordable. For example, by no later than 2023, all new construction projects that receive Tax Credit funding through HCR will be required to be high-performance and all-electric buildings, as required in HCR’s Sustainability Guidelines for New Construction. The State should also continue to streamline access to all incentives and resources for regulated affordable housing building decarbonization to go through the housing agencies that are making projects affordable, to also make these projects energy-efficient, electrified or electric-ready, and resilient.
- **Integrate energy performance into underwriting:** The State should provide support for lenders to underwrite to energy performance standards and applicable regulatory requirements. HCR should consider updating its underwriting standards, consistent with federal regulations and requirements, to take into account potential reduced operational costs stemming from the new

²²² Federal Reserve Bank of New York. October 2022. “Sustainable Affordable Housing: Strategies for Financing an Inclusive Energy Transition.” Available at <https://www.newyorkfed.org/outreach-and-education/climate/fed-affordable-housing-and-energy-transition>

high performance buildings standards. Data collected from existing projects in operation of similar construction type will inform the new underwriting standards.

- **Expand access to financing:** The State should provide greater access to low-cost financing products for upgrades, including for low-income homeowners and buildings located in Disadvantaged Communities. This financing also should be available for non-energy improvements needed for code compliance and to enable electrification of heating and hot water systems. The State should also explore new mechanisms to deploy public financial resources to enable low-interest financing products coupled with credit enhancement or insurance. The State should prioritize support for financing products made available by community development financial institutions and credit unions as part of the Community Reinvestment Act regulatory compact.
- **Expand energy savings performance contracting for public sector buildings:** The State should enact enabling legislation to expand the use of energy savings performance contracting to support implementation of emissions reduction upgrades in State and municipal buildings, P-12 schools, and other public facilities. Performance contracting is a financing mechanism in which efficiency upgrades are paid for through savings from reduced utility costs. Changes to existing statute should expand the eligible list of measures for energy savings performance contracting, expand the allowable payback term for deep decarbonization performance contracts, allow some fast payback measures to help fund deferred maintenance needs, and allow a State agency or authority to request to keep a portion of cost savings that result from performance contracts.
- **Create a revolving loan fund:** The State should create a revolving loan fund for building decarbonization and the reuse of buildings and building materials. For example, Environmental Facilities Corporation's (EFC) Clean Water State Revolving Fund provides a model for enabling public mandates to be coupled with access to low-cost capital. This would be implemented through a bond-issuing government authority.

B6. Support Development of Thermal Energy Networks

Thermal energy networks offer an important pathway to both scale up zero-emission heating and cooling in buildings and to transition highly skilled gas workers into a similar sector, utilizing the existing skills of utility workers and the building trades workforce. Thermal energy networks leverage shared infrastructure to provide space heating and cooling to connected buildings, using distribution pipes and heat pumps to move thermal energy from an initial source and sink (such as a geothermal borehole or waste heat from local facilities) to connected buildings. This allows thermal energy networks to be highly efficient, to mitigate electric grid impact by smoothing loads across connected buildings, and to be

powered from renewable, zero-emission resources. Shared infrastructure and thermal resources also help achieve economies of scale, presenting the opportunity to lower costs per customer.

The Utility Thermal Energy Networks and Jobs Act allows gas and combined gas and electric utilities to become holistic thermal energy providers. Specifically, the statute directs the PSC to adopt rules and regulations to create fair market access requirements for utility-owned thermal energy networks; exempt small-scale thermal energy networks not owned by utilities from PSC regulation; promote the training and transition of utility workers impacted by the Climate Act; and encourage third-party participation and competition where it will maximize benefits to customers. The statute also requires that the State's largest gas and electric utilities propose thermal energy network pilot projects for PSC review and approval, with an emphasis on serving Disadvantaged Communities. For the operations and maintenance of thermal energy networks, the statute prioritizes hiring transitioning gas utility workers and requires that the utility enter into a labor peace agreement with a labor organization that represents gas and electric utility workers. The PSC initiated a proceeding in September 2022 and is actively working to implement this new statute and assess utility pilot proposals. To support the identification of strong projects, NYSERDA has provided information on feasibility studies conducted through its Community Heat Pumps Pilot Program, a competitive solicitation to support development and demonstration of thermal energy networks.

Components of the Strategy

The highly efficient performance and economies of scale presented by thermal energy networks offer a promising opportunity for the State to support building decarbonization through centralized investments that are equitable for Disadvantaged Communities and preserve family-sustaining jobs in the heating and cooling sector. The PSC and DPS, NYSERDA, DEC, DOL, and the Office of Just Transition should work together with utilities, affected workers and unions, local governments, and private-sector partners to support clean thermal energy networks that supply thermal energy via piped non-combustible fluids used to transfer heat into and out of buildings and eliminate onsite GHG emissions from heating and cooling end uses, in alignment with the Climate Act's requirements to promote climate justice and reduce GHG emissions. Support for this nascent industry is anticipated to include pilot programs, regulatory support, potential studies and analysis, and workforce development.

- **Workforce training for gas sector workers to operate thermal energy networks:** The piped infrastructure of thermal energy networks makes gas sector and pipeline workers a strong fit to install the clean heating and cooling infrastructure of the future. Labor unions for these sectors

were vital partners in passing the Utility Thermal Energy Networks and Jobs Act. The PSC and DPS, DOL, the Office of Just Transition, and other State agencies should work together with utilities and unions, including unions for operations and maintenance workers, to help connect trained gas workers with new thermal energy network projects, on training and skills development, and on efforts to bring new workers into the sector.

- **Develop appropriate regulations and permit fees for geothermal wells greater than 500 feet deep:** DEC regulations developed for oil and gas wells also apply to geothermal wells greater than 500 feet, despite differences in environmental risks. These regulations further apply on a per-well basis, whereas large GSHP and thermal energy network projects benefit from drilling multiple boreholes to distribute heat, adding a regulatory burden and permitting costs to geothermal projects. Currently, financial security requirements for regulated well types are set in statute, including the specific dollar amounts. The following actions should be taken to make regulations more appropriate for geothermal wells:
 - DEC should develop regulations for geothermal and stratigraphic wells to relieve some of the economic and time burden while still protecting the environment and public health from the risks associated with these well types.
 - Remove the dollar amounts from ECL §§ 23-0305(8)(k) (FS for oil and gas) and 23-0305(14)(f) (FS for geothermal wells) and allow DEC to establish financial security requirements in regulation as it does for mines.
 - Remove the fixed dollar amount in ECL § 23-1903, which sets permit fees for regulated wells on a variable depth, per-well basis, and allow DEC to develop an appropriate permit fee schedule in regulation.
- **Streamline access to public and utility rights of way as well as heat sources/sinks:** The State, in partnership with local governments, should develop clear processes and rules for thermal energy network projects to access already established public and utility rights of way. In addition, the State should establish appropriate default compensation levels intended to compensate property owners in these rights of way. In high density areas, thermal energy network infrastructure should be evaluated and pursued simultaneously with other planned infrastructure projects to minimize incremental cost and disruption. State and local governments also should provide simple and transparent access to heat sources and sinks for potential use by thermal energy network developers. Any rules promoting thermal energy networks should be carefully designed to avoid undermining private property rights or diminishing private property values.
- **Support public-private partnerships for geothermal and thermal energy network financing and development:** The PSC is working to advance a regulatory framework that encourages both

utility development of thermal energy networks and third-party participation and competition where it will maximize benefits to customers. The passage of the federal Inflation Reduction Act may provide opportunities to develop new approaches for financing geothermal investments, due to the combination of generous long-term tax credits and accelerated depreciation. Ongoing analysis of legal, tax, and regulatory issues, institutional investor scale investment structures, and funding approaches is needed to determine the feasibility of and consumer benefit from potential third-party ownership financing structures that would leverage private-sector investment to finance GSHP systems and thermal energy networks.

- **Prioritize public sector support for thermal energy networks that serve LMI housing and buildings in Disadvantaged Communities:** The State should place emphasis on leveraging the economies of scale presented by thermal energy networks to support a transition to clean heating and cooling in LMI, affordable, and public housing and historically underserved or Disadvantaged Communities. The Utility Thermal Energy Networks and Jobs Act and subsequent direction from the PSC support this goal by requiring that at least one thermal energy network pilot project per utility service territory must be located in a Disadvantaged Community.
- **Explore thermal energy networks as part of the gas system transition:** The State should further explore opportunities to convert buildings to heat pumps or thermal energy networks on a street-by-street or neighborhood-by-neighborhood basis, which could allow for strategic decommissioning of gas infrastructure as part of the managed transition of the gas system.

B7. Align Energy Price Signals with Policy Goals

The low relative cost of gas compared with electricity is a major barrier to building electrification. Over time, the costs of operating high-efficiency electric heat pumps will need to become more attractive compared with heating with fossil natural gas. *Chapter 17. Economywide Strategies* discusses a potential economywide policy that would price carbon emissions, and *Chapter 18. Gas System Transition* addresses a managed transition of the gas system. Such policy actions are expected to increase consumer energy prices for fossil fuels. Moreover, electric rate structures will need to evolve to be supportive of and appropriate for higher levels of electrification of buildings and vehicles, with attention to equitable rate design.

The CJWG called for a more expansive set of actions related to consumer protection that would include a safety net style guarantee of renewable energy to every household. Expanding access to community solar (as discussed above) and aligning energy bill discount programs (discussed below) are related strategy components.

Components of the Strategy

- **Price GHG emissions from fossil fuels:** *Chapter 17. Economywide Strategies* of this Scoping Plan discusses a potential economywide program that would effectively price GHG emissions.
- **Align electric rates:** The PSC and DPS should lead consideration of dynamic underlying electric rate structures and programs (such as dynamic load management) that provide appropriate price signals to customers to incentivize deployment and usage of DERs, including heat pump systems, EV charging, battery and thermal storage, and other load flexibility measures that promote more efficient utilization of the electric delivery system and help to mitigate summer and winter system peaks. In March 2022, the PSC adopted an alternative cost of service approach that will result in Standby Service and Buyback Service rates that more accurately align individual customers' contribution to system costs with the rates such customers pay, thereby sending improved price signals to those customers. Customers opting into the voluntary Standby Service rates will have an increased ability to manage their bills, and those bills will more accurately reflect the effects of those customers' usage, specifically when combined with the installation of DERs and electrification technologies.²²³
- **Align bill discount programs:** For low-income households, the State should expand existing low-income energy bill discount programs administered by the major electric and gas utilities and ensure that current or future public utility bill assistance programs recognize and adjust for both increased cooling needs and the shift from traditional forms of heating to efficient electrification.

Expand New York's Commitment to Market Development, Innovation, and Leading-by-Example in State Projects

In coordination with financial incentives and regulations, State support for market development and innovation is important for ensuring the delivery of building decarbonization solutions that perform well and make our lives better. Areas of focus should include workforce skills and broad public awareness and engagement that motivates behavioral change. State RD&D investment in building decarbonization solutions should be structured to help attract and expand economic development and support products that are manufactured in New York, to serve the growing New York and regional markets.

The CJWG expressed broad support for market development and innovation investments as proposed in the following strategies. The group called for attention to growing local supply chains and creating jobs in

²²³ New York State Department of Public Service. "Case 15-E-0751, Allocated Cost of Service Methodology for Standby and Buyback Service Rates and Energy Storage Demand Charge Exemptions Order." Issued March 16, 2022.

clean energy businesses that serve Disadvantaged Communities, as well as providing dedicated support to minority- and women-owned business enterprises (MWBE) to innovate and actively participate in the transformation of the buildings sector.

B8. Invest in Workforce Development

Chapter 7. Just Transition discusses critical actions to scale up workforce education, training, job placement, and development initiatives that equip New York’s current and future workforce for the clean energy economy and ensure the application of appropriate labor standards. Equally important, the chapter describes strategies to increase industry diversity and clean energy job placements for residents of Disadvantaged Communities, low-income residents, veterans, workers in fossil fuel industries, and other priority populations.

Consistent with the just transition framework and implementation partners described in *Chapter 7. Just Transition*, equipping a workforce to design, install, inspect, maintain, and operate healthy, comfortable, zero-emission buildings needs to include expanded or new training. For example, many heat pump installers today have knowledge or skill gaps around best practices for sizing, selecting, and installing ASHPs in New York’s cold climate, underscoring the importance of workforce development to support quality installations and build market confidence. Overall, workforce development investments are critical to close skill gaps and address the shortage of qualified, skilled workers who are ready to deliver the unprecedented speed and scale of adoption of heat pumps and energy efficiency measures that is needed over this decade to meet New York’s climate requirements.

Components of the Strategy

NYSERDA, DOL, the Office of Just Transition, and Empire State Development (ESD) should work together to support workforce development actions, in a manner that is responsive to industry needs and job placement opportunities and is supportive of applicable labor standards and the promotion of equitable access to family-sustaining jobs, including union jobs, consistent with the discussion in *Chapter 7. Just Transition*. State agencies should work in coordination with educational institutions, training organizations, unions, industry actors, local governments and community-based organizations, workforce one-stops, and foundations.

- **Expand training:** Training for incumbent and new clean energy workers and adjacent industries needs to be increased dramatically, through investments in training infrastructure/delivery, career pathways, direct-entry Pre-apprenticeship and Registered Apprenticeship programs, on-the-job-

training, and industry partnerships. The State should support expanded or new training and resources across targeted workforce segments in the following priority areas listed in Table 12.

Table 12. Priority Training and Resource Areas and Target Workforce Segment

Priority Training and Resource Area	Target Workforce Segment
Building and energy code education, requirements, and enforcement	<ul style="list-style-type: none"> • Local government code officials • Building inspectors • Contractors • Labor unions and Registered Apprenticeships
Sizing, selection, and installation of heat pumps and supporting measures	<ul style="list-style-type: none"> • Contractors • Technicians • Designers
Addressing leak reduction and proper disposal of HFCs already in use in building equipment, and transitioning to low-GWP alternatives for building equipment and spray foam insulation to reduce HFC emissions	<ul style="list-style-type: none"> • Contractors • Technicians • Designers
Continuing education on building decarbonization as part of existing or new licensing and/or registration requirements	<ul style="list-style-type: none"> • Contractors • Architects • Engineers • Building operators • Labor unions and Registered Apprenticeships • Real estate professionals, such as brokers and inspectors
Retention of experienced building service workers	<ul style="list-style-type: none"> • Building and facility operators • Maintenance workers • Service workers • Labor unions and Registered Apprenticeships
Building management systems training	<ul style="list-style-type: none"> • Building and facility operators • Labor unions and Registered Apprenticeships
Understanding and engagement in planning processes that will support the clean energy transition	<ul style="list-style-type: none"> • Planners • Designers • Planning boards
Identifying and addressing health and safety issues during audits and home visits with cross-training on healthy homes	<ul style="list-style-type: none"> • Contractors • Energy auditors • Health and social workers
Partnering with industry to increase the number of qualified geothermal drillers	<ul style="list-style-type: none"> • Drilling contractors • Labor unions and Registered Apprenticeships
Just Transition of workers in fossil fuel industries to transfer their skills to clean energy opportunities	<ul style="list-style-type: none"> • Existing fossil fuel workers, including utility workers equipped to build and maintain thermal energy networks • Technicians • Labor unions and Registered Apprenticeships

- **Curricula and career services:** The State should encourage building decarbonization curricula and career services in State-funded and private education including P-12, technical schools, apprenticeships, and engineering and architecture programs at universities.
- **Prioritize Disadvantaged Communities and other priority populations:** The State should prioritize Disadvantaged Communities and low-income residents for training and job placement by creating community-to-employment pipelines and career pathways that are informed by an analysis of the effectiveness of current on-the-job training investments, led by the skills and hiring needs of employers to maximize job placement, and paired with wrap-around services to support job retention. Family sustaining wages, comprehensive benefits, and local and targeted training and hiring should be ensured through direct-entry Pre-apprenticeships and Registered Apprenticeships, project labor and Community Benefits/Workforce Agreements, and On the Job Training Funding as described in *Chapter 7. Just Transition*. The State should increase ranks of MWBEs, service-disabled veteran-owned businesses (SDVOBs), and worker cooperatives through increased funding for workforce training, business development support, and certification assistance, so as to provide increased opportunities for MWBE and SDVOB utilization on State contracts, in accordance with Executive Law Articles 15-A and 17-B.

B9. Scale Up Public Awareness and Consumer Education

With competing demands on our attention, there is low public awareness about New York’s Climate Act in general, and more specifically, low awareness about steps to take to decarbonize buildings. Similarly, most people are not aware that using combustion appliances in their home such as heating systems and gas stoves may increase indoor air pollutant concentrations (see *Chapter 8. Public Health* for a description of associated health risks), while also contributing to outdoor air pollution and climate change. New York should expand its support for broad public awareness and consumer education, create strategic partnerships with trusted community leaders, and scale up targeted outreach and decision-making support to increase market demand and accelerate the transition to low-carbon, energy-efficient, and electrified buildings.

Components of the Strategy

NYSERDA, the PSC and DPS, and utilities should lead these efforts, in coordination with local governments and community-based organizations and leaders.

- **Scale up campaigns:** The State should support and scale up multilingual, culturally appropriate public and consumer education efforts through large-scale, coordinated awareness, inspiration,

and education campaigns. This would include traditional and broad reaching media, digital communication, “influencer” style campaigns, user-generated campaigns, virtual tours, and mailers. Campaigns would provide specific resources and tools for installers, distributors, the home-visiting workforce, and other supply chain actors to educate consumers on building decarbonization options that will decrease GHG emissions and improve resilience. Topics for informational campaigns targeting building owners and residents would emphasize available incentives to replace equipment before failure, available low-cost financing products, and information on upcoming applicable codes and standards requirements. Broad education would further communicate the benefits of healthy, efficient, and low-/zero-emission building systems and building materials for occupants and property values.

- **Create strategic partnerships:** The State should create strategic partnerships that can have broad impact, including with trusted community leaders, religious leaders, and community-based organizations. The State should also partner with utilities to promote decarbonization and sunset messaging that promotes fossil natural gas as a “cleaner” choice. Other partners should include the State University of New York (SUNY), cooperative extensions, business councils, industry organizations and leading companies, unions, schools and teachers, film and public venues, and State and local elected officials. This work can build on experience from NYSERDA’s HeatSmart programs.
- **Prioritize Disadvantaged Communities:** The State should ensure messages, messengers, and media reflect Disadvantaged Communities in marketing efforts, and prioritize education and technical assistance for Disadvantaged Communities. NYSERDA should build on its development of regional Clean Energy Hubs and on NYSERDA’s and the State’s electric and gas utilities’ commitment to maintain the New York Energy Advisor website as a “one-stop shop” source of information for clean energy, electrification, and energy efficiency programs for LMI households. The State should fund and expand community hubs to offer education, resources, local contractors, technical assistance, and program navigator support.
- **Publicize leaders:** The State should publicize best practices for efficient building operations and recognize leaders and innovators in efficient operations that support building occupants. The State should create an incentive program or challenge to attract or encourage others to sign a pledge to commit to neutrality.
- **Provide technical resources:** The State should provide technical assistance and resource toolkits for building decision-makers and residents including playbooks for low-carbon solutions in common building types, free in-home or virtual audits to homeowners, and capital planning support for large buildings. This includes resources and tools to support tenant engagement and

demonstrating low-carbon solutions through challenges and case studies. The State should develop case studies showing the feasibility, performance, and costs for three paths to transition to highly efficient and electrified buildings: full electrification, phased electrification, and electrification readiness. The State should support new public-private partnerships or local government entities (such as the NYC Accelerator) to work with building owners and assist with access to useful resources and guidance, where appropriate in coordination with the State's regional Clean Energy Hubs.

B10. Support Innovation

For nearly all buildings in New York, technologies exist today that can dramatically reduce the building's energy use and, with zero-emission electricity, decarbonize the building. However, ongoing innovation with respect to technology, design and planning, and business models is needed to reduce the cost and increase the value of such upgrades in order to make their value proposition competitive with conventional building systems. RD&D also should be pursued to develop and deploy specific technologies, such as long-duration energy storage and ultra-low GWP alternatives to HFCs, including natural refrigerants, spray foam insulation, HVAC, water heating, and refrigeration technologies. In these areas, federal government RD&D funding and leadership is critical.

Complementary RD&D investment by New York in building decarbonization solutions offers multiple benefits. These include a strong multiplier for jobs and economic development, in-state demonstration projects and case studies for emerging technologies in prevalent building types, increased resilience of New York's buildings stock, and demonstration projects that are located in and benefit Disadvantaged Communities. The State should continue to support RD&D and help to bring new companies and manufacturers to New York that offer innovative solutions for highly efficient, electrified, and resilient buildings; for grid-interactive buildings; and for reducing embodied carbon in buildings.

Components of the Strategy

NYSERDA and ESD should lead the State's RD&D investments in coordination with Regional Economic Development Councils (REDCs) and local economic development agencies (as critical partners to assess innovation opportunities), SUNY, DEC, DPS, and the utilities.

- **Leverage federal resources:** The State should advocate for, and leverage, federal and national laboratory resources focused on identifying and commercializing advancements in technologies for building decarbonization and building resilience.

- **Scale up tech transfer:** The State should scale up resources to identify and promote technology transfer for innovative building decarbonization technologies and design approaches that are in use internationally and could be transferred to the New York market. For example, key areas for tech-transfer support include adapting technologies for U.S. and New York standards, in-state demonstrations, market research, partnering with New York entities, and manufacturing assistance.
- **Attract and expand in-state businesses, manufacturing, and economic development:** As discussed in *Chapter 14. Industry*, the State should continue to develop an in-state supply chain of green economy businesses and manufactures by offering economic incentives such as loans, grants, tax credits, technical assistance programs, and access to venture capital investments. These incentives should attract, expand, and retain green economy businesses as well as identify and advance in-state economic opportunities, for example to take advantage of production line re-purposing or attract green manufacturing to legacy/rust belt cities and Disadvantaged Communities.
- **Support minority- and women-owned and socially responsible business enterprises:** The State should provide support and outreach for MWBEs, cooperatives, and B Corps, including dedicated access to expert advisory services, internships, fellowships, board placement in innovative companies, and access to venture capital for underrepresented women and minority entrepreneurs, via New York Ventures.
- **Support NextGen building decarbonization solutions:** The State should continue to support RD&D, demonstrations, and technology transfer and commercialization for next generation HVAC systems, building envelopes, and design approaches that meet technical needs, deliver high performance, and lower costs. This includes continued improvement in cold climate performance across a range of heat pump products and sizes; improved domestic hot water heat pump technologies; solutions for harder-to-electrify buildings, including those on the Con Ed steam system; community thermal loops; advanced heat recovery and ventilation; improved thermal storage for HVAC applications; innovative materials, construction approaches, and manufacturing methods that improve building envelopes; and other technologies.
- **Support NextGen grid-interactive buildings solutions:** The State should support RD&D, demonstrations, technology transfer and commercialization, and development of standards across manufacturers and equipment for Grid-Interactive Efficient Buildings to deliver energy efficiency, load flexibility, and modulation capabilities that contribute to efficient grid management and grid reliability. The State should support the development of market signals, including revenue streams for Grid-Interactive Efficient Buildings, via analysis of opportunities

to provide grid services and electric/thermal services to neighboring buildings, assessment of market mechanisms for supporting desired policy outcomes, and pilots and demonstrations to inform rulemaking and ratemaking.

- **Support RD&D for alternative fuels:** The State should assess and then support RD&D needs with respect to the potential for some use of alternative fuels in buildings (such as renewable natural gas [RNG], green hydrogen, wood, and/or high-percentage biodiesel blends) and bioenergy with carbon capture and storage for harder-to-electrify building end uses or systems, which may include campuses with district energy systems. This research should account for impacts on not only the buildings sector, but the industrial, transportation, agriculture, waste, and power sectors, which could benefit from advancement of these solutions. The research agenda should include:
 - Rigorous energy, GHG, and environmental sustainability guidelines and metrics
 - Analysis of the potential air quality and health impacts and best practices to minimize these impacts, such as emissions control technologies, as well as mitigating localized impacts in Disadvantaged Communities
 - Life cycle GHG accounting, with strong preference given to zero- or negative-emission sources
 - The safety of green hydrogen
- **Support RD&D for building resilience:** The State should assess and then support RD&D needs with respect to building resilience as it looks toward both widespread building electrification and more frequent extreme weather and chronic changes to the climate. The State should research, develop, and pilot grid-independent, non-fossil fuel approaches for heating and cooling buildings during prolonged power outages, such as long-duration thermal storage, GSHP plus battery systems, and passive cooling approaches. Related RD&D investments (also discussed in *Chapter 13. Electricity*) include the flexibility and resilience of the electrical system and long-term energy and thermal storage solutions.

B11. Reduce Embodied Carbon from Building Construction

A specific area for RD&D and for the State to lead by example is to reduce the embodied carbon associated with building construction, which describes all GHG emissions that result from the mining, harvesting, processing, manufacturing, transportation, and installation of the products and materials that are used in buildings, as well as end-of-life emissions associated with the disposal of those materials. The most impactful way to reduce embodied carbon is to reuse existing buildings where practical, rather than demolishing and constructing anew. When new construction or renovation occurs, smart and integrated

building design processes can significantly reduce embodied carbon at little-to-no added cost of construction. Moreover, in-state manufacturing can grow to produce the low-carbon alternative products. However, there is currently a broad lack of awareness in the industry of embodied carbon impacts from products in use in buildings, including among designers, contractors, and manufacturers.

To lower the embodied carbon of products and materials used in the buildings sector, New York should establish procurement requirements and design specifications for State-funded projects, building on the framework established in Executive Order 22 directing the GreenNY Council to issue operational directives and guidance for common construction materials to be used in projects using the state procurement process. To lower emissions associated with concrete use in buildings, the State should build on the elements of the Low Embodied Carbon Concrete Leadership Act of 2021, directing the Office of General Services to establish a stakeholder group to set guidelines for state agency procurement of low-carbon concrete.

The State should further take actions to create broad carbon literacy regarding the impact of construction materials as well as support education, building reuse, building de-construction and material reuse, RD&D, and in-state manufacturing of alternative products. These efforts also will increase industry attention to carbon-sequestering products, such as hempcrete and sustainable wood products like mass timber. Some of the components in this strategy relate closely to those presented in *Chapter 14. Industry* (Strategy I2) and *Chapter 15. Agriculture and Forestry* (Strategy AF19).

Components of the Strategy

Interagency coordination through the GreenNY Council should include DASNY, DEC, New York State Office of General Services (OGS), NYPA, NYSERDA, DOS, ESD, and other agencies.

- **Lead by example in State projects:** Pursuant to the Low Embodied Carbon Concrete Leadership Act and Executive Order 22, the State should continue to drive embodied carbon reductions through design and procurement in State-funded new construction projects.
- **Make embodied carbon transparent:** In design specifications, the State should require Environmental Product Declarations for structural building materials where available and require the use of available modeling software and design tools for calculation of the project's embodied carbon budget. The State, through the GreenNY Council, should adopt methodologies for calculation of carbon reduction, including use of a standardized database of values to support analysis for calculation of carbon emissions for use in environmental product declarations. The

methodologies, database, and analyses should leverage the efforts of the federal Buy Clean Initiative and Inflation Reduction Act directives for federal agencies to establish consistency and allow for a like for like comparison across different building materials.

- **Follow lower-carbon specifications:** The State should require that State-funded projects follow lower-carbon specifications (see GreenNY) for the most carbon intensive construction materials and products (such as concrete, foam insulations, glass, and window units).
- **Set reduction targets for projects:** Subsequently, the State should set a target embodied carbon reduction level for projects that is below the established mean embodied carbon budget, as illustrated over the previous years.
- **Incorporate embodied carbon budgets into permitting:** The State should require an embodied carbon budget to be submitted as part of the permit process for all commercial and institutional new construction (and additions and alterations as applicable), immediately for State entities and no later than 2025 for local government entities. The State should provide funding for training and resources for designers and for State and local permitting entities to check carbon budgets for completeness at first and then for accuracy as the market improves in its abilities.
- **Encourage building reuse:** The State should identify and pursue financial incentives, changes to building codes, and other strategies to encourage building reuse, beginning in urban centers that are returning vacant buildings to use. Maintaining the existing building facade and architectural style can be an additional benefit to the embodied carbon reduction. Consistent with *Chapter 16. Waste*, this would include State support for local communities to establish and expand material reuse and exchange centers, as well as training for local crafts and trades people, to encourage the reuse, retrofitting, and repair of existing buildings and building systems and the deconstruction and reuse of building materials.
- **Support RD&D:** The State should support RD&D, demonstration projects, and technology transfer and commercialization for enhanced low-embodied carbon construction, including preference for reuse of existing buildings, as well as showcase low-embodied carbon designs and undertake industry outreach.
- **Expand in-state manufacturing for products:** The State should provide economic incentives and technical assistance to expand in-state manufacturing and assembly for products that are lower in embodied carbon or made of carbon sequestering materials (also known as biogenic or agriculture-based materials). ESD, the New York State Wood Products Development Council (WPDC), SUNY College of Environmental Science and Forestry (ESF), and DEC are well-positioned to provide and coordinate assistance.

- **Incorporate embodied carbon specifications into incentive programs:** In the design of energy efficiency incentive programs, the State should incorporate lower-carbon specifications for the most carbon intensive products (such as foam insulations in homes).
- **Leverage federal efforts and policy development:** The Inflation Reduction Act directs the EPA to develop a program to support the development, enhanced standardization and transparency, and reporting criteria for environmental product declarations for construction materials and products, through offering grants and technical assistance to manufacturers. New York should participate in the federal Buy Clean state government partnership effort in order to expand markets for clean manufacturing and low-carbon materials across the U.S. To assist with standardization and methodological consistency, New York should leverage tools being developed by the federal government, such as the U.S. Department of Energy’s Building Technology Office, for life cycle analysis and standard setting for specific products.

Transition from Hydrofluorocarbons

B12. Advance a Managed and Just Transition from Reliance on Hydrofluorocarbon Use

HFC use is currently widespread in refrigeration and HVAC equipment, including in heat pumps that are being recommended to electrify space conditioning and water heating and in foams that provide insulation for higher efficiency buildings. New York State agencies should continue to coordinate with U.S. Climate Alliance states on HFC reduction policies and ensuring an effective phasedown of HFCs. In 2020, DEC adopted the 6 NYCRR Part 494 regulation as a first step in reducing the use of high-GWP HFCs in New York. In 2022, DEC began stakeholder outreach on a rulemaking to expand Part 494 in response to the draft Scoping Plan.

Components of the Strategy

- **Provide education and training:** The State should provide resource toolkits, programs, and incentives that make low-GWP refrigerant technologies and low-GWP alternatives available and affordable, including a focus on natural refrigerants. NYSERDA should support design professional and workforce training and education, including in Registered Apprenticeship programs, around low-GWP refrigerants and alternatives, including natural refrigerants, in building equipment and in building/construction spray foam. DEC should promulgate regulations regarding proper disposal of HFCs already in use in existing equipment and such regulations should be supported by training installers and contractors on handling, equipment maintenance, and disposal protocols.

- **Update regulations, codes, and standards:** As soon as possible, the State should update relevant codes, including the mechanical code, to allow the use of low-GWP alternatives for HFCs in relevant building equipment. DEC should promulgate regulations requiring reclamation or destruction of refrigerants from appliances at end-of-life, with verification and reporting, and require leak detection for certain commercial refrigeration. In addition to education and training, the State should provide economic support (such as, incentives to purchase leak detection and reclamation equipment, or compensation for refrigerant reclamation) to aid local industry with this transition.
- **Support the HFC phase-out in food stores:** Supermarkets are the largest source of HFC emissions in New York. There are natural alternatives available today that not only provide significant GHG reduction benefits but are also more efficient, do not contain fluorinated chemicals, and have a lower total cost of ownership. The key barrier to wider adoption is the high cost of installation, which may be prohibitive for small businesses and for stores in Disadvantaged Communities. NYSERDA, DPS, and DEC should coordinate to develop incentives such as utility rebates and grant programs to support the adoption of natural refrigerants in food stores. Incentives are particularly needed to fund a substantial portion of the installation of new equipment in existing stores in Disadvantaged Communities or stores operated by independent companies or small chains, to enable food stores to phase out HFCs without impacting LMI consumers or negatively affecting food security.
- **Phase out high-GWP HFCs:** DEC should expand the scope of 6 NYCRR Part 494, which prohibits certain HFCs in refrigerator/freezers, chillers, commercial refrigeration, and aerosols/foams/solvents end uses, including through the establishment of a GWP threshold that decreases over time as low and ultra-low GWP options become available and addressing leakage in existing equipment during the transition. DEC should align New York policy with anticipated federal (EPA) policy measures to meet HFC reduction requirements as well as with other U.S. Climate Alliance states, to send a strong market signal to manufacturers and industry while mitigating costs of the transition.
- **Research health effects and environmental impacts:** The State should support further research into known data gaps, including an analysis of typical leak rates and charge size in heat pump technologies and research into long-term health effects of exposure to new HFC-alternative chemicals in building materials.
- **Support RD&D:** The State should continue to support demonstration projects for low and ultra-low GWP refrigerants in HVAC and hot water systems and for refrigerant leakage detection and reduction strategies. The State should develop case studies in refrigerant management and

alternatives to HFCs, including natural refrigerants, showing the safety, performance, and cost impacts.