New York Cap-and-Invest (NYCI)
Pre-Proposal Stakeholder Outreach

Preliminary Scenario Analyses

January 2024

NEW YORK STATE | Department of Environmental Conservation

NEW YORK STATE | NYSERDA

Introduction and Context

Meeting Procedures

- Attendees will not be able to unmute or turn on video.
- Attendees will be able to submit questions via the Q&A feature. Select questions will be answered by panelists at the end of the presentation.
- If you can't hear the presentation, you can configure your audio settings by clicking the arrow in the "audio" box.
- You can turn on closed captioning for the presentation and change the language of the captions.
- This webinar will be recorded.

Introduction and Context

Climate Act – Overview

Carbon neutral economy, requiring at least an

85% reduction below 1990 level of greenhouse gas emissions by 2050

and 40% reduction in emissions by 2030

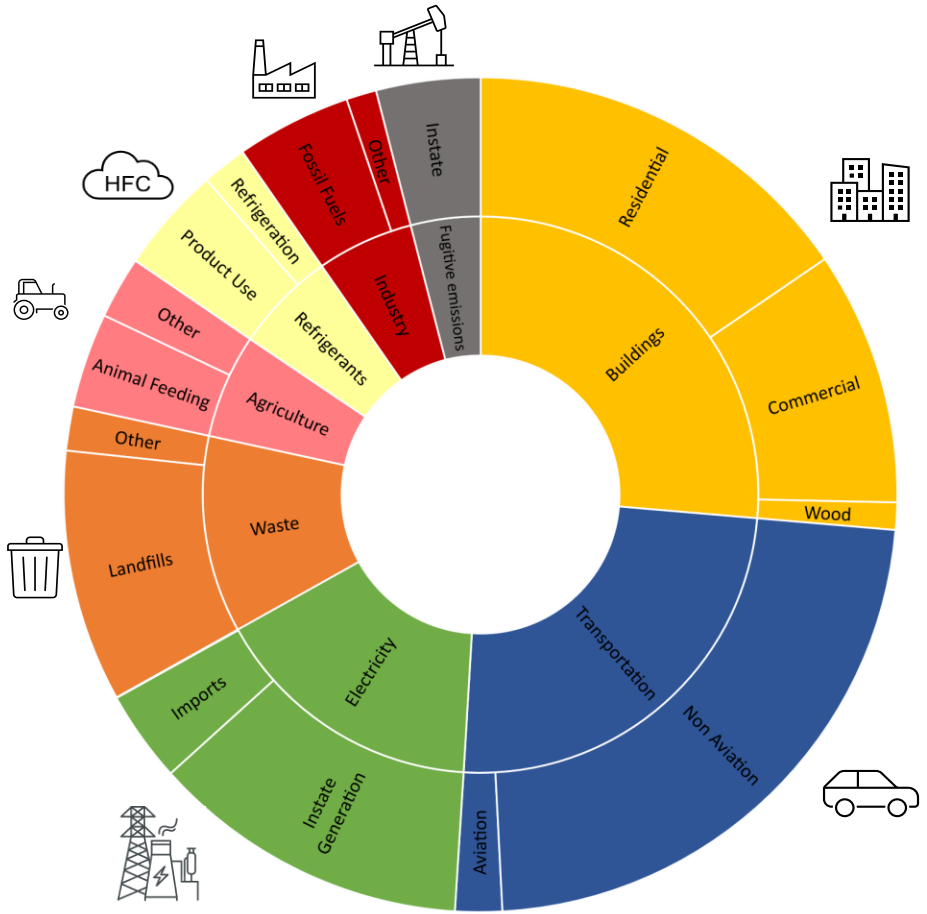
- **100% zero-emissions electricity by 2040**
- **70% renewable electricity by 2030**
- **9,000 MW of offshore wind by 2035**
- **6,000 MW of distributed solar by 2025**
- **3,000 MW of energy storage by 2030**
- **185 TBtu on-site energy savings by 2025**

Commitments to climate justice and just transition

Introduction and Context

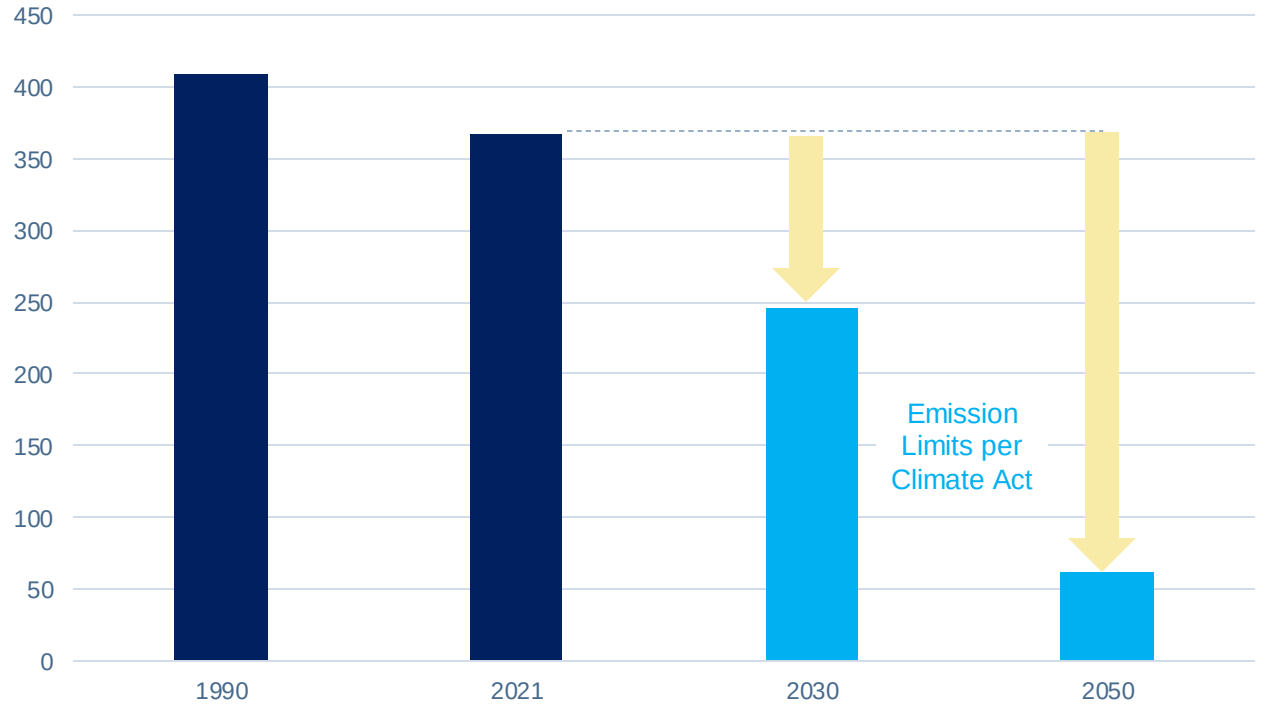
Greenhouse Gas Emission Reduction Requirements

Current Estimated Greenhouse Gas Emissions by Sector



2021 Calendar Year Emissions: Based on 2023 Statewide Greenhouse Gas Emissions Report.

New York State Greenhouse Gas Emissions ($MMtCO_2e$)



Sources: New York State Greenhouse Gas Inventory; § 496.4 Statewide Greenhouse Gas Emission Limits

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New York State Cap-and-Invest

The Climate Action Council's final Scoping Plan recommends - and Governor Hochul's 2023 State of the State Address and the FY 2024 State Budget advanced - an economywide Cap-and-Invest Program.

DEC and NYSERDA have been developing a proposal to help meet the Climate Act's requirements to reduce greenhouse gas emissions and advance equity – NYCI.

NYCI will work in concert with the State's suite of other climate change and clean energy programs and policies.

Economywide Cap-and-Invest Program

> **At Governor Hochul's direction, the program will incorporate these guiding principles:**

- *Affordability*: Craft a program to deliver money back to New Yorkers to ensure energy affordability
- *Climate Leadership*: Catalyze other states to join New York and allow linkage to other jurisdictions
- *Creating Jobs and Preserving Competitiveness*: Protect existing jobs and support new and existing industries
- *Investing in Disadvantaged Communities*: Ensure 35%+ of investments benefit DACs
- *Funding a Sustainable Future*: Support ambitious clean energy investment

Modeling and analysis will seek to evaluate policy choices in support of these priorities.

New York's Cap-and-Invest Program – How it Works

Cap-and-Invest sets an annual limit on the amount of greenhouse gas emissions emitted in New York. Every year, the cap will be set lower to reduce greenhouse gas emissions.

Large-scale greenhouse gas emissions sources and distributors of heating and transportation fuels will be required to purchase or obtain allowances for emissions associated with their activities.

The Program will prioritize frontline disadvantaged communities that have suffered from pollution as a result of environmental injustice and will ensure emissions reductions.

Proceeds will minimize potential consumer costs while supporting critical investments in focus areas such as climate mitigation, energy efficiency, and clean transportation.

Cap-and-Invest Guiding Principles:

- Affordability
- Climate leadership
- Creating jobs and preserving competitiveness
- Investing in disadvantaged communities
- Funding a sustainable future

Context of this analysis

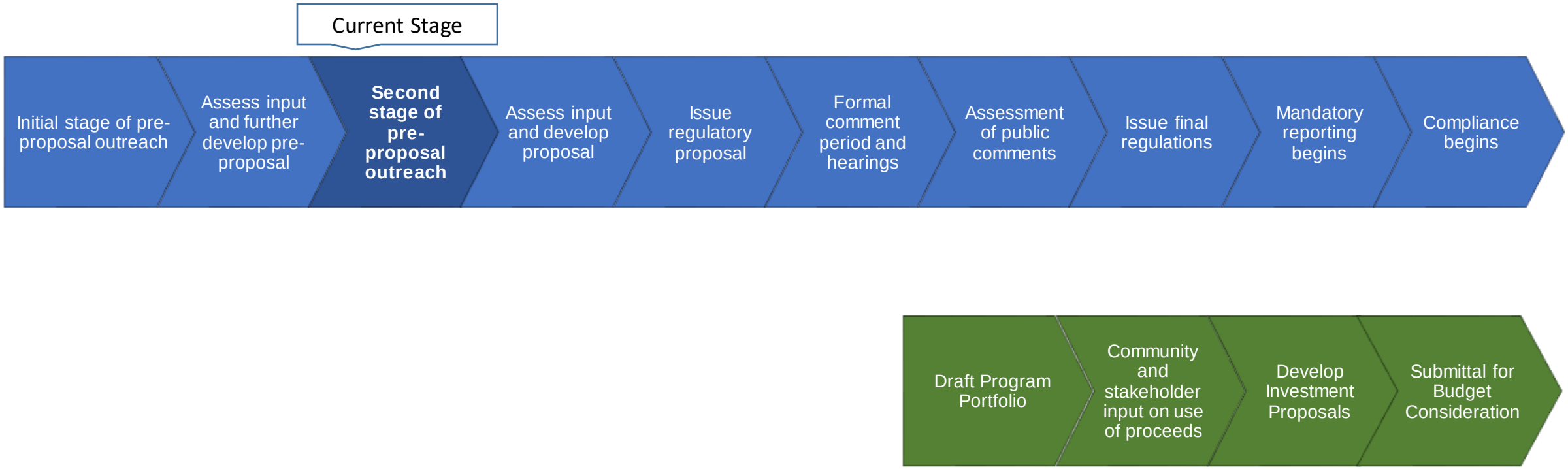
This analysis will assess potential market outcomes and impact from the proposed New York Cap-and-Invest (NYCI) program

- In December 2022, New York State's Climate Action Council adopted a *Scoping Plan* that recommends a range of policies and actions to meet the goals under the *Climate Leadership and Community Protection Act* (Climate Act)
- The *Scoping Plan* included a recommendation to implement an economywide cap-and-invest program as the most cost-effective means of meeting the Climate Act's emission limits
- Scenario analyses are needed to support program development and associated rulemakings by DEC and NYSERDA
- This study will analyze potential market outcomes and associated impacts from the proposed *New York State Cap-and-Invest (NYCI)* program. This presentation includes preliminary findings encompassing a range of potential options for pre-proposal consideration.

Note: Details on New York State's Scoping Plan available on https://climate.ny.gov/resources/scoping-plan/

Introduction and Context

New York Cap-and-Invest (NYCI) Regulation Development Timeline



Introduction and Context

Follow the Process

Join the mailing list to receive updates on program development: https://climate.ny.gov/email-list/

Meeting recordings and materials can be found at:

www.capandinvest.ny.gov/meetings-and-events

Provide feedback:

Comments can be submitted online at:

www.capandinvest.ny.gov

or by mail:

Bureau of Air Quality Planning
NYS DEC, Division of Air Resources
625 Broadway, Albany, NY 12233-3251

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Material and Resources Available

- A recording of this webinar and associated presentation will be posted online today.
- Additional materials to be shared by DEC and NYSERDA at capandinvest.ny.gov in the coming days include:
  - An extended version of this presentation with supplementary outputs.
  - Additional data annexes providing more detailed outputs across the range of scenarios being presented today.

Supplementary data and outputs will be available online.

Outline

- **Scenarios Analyzed**
- Preliminary Analyses
  - Econometric and Greenhouse Gas Emissions
  - Health Effects
  - Employment Effects
- Obligating Electricity

Scenarios Analyzed

Common Definitions and Assumptions

Model design is not fully aligned with preproposal materials including obligated sector list, emissions and cost containment reserves, and price floor. Analysis accompanying formal regulatory process will incorporate the final policy design.

Allowance Supply

1. **Statewide greenhouse gas emissions cap**
   The cap was defined by interpolating between 2025 starting point emissions (described subsequently) and the 2030 emissions limit, and then interpolating between 2030 and 2050 limits. The modeling employs non-linear interpolation, with gradual reductions at first followed by acceleration to the target year. The cap is economywide covering all sectors. The State would retire allowances for all non-obligated emissions.

2. **Allowance budget**
   The allowance budget represents the portion of the cap that remains after removing estimated non-obligated emissions. Sectors assumed to be obligated in the current scenarios include: residential buildings, commercial buildings, transportation (excluding aviation), waste, and oil and gas fugitive emissions. A separate discussion regarding the option of obligating electricity emissions is included as well. The model assumes that non-obligated sector emissions in 2025 are as defined in the baseline emissions provided in the updated (v.2023) Pathways Integration Analysis Reference case, and in other years, follow the Pathways Integration Analysis Scenario 2.

3. **No cost allocations**
   Energy-intensive and trade exposed (EITE) industry would receive no cost allowances. The quantity of no cost allocations that each EITE sector receives is 100% of their obligated emissions in 2025, declining over time proportional to the trajectory of the allowance budget. This is comparable but not identical to consignment mechanism incorporated in pro-proprosal outline.

Allowance Demand

1. **Compliance obligations**
   Obligated entities are required to surrender emissions allowances following a three-year compliance period, the first one being 2025-2027.

2. **Emissions and technology pathways**
   For most of the obligated sectors, the model simulates their emissions trajectory over time by computing the technology-switching patterns under the influence of the allowance price. Limited sectors where data was not available or this was otherwise not practicable were modeled ‘exogenously’ where their emissions are assumed to follow the Pathway Integration Analysis Scenario 2 emissions.

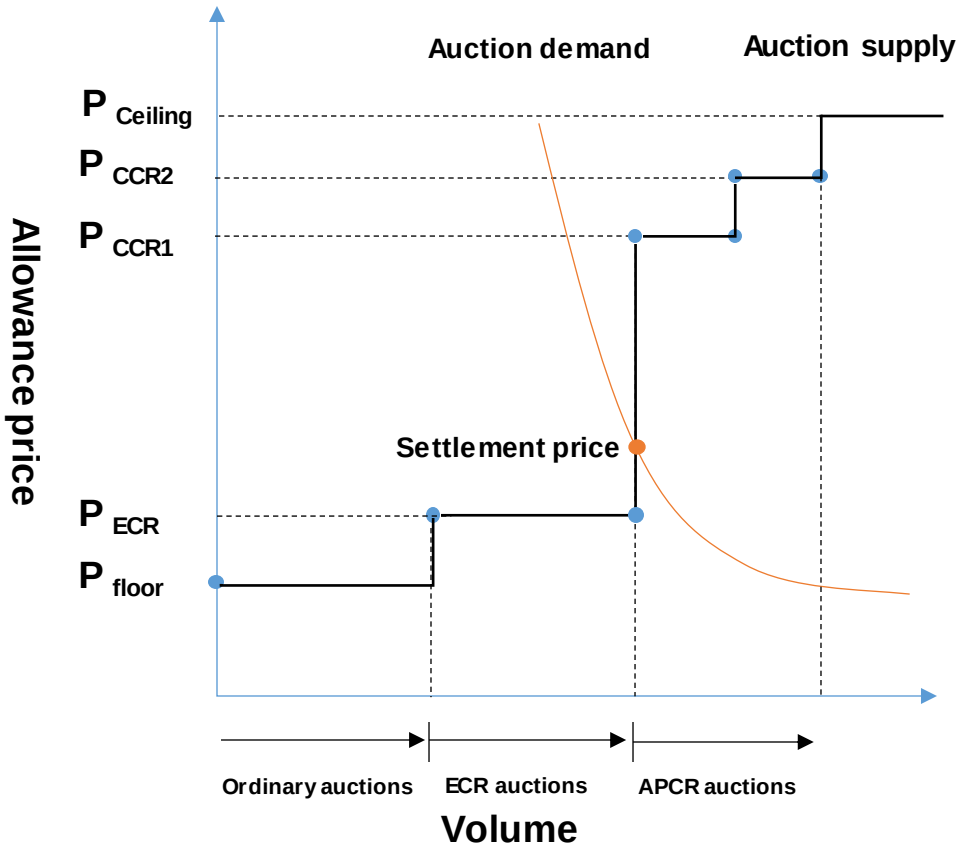
3. **Financial sector participation**
   The model assumes that the financial sector participate in the market freely by arbitraging on changes in the price of allowances.

Scenarios Analyzed

Common Definitions and Assumptions

Scenarios presented today focus on evaluating price ceiling levels.

ILLUSTRATIVE



Model is capable of modeling scenarios with price stability mechanisms typically used in cap-and-invest programs, should NY propose to include any of these mechanisms, including:

- **Auction reserve price:** If price is below the auction reserve price P_{floor} allowances would be withheld from auctions until the settlement price is at P_{floor}.
- **Emissions Containment Reserve (ECR):** ECR allowances are withheld if market price falls below P_{ECR} . A certain share of the allowance budget is typically set aside for the ECR.
- **Cost Containment Reserve (CCR):** If the bidding price reaches at P_{CCR1} additional allowances would be released from CCR1 reserve. Allowances would be released from CCR2 reserve at P_{CCR2} . A certain share of the allowance budget is typically set aside for the CCR.
- **Price ceiling**: If prices reach $P_{ceiling}$, additional allowances would be made available for buyers until demand is fully met limited to actual emissions. Allowances sold at $P_{ceiling}$ would not be removed from future auction supply and would be net additional to the carbon budget.

Because price ceiling is binding across tested scenarios, the functionality of other price mechanisms is not reflected in today's scenarios. They are necessary to include in actual rule in the event that clean energy deployment and emissions abatement happens faster than predicted.

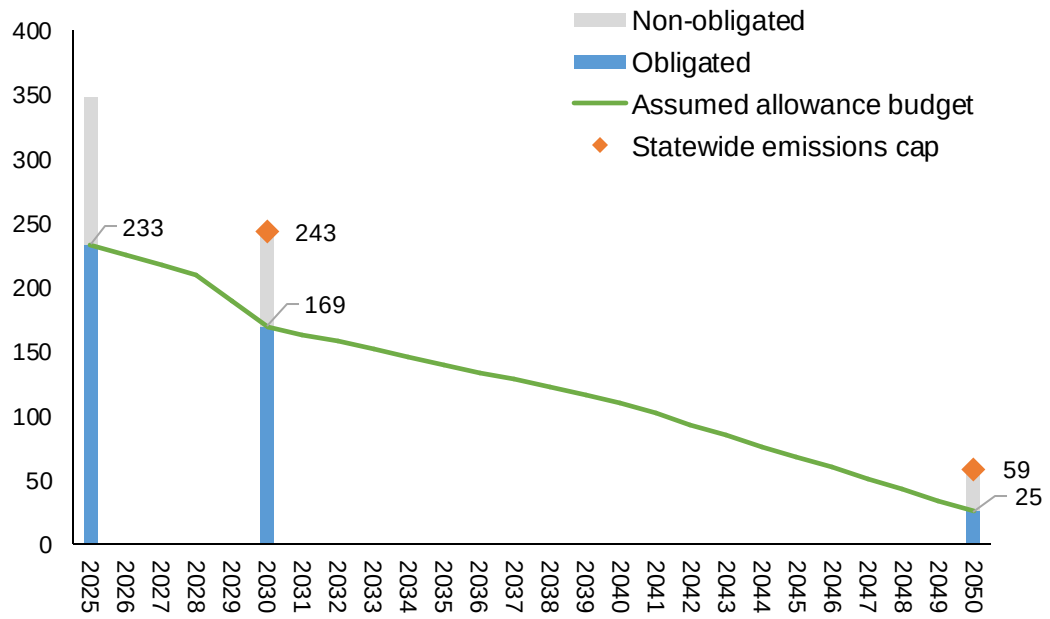
Auction schedule represented annually due to model's time resolution.

Scenarios Analyzed

Common Definitions and Assumptions

Economywide Greenhouse Gas Emissions Cap

GHG emissions trajectory & modeled allowance budget (MMT CO_2e)



Allowance budget construction

The modeled allowance budget represents a tentative estimate of allowance supply for obligated sectors. It is constructed assuming allowance budgets conform with NYS economy-wide greenhouse gas emission limits in 2030 and 2050.

- **Obligated sectors**: residential and commercial buildings, transportation, industry, waste, and oil and gas fugitive emissions. These sectors are closely aligned with the proposed rule but are not identical.
- **Allowance budget:** model assumes concave interpolations between the Pathways Integration Analysis Reference case Scenario 2 emissions in 2025 and the emissions limits for 2030 and 2050, resulting in a cap that declines somewhat slower in earlier years and accelerating in later years; The allowance budget, representing emissions excluding non-obligated sector emissions, follows the same concave trajectory.

Scenarios Analyzed

Scenario Differentiation

Modeled allowance price ceiling

(real 2022 USD)

All scenarios presented feature a phased-in price ceiling, with an initial ceiling in 2025, 5% escalation for 2026, and an increase to a higher ceiling in 2027, escalating by 6% annually thereafter.

Scenario	2025	2027
Scenario A	$23	$54
Scenario B	$15	$36
Scenario C	$14	$25

Outline

- Scenarios Analyzed
- Preliminary Analyses
  - **Econometric and Greenhouse Gas Emissions**
  - Health Effects
  - Employment Effects
- Obligating Electricity

Econometric and greenhouse gas emissions

Methods Overview

Model overview and specifications

Model overview

- The model is an agent-based model that computes the equilibrium in an emissions allowance market based on (a) the supply of allowances and (b) emissions from companies that face compliance obligations under the emissions trading system
- Each subsector covered by the system is a unique model agent which responds to the carbon price by optimizing timing and extent of decarbonization
- For each scenario run, the model finds the market equilibrium where the allowance price equates allowance demand and supply in every year from 2025 to 2035
- The model will be calibrated to the NYS Cap-and-Invest program which involves drawing on the most recent data on sectoral emissions and technology costs (as determined by review of State and technical teams)

Technical specifications

Time coverage	2025-2035, annual
Sectoral coverage	Sectors obligated under the cap and invest program determined
Model outputs	Allowance prices, allowance supply and demand, sectoral emissions and detailed technology mix
Model inputs	Policy parameters, technoeconomic assumptions (capex, opex), fuel prices, assumed agent behavior
Model type	Discrete time (annual), agent-based market simulation and clearing model
Agent behavior	Each agent has a limited forward-looking horizon and acts as a carbon price-taker in their abatement decisions and trading behavior

Econometric and greenhouse gas emissions

Methods Overview: Starting emissions

The Scoping Plan's Reference Case was updated with policies adopted since the original case was designed.

Policies include:

- **Buildings**
  - New York City Local Laws (e.g., Local Law 97)
  - Statewide new construction codes
  - Federal Inflation Reduction Act (IRA) Incentives

- **Transportation**
  - Advanced Clean Cars II/Advanced Clean Trucks
  - 100% sales zero emission medium/heavy-duty vehicles by 2045
  - 100% zero emission school buses by 2035, 100% transit buses by 2040

- **Natural Gas**
  - New York State Part 203

- **Refrigerants**
  - AIM Act (EPA Technology Transitions)

Econometric and greenhouse gas emissions

Methods Overview: Agent-based modeling approach

Endogenous agents (>85% of obligated emissions)

Emissions simulated by evaluating the relative costs (total cost of ownership during economic lifetime) of available technologies and carbon price, which drive a shift towards clean technologies

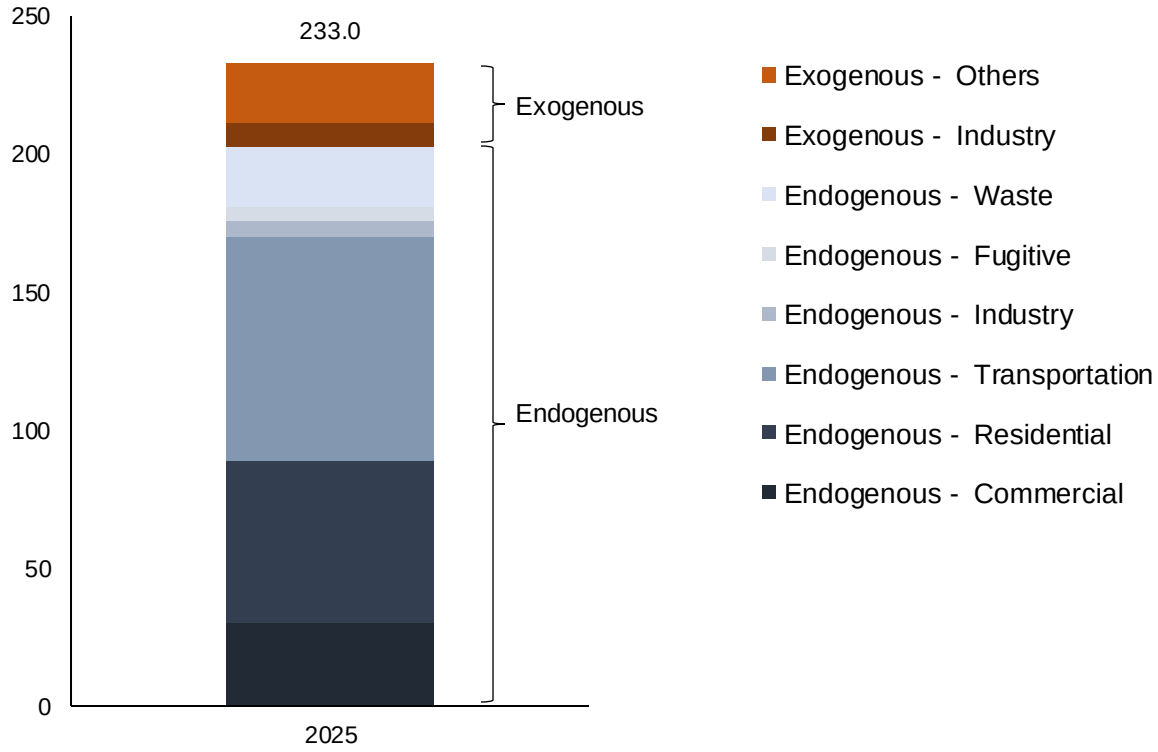
- **Commercial**: space heating, water heating, cooking, cooling
- **Residential**: space heating, water heating, cooking
- **Transport**: passenger cars, light trucks, MDT, HDT, buses, rail freight
- **Industry**: paper, cement, steel
- **Oil & Gas fugitive emissions**: downstream
- **Waste**: landfills, incineration, wastewater

Exogenous agents (<15% of obligated emissions)

Emissions assumed to follow a fixed trajectory that starts at 2025 reference emissions, then linearly interpolated to 2030 Integration Analysis S2 emissions, and follow S2 from 2030-2050.

- **Commercial**: others (e.g., clothes drying)
- **Residential**: others (e.g., clothes drying)
- **Transport**: others (e.g., non-road vehicles, maritime)
- **Industry**: food, other manufacturing
- **Oil & Gas fugitive emissions**: mid-stream

2025 Reference case GHG emissions (MMT CO_2e)

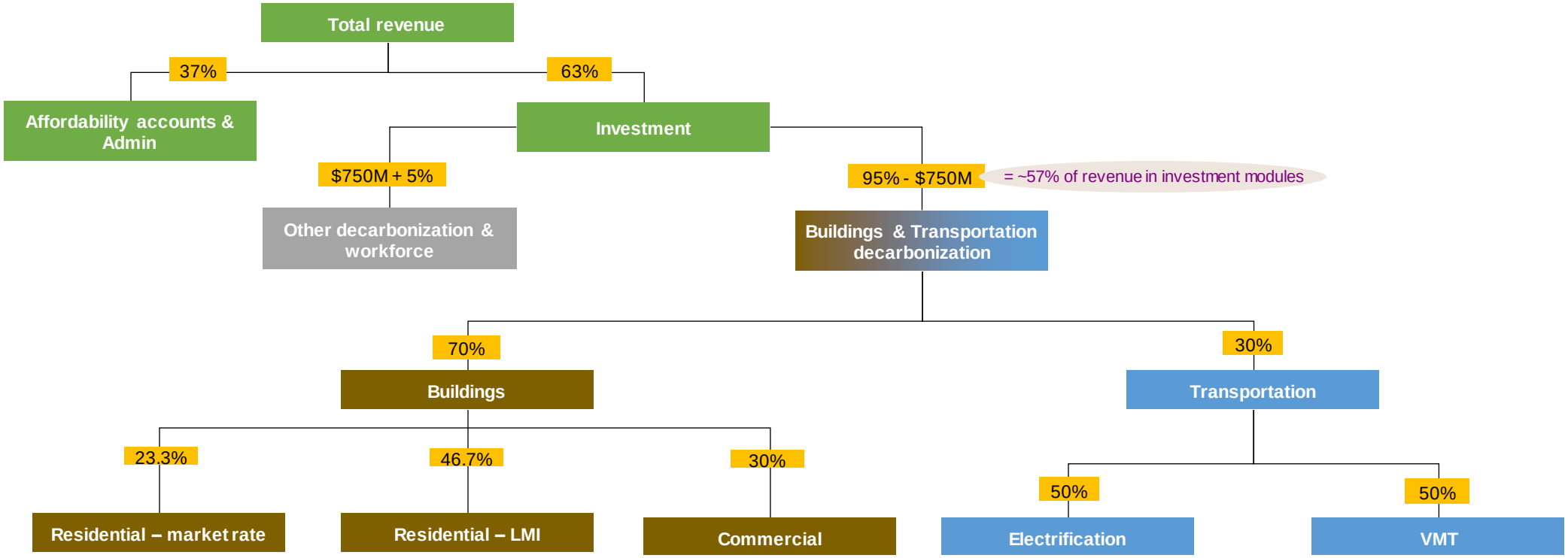


S2 emissions refer to scenario published as part of New York State's Scoping Plan. Reference emissions have been updated for a 2023 version.

Econometric and greenhouse gas emissions

Methods Overview: Auction revenue investment allocation

Assumed allocation of auction revenue to investment for modeling purposes



% Split

This allocation is intended to estimate the impact of investment for the purpose of evaluating the market effects and does not represent any decision regarding investment allocation.

Econometric and greenhouse gas emissions

Methods Overview: Transportation investment options and assumptions

- Transportation investments fall into two main categories—conversion to the zero emission vehicles across all vehicle classes and reduction in vehicle travel.
  - Vehicle fuel-switching supports conversion of light duty, transit and school buses, and medium- and heavy-duty short haul trucks to electricity, and heavy-duty long-distance trucks to hydrogen fuel cells.
  - Vehicle travel reduction includes transit expansion, land use measures, and non-motorized transportation infrastructure.

Electrification Strategy	Key Assumptions
Light duty EV incentives	EV sales change per $ of incentive based on previous national modeling
Light duty EV infrastructure	EV uptake per unit of new infrastructure based on literature
Electric transit and school buses	Incentive needed is equal to incremental capital cost of vehicle + infrastructure
Electric medium- and heavy-duty short-haul trucks	Incentive needed is equal to incremental capital cost of vehicle + infrastructure less 3 years operating cost savings
Hydrogen trucks	
Passenger rail electrification	Incremental cost of infrastructure per track-mile electrified

Vehicle Travel Reduction Strategy	Key Assumptions
Land use/smart growth	Investment required and VMT reduction per household shifted into smart growth area
Bicycle facilities	New bike trips per new mile of facility, by area type (based on population density)
Bus rapid transit	New riders and reduced auto travel per new revenue-mile of service, based on average ridership levels for existing service
Bus service expansion	
Electric microtransit	
Bus service efficiency	Change in ridership with respect to change in travel time as reported in the literature

Econometric and greenhouse gas emissions

Summary Conclusions

- Modeling predicts that **all three price ceilings currently evaluated are binding**. This means they provide a limit on potential emissions prices, associated up-front costs, and emission reductions.
  - Obligated sectors see accelerated progress towards meeting 2030 Climate Act limit across all scenarios, depending on price ceiling level. Complementary policies and market transformation would further accelerate emission reductions.
- At all levels, **NYCI helps substantially accelerate emission reductions** and can be an essential contributor to clean energy transition in New York. Analysis projects up to an additional over 1,000,000 heat pump homes by 2035, over 100,000 zero emission trucks by 2035, and billions invested in an equitable clean energy transition.
  - Revenue and reinvestment are essential drivers of this deployment, with **total revenue by 2030 estimated to be between $6 and $12 billion per year ($4-8 billion available for investments).**
- **Gross state product in New York State continues to grow under NYCI**, with the rate remaining essentially unchanged.
- The program has the ability to effectively manage total costs.
  - Initial analysis shows that **millions of households would break even after NYCI**, especially lower income and low energy use households.
  - Although some households, especially high fossil fuel users, are likely to have residual costs after benefits, **total cost impacts may be managed for a very large percentage of households**.
  - In addition to driving emission reductions, **NYCI investments are an essential affordability strategy**. The program's support for EV, heat pump, transit, and other related incentives and programs reduces cost exposure for households across New York, with a growing share receiving more benefits than costs.

Econometric and greenhouse gas emissions

Resulting Transformation: Total GHG Emissions

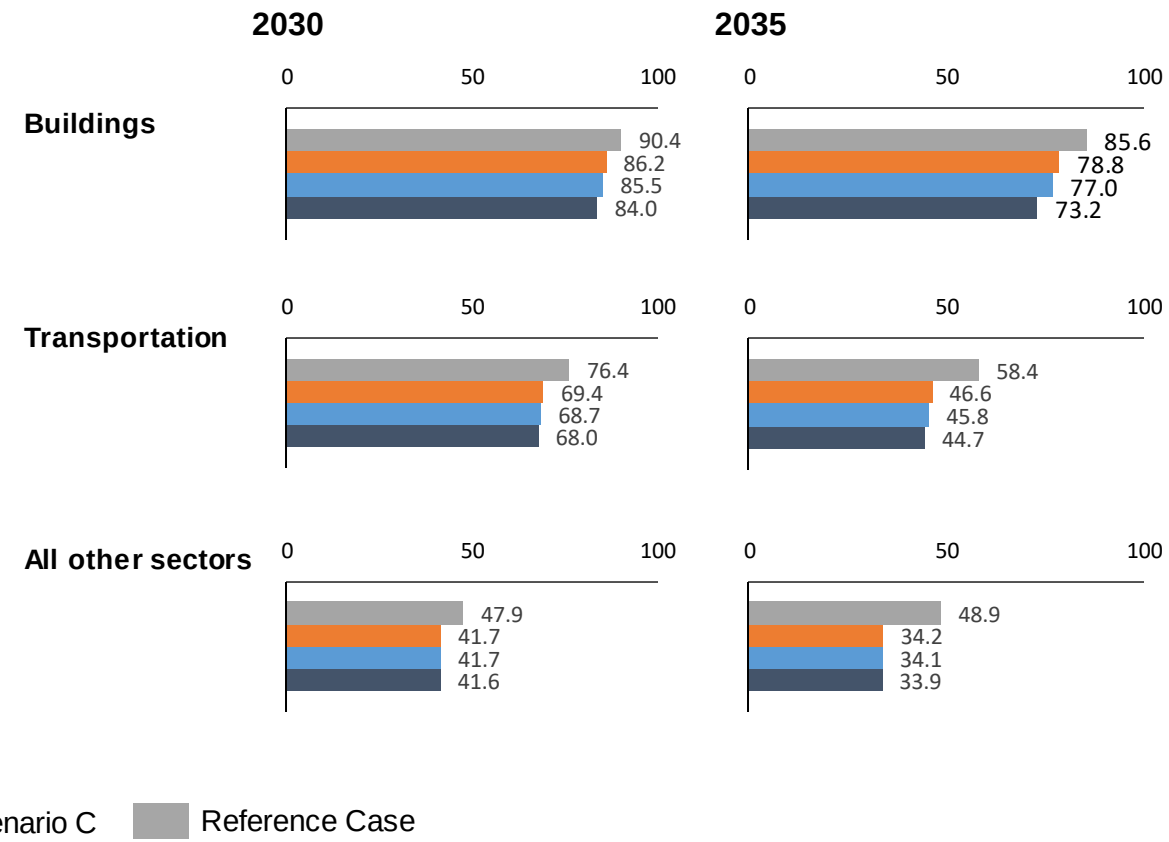
At all three evaluated price ceilings, NYCI substantially accelerates emissions reductions compared to currently enacted policy.

In 2030, compared to 2025 without NYCI, annual emissions in obligated sectors fall substantially:

- **Scenario A:** 39 MMT annual reduction (to 194 MMT)
- **Scenario B:** 37 MMT annual reduction (to 196 MMT)
- **Scenario C:** 36 MMT annual reduction (to 197 MMT)

Annual obligated GHG emissions by sector

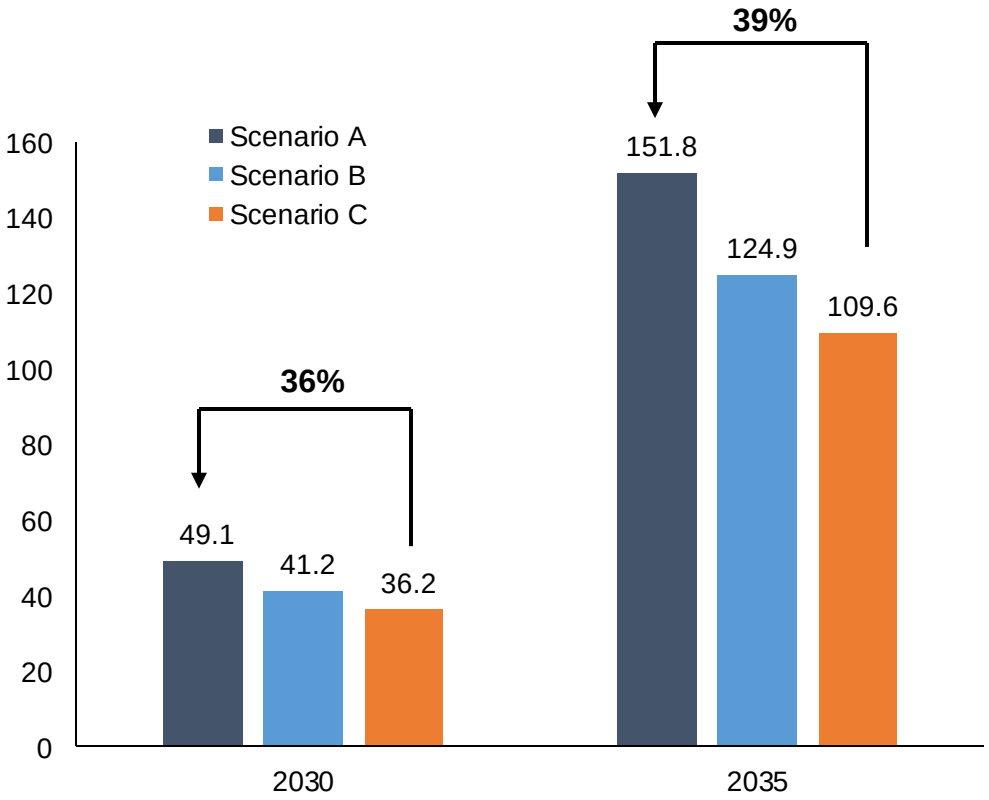
(MMT CO_2e)



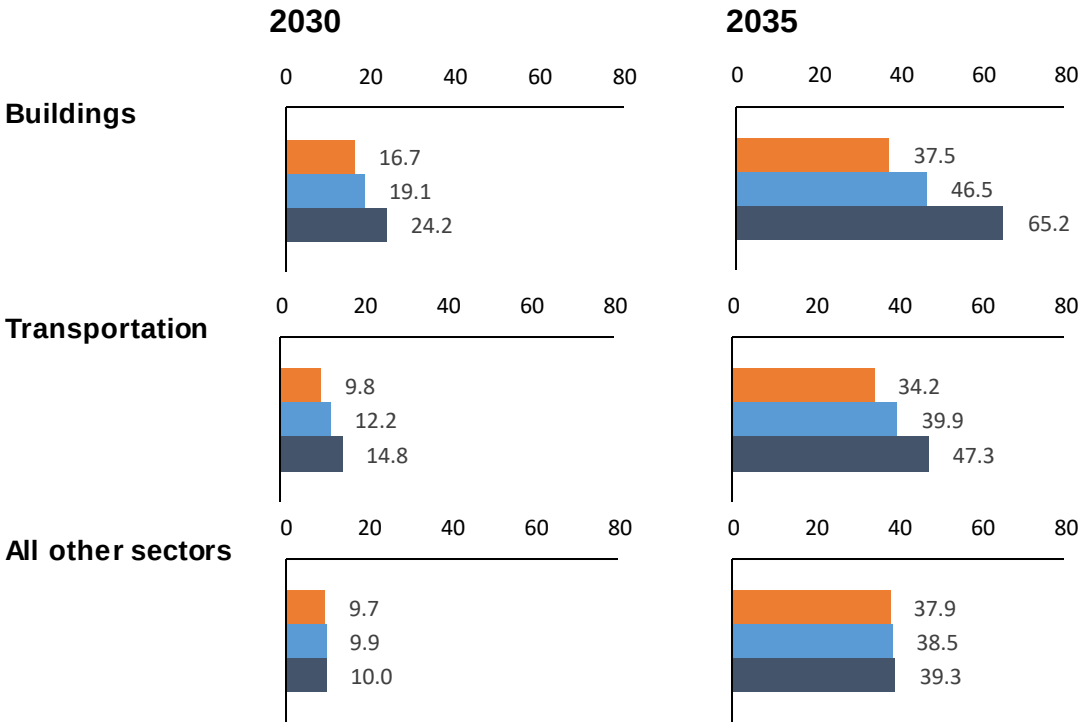
Econometric and greenhouse gas emissions

Resulting Transformation: GHG Emission Reductions

Cumulative endogenous GHG emission reductions relative to reference case (MMT CO_2e)



Cumulative endogenous GHG emission reductions relative to reference case by sector (MMT CO_2e)

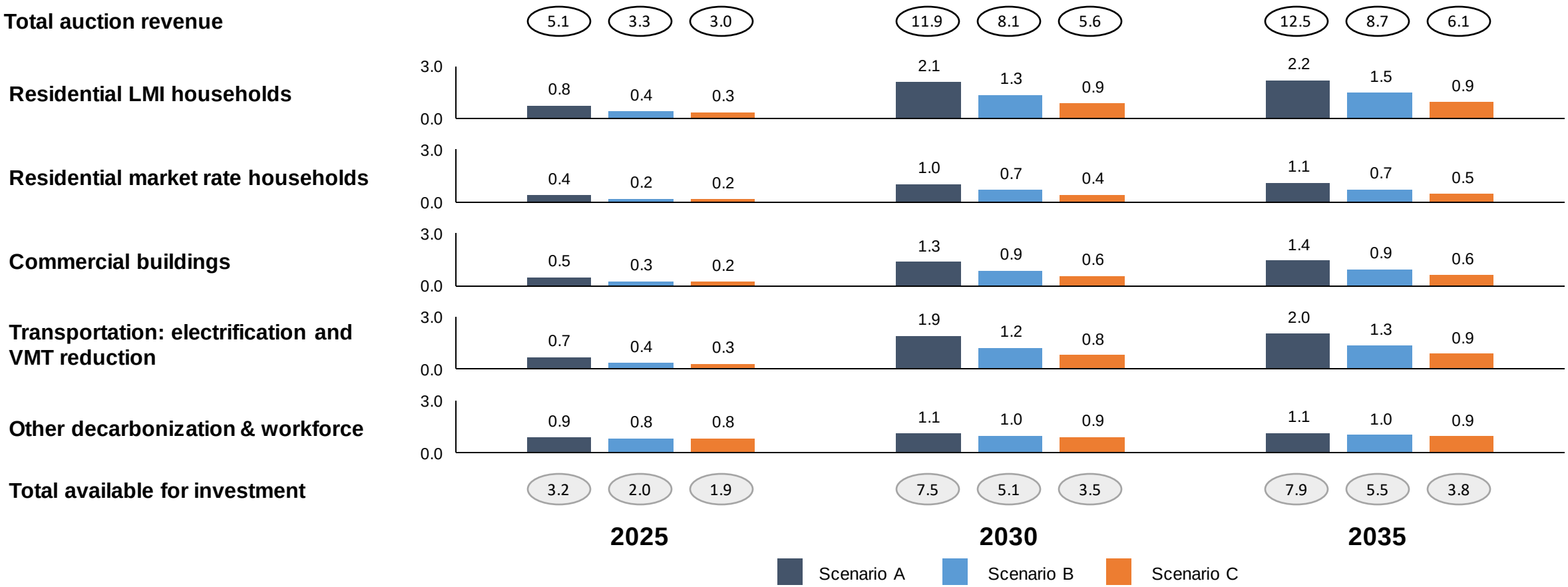


Scenario A Scenario B Scenario C

Econometric and greenhouse gas emissions

Resulting Transformation: Modeled Revenue and Illustrative Investment

Total NYCI auction revenue investment by sector (Billion, real 2022 USD)



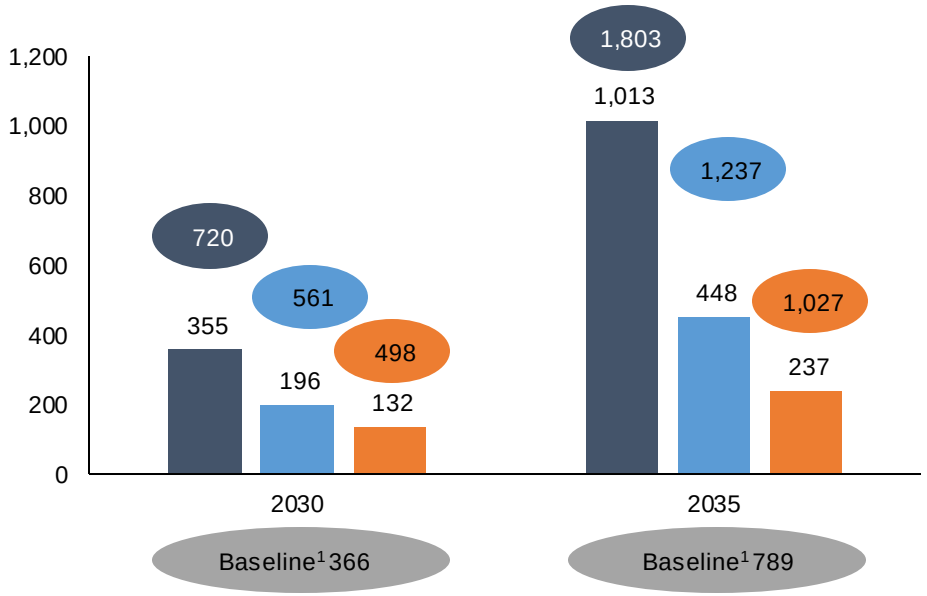
Econometric and greenhouse gas emissions

Technology Deployment: Residential Heating

Number of homes with heat pumps

Higher allowance prices could progressively increase heat pump adoption

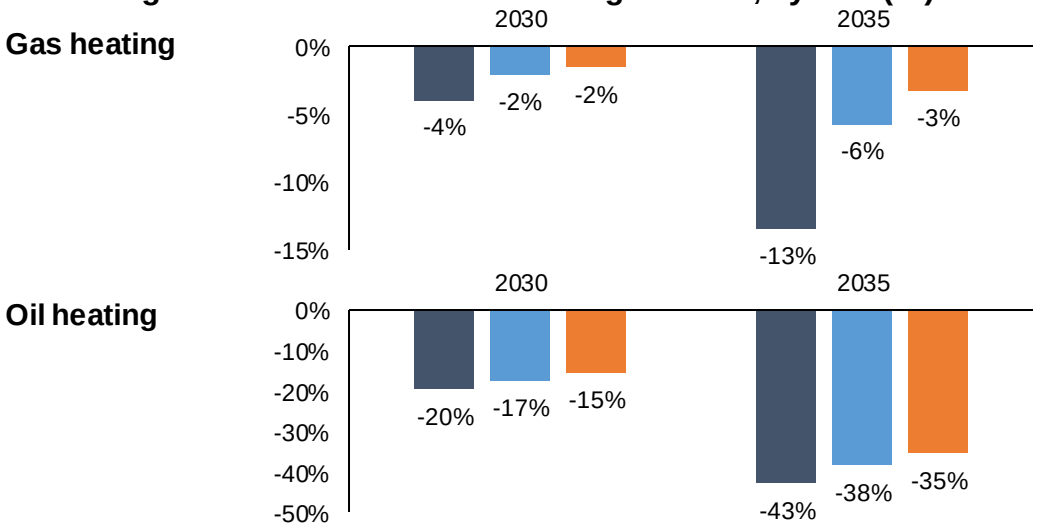
Incremental number of homes with heat pumps[1] (thousands)



Number of homes with gas and oil heating

Higher allowance prices reduce gas and oil use in residential buildings

Percentage reduction in share of heating devices, by fuel (%)



X Total number of heat pumps (baseline + incremental)

Scenario A Scenario B Scenario C

1. Incremental relative to baseline with no NYCI allowance price

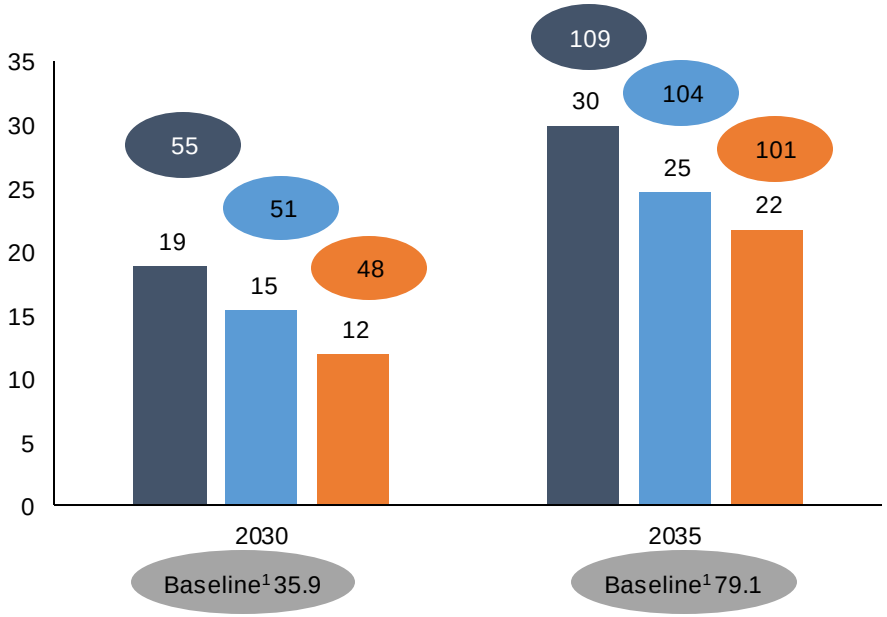
Econometric and greenhouse gas emissions

Technology Deployment: Medium and Heavy-Trucks

Number of Electric vehicles

Higher allowance prices could progressively increase electric vehicle adoption

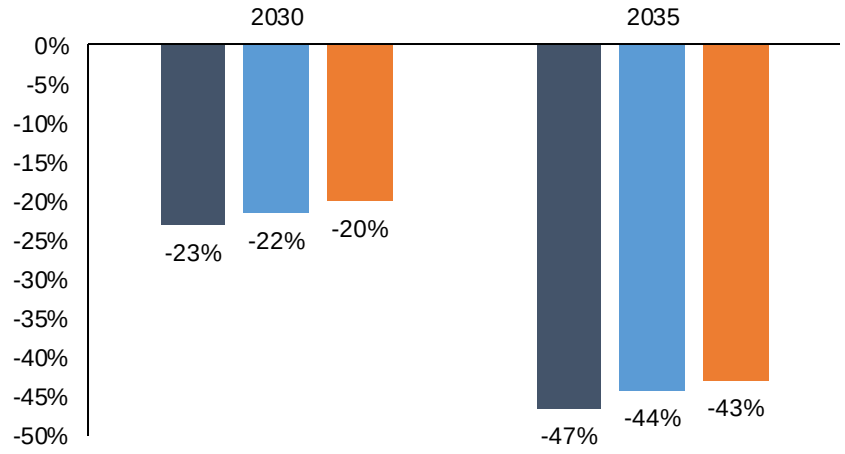
Incremental[1] Battery and hydrogen fuel cell trucks[2] (thousands)



Number of gasoline and diesel vehicles

Higher allowance prices reduce use of gasoline and diesel vehicles

Percentage reduction in share of gasoline and diesel trucks[2] (%)



X Total number of vehicles (baseline + incremental)

Scenario A Scenario B Scenario C

1. Incremental relative to baseline with no NYCI allowance price
2. Trucks includes medium- and heavy-duty trucks

Econometric and greenhouse gas emissions

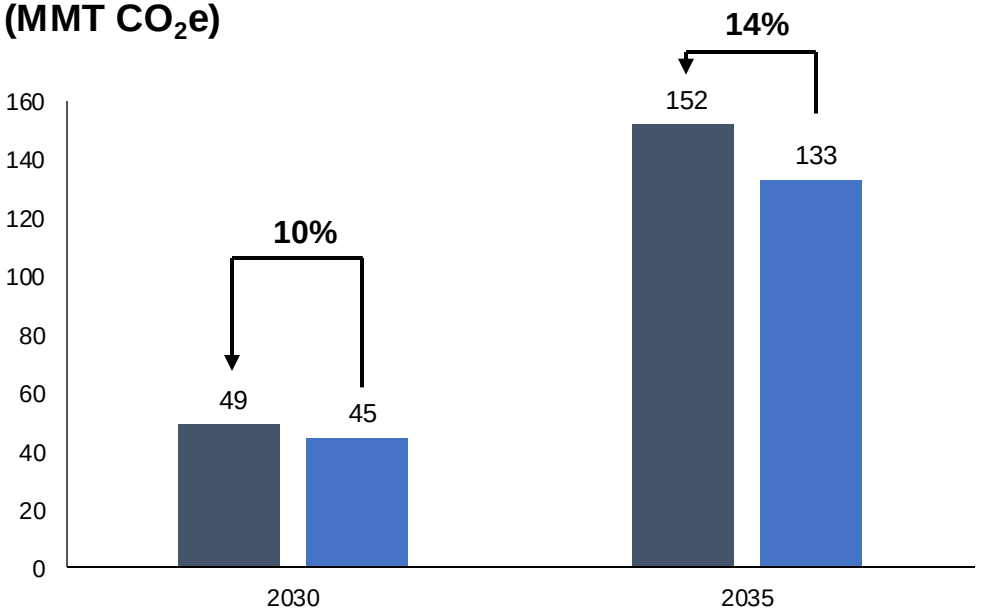
Sensitivity: The Role of Investment

Scenario A Scenario A with no investment

Impact of investments on emissions reductions

Investment leads to higher emissions reductions

Cumulative emissions reductions relative to reference case (MMT CO_2e)

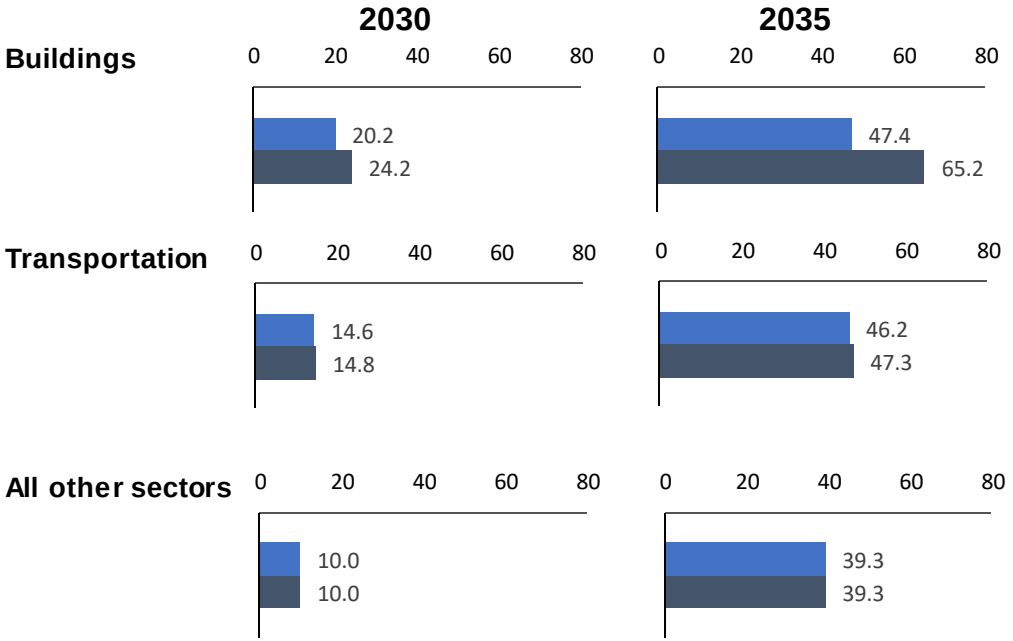


1. Incremental relative to baseline with no NYCI allowance price
2. Trucks include medium- and heavy-duty trucks

Impact of investments by sector

Investments drive the largest emissions reductions in the buildings sector

Cumulative endogenous emissions reduction relative to reference case by sector (MMT CO_2e)



Econometric and greenhouse gas emissions

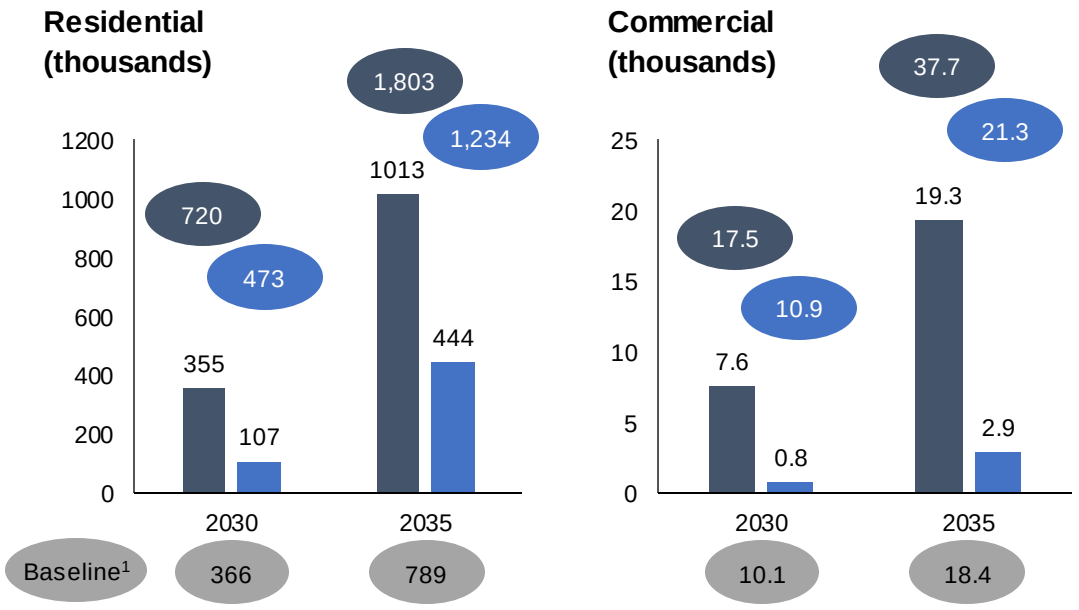
Sensitivity: The Role of Investment

Scenario A Scenario A with no investment

Number of heat pumps

Investments increase uptake of heat pumps in residential and commercial buildings

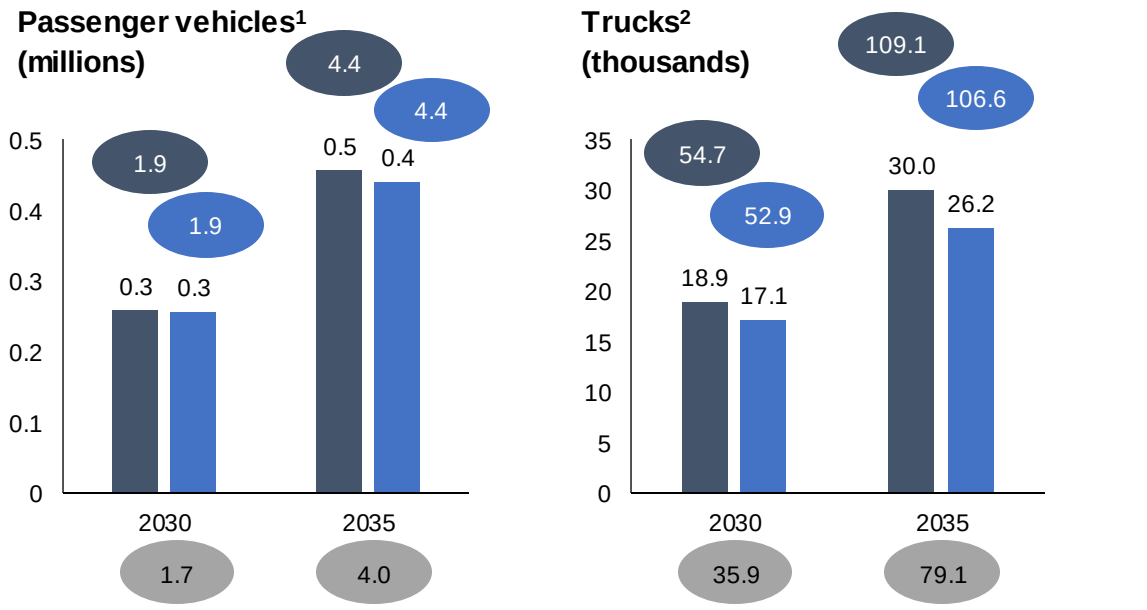
Incremental[1] heat pumps X Total number of heat pumps



Number of electric vehicles

Investments could increase adoption of electric and hydrogen vehicles

Incremental[1] Electric and hydrogen vehicles X Total number of electric and hydrogen vehicles



1. Incremental relative to baseline with no NYCI allowance price
2. Trucks include medium- and heavy-duty trucks

Econometric and greenhouse gas emissions

Emissions and Clean Energy Transformation

Summary Conclusions

- Modeling predicts that all three price ceilings currently evaluated are binding. This means **price ceilings provide a limit on potential emission prices and associated up-front costs**.
- Obligated sectors see accelerated progress towards meeting 2030 Climate Act limit across all scenarios, depending on price ceiling level. Complementary policies and market transformation would further accelerate emission reductions.
- At all levels, **NYCI helps substantially accelerate emission reductions** and can be an essential contributor to clean energy transition in New York. This includes:
  - 250,000 to over 1,000,000 incremental heat pump homes by 2035
  - Reductions in on-road diesel use in excess of 40% by 2035
  - Significant funding made available for equitable decarbonization, including substantial LMI home electrification, investments in transit service and reliability and more. Total revenue by 2030 is estimated to be between $6 and $12 billion per year ($4-8 billion available for investments)

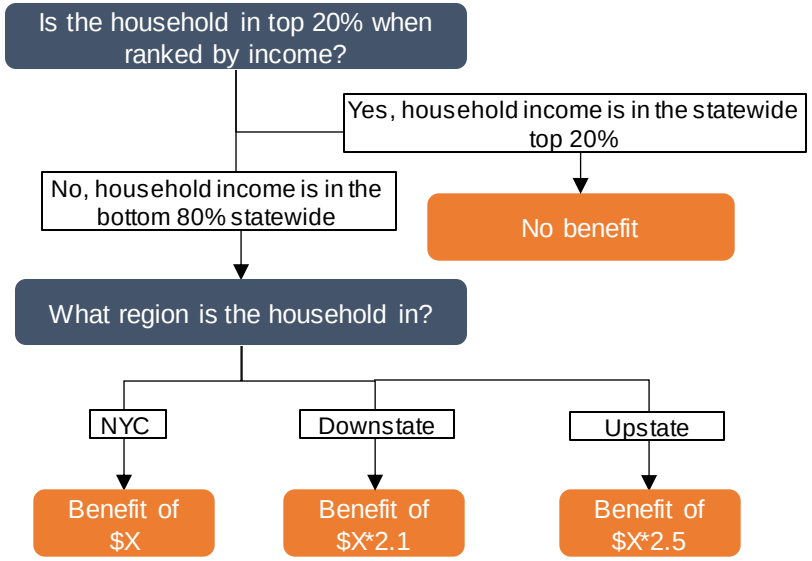
Econometric and greenhouse gas emissions

Household Impacts: key assumptions

The expenditure of the Consumer Climate Action Account presented here is **illustrative and not a formal proposal**. The Affordability Study recommends a more complete progressive structure but includes the geographic differentiation evaluated here. This analysis does not include the affordability impacts of potential electric utility consignment pending stakeholder feedback.

1 Illustrative benefit design

30% of NYCI auction revenue is used for household benefits:



Simplifying assumption: top 20% of earners are equally distributed across the state

2 Income bands

This analysis is focused on the impact of NYCI on affordability for low and middle-income households, defined as follows:

A. Low income

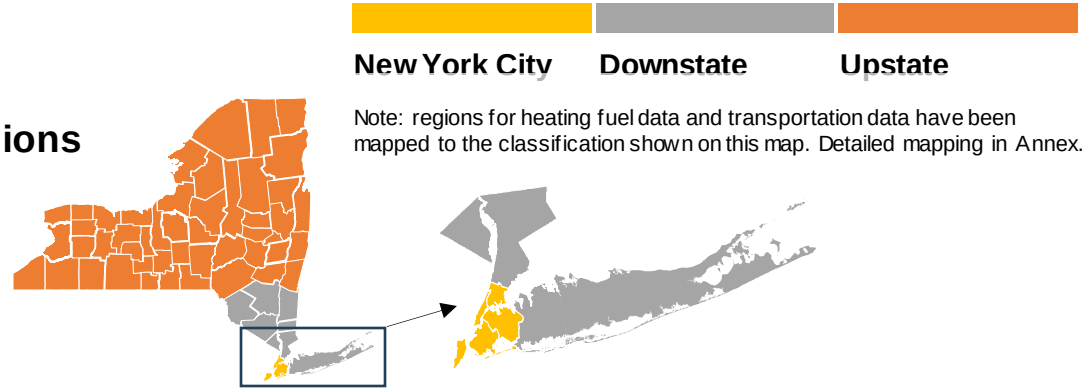
Low income is identified as all income bands entirely below 60% of state median annual household income, i.e., below $35,000 for the purpose of this analysis

B. Middle income

Middle income is identified as the income band that contains the median annual household income in NYS, i.e., $50-75,000 for the purpose of this analysis.

Notes:
(i) Low-income and middle-income definitions are consistent across regions in the State
(ii) Income bands use ACS-PUMS microdata (2018), which reports in 2018 USD

3 Regions



Note: regions for heating fuel data and transportation data have been mapped to the classification shown on this map. Detailed mapping in Annex.

Econometric and greenhouse gas emissions

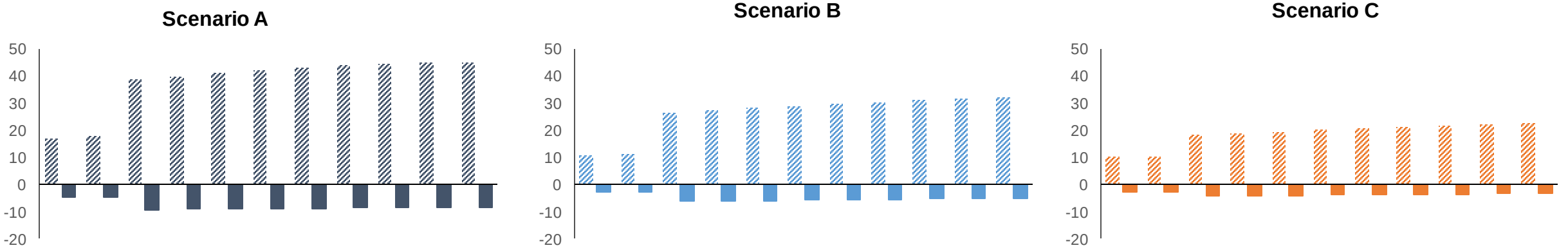
Household Impacts: key results

Monthly program impact on households (Real 2022 USD)

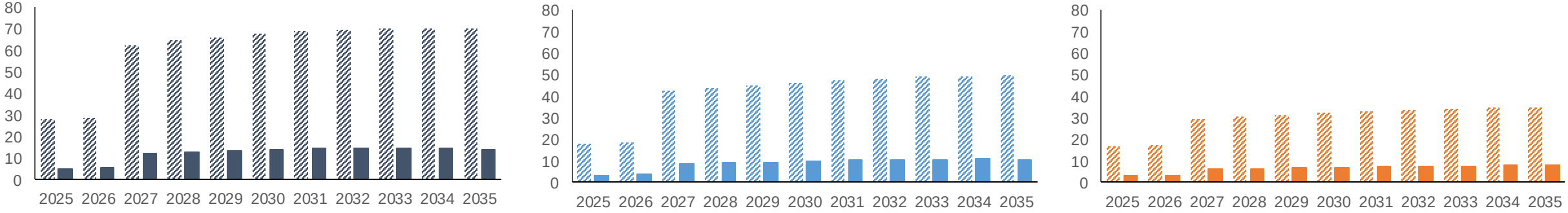
Net household impact after benefit payment

Gross household impact

Average low income household[1]



Average middle income household[1]



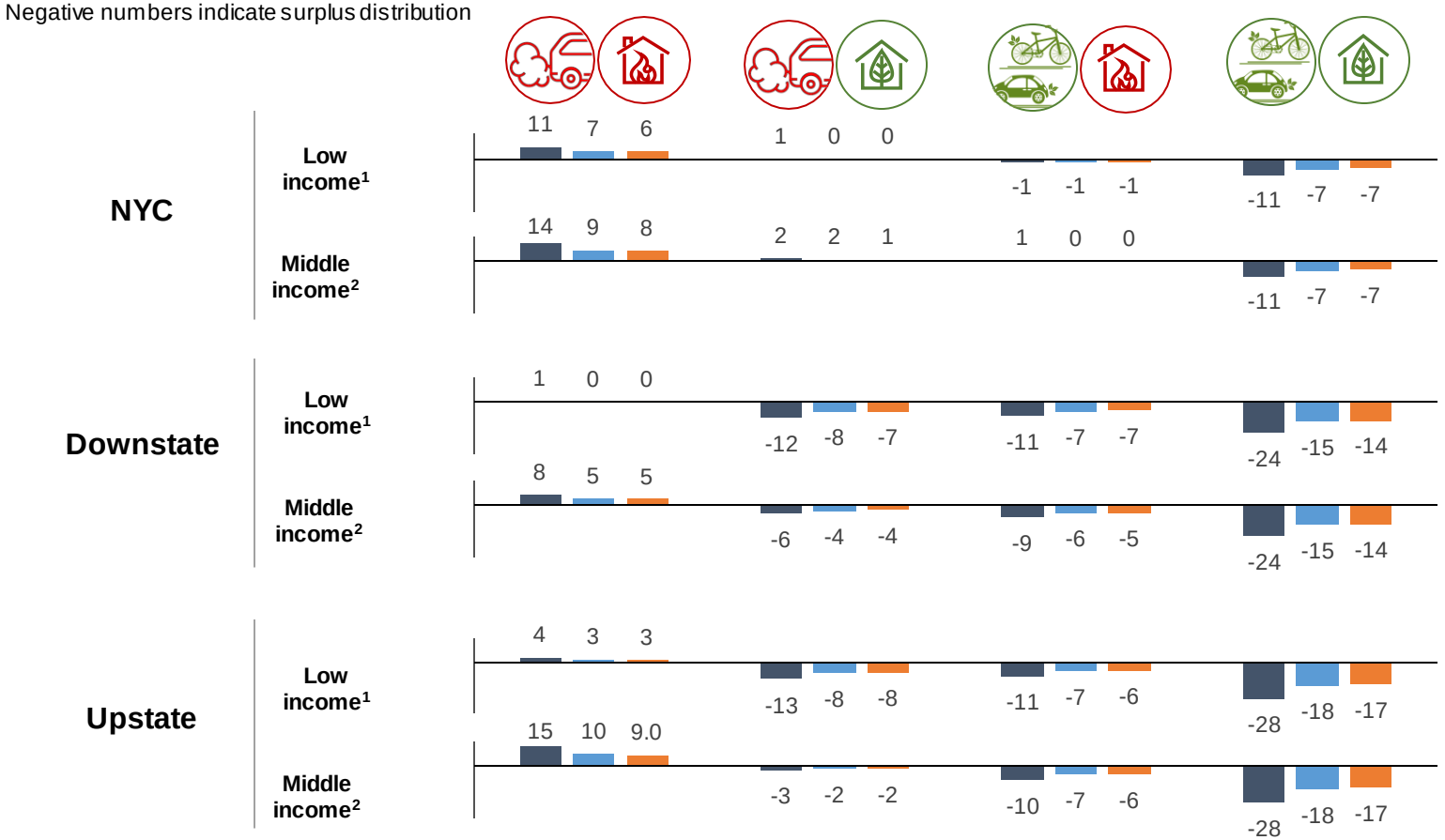
1. Low income defined as average household with annual income below $35k, Middle income defined as households with the median statewide income

Econometric and greenhouse gas emissions

Household Impacts: by type, location and income

Monthly program net impact on the average household in 2025 (Real 2022 USD)

Negative numbers indicate surplus distribution



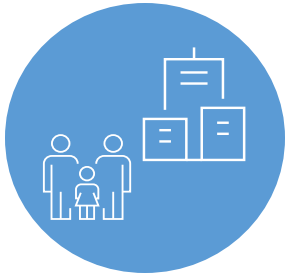
- Total net costs from NYCI are a function of fuel type and fuel use for a given household.
- Across all pricing scenarios middle- and low-income households whose energy consumption is typical for their income level:
  - That have both gasoline vehicles and heat with a fossil fuel are likely to see a net cost in all parts of the state.
  - That have one zero emission option—an electric car, no car, or electric heating–are financially better off immediately or break even depending on the part of the state.

1. Low income defined as average household with annual income below $35k
2. Middle income defined as households with the median statewide income

Econometric and greenhouse gas emissions

Household Impacts: low-income household journey

Pricing Scenario A



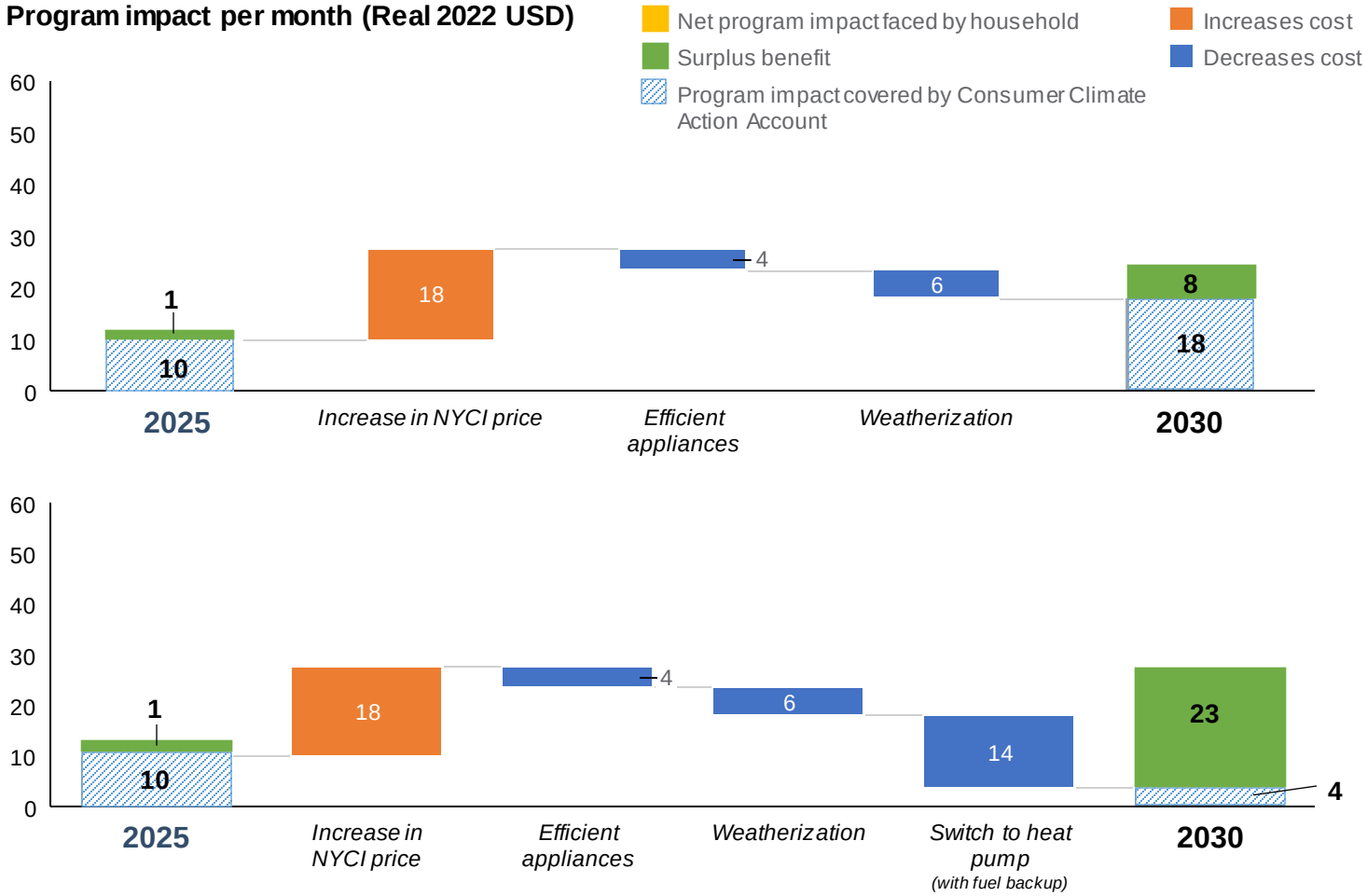
Low-income household[1] in New York City --

- Do not have a car so no impact on transportation cost
- Home is non-weatherized and uses gas heating

Moderate decarbonization

Increased decarbonization

Program impact per month (Real 2022 USD)



1. Low income defined as average household with annual income below $35k

Econometric and greenhouse gas emissions

Household Impacts: middle-income household journey

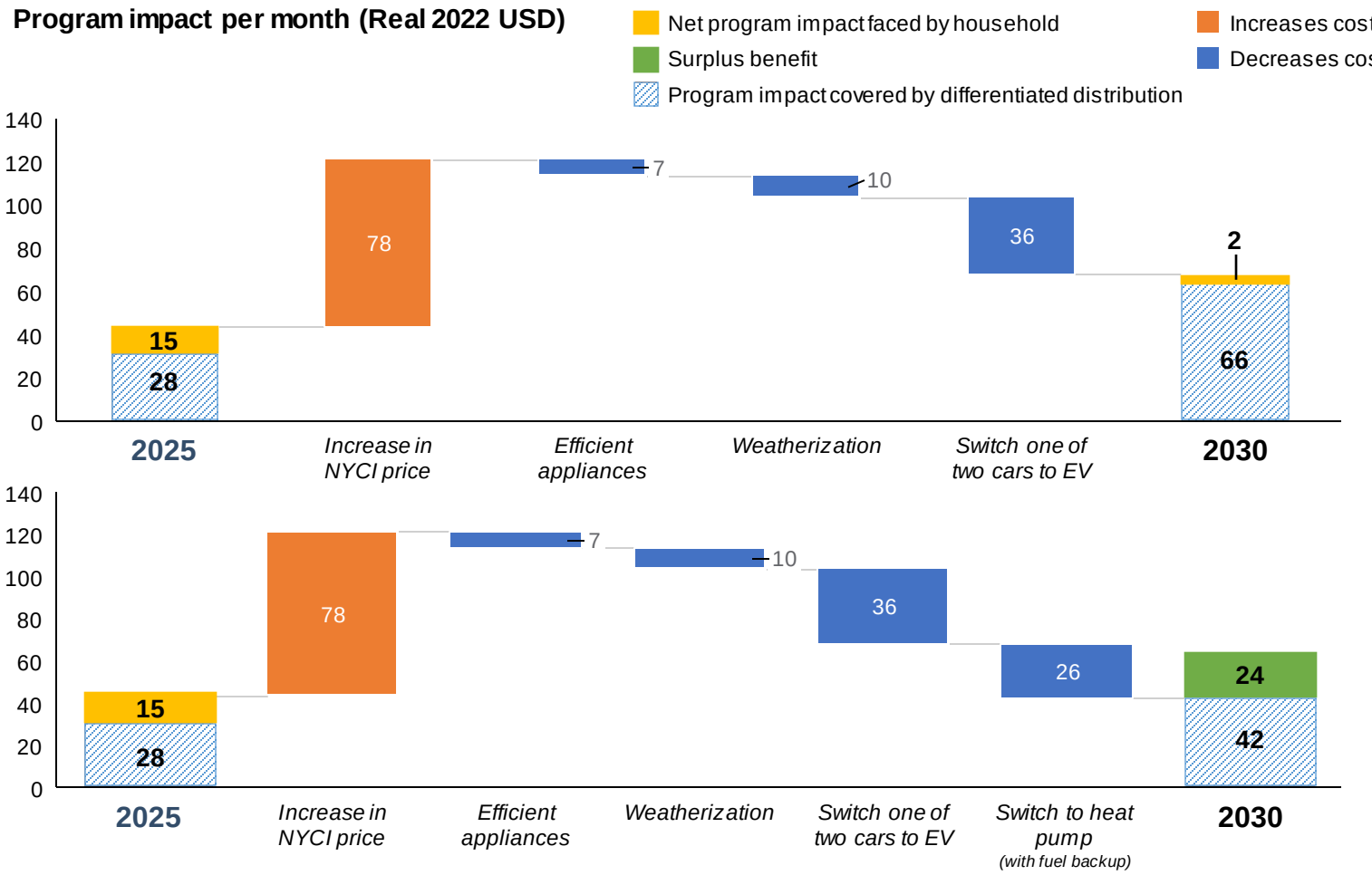
Pricing Scenario A

Middle income household[1] in Upstate New York

- Start with two ICE cars
- Home is not weatherized and uses gas heating

Moderate decarbonization

Increased decarbonization



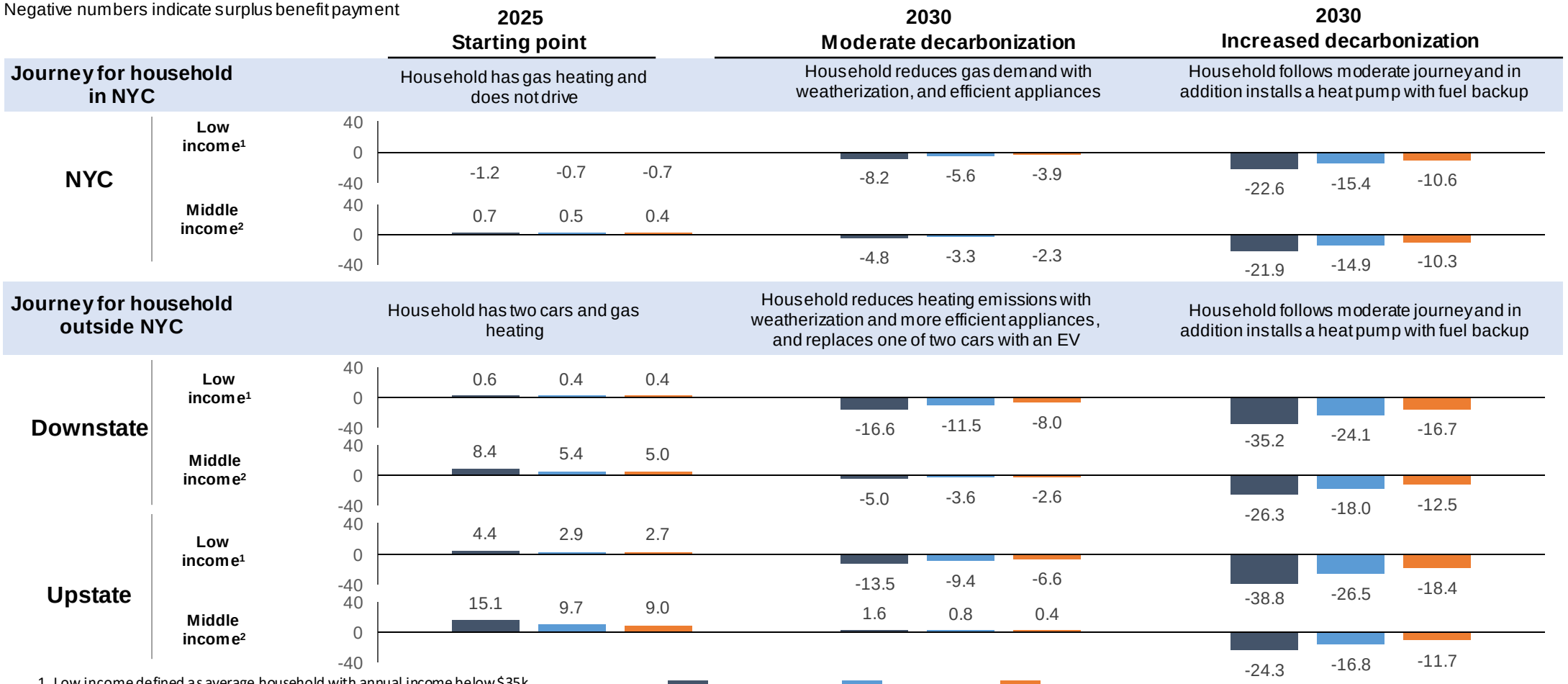
1. Middle income is defined as the income band that contains the median annual household income in NYS, i.e., $50-75,000 for the purpose of this analysis.

Econometric and greenhouse gas emissions

Household Impacts: net benefits and costs

Monthly program impact by decarbonization journey (Real 2022 USD)

Negative numbers indicate surplus benefit payment



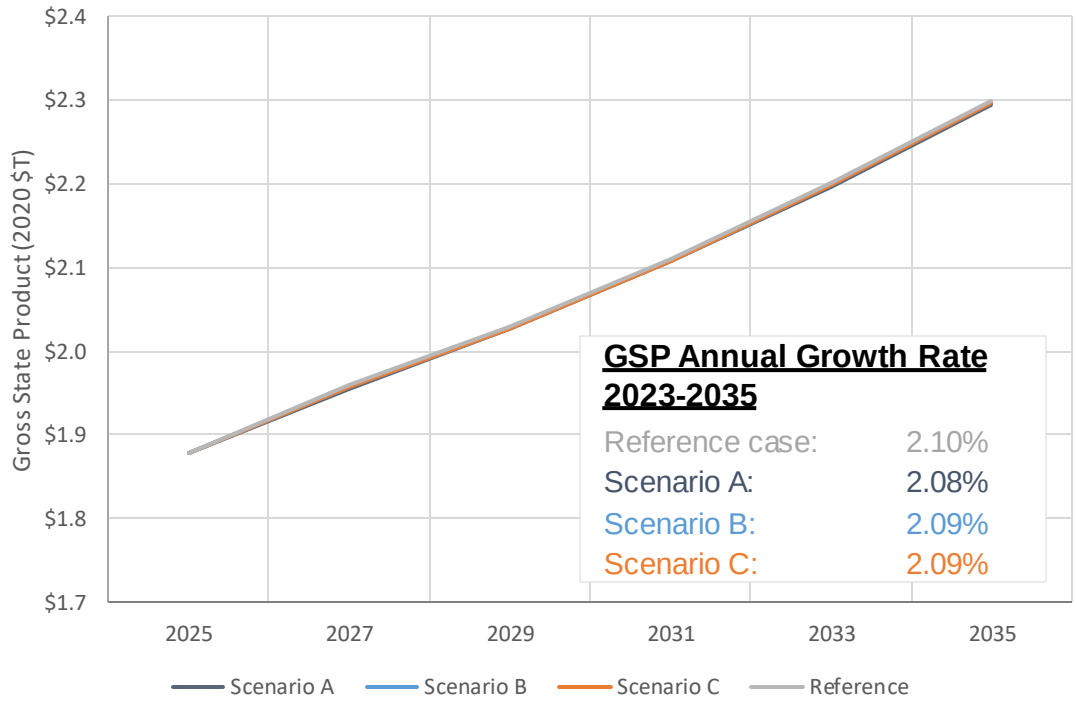
1. Low income defined as average household with annual income below $35k
2. Middle income defined as households with the median statewide income

Econometric and greenhouse gas emissions

Macroeconomic Impact: Gross State Product

- New York State continues to experience economic growth under NYCI under all scenarios
- Gross State Product remains largely unchanged through the modeling period, with the annual growth rate continuing at approximately 2.1% in all cases

Changes to New York Economic Growth Projection



Econometric and greenhouse gas emissions

Cost Impacts

Summary Conclusions

- While more work is needed to fully design this benefit, an illustrative distribution of the Consumer Climate Action Account shows that **millions of households break even due to NYCI**, especially low-income households and those that rely on clean energy like EVs, transit, and heat pumps.
- While some households, especially high fossil fuel users, have residual costs after benefits, **the Consumer Climate Action Account has the potential to manage impacts for a very large percentage of households** in New York.
- **NYCI investments in clean energy are an essential affordability strategy.** The program's support for EV, heat pump, transit, and other related incentives and programs reduces cost exposure for households across New York, with a growing share receiving more benefits than costs.
- Impacts to New York's economy are small and manageable. **Gross state product growth remains largely unchanged under NYCI.**

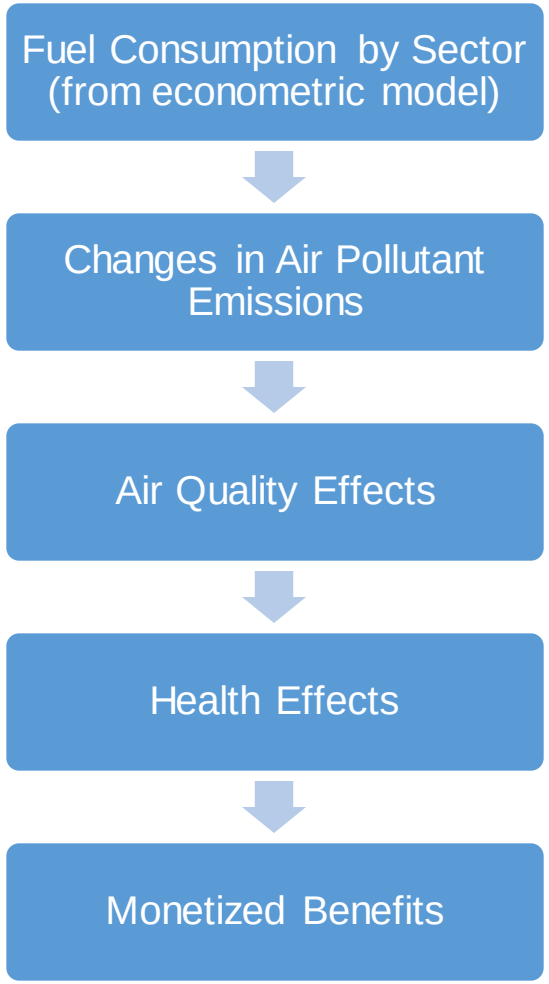
Outline

- Scenarios Analyzed
- Preliminary Analyses
  - Econometric and Greenhouse Gas Emissions
  - **Health Effects**
  - Employment Effects
- Obligating Electricity

Health Effects

Methods Overview

- The air quality and health effects of the preliminary NYCI scenarios were analyzed using a **new health impacts modeling framework** developed to assess benefits at the community level.
- This model enables **identification of benefits to disadvantaged and non-disadvantaged communities**, according to the definitions developed by the Climate Justice Working Group.
- This represents an **improvement over the analysis of the health benefits for the Scoping Plan**, which used EPA's CO-Benefits Risk Assessment Health Impacts Screening and Mapping Tool (COBRA) and was not able to identify benefits by community type such as the Disadvantaged Communities defined by the Climate Act.

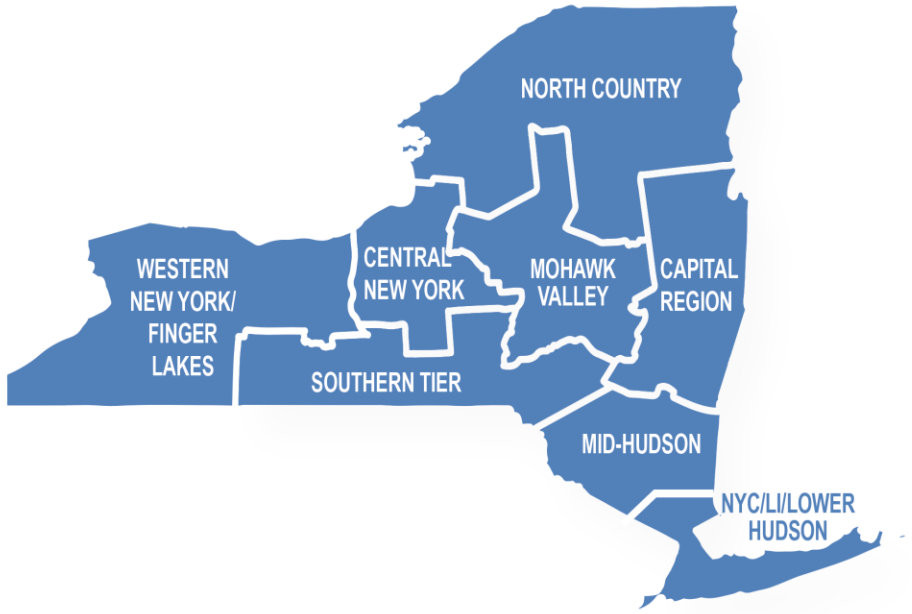


Health Effects

Methods Overview (continued)

Model overview

- The new health impacts model is based on the framework for the ZIP code-level Air Pollution Policy Assessment tool (ZAPPA, Shukla et al. 2022).
- This approach combines C-TOOLS, an air quality model similar to AERMOD, to determine air quality effects from changes in pollutant emissions in 8 separate regions.
- It also uses COBRA to account for transport across regions, and to determine the health benefits and monetary value from the air pollutant emissions reductions.
- The results of this model have been shown to compare well to ambient air quality data and the results of photochemical grid cell models, such as CMAQ.



Air Quality and Health Model Regions

Health Effects

Methods Overview (continued)

Emissions methods

Fuel consumption data (from econometric modeling) is available at the state level and is downscaled to the Census tract level. The downscaling approach differs by sector:

Industrial	Modeled as point sources where data is available; rest of emissions downscaled based on proportion of industrial land area (based on land use designations from NY Dept of Taxation and Finance)
Commercial	Proportion of commercial land area (based on land use designations from NY Dept of Taxation and Finance)
Residential	Proportion of occupied homes in each Census tract. Note that the NYCI analysis **excludes the benefits of reduced residential wood combustion**.
On-road	Road-link-level VMT and speeds for most road types; proportion of land area for local and minor collector roads
Nonroad	Airports: landing and takeoff data; marine and rail: land area; all other categories: population

Health Effects

Projected Health Effects

Summary Conclusions

- NYCI is projected to **reduce emissions and improve air quality in all regions and communities** in New York, resulting in **substantial health benefits**
- **Disadvantaged Communities would experience health benefits that exceed their fraction of the population in all regions**
  - greater annual-average reductions in $PM_{2.5}$ concentrations;
  - **higher per-capita health benefits**;
  - some health benefits, such as reduced asthma incidence and emergency room visits, would improve markedly within Disadvantaged Communities relative to non-DAC because of the higher baseline rates in Disadvantaged Communities
- Benefits would largely be concentrated in urban areas.
- **Most of the benefits projected are associated with reductions in emission from buildings (44%) and on-road transportation (45%).**
- Directly obligated industrial entities represent a very small portion of emissions and therefore of potential emission reductions in all regions and community types

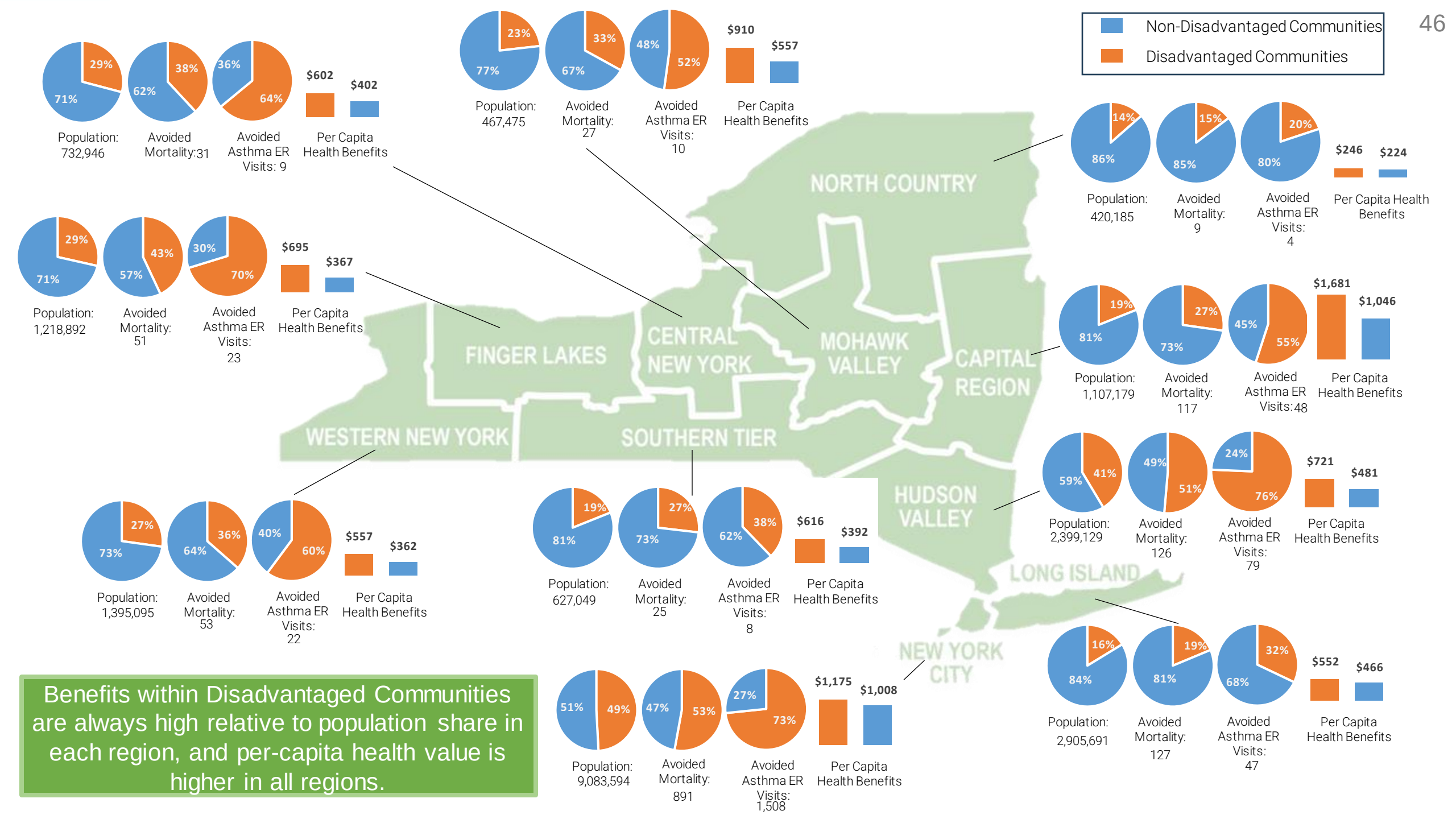
Health Effects

Projected Health Effects: Physical Benefits (Scenario A)

By 2035, air quality improvements can provide significant **annual** health benefits, including **avoiding** up to –

Health Effect	Avoided Cases Per Year	Fraction in Disadvantaged Communities
Population of Disadvantaged Communities in New York:		36%
Premature Mortality	1,500	45%
Nonfatal Heart Attacks	620	52%
Hospitalizations	440	45%
Acute Bronchitis	670	45%
Respiratory Symptoms	20,800	52%
Emergency Room Visits, Asthma	1,800	71%
Asthma Exacerbation	12,700	45%
Minor Restricted Activity Days	410,000	44%
Work Loss Days	70,500	44%

The fraction of each health benefit accrued within Disadvantaged Communities is larger than the Disadvantaged Communities share of the population

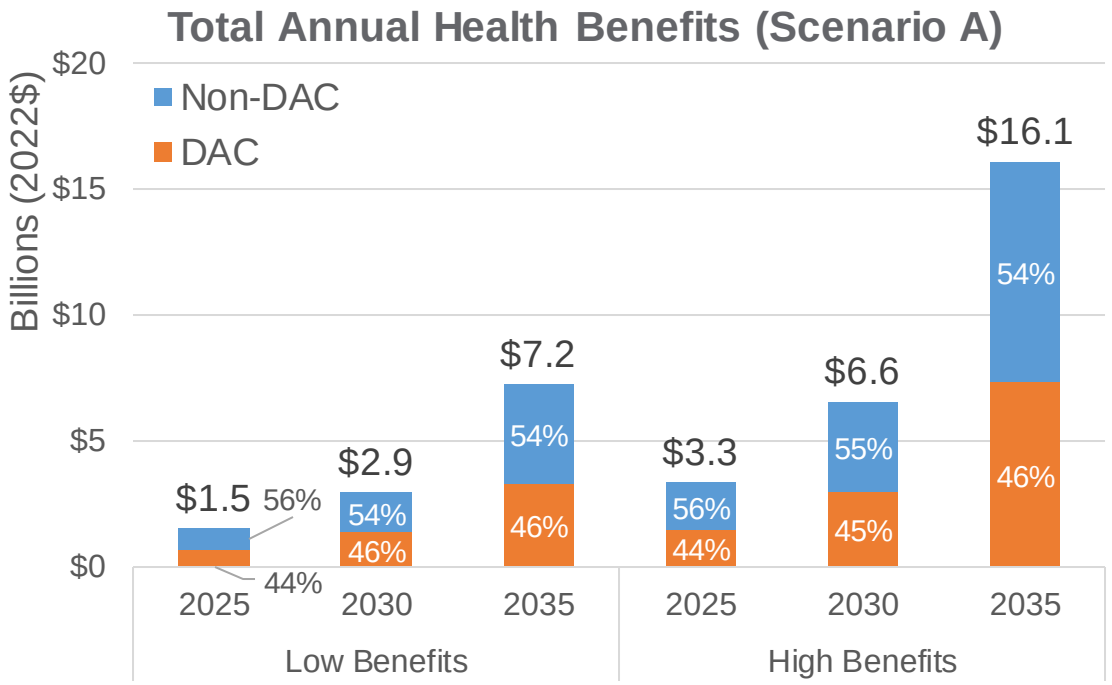


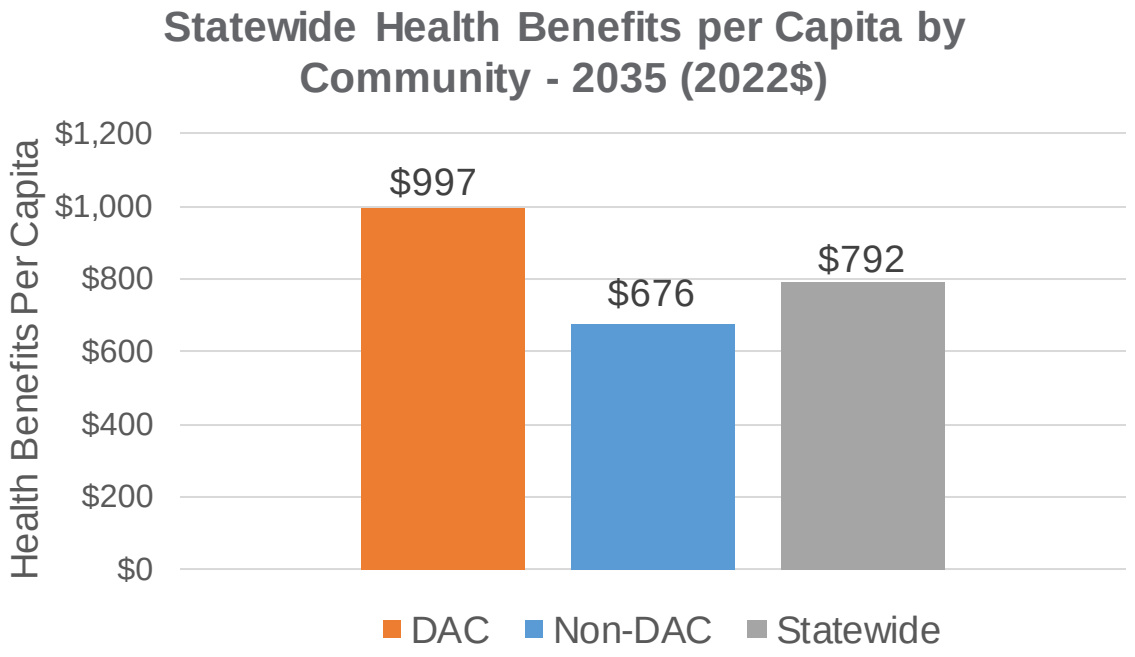
Benefits within Disadvantaged Communities are always high relative to population share in each region, and per-capita health value is higher in all regions.

Health Effects

Projected Health Effects: Total Value

Value of annual health benefits is estimated at $7-16 billion by 2035, with 44-46% of the benefits attributed to health benefits within Disadvantaged Communities (relative to 36% population share)





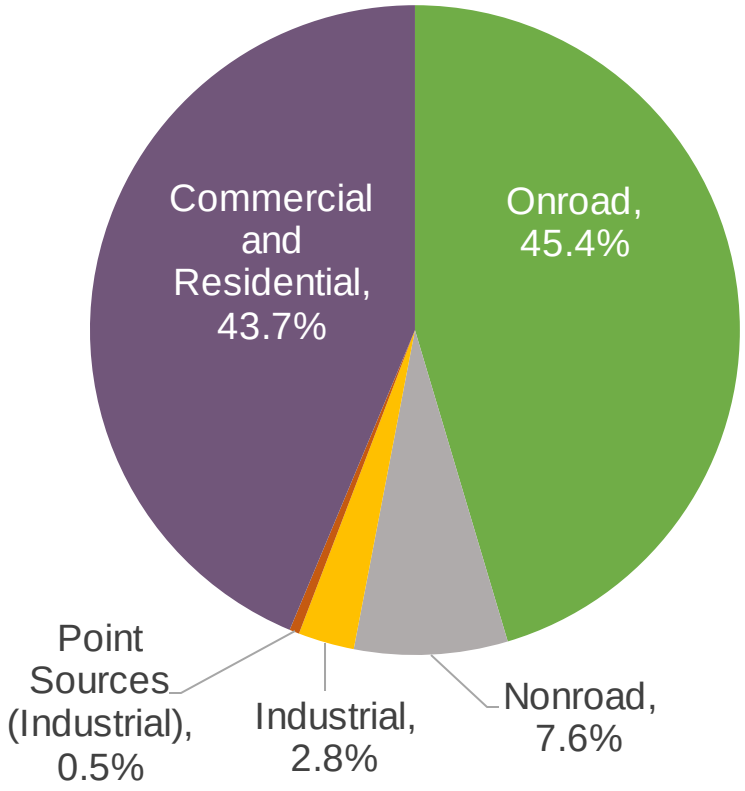
Notes: "High" and "Low" values represent two estimates based on two methods for estimating premature mortality and heart attack incidence in response to $PM_{2.5}$ exposure. Unless otherwise noted, all results presented are for the High case.

'DAC' denotes geographically defined Disadvantaged Community areas, encompassing 36% of the population in NYS

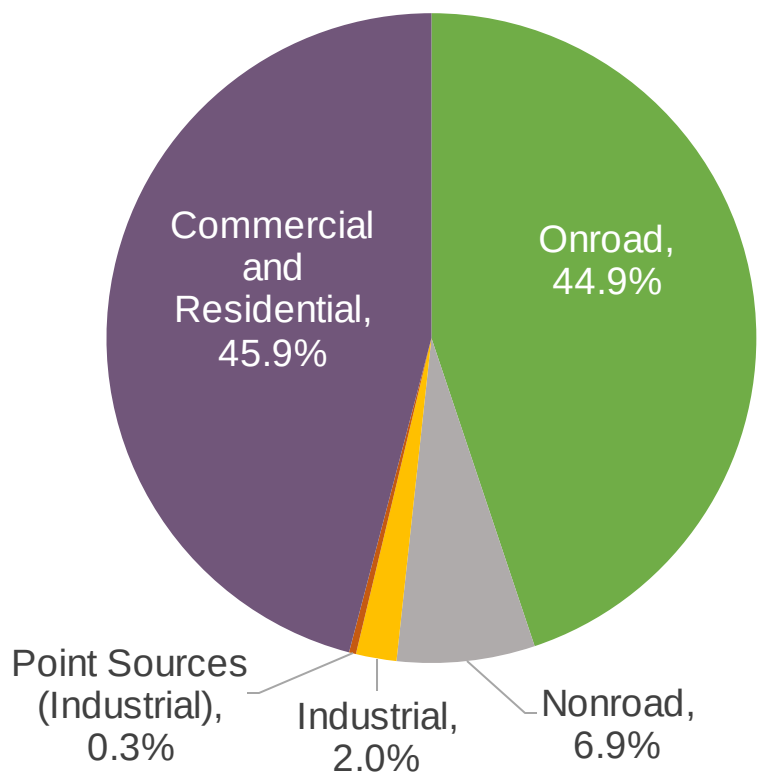
Health Effects

Projected Health Effects: By Sector

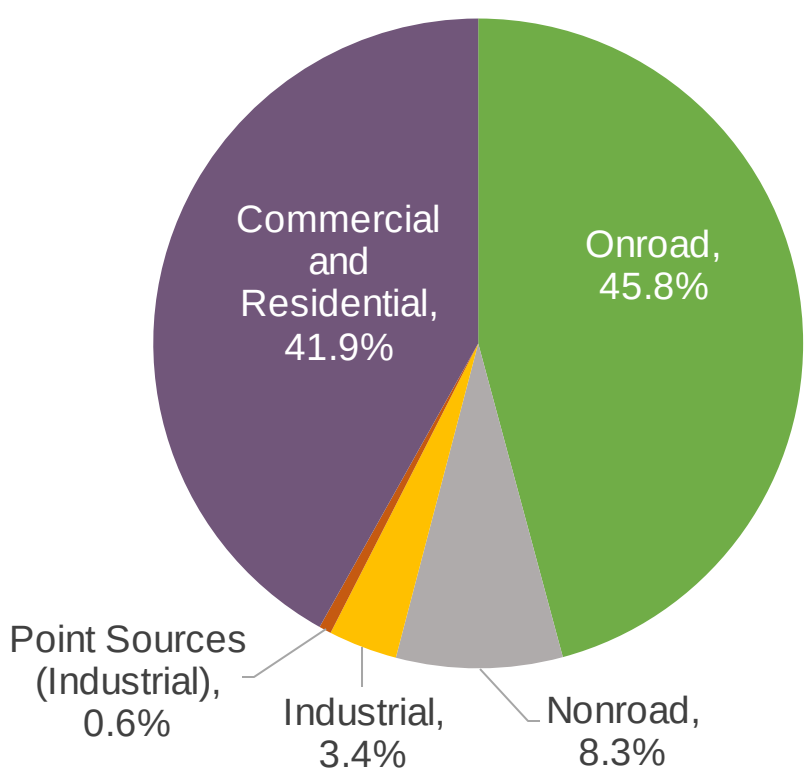
Health Benefits by Sector (Statewide)



Health Benefits by Sector (DAC)



Health Benefits by Sector (Non-DAC)



Outline

- Scenarios Analyzed
- Preliminary Analyses
  - Econometric and Greenhouse Gas Emissions
  - Health Effects
  - **Employment Effects**
- Obligating Electricity

Employment Effects:

Methods Overview – Initial Employment Outputs

Employment effects of NYCI are analyzed across six sectors generating changes:

- Electricity
- Fuels
- Buildings
- Transportation
- Industrial
- Waste

The investments in these six sectors drive changes in employment in five industries:

- Construction
- Professional Services
- Manufacturing
- Other supply chain
- Induced employment in other industries.

- Job impacts are estimated using IMPLAN and NREL's JEDI models. These industry standard input-output models measure the workforce impacts of investments in new energy facilities, building electrification and efficiency measures, and transportation transition incentives.
- The analysis estimates and characterizes net job changes in the NYCI scenario compared to a 2025 pre-NYCI baseline.
- Analysis is focused on Scenario A. Scenarios B and C would have somewhat less effect on employment.

Employment Effects:

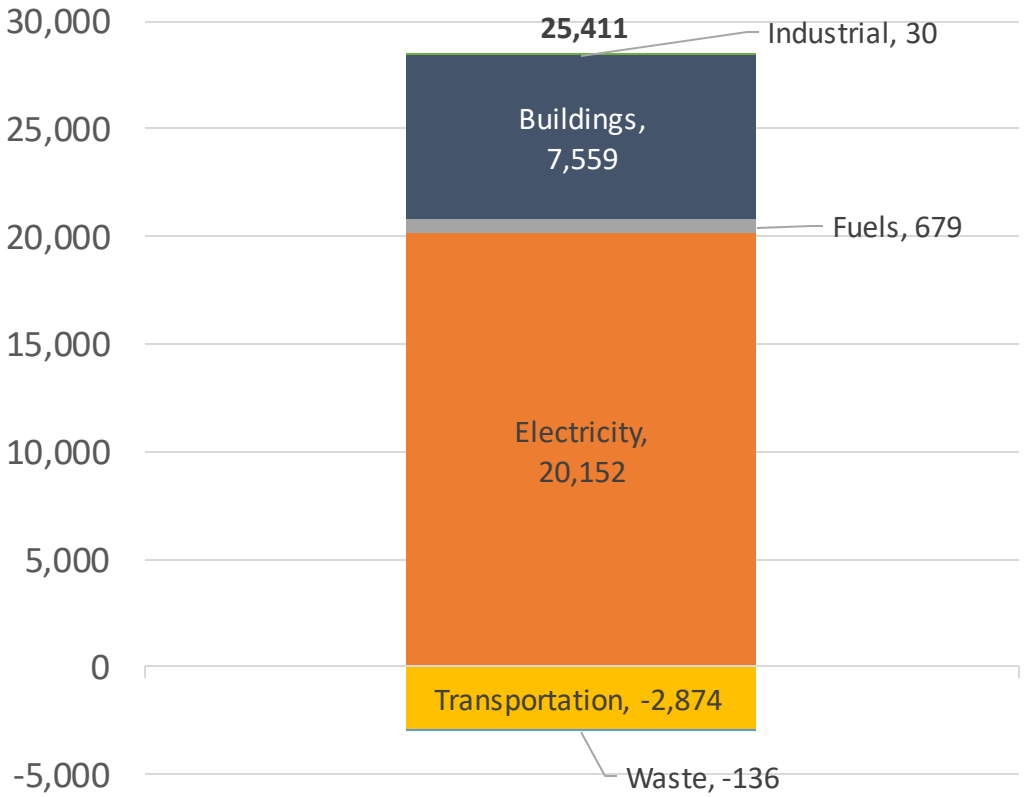
Analysis Results: Summary Conclusions

Investment in the six sectors (Electricity, Fuels, Buildings, Transportation, Industrial, Waste) are projected to affect the following changes in employment from 2025 to 2030:

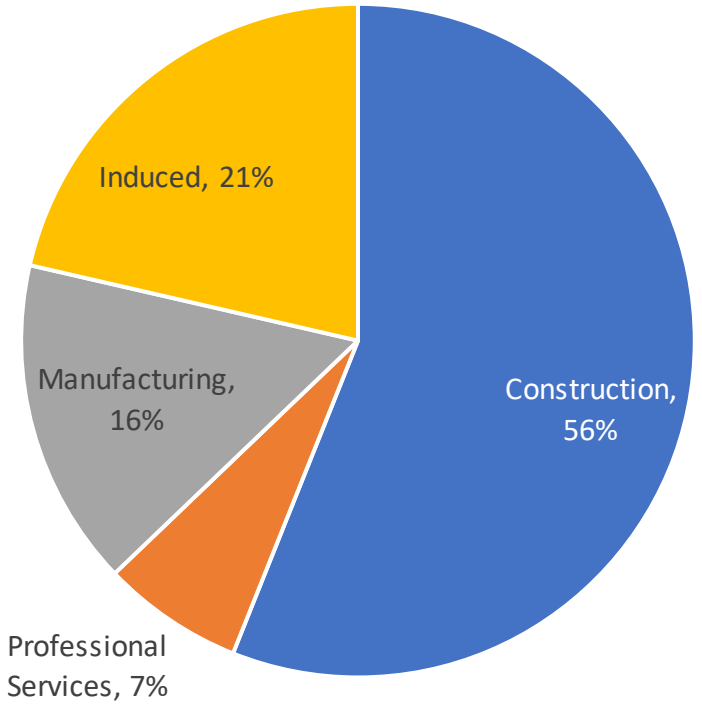
- NYCI, alongside other policies including the Clean Energy Standard, Clean Energy Fund, and other programs, helps support job creation of over 28,000 jobs by 2030 across four growth sectors, with continuing growth anticipated in subsequent years.
  - Electricity (+20,150), Fuels (+680), Buildings (+7,560), and Industrial (+30) drive net employment growth.
- Job creation in these sectors exceeds displacement by 9x in the sectors that see declines.
- Most jobs created by 2030 by the Electricity and Buildings sectors are in construction (46% and 67%, respectively).

Employment Effects:

Analysis Results: Change in Employment by Sector and Industry, 2030



Employment Change By Generating Sector



Job Creation By Employment Industry

Outline

- Scenarios Analyzed
- Preliminary Analyses
  - Econometric and Greenhouse Gas Emissions
  - Health Effects
  - Employment Effects
- **Obligating Electricity**

Obligating Electricity

Methods Overview

- Analysis used the Integrated Planning Model (IPM) – a capacity expansion model that solves for a least-cost capacity and generation mix while incorporating constraints such as clean energy requirements, procurement targets and carbon pricing mechanisms such as RGGI.
- Analysis includes three principal scenarios that are compared against each other to understand the impact of NYCI obligation on electricity system, costs, and emissions leakage. A non-obligated case and two scenarios with electricity obligated were analyzed:
  - *Electricity Non-Obligated scenario:* all baseline assumptions (described on next slide) and no NYCI obligation
  - *Electricity Obligated scenario – Average Emission Factor:* in-state generation is obligated directly, imported electricity is obligated with a border charge equal to the annual average emission factor of the region from which the import originates. This method aligns with New York's current GHG inventory.
  - *Electricity Obligated scenario – NY Marginal Emission Factor:* in-state generation is obligated directly, imported electricity is obligated with a border charge equal to New York's marginal emission factor at the time of import.

  The obligated scenarios apply NYCI allowance prices consistent with Scenario A. Scenarios reflect a policy design that provides a credit for RGGI allowance payments, applying the higher of RGGI or NYCI prices.

Obligating Electricity

Methods Overview – Scenario Assumptions

- *Existing Policies – New York.* All cases include several existing electricity policy characterizations:
  - Contracted New York State projects as of Summer 2023
  - Full achievement of 70x30 renewable electricity requirement
  - Full achievement of 0x40 clean electricity requirement
  - Loads track Integration Analysis Scenario 2
- *RGGI.* All cases include the same characterization of the future RGGI system:
  - States included: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont
  - RGGI allowance budget trajectory declines to zero allowances in 2040 and beyond with unlimited banking
- *Other States and Federal Policy*
  - Incorporates federal Inflation Reduction Act (IRA) incentives
  - Reflects achievement of clean energy procurement and renewable portfolio/clean energy standards as of Summer 2023 for non-NY states.

Obligating Electricity

Takeaway: Average Emission Factor

- Obligating electricity while applying the Average Emission Factor to electricity imports accelerates 2.4 GW of renewable deployment in New York by 2035 which would otherwise occur by 2040.
- Relative to the non-obligated case, emissions occurring in New York are projected to reduce by relying more on imports. In 2025, net imports increase by 13 TWh, which falls to 10 TWh higher net imports in 2035.* These imports are projected to be filled principally by increased use of fossil fuel generation in neighboring regions.
- As a result, from 2025 to 2035, 82% of the emissions reductions in New York are projected to be offset by increased emissions out of state. After accounting for this leakage, global emission reductions total 23 MMT over 10 years. Emission reductions emerge principally after 2030 as new renewable generation comes online.
- Electricity costs projected to increase in New York, even after accounting for other savings.
  - 2025 increase: $1.05bn (18% of cost increase accrues to Consumer Climate Action Account/Industrial Small Business Climate Action Account)
  - 2030 increase: $0.87bn (16% of cost increase accrues to Consumer Climate Action Account/Industrial Small Business Climate Action Account)

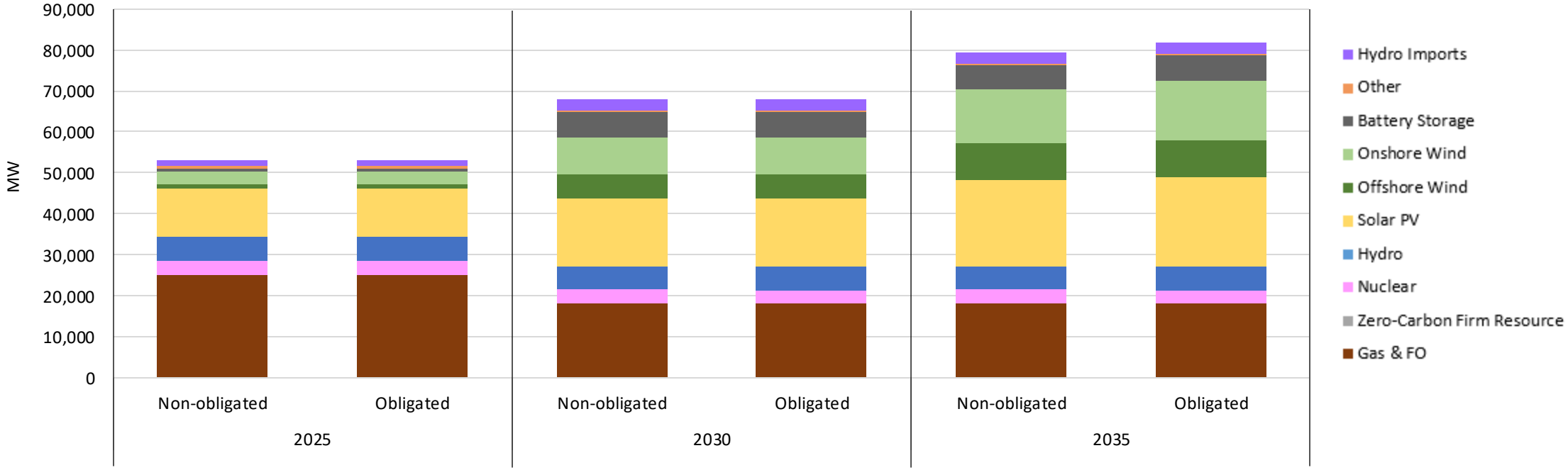
* **Note**: Net imports accounting in this context does not include contracted and legacy imports from Quebec, as those are considered part of the New York supply mix and do not vary between cases and scenarios.

Obligating Electricity

Average Emission Factor: Installed Capacity

Change in Capacity for Electricity Generation Installed in New York, Obligated Scenario v. Non-Obligated Case (MW)

Resource Type	2025	2030	2035
Thermal	0	-172	-172
Renewable Energy	0	0	+2,405



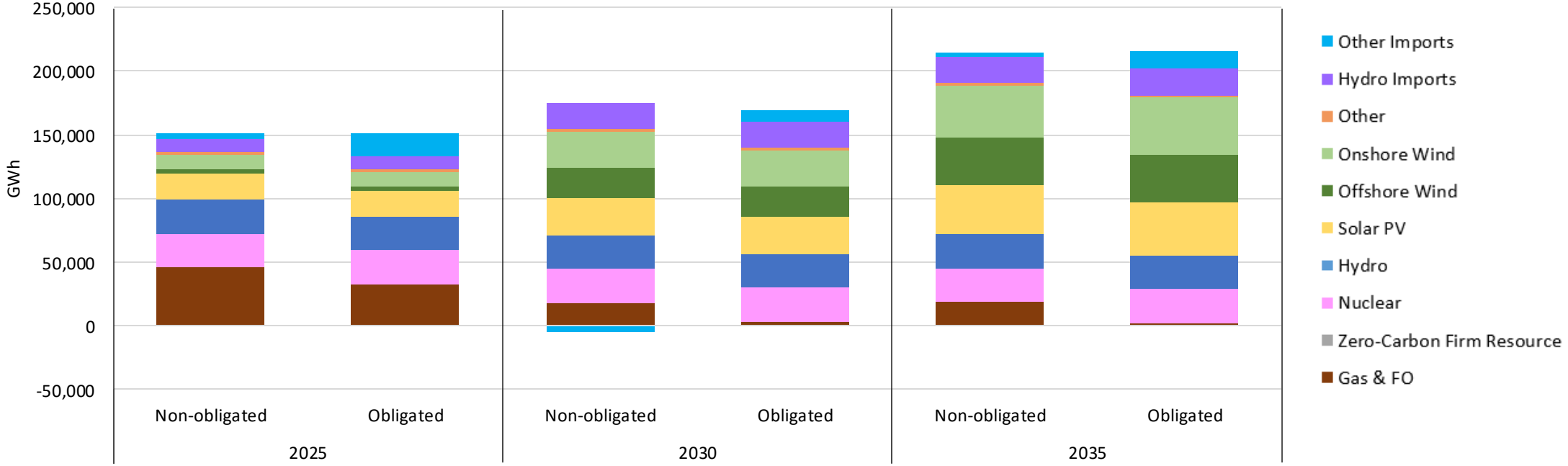
Notes: "Other" refers to municipal solid waste and landfill gas combustion

Obligating Electricity

Average Emission Factor: Energy Balance

Change in New York electricity generation, Obligated Scenario v. Non-Obligated Case (GWh)

Resource Type	2025	2030	2035
Thermal	-13,237	-14,644	-16,513
Renewable Energy	-330	+14	+6,873
Imports	+13,100	+14,559	+10,289



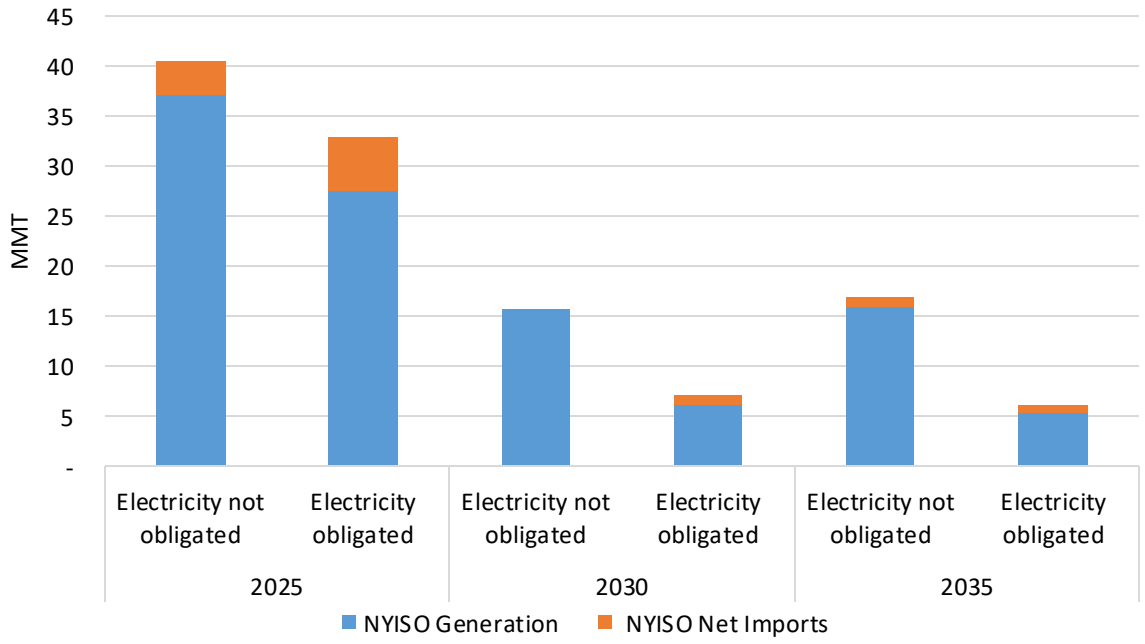
Notes: "Other imports" indicates the NYCA net imports excluding assumed constant contracted (CHPE) and legacy hydro imports into New York from Quebec.
"Other" refers to municipal solid waste and landfill gas combustion

Obligating Electricity

Average Emission Factor: Emissions

Apparent NYCA Emissions

(NY Climate Act Accounting)



Relative Change in Emissions, Non-Obligated Minus Electricity Obligated

(Cumulative Emissions Changes 2025-2035)

Geography	Cumulative Emissions Changes Due to Obligation 2025-2035 ($MMT CO_2e$)
New York	-131
Eastern Interconnection + Quebec (net of NY)	+108
Net Change:	**-23**

82% of NY emission reductions leak to neighboring regions

Obligating Electricity

Average Emission Factor: Total Cost

- Revenue to existing fossil fuel generators in New York declines as a result of reduced dispatch under NYCI. While energy prices increase, this is not enough to increase overall payments to these generators.
- Existing hydro generated in New York and Quebec sees significantly increased revenue due to higher energy prices, though dispatch is largely unchanged.
- The significant increase in imported electricity substantially increases payments to out-of-state generators.
- **As a result of NYCI obligation, total energy payments projected to increase by over $1 billion in 2025 and nearly $900 million in 2030.**

	2025	2030
(thousands 2022$)	Incremental Revenue in Obligated vs. Non-Obligated Cases	
Gas and Fuel Oil	-$64,326	-$364,873
Nuclear[3]	$0	$0
Hydro	$216,832	$406,826
RE[3]	$0	$0
Other	$17,879	$32,814
Hydro Imports-New[1]	$0	$0
Hydro Imports-Existing[2]	$113,708	$166,777
Other Imports	$763,665	$629,480
TOTAL	**$1,047,758**	**$871,024**

1. The "Hydro Imports-New" refers to the imports from Champlain Hudson Power Express (CHPE).
2. Hydro Imports-Existing refers to hydro power from Canada Quebec. Both existing and new hydro imports are assumed to be constant thorough the modeling horizon.
3. Because most renewable and nuclear generation receives out-of-market payments from NYSERDA that are a function of energy and capacity prices, it is assumed that increased energy costs under NYCI obligation reduces revenue under the Clean Energy Standard programs, resulting in no net revenue.

Obligating Electricity

Takeaway: NY Marginal Emission Factor

- Obligating electricity while applying a NY Marginal Emission Factor to electricity imports accelerates 7.8 GW of renewable deployment in New York by 2035 which would otherwise occur by 2040.
- Relative to the non-obligated case, New York is projected to rely more on imports in 2030, with 3.5 TWh higher net imports. In 2035, however, the incremental renewable builds lead to New York becoming a net exporter.* Relative to the Average Emission Factor approach, the NY Marginal approach reduces imports in 2025 and 2030.
- Between 2025 and 2035, 42% of the emission reductions achieved in New York are projected to be offset by increases in neighboring regions, resulting in an emission reduction of 27 MMT CO_2e, slightly higher than the 23 MMT projected in the Average scenario.
- Electricity costs increase in New York, even after accounting for other savings.
  - 2025 increase: $1.46bn (18% of cost increase accrues to Consumer Climate Action Account/Industrial Small Business Climate Action Account)
  - 2030 increase: $1.87bn (15% of cost increase accrues to Consumer Climate Action Account/Industrial Small Business Climate ActionAccount)

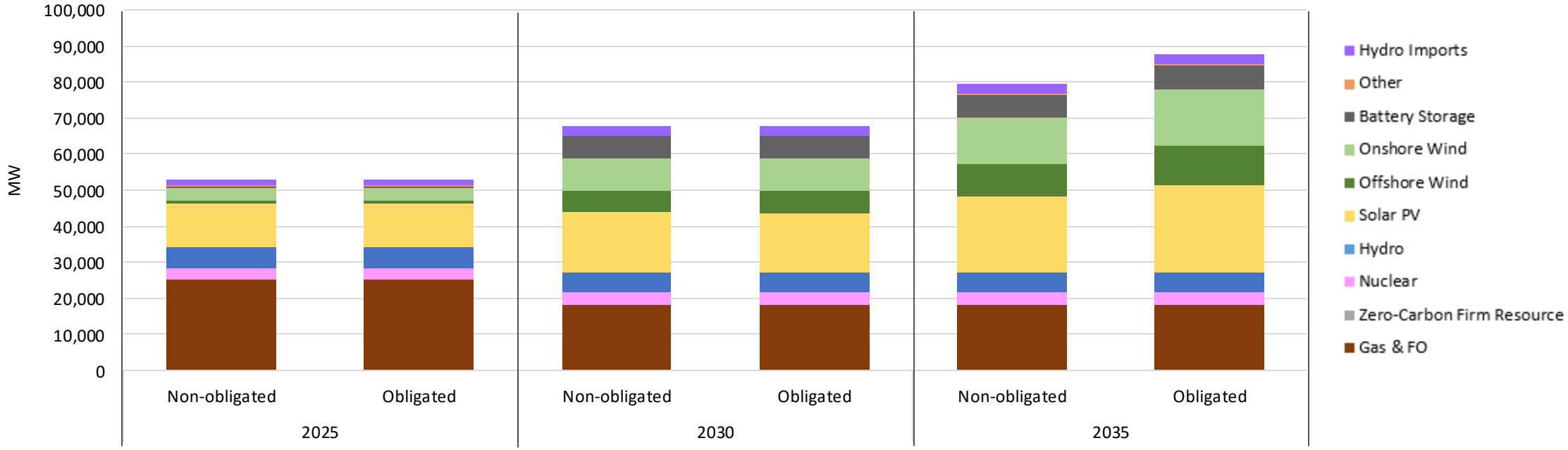
* **Note**: Net imports accounting in this context does not include contracted and legacy imports from Quebec, as those are considered part of the New York supply mix and do not vary between cases and scenarios.

Obligating Electricity

NY Marginal Emission Factor: Installed Capacity

Change in Capacity for Electricity Generation Installed in New York, Obligated Scenario v. Non-Obligated Case (MW)

Resource Type	2025	2030	2035
Thermal	0	-4	-4
Renewable Energy	0	0	+7,801



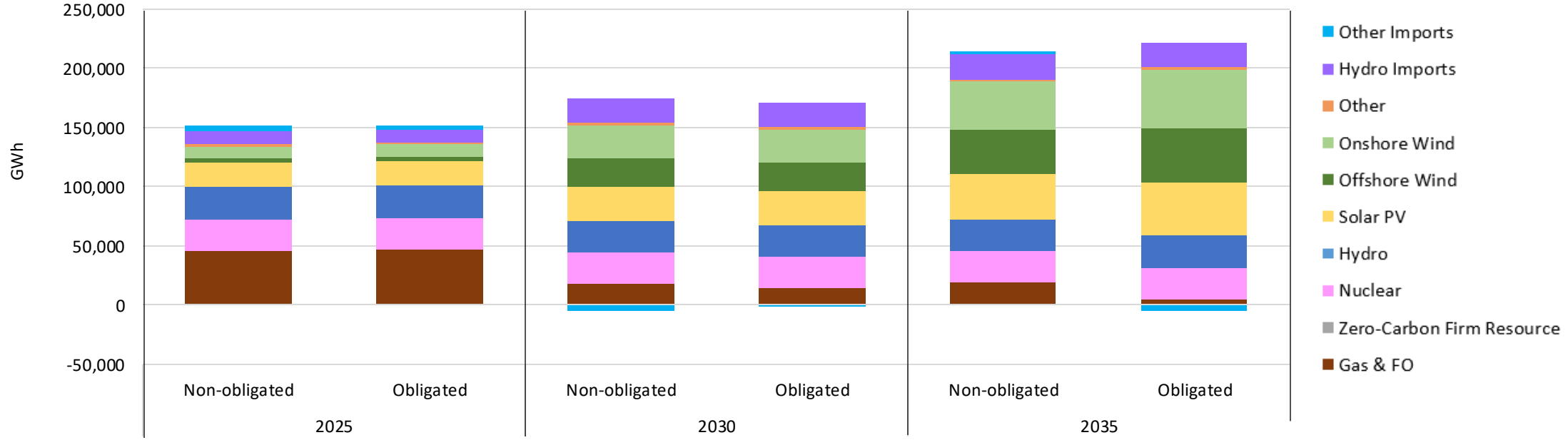
Notes: "Other" refers to municipal solid waste and landfill gas combustion

Obligating Electricity

NY Marginal Emission Factor: Energy Balance

Change in New York electricity generation, Obligated Scenario v. Non-Obligated Case (GWh)

Resource Type	2025	2030	2035
Thermal	+1,462	-3,673	-13,976
Renewable Energy	+64	+14	+24,144
Imports	-1,269	+3,556	-8,113



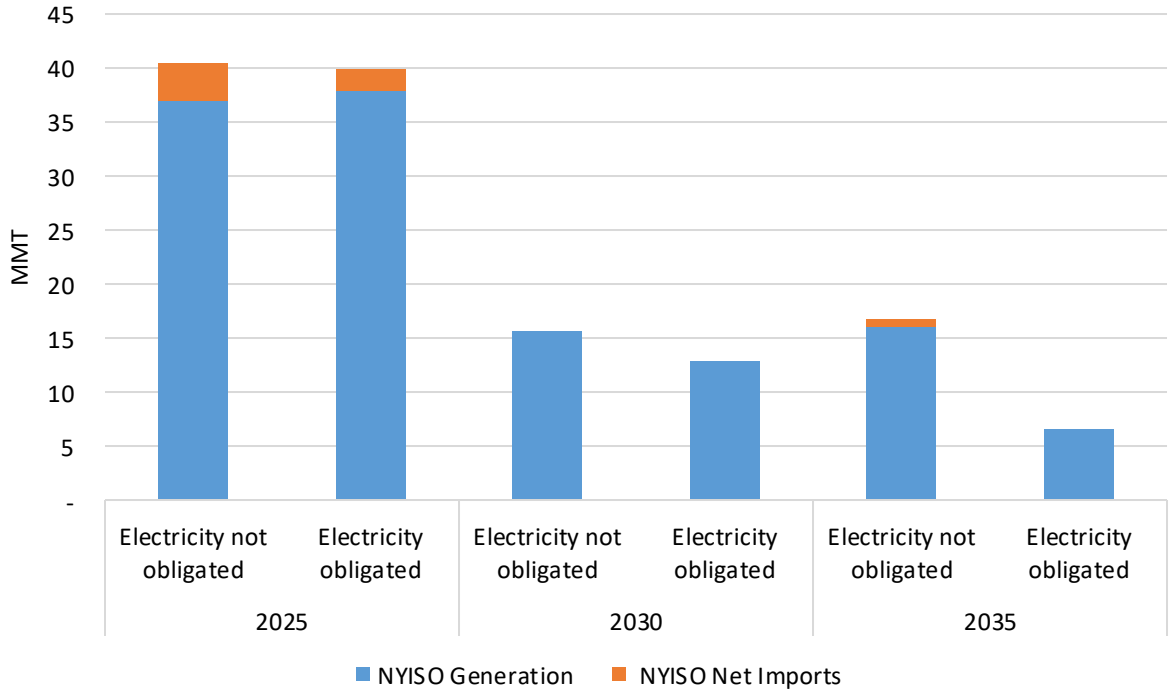
Notes: "Other imports" indicates the NYCA net imports excluding assumed constant contracted (CHPE) and legacy hydro imports into New York from Quebec.
"Other" refers to municipal solid waste and landfill gas combustion

Obligating Electricity

NY Marginal Emission Factor: Emissions

Apparent NYCA Emissions

(NY Climate Act Accounting)



Relative Change in Emissions, Non-Obligated Minus Electricity Obligated

(Cumulative Emissions Changes 2025-2035)

Geography	**Cumulative Emissions Changes Due to Obligation 2025-2035** ($MMT CO_2e$)
New York	-47
Eastern Interconnection + Quebec (net of NY)	+20
Net Change:	**-27**

42% of NY emission reductions leak to neighboring regions

Obligating Electricity

NY Marginal Emission Factor: Total Cost

- Revenue to existing fossil fuel generators in New York substantially increases due primarily to increased energy prices.
- Existing hydro generated in New York and Quebec sees significantly increased revenue due to higher energy prices, though dispatch is largely unchanged.
- Changes in export patterns increases payments to out-of-state generators.
- **As a result of NYCI obligation, total energy payments projected to increase by nearly $1.5 billion in 2025 and nearly $1.9 billion in 2030**

	2025	2030
(thousands 2022$)	Incremental Revenue in Obligated vs. Non-Obligated Cases	
Gas & Fuel Oil	$729,774	$446,805
Nuclear[3]	$0	$0
Hydro	$419,511	$827,991
RE[3]	$0	$0
Other	$24,822	$72,045
Hydro Imports-New[1]	$0	$0
Hydro Imports-Existing[2]	$139,005	$325,415
Other Imports	$144,424	$200,758
TOTAL	**$1,457,535**	**$1,873,013**

1. The "Hydro Imports-New" refers to the imports from Champlain Hudson Power Express (CHPE).
2. Hydro Imports-Existing refers to hydro power from Canada Quebec. Both existing and new hydro imports are assumed to be constant thorough the modeling horizon.
3. Because most renewable and nuclear generation receives out-of-market payments from NYSERDA that are a function of energy and capacity prices, it is assumed that increased energy costs under NYCI obligation reduces revenue under the Clean Energy Standard programs, resulting in no net revenue.

Obligating Electricity

Summary Conclusions

- Obligating the electricity sector under NYCI accelerates renewable capacity additions in NY between 2.4 GW and 7.8 GW by 2035 relative to the non-obligated case; such builds would otherwise occur in the non-obligated case by 2040.
- When obligating the electricity sector, the resulting higher energy prices are projected to lead to annual energy payments that are between $900 million and $1.9 billion higher vs. non-obligated case. The Average Emission Factor case sees lower total cost increases.
- Less than 20% of this total cost increase accrues to the affordability accounts due to a portion of increased costs accruing to generating units as additional profit, principally fossil fuel and hydropower. The share of cost that accrues to the affordability accounts declines over time.
- The use of the Average Emission Factor approach for putting a NYCI price on electricity imports results in substantial amounts of resource shuffling, and as a result, a large portion of New York's emissions reductions are projected to leak to neighboring regions. Applying a NYCI price to electricity imports using NY Marginal Emission Factor reduces this resource shuffling and reduces but does not eliminate projected emissions leakage. After accounting for leakage and resource shuffling, actual net emissions benefits across the two cases are similar.

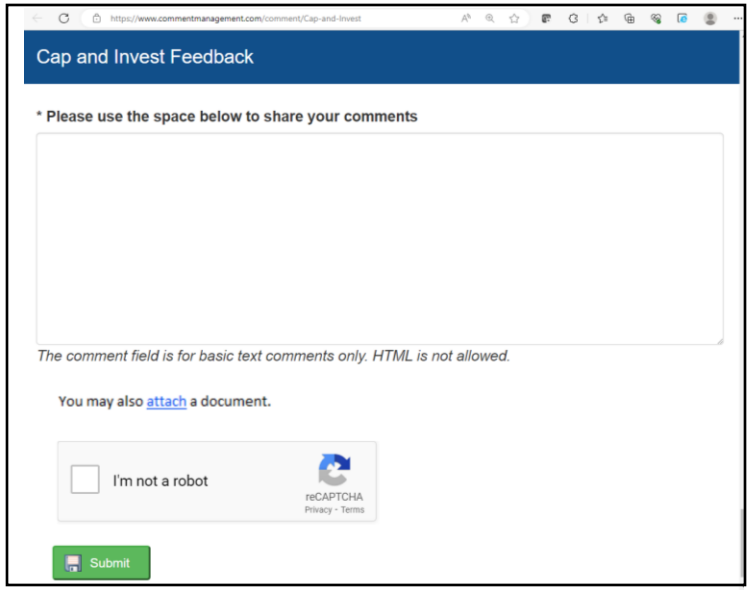
Intermission

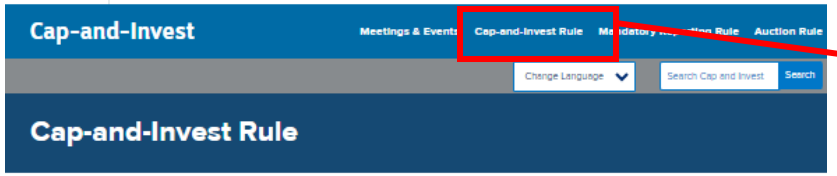
A Question-and-Answer session will follow a short Intermission

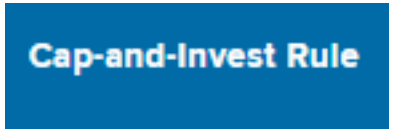
Questions & Answers

Next Steps

Submitting Comments







Developing New York State's Economywide Cap-and-Invest Regulations

Cap-and-Invest Rulemaking (6 NYCRR Part 252)

Public input will inform development of the regulations to implement New York's Cap-and-Invest Program, including the mandatory reporting of emissions under that program. As a starting point, DEC and NYSERDA invite the public to review the regulation governing California's economywide program [PDF] as well as those operating in Quebec and Washington State [PDF]. DEC and NYSERDA are interested in hearing what elements of those regulations would work well and what improvements or changes may best serve New York.

Meeting the Climate Act Limit on Greenhouse Gas Emissions (GHG) with a Cap-and-Invest Solution

- All GHG emissions would be accounted for under the program and the cap must reduce at a rate to achieve the statewide GHG emission limits set in law.
- Obligated sources (e.g., large-scale GHG emitters and distributors of heating and transportation fuels) would be required to report emissions and obtain allowances equal to the GHG emissions associated with their activities. All obligated sources will have a reporting requirement.
- Non-obligated sources would not be required to obtain allowances, but their GHG emissions would be accounted for in setting the allowance budget. The allowance budget plus the non-obligated emissions would equal the statewide GHG emission cap. Some non-obligated sources may have an emissions reporting obligation.

Invitation to Provide Comments on the development of the regulations. The major design elements that New York is seeking feedback on at this time are listed below. Expand each heading for further information on what is being considered for New York State.

DEC and NYSERDA have developed a template document [PDF] to assist commenters in providing feedback on these topics.

SUBMIT COMMENTS

Thank You!

Join the Mailing list to receive updates on program development

Meeting recordings and materials can be found at:

www.capandinvest.ny.gov/meetings-and-events

Provide feedback:

Comments can be submitted online, preferably **by March 1, 2024**, at:

www.capandinvest.ny.gov

or by mail:

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