

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

Cap-and-Invest Rulemaking
GHG Reporting Rulemaking
Auction Rulemaking

June 20, 2023
Modeling Methods Webinar



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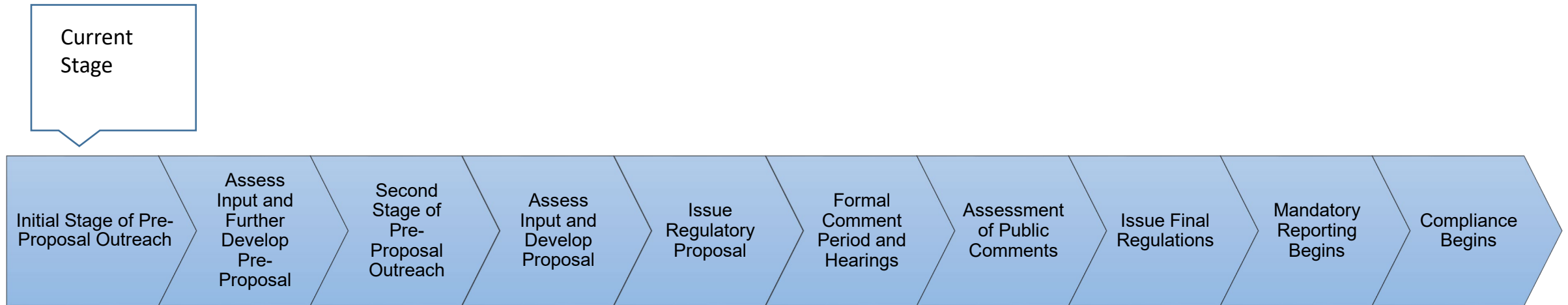
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Meeting Procedures

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



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or by mail:

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



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Climate Act – Overview

Carbon neutral economy, mandating at least an 85% reduction in emissions below 1990 levels by 2050

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

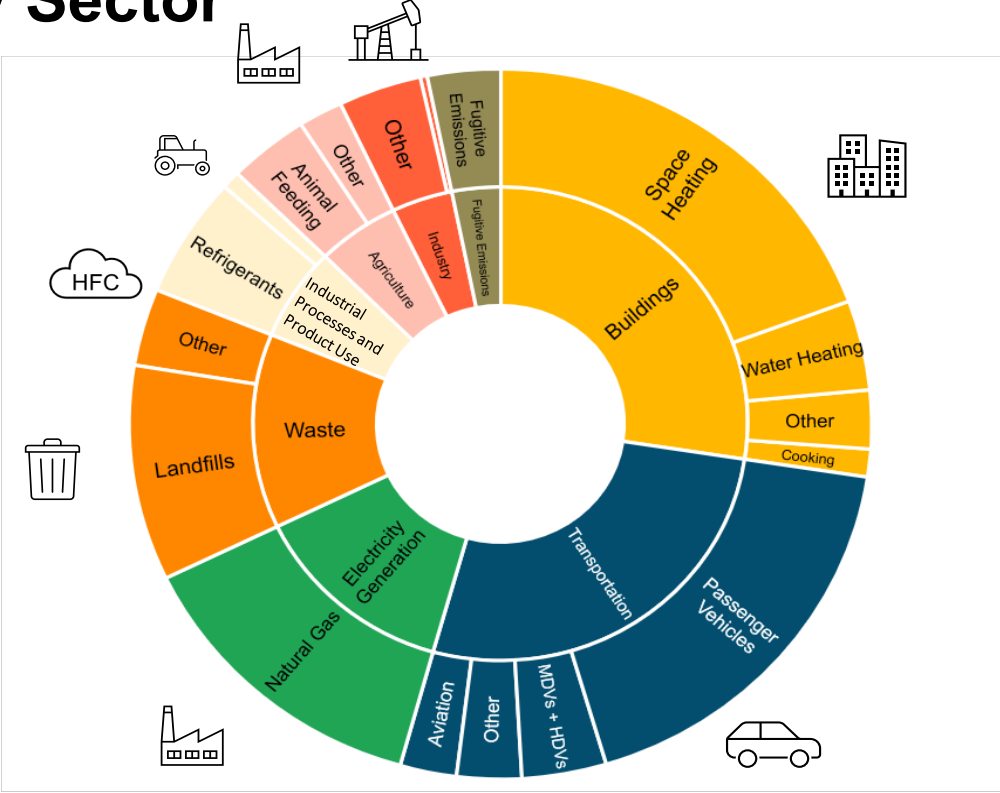


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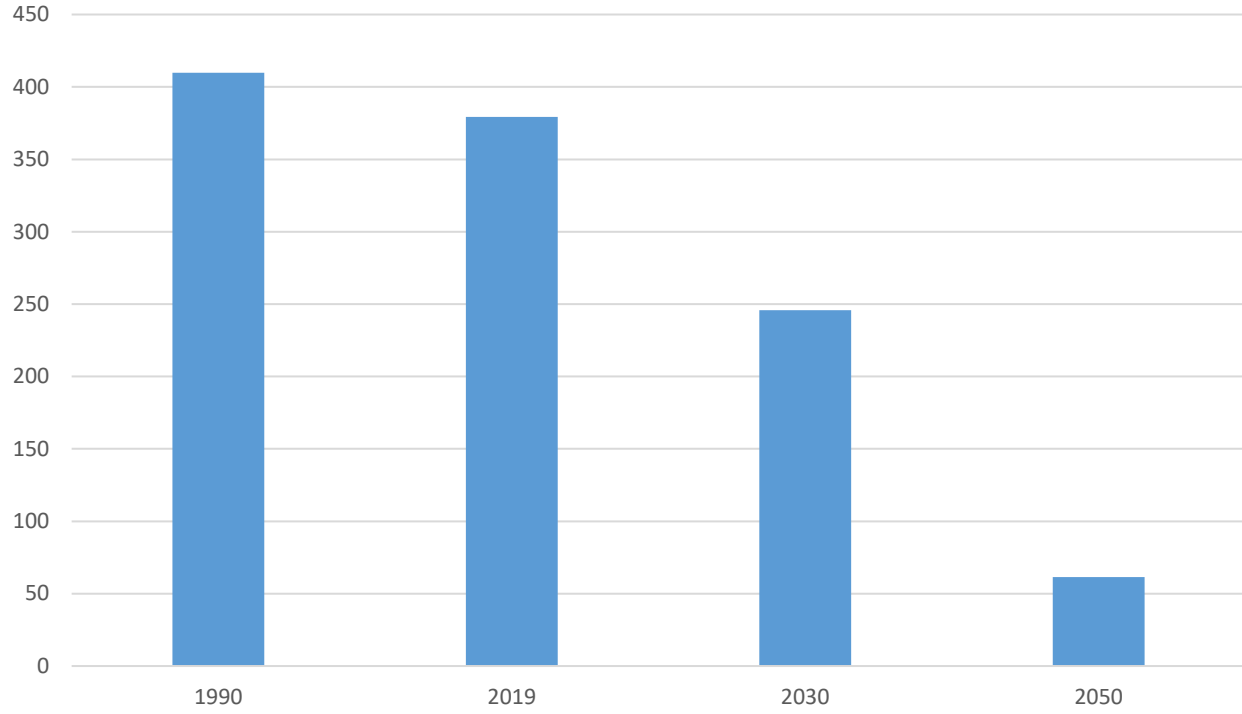
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GHG Emissions Reduction Requirements

Current Estimated GHG Emissions by Sector



New York State GHG Emissions (MMtCO₂e)



New York State Cap-and-Invest (NYCI)

The Cap-and-Invest Program was recommended by the Climate Action Council's final Scoping Plan and proposed in Governor Kathy Hochul's 2023 State of the State Address and Executive Budget.

DEC and NYSERDA are developing the program to meet the greenhouse gas emission limits and equity requirements under the 2019 Climate Act.



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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



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Equity Consideration for Disadvantaged Communities

- The Climate Act directs that a minimum of 35% of proceeds—with a goal of 40%—be invested to benefit Disadvantaged Communities (DACs).
- In addition to investments to reduce emissions, DEC is soliciting feedback about any additional regulatory mechanisms in the NYC1 regulation that should be considered to ensure emission reductions in DACs.



Context of this study

This analytics study 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 program (NYCI)**

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



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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 allows 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.



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Agenda

Model Overview

Key inputs to NYCI Analysis

- (A) Starting point emissions
- (B) Policy parameters
- (C) Technoeconomic inputs
- (D) Revenue reinvestment inputs
- (E) Electricity sector response

Approach to modeling the Command-and-Control scenario

Next Steps



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Model Overview

The study will use an emissions market model to provide objective analytical support for rulemaking

Model overview

- The model is agent-based and 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 program
- Each subsector covered by the system is a unique model “agent” which responds to the allowance price by optimizing timing and extent of decarbonization
- For each scenario run, the model finds the market equilibrium where the allowance price equals allowance demand and supply in every year from 2025 to 2035
- The model will be calibrated for NYCI. This involves drawing on the most recent best available data on sectoral emissions and technology costs

Technical specifications

Time coverage	2025-2035, annual
Model outputs	Allowance prices, allowance supply and demand, sectoral emissions and detailed technology mix
Model inputs	Policy parameters, technoeconomic assumptions (capital and operating expenditures), 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 an allowance price-taker in their abatement decisions and trading behavior

Modeling will provide objective analytical support in the development of a program that meets the guiding principles of *Affordability; Climate Leadership; Creating Jobs and Preserving Competitiveness; Investing in Disadvantaged Communities; and Funding a Sustainable Future.*



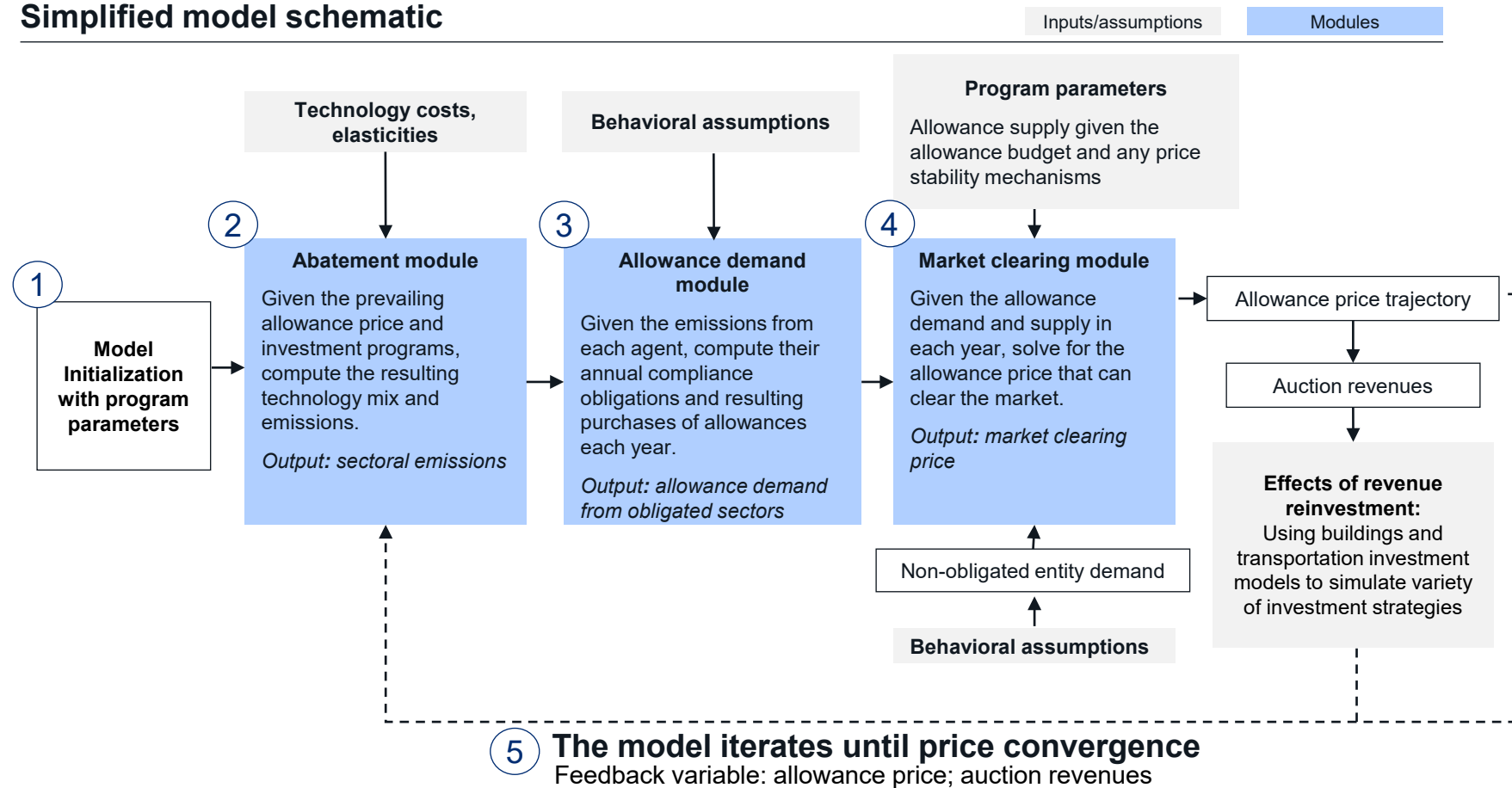
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Model Overview

Model computes the equilibrium allowance price and resulting sectoral emissions under each scenario

Simplified model schematic



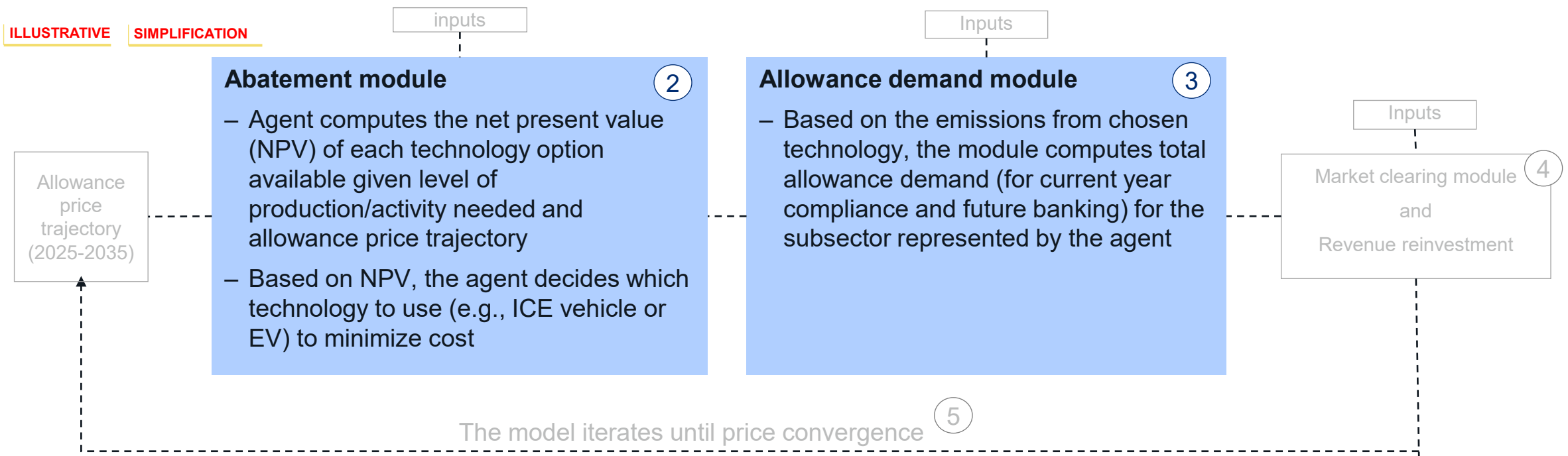
The model methodology involves iterating across five major steps until model convergence:

1. Initialize the model and set up model parameters
2. Simulate potential abatement in each sector and resulting emissions
3. Compute the demand for allowances from obligated sectors
4. Check if the allowance price clears the market given demand and supply.
5. If market is not cleared, generate a new market allowance price trajectory and revenue reinvestment effects for the next iteration

Model Overview

Illustrative model agent

The model represents each subsector with a model 'agent' which complies with the NYCI program while minimizing cost. Agents may include, for example, industrial subsectors, or building subsectors like space heating.



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Key Inputs

State team will guide model calibration using data inputs from complementary analyses, and literature review (1/2)

Input type	Input or assumption	Source
(A) Starting point emissions	A1. Starting point emissions	Update to Integration Analysis Reference Case
(B) Policy parameters	B1. Accounting Standards	Policy parameters to be provided by the State team consistent with guiding principles and stakeholder feedback
	B2. Obligated vs non-obligated sectors	
	B3. Allowance budget	
	B4. Price stability mechanisms	
	B5. Compliance schedule	
	B6. Free allocations to EITEs	
	B7. Offset use	Disallowed
(C) Technoeconomic inputs	C1. Buildings technology costs	Integration Analysis, with policy updates
	C2. Transportation technology costs	Integration Analysis, with policy updates
	C3. Industry technology costs	State-team validated costs drawing on additional databases of industrial decarbonization costs
	C4. Waste technology costs	Literature review
	C5. Demand response to price changes	Literature review
	C6. Behavioral assumptions	Literature review, calibration to Integration Analysis & additional NYSERDA adoption modeling
	C7. Interest rate	Integration Analysis



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Key Inputs

State team will guide model calibration using data inputs from complementary analyses, and literature review (2/2)

Input type	Input or assumption	Source
(D) Revenue reinvestment inputs	D1. Investment mix by sector	Modeling assumption consistent with guiding principles
	D2. Effects of investment in transportation	transportation reinvestment module
	D3. Effects of investment in buildings	buildings reinvestment module
(E) Electricity sector response	E1. Impact of allowance price on generation capacity mix	ICF's Integrated Planning Model (IPM)



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Key Inputs

Development of starting point emissions

NYCI modeling will be based on an updated view of New York State's emissions under current policies

- Based on the Integration Analysis framework, but with new policies incorporated
- NYCI modeling effort will seek to simulate reducing emissions beyond the starting point to achieve Climate Act-established 2030 and 2050 emissions limits

The Scoping Plan's Reference Case will be updated with policies adopted since the original case was designed. We seek input on which policies to include, such as:

- **Buildings**
 - NYC Local Laws
 - Statewide new construction codes
 - IRA Incentives
- **Transportation**
 - Advanced Clean Cars II/Advanced Clean Trucks
 - 100% sales MHDVs by 2045
 - 100% ZEV school buses by 2035, 100% transit buses by 2040
- **Natural Gas**
 - IRA Methane Charge
 - EPA Supplemental Rule
 - NYS Part 203
- **Refrigerants**
 - AIM Act (EPA Technology Transitions)



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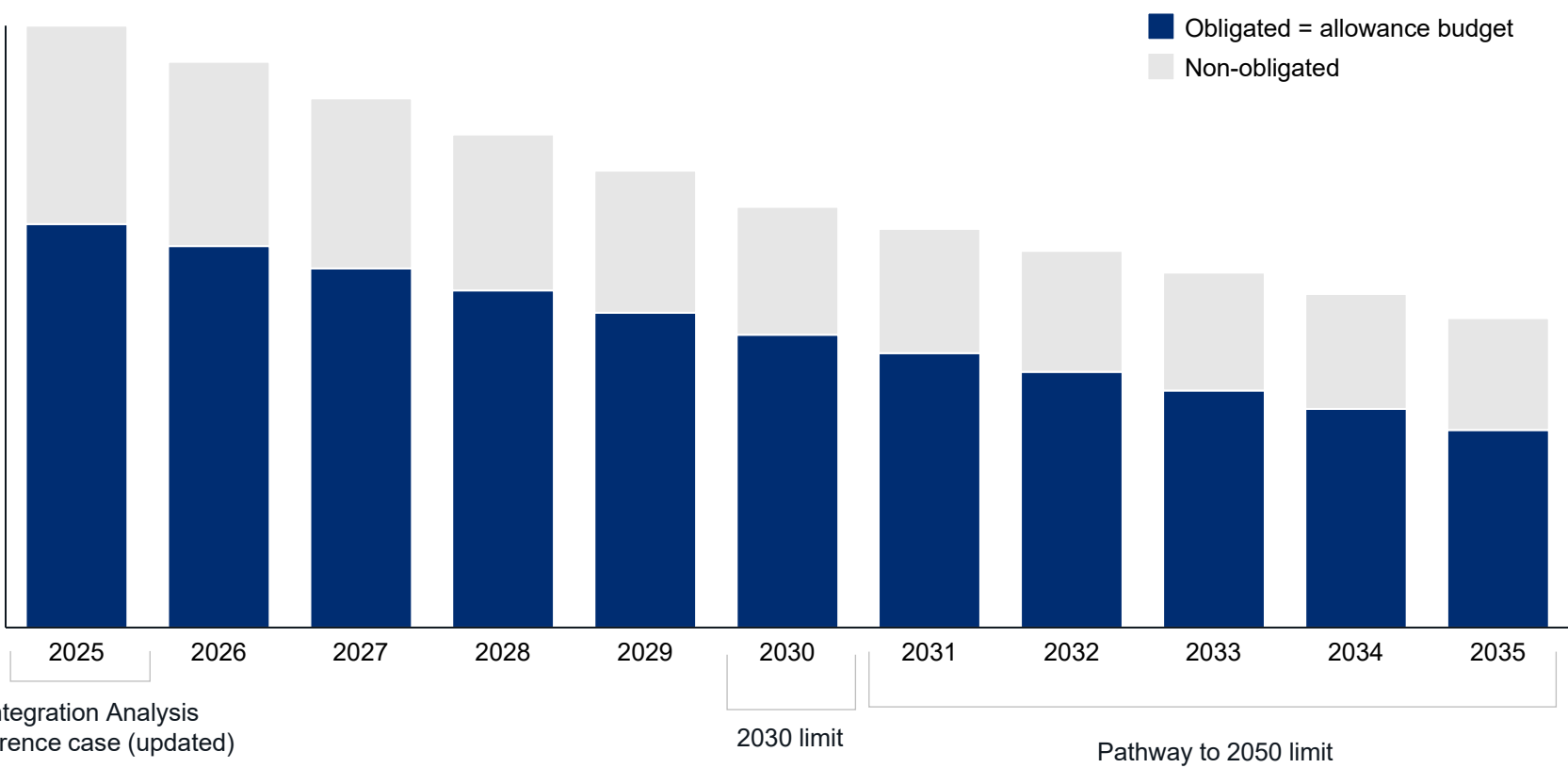
Key Inputs

Policy parameters:

The allowance budget developed by the State team will be consistent with a pathway to 2030 and 2050 emissions limits

ILLUSTRATIVE

Annual GHG emissions & allowance budget (MMT CO₂e)



The State team will construct the allowance budget based on:

- **2025:** Starting point emissions estimate
- **2025-2030:** Pathway to Climate Act 2030 Emissions Limit (60% of 1990 emissions)
- **2030-2035:** Pathway to Climate Act 2050 Emissions Limit (15% of 1990 emissions)
- The updated starting point provides detailed sectoral emissions, help set allowance budgets:
 - Emissions from obligated sectors in 2025
 - Allowance budget in 2025 = emissions for obligated sectors
 - Allowance budget in 2030 = emissions limit – non-obligated emissions

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Model Overview

Key inputs to NYCI Analysis

(A) Starting point emissions pathway

(B) Policy parameters

(C) Technoeconomic inputs

(D) Revenue reinvestment inputs

(E) Electricity sector response

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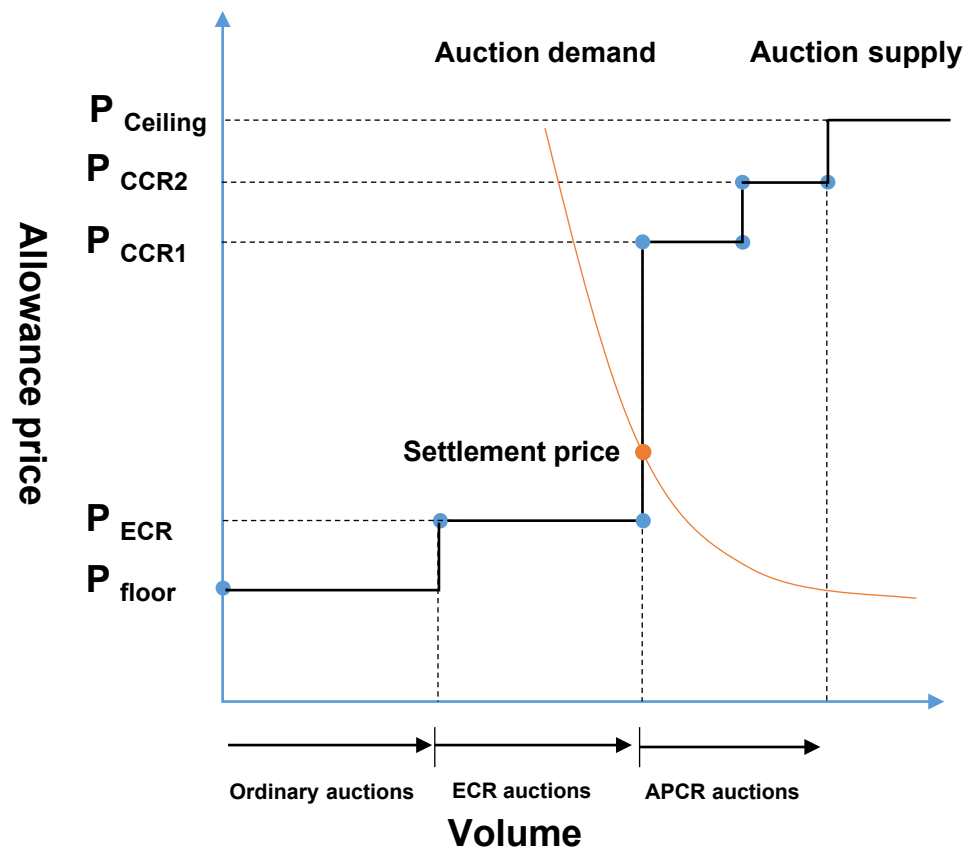
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Key Inputs

Policy parameters:

Model is capable of modeling scenarios with price stability mechanisms including price floors, price ceilings, and auction reserves

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 auctions would be held if market price exceeds 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. Allowances sold at P_{ceiling} may or may not be removed from future auction supply to maintain the overall carbon budget.

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



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Key Inputs

Policy parameters:

Model is capable of modeling scenarios with varying rules on compliance schedule and free allocation to EITE sectors

Options that can be tested using scenario analysis

Compliance Schedule

- Different lengths of compliance periods
- Different schedules for surrendering allowance obligations within the compliance period (e.g., minimum amount to be surrendered within X number of years)

Banking

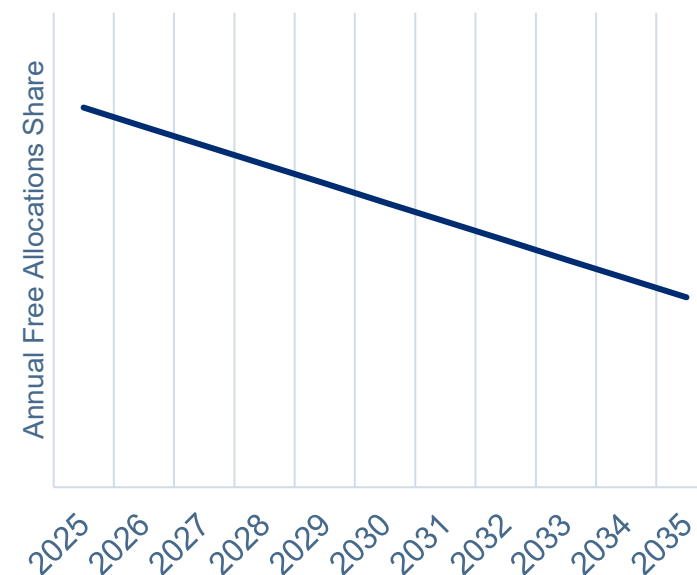
- Consideration of banking parameters and restrictions.

EITE and direct allocations

- Direct allocation at sub-sectoral level, applied to the portion of subsector that is estimated to meet the compliance threshold (facility level is not possible at current model resolution)
- Changing direct allocation share over time

Offset use

- Disallowed

ILLUSTRATIVE**Share of free allocations over time**

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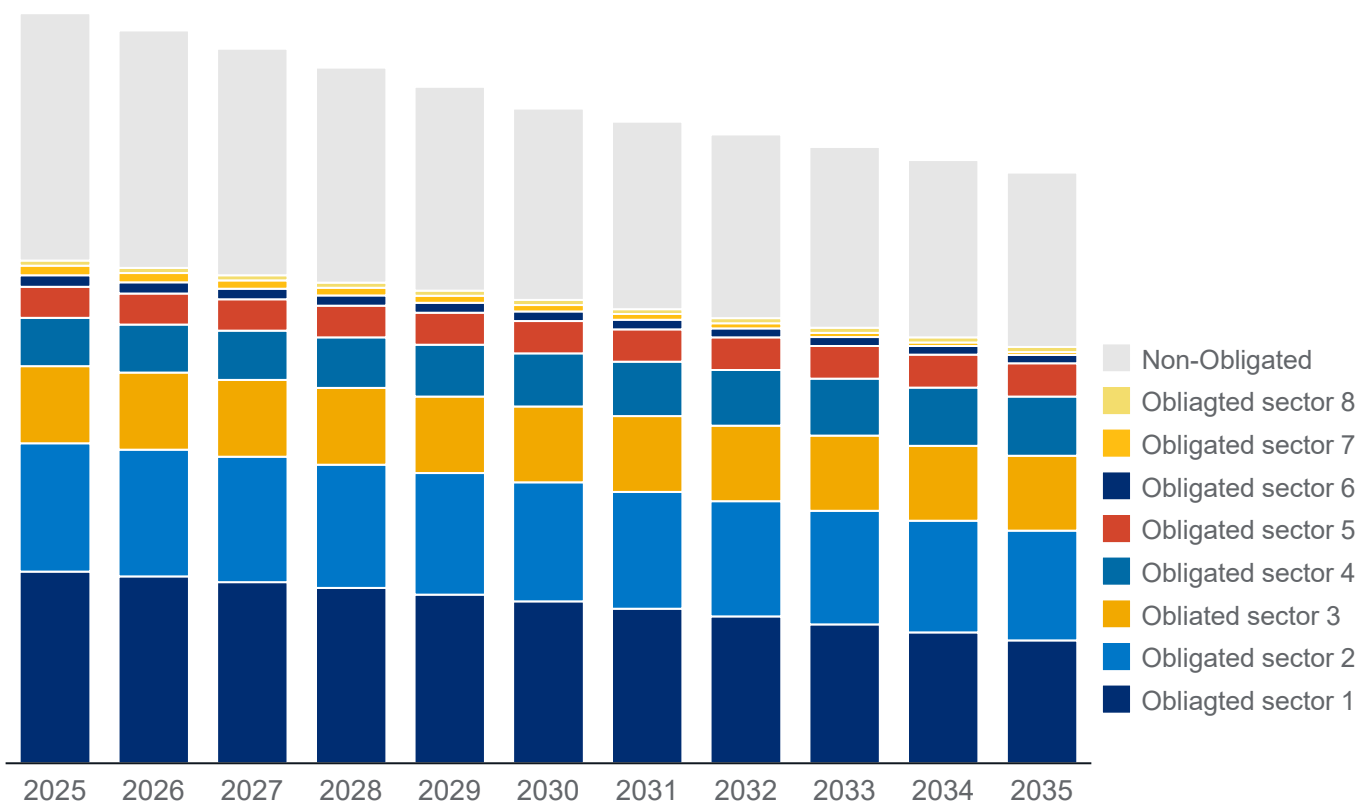
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Key Inputs

Technoeconomic inputs:

A new emissions starting point based on the Integration Analysis' will be used to facilitate model calibration

ILLUSTRATIVE

Starting point GHG emissions (MMT CO₂e)**How is the model calibrated to New York?**

- The starting point emissions will be developed using the Scoping Plan's Integration Analysis framework and will be updated to reflect current New York State policy. They will represent the emission reductions that might be achieved with current policy before accounting for NYCI.
- A variety of other model calibration components will be based on starting point emissions and other inputs from Annex I and Annex II of the Integration Analysis. Where possible, these inputs will be adopted:
 - Starting point emissions are used for calibrating technology adoption inertia (see C6 on Slide #17)
 - Technology costs informed by IRA and other policy updates (see C1, C2 on Slide #17)
 - Borrowing costs and economic lifetimes (see C6 on Slide #17)



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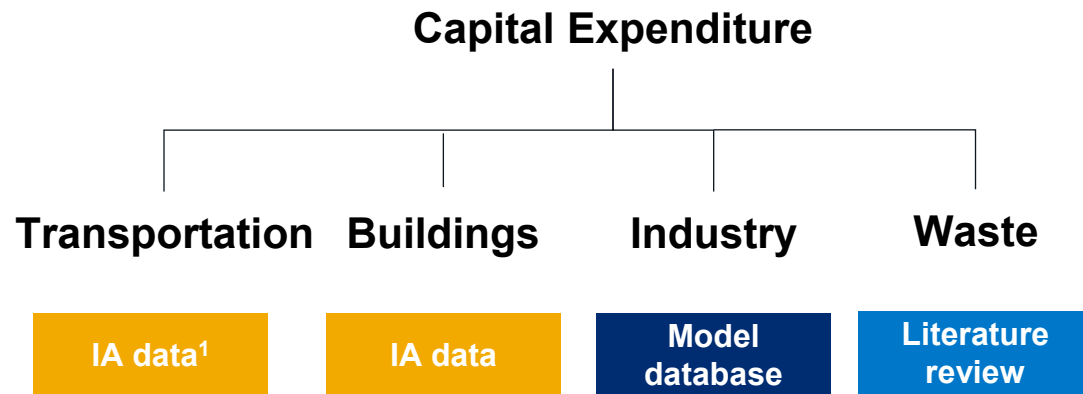
Key Inputs

Technoeconomic inputs:

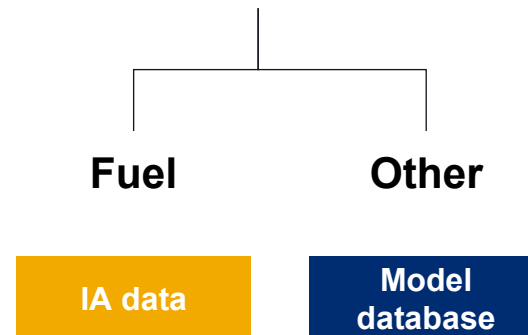
Technology costs will be derived using Integration Analysis data where available

Agreed approach

Use Integration Analysis data¹ where possible (including any updates), with any gaps filled by additional data and literature review



Operating Expenditure



1. Refers to data annexes from [Scoping Plan 2022](#) and subsequent updates covering emissions, technology costs and usage patterns

Key Inputs

Technoeconomic inputs:

Consumer demand response will be modeled using estimates from latest and best available literature

Modeling demand response

In the context of scenario analysis, demand response refers to a change in activity levels (e.g., driving, or heating) due to the pass-through impact of an allowance price

The size of this response depends on two factors:

- how much the allowance price increases the costs for consumers
 - Model directly calculates using fuel prices and emissions intensities of fuels, assuming full cost pass-through
- how much consumer demand responds to changes in costs
 - assumptions are drawn from the literature regarding consumer response to price

Examples of price elasticities of demand from the latest literature

Subsector	Estimate of demand response	Source
Passenger cars	15%	Goetzke and Vance (2018) Short run elasticity estimated using panel data of US household travel surveys
Residential heating	8%	Energy Information Administration (2021) Own-price elasticities in AEO2020 – short run (1y)
Commercial heating	3%	Energy Information Administration (2021) Own-price elasticities in AEO2020 – short run (1y)



Key Inputs

Technoeconomic inputs:

Behavioural assumptions are likely to be included to capture drivers of abatement beyond technology cost

	Abatement module	Allowance demand module
Obligated sectors	<ul style="list-style-type: none"> • Investment horizon for switching to new technologies based on technology lifetimes in Integration Analysis • Interest rate aligned with Integration Analysis assumptions on borrowing costs • Inertia against technology adoption <ul style="list-style-type: none"> – To be calibrated such that model emissions at zero allowance price align with Integration Analysis Reference case emissions for key sectors and other NYSERDA analyses 	<ul style="list-style-type: none"> • Forward-looking horizon for purchasing and banking allowances for future compliance obligations to be based on duration of compliance periods
Demand from non-obligated entities		<ul style="list-style-type: none"> • Hurdle rate for participating in NYCI market assumed to be 10% given the risks associated with potentially volatile allowance prices • Participation sensitivity - Standard deviation set to default model values, which mimic arbitrage patterns suggested by industry experts



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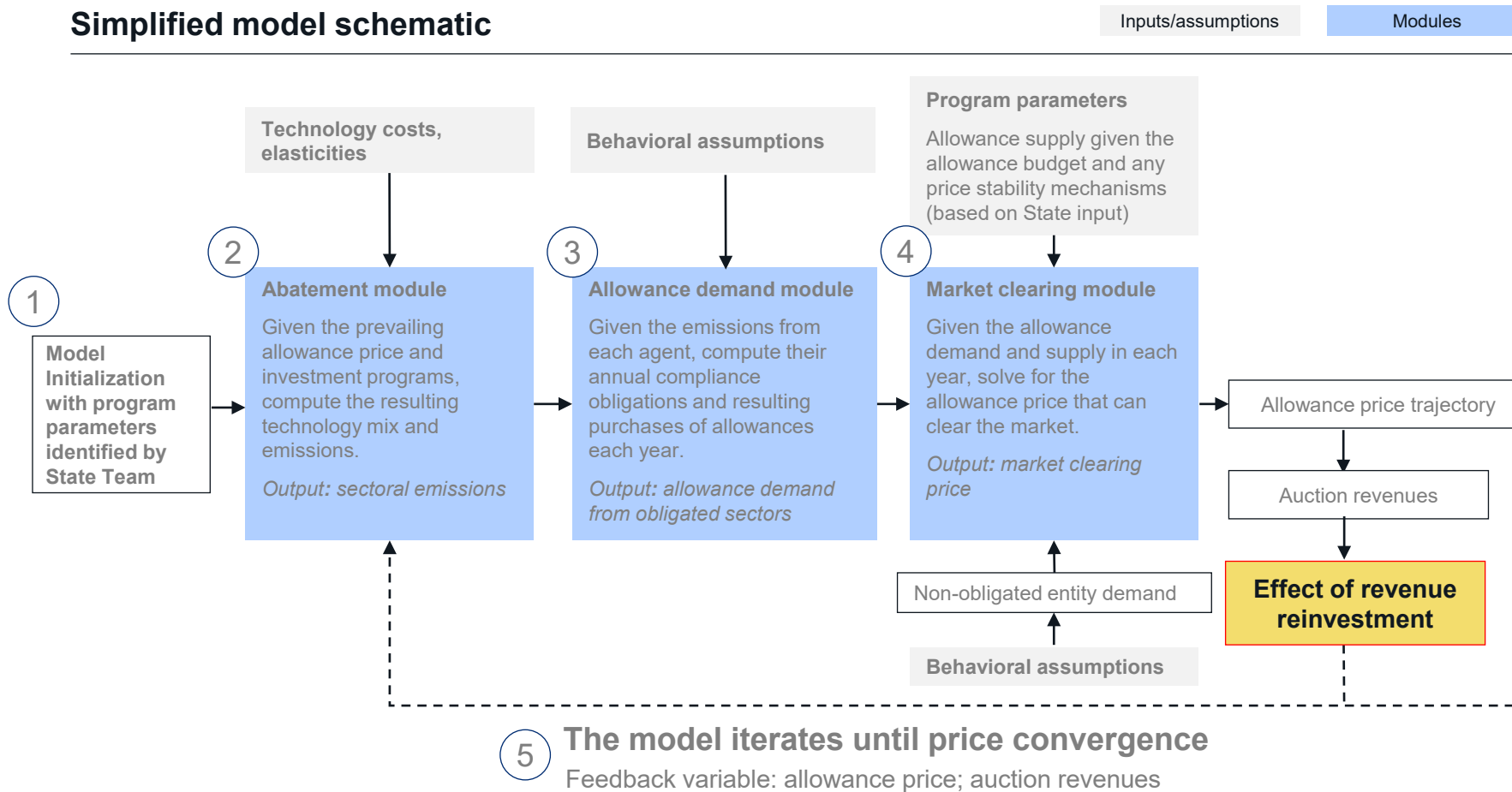
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Key Inputs

Revenue reinvestment input:

The impact of investment will be based on complementary investment impact models

Simplified model schematic



The effects of revenue reinvestment are accounted for in the following steps:

1. Distribute auction revenues into investment programs in buildings and transportation sectors based on assumption developed by State team
2. Using custom buildings and transportation investment models, compute the incremental effects of revenue reinvestment on technology mix for each sector and each year.
3. Feed the effect on technology mix back into the abatement module, such that the impact of revenue reinvestment is reflected in the market clearing price for the next iteration



Key Inputs

Revenue reinvestment input: Investment mix for investing proceeds

Reinvestment of proceeds will help realize policy guiding principles, especially affordability, health and other benefits for disadvantaged communities, and job creation

- Mitigate consumer costs: at least 30% of future NYCI proceeds will be delivered to New Yorkers every year to mitigate consumer costs through the Consumer Climate Action Account
- Incentivize decarbonization: The type of investments and share of proceeds to be invested in each sector is yet to be determined.
 - For the purposes of modeling, a representative investment mix will be used to develop a preliminary understanding of potential emissions reductions and the affect on allowance price
 - Investment modeling will reflect cost reduction for energy transition and help reduce allowance prices



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Key Inputs

Revenue reinvestment input: Strategies and modeling approach for the transportation sector

- The transportation reinvestment module will estimate a *response* (e.g., change in electric or hydrogen vehicle sales and stock, reduced vehicle-miles of travel) per *million dollars of investment per year* for each strategy
- The module will provide changes in vehicle-travel by vehicle technology and year per million dollars

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	
Bus service expansion	New riders and reduced auto travel per new revenue-mile of service, based on average ridership levels for existing service
Electric microtransit	
Bus service efficiency	Change in ridership with respect to change in travel time as reported in the literature

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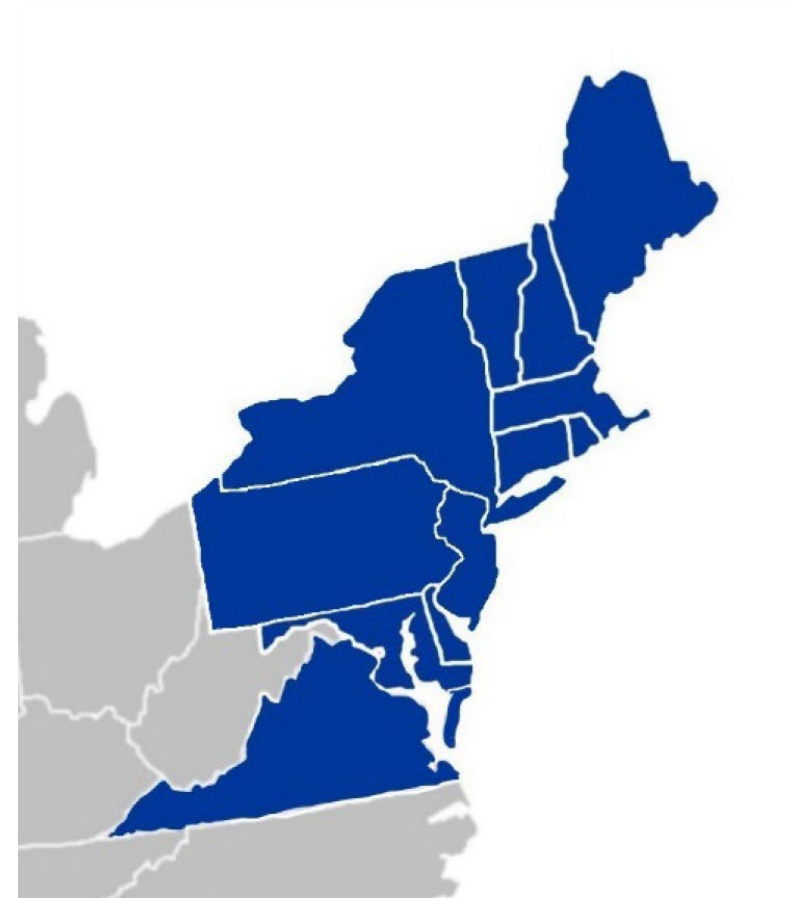
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Key Inputs

Electric sector response to potential NYCI obligation

NYCI modeling will include evaluation of the impact of obligating electricity

- The Integrated Planning Model (IPM) will be used for a complete RGGI footprint
- State will look to leverage ongoing and parallel RGGI program review modeling efforts, including IPM
- Analysis will evaluate the interaction between a NYCI price and a regional cap
- Like the investment models, a variety of price responses will be developed that can be integrated with market model to settle on a single price across the economy and provide associated outputs
- Analysis will consider emissions and capacity additions in NYS/RGGI, generation profiles, costs, etc



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Command-and-Control (C&C) scenario: Context and proposed scenario design

Context for C&C scenario

- NYCI was recommended by the Climate Action Council's Scoping Plan as the most cost-effective method for achieving the State's greenhouse gas emission limits.
- Without NYCI, the State would need to achieve the emission mandates through other mechanisms.
- This study will model a stylized Command-and-Control (C&C) scenario as a comparison to Cap-and-Invest (NYCI) scenario.

Scenario design

- Will develop sector-specific clusters based on the potential to regulate at the highest possible aggregation; for example, all building use of natural gas.
- Model will identify the cluster-specific price trajectories and associated technology switching patterns that would keep each cluster within its allotted emissions budget. There would be cost optimization within clusters, but not between them as under NYCI.
- Each cluster's emission limits will be determined by emissions trajectories consistent with meeting 2030 and 2050 Climate Act emission limits.

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Next Steps

- NYSERDA and DEC will share an additional set of input cost assumptions used in the modeling.
- NYSERDA and DEC will develop complementary analysis on air quality/health impacts and workforce implications.
- We are interested in feedback and comment on analytic methods, modeling framework and coverage, and input choices being used.
- Analysis results will accompany proposed rule publication as part of the Regulatory Impact Statement.



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Substantive Questions

Comments can be submitted online
at: www.capandinvest.ny.gov

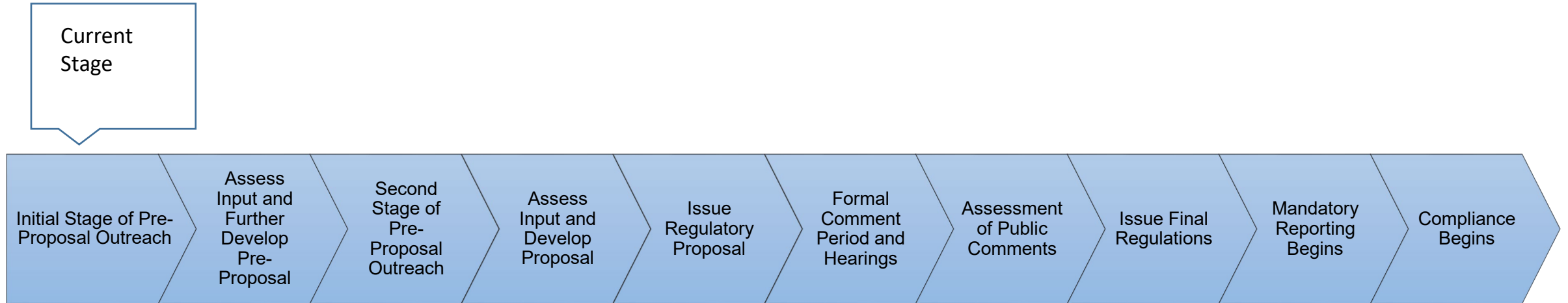
Meeting recordings and materials can be found at:
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NYCI Regulation Development Timeline



Spring Webinars Series

June 1: 1 to 3 p.m. – Cap-and-Invest Overview (Slides and Recording Available)

June 6: 11 a.m. to 1 p.m. – Natural Gas focus (Slides and Recording Available)

June 8: 1 to 3 p.m. – Liquid Fuels focus (Slides and Recording Available)

June 13: 11 a.m. to 1 p.m. – Energy Intensive and Trade Exposed Industries focus

June 15: 1 to 3 p.m. – Waste focus

June 20: 11 a.m. to 1 p.m. – Cap-and-Invest Analysis Inputs and Methods

June 22: 1 to 3 p.m. – Electricity focus

Details for future webinars and recordings of past webinars are at

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Submitting Comments


Cap and Invest Feedback

* Please use the space below to share your comments

The comment field is for basic text comments only. HTML is not allowed.

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Cap-and-Invest Rule

Cap-and-Invest Rule

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.

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



Public input will inform development of the regulations to implement New York's Cap-and-Invest program.

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. Please enter your feedback in the form fields below each heading.

Submit Comments

DEC and NYSERDA will review comments and further develop pre-proposal materials to define New York's program. Notices will be sent to the distribution list when the second round of pre-proposal materials are posted. To inform the development of the pre-proposal, DEC and NYSERDA request first round feedback no later than July 1, 2023.

Applicability and Thresholds – Defines which sources and at what emissions thresholds sources are covered by the regulations, who must report emissions, and who must obtain and surrender allowances equal to their GHG emissions. Establishes obligated and non-obligated sources.

Allowance Allocation – Defines how allowances are made available: auctions, set asides and free allocations.



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SUBMIT COMMENTS 

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Viewing Expanded List of Questions

Applicability and Thresholds - Defines which sources and at what emissions thresholds sources are covered by the regulations: who must report emissions; defines what entities must obtain and surrender allowances equal to their GHG emissions; establishes obligated and non-obligated sources.



Allowance Allocation - Defines how allowances are made available: auctions, set asides, and free allocations.



Program Ambition - Defines the cap and the allowance budget for how many allowances will be available year-by-year to reach the Climate Act GHG limits.



Program Stability Mechanisms - Defines the automatic and planned program adjustments to moderate costs and sustain program ambition if emissions are higher or lower than anticipated.



Compliance, Enforcement and Penalties - Defines compliance periods and types of enforcement mechanisms.



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Program Ambition - Defines the cap and the allowance budget for how many allowances will be available year-by-year to reach the Climate Act GHG limits.



- Cap includes economywide GHG emissions from obligated sources and non-obligated sources. The cap must set a starting point and downward trajectory to reach the GHG emission limits established in the Climate Act
 - How should the starting point for the cap be set? For example, based on current emissions, or surrogate?
 - How should the cap decline? Should the cap decline at a fixed rate or take steps?
- Allowance budget - The budget is allowances available for obligated sources. A set-aside account will hold allowances to be retired to account for GHG emissions from non-obligated sources.
 - What should be considered when designing the set-aside account and budget so that the program is consistent with the NYS GHG annual inventory?



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Provide Written Feedback

Via US Postal Service to:
Bureau of Air Quality Planning
NYS DEC, Division of Air Resources
625 Broadway, Albany, NY 12233-3251



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Thank You

Comments can be submitted online
at: www.capandinvest.ny.gov

Meeting recordings and materials can be found at:
www.capandinvest.ny.gov/meetings-and-events



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