Power Generation Advisory Panel

Meeting 3

November 5, 2020

NEW YORK STATE OF OPPORTUNITY. | Climate Action Council

Agenda

> Topic Overview: Methane Leakage and the Natural Gas System
> Emissions Reduction: Near- and Long-term
> Consideration of Disadvantaged Communities
> Subgroup Kickoff
> Presentation: Impacts of Electrification

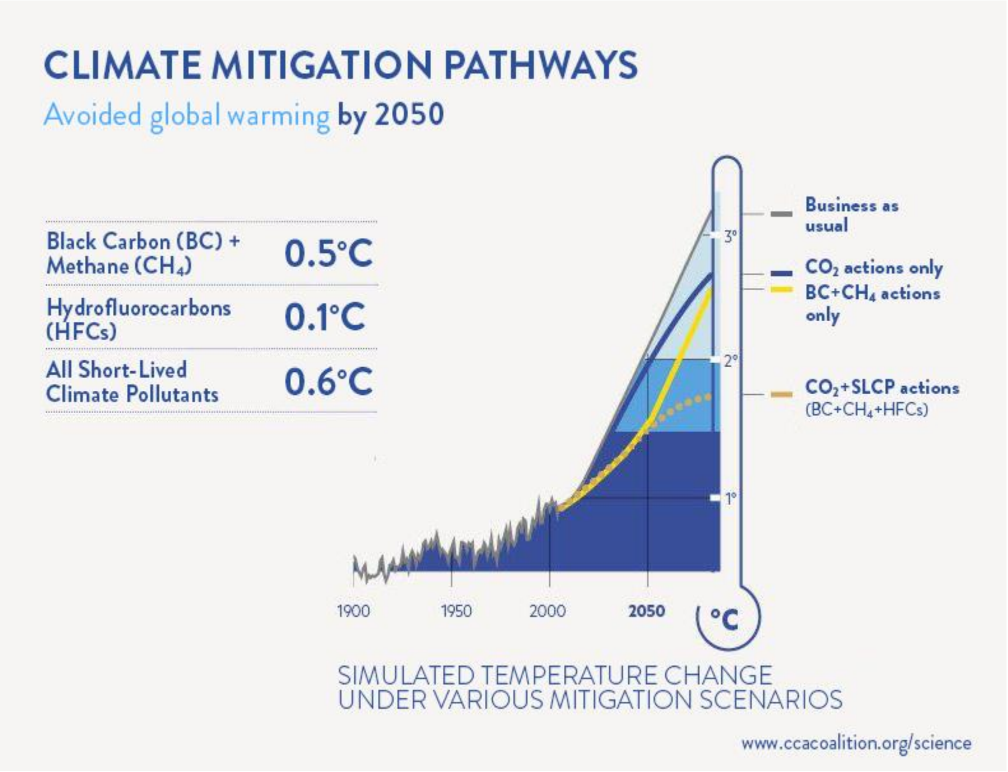
Methane Leakage and the Natural Gas System

Short-Lived Climate Pollutants (SLCPs)

- SLCPs (Methane, HFCs, Black Carbon) contribute to 45% of current global warming and play an important role in slowing the rate of global warming and achieving the 2°C target set by the Paris Agreement.

- Widespread and fast action to reduce SLCP emissions has the potential to reduce the amount of warming over the next few decades by as much as 0.6°C.

- Such actions would also prevent climate tipping points that could exacerbate long-term climate impacts and make adapting to climate change harder, especially for the poor and most vulnerable.

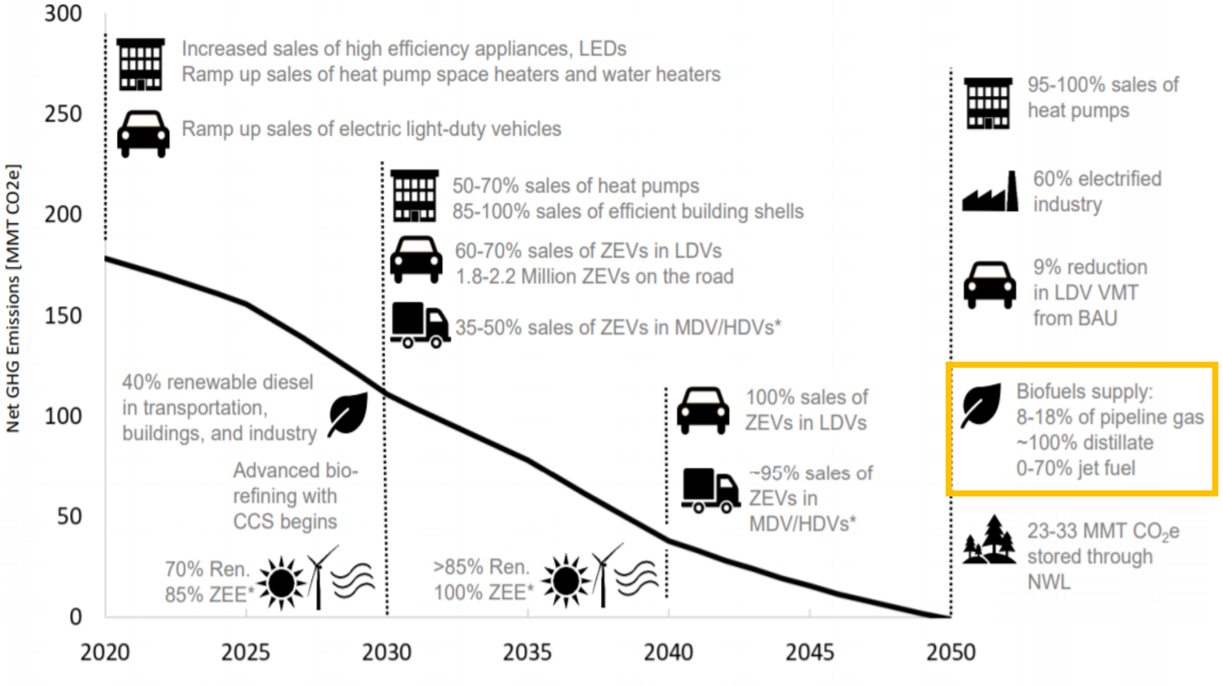


The Natural Gas System: Looking Ahead

- **Natural gas infrastructure is an extensive statewide network. As customers switch to electric options, demand for natural gas will decrease and some infrastructure may become obsolete. How to decommission the infrastructure will be a challenge.**

- **However, as we look to bring more intermittent renewables (wind and solar) onto the grid, and convert heating systems to electric heat pumps, reliability and our ability to meet winter heating demands becomes a critical issue.**
  - Drawing from the E3 Pathways Analysis, NY may require Renewable Natural Gas (RNG) or other natural gas replacements (e.g. hydrogen) to meet these needs.

- **NYS will likely need to rely on natural gas infrastructure for the near future, and perhaps longer, to decarbonize effectively and reliably.**



*Zero-Emissions Electricity (ZEE) includes wind, solar, large hydro, nuclear, CCS, and bioenergy; MDV includes buses

The Natural Gas System: Methane Leakage

> **The CLCPA requires the calculation of greenhouse gas emissions to use a 20-year Global Warming Potential (GWP) as well as 100-year GWP (used in the current inventory). Methane is approximately 3x more potent within a 20-year time horizon than it is on a 100-year time horizon.**

> **Methane leakage from instate natural gas systems currently contribute 14% of the methane emissions in the State (GWP100) and 1% of total greenhouse gas emissions. Under a GWP20 framework, the contribution of natural gas leakage to total emissions will grow significantly.**

> **Recent scientific studies suggest that the methane leakage rate from the natural gas system is much higher (1.63 – 4.29%) than currently estimated (1%).**
>
> - The differences are largely due to accounting methodologies. The NYS inventory uses a bottom-up approach, which is the traditional scientific approach, where emissions rates from specific types of equipment are multiplied across the number of each type of equipment. The studies citing higher leakage rates are using a top-down approach, relying on satellite imagery and other sensing technologies to measure methane leakage.

The Natural Gas System: Methane Leakage

> **As we decrease natural gas demand, this may have limited impact on overall leakage and emissions. To push less gas through the system, system pressures must increase, so leakage rates do not diminish.**
  - Fully decommissioning and removing the natural gas system would be a huge undertaking, as much of this infrastructure is underground.

> **RNG has a net reduction of greenhouse gas emissions from capturing and utilizing the methane produced from waste sources (e.g. cow manure). However, if RNG is needed to meet winter peaking demand or ensure reliability, there will still be a net release of methane emissions through natural gas pipeline leakage.**

> **Due to the short-term potency of methane and current dependence on the natural gas system, and the likelihood that we will need to continue to utilize the natural gas system for reliability within the power generation sector to meet our goals, we must address methane leakage within this infrastructure.**

Emissions Reduction: Near- and Long-term

> **DEC to establish Statewide greenhouse gas emissions limits consistent with:**
>
> - 2030: 60% of 1990 emissions
> - 2050: 15% of 1990 emissions

> **Greenhouse gas emission limits shall be measured in units of carbon dioxide equivalents and identified for each individual type of greenhouse gas.**

> **"Greenhouse gas" means carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, and any other substance emitted into the air that may be reasonably anticipated to cause or contribute to anthropogenic climate change.**

> **All state agencies shall assess and implement strategies to reduce their greenhouse gas emissions.**

> **In considering and issuing permits, licenses, and other administrative approvals and decisions, including but not limited to the execution of grants, loans, and contracts, all state agencies, offices, authorities, and divisions shall consider whether such decisions are inconsistent with or will interfere with the attainment of the statewide greenhouse gas emissions limits.**

> **Panel is able to advance recommendations for CAC consideration about near-term reductions that may require system investments**

Consideration of Disadvantaged Communities

Consideration of Disadvantaged Communities

> **NY has adopted an interim approach to defining disadvantaged communities which includes areas that meet either of the two criteria listed below:**

- Census block groups that meet the LMI Area Threshold (see below), that are also located within the DEC Potential Environmental Justice Areas
- New York State Opportunity Zones

> **LMI Area Threshold: Top quartile of census block groups in New York, ranked by the percentage of LMI Households in each census block. LMI Households are defined as households with annual incomes at or below 50% of the Area Median Income of their Census block group.**

Subgroup Kickoff

Housekeeping

- **Point(s) of contact for Adaptation and Resilience needed**
  - Land Use & Local Government panel wants to get going with kickoff meeting next week
- **Point(s) of contact for Just Transition Working Group needed**
  - JTWG Power Plant subgroup wants to have subgroup meeting on Power Plant Inventory next week
- **External Engagement ideas?**
  - Should we convene specific groups?
  - Are there speakers we should invite?

Resource Mix: Renewables

> **Key renewable electricity procurement programs have been established and progress is being made toward the 70 by 30 goal, yet there remains a large amount of renewables that must be procured and developed to reach the goal**

> **Key Issues:**

- Renewables penetration downstate continues to lag upstate. Renewables penetration in the downstate region can either be met with increased siting of renewables into downstate (which is a challenge due to the lack of available space for large-scale renewables) or by increased delivery of renewables into the respective zones (e.g. OSW and CES Tier 4).

> **Identified Barriers:**

- Building the transmission necessary to carry a sufficient amount of renewables from upstate to downstate.
- Meeting the reliability needs of the downstate region as we increase renewables penetration.

Resource Mix: Fossil Fuels

> **Key Issues:**

- Natural gas infrastructure is an extensive statewide network. As customers switch to electric options, and we move away from fossil fuels, demand for natural gas will decrease. NY may still partially rely on natural gas infrastructure, but some infrastructure may be made obsolete. How to decommission the infrastructure will be a challenge.
- As more wind and solar are added onto the grid and heating systems are converted to electric heat pumps, reliability to meet winter heating demands becomes a critical issue. NY may require Renewable Natural Gas (RNG) or other natural gas replacements (e.g. hydrogen) to meet these needs.
- Methane - whether from natural gas or RNG - is a potent greenhouse gas with significant short-term impacts on global warming. NYS will likely need to rely on natural gas infrastructure for the near future, and perhaps longer, to decarbonize effectively and reliably. Therefore, addressing methane leakage from natural gas infrastructure is a necessity.

> **Identified Barriers:**

- Fossil fuel fired “peaking” resources have typically been relied upon to provide the final megawatts in the supply stack. These peak resources were chosen due to their low capital cost and their ability to quickly cycle on, although they are typically the most expensive and polluting units on the system (on an emission rate basis). Peaking resources may also be needed in certain load pockets where energy delivery into the pocket may become congested, requiring energy to be created and delivered within the load pocket itself.
- The natural gas system is wide ranging with different segments that fall under different public authorities which need to be clearly defined to understand the best way to control emissions from each segment.
- In addition, the cost of natural gas that is leaked through the smaller distribution pipelines is passed on to customers/ratepayers so there is little incentive for the utility/pipeline owner to identify and repair leaks, which can be costly and time consuming.

Solutions Needed for the Future: Technology

> **New and under-utilized technology offers promise to accelerate grid evolution and achieve the goals set forth in the CLCPA by leveraging advances in computational power, materials, and communications to bring new functionality to the grid that can solve many of the most pressing challenges.**

> **Key Issues:**

- Are there existing technologies that can improve the grid that are being underutilized?
- Are there research and development opportunities for new or emerging technologies?
- How will utilities integrate new technologies into planning and operations?
- How can adoption of new/under-utilized technology be accelerated while maintaining appropriate controls on performance risk, cost and longevity?

> **Identified Barriers:**

- Adoption of new technology to enable CLCPA goals must be funded alongside investments for continued safe and reliable operation of the grid. While new technology expenditures are not mutually exclusive from these expenses, new technology will place additional pressure on rates and other sources of grid investment.
- Adoption of new technology on the electric grid typically takes 5+ years from initial commercial product availability to deployment at scale. Given that we are less than 10-years from 2030, timelines for adoption will need to be accelerated.
- New technology, while promising, are also unproven in terms of their performance, cost, and longevity.

Solutions Needed for the Future: Last Clean Megawatts

> **Key Issues:**

- Ensuring there are dispatchable, flexible, resources on the grid to balance increasing intermittent resources so during periods where the wind isn't blowing and the sun isn't shining, the grid remains reliable.
- Possible technologies to meet these needs are energy storage, hydropower, advanced biofuels, nuclear power, synthetic fuels (e.g. hydrogen), and carbon capture and storage (CCS).

> **Identified Barriers:**

- Bringing necessary technologies to full commercial scale (long duration storage, hydrogen, CCS).
- Bringing the necessary technologies to the market (increasing production and distribution).
- Determining how much of these technologies is necessary to meet our full needs.
- Particularly for advanced biofuels, there is likely a limited quantity available to NYS. Allocating the amount available to the highest priority end-uses will be necessary.

Solutions Needed for the Future: Markets

> **Key Issues:**

- What market barriers exist that should be addressed if New York policy requirements will be met?
- What market opportunities should be explored that could assist in New York meeting policy requirements?

> **Identified Barriers:**

- The NYISO's Buyer Side Mitigation Rules (BSM), overseen by FERC, present a barrier to efficiently integrating bulk system renewable and storage resources in the quantities needed in the specified timeframes.
- Current market design and rules are not well aligned with State policy. There is no market design in place for hybrid storage resources and a full wholesale distributed energy resource (DER) market design has yet to be implemented.
- Evolving climate will pose new challenges to system reliability and customer costs as the system adds more renewable resources over time. System resilience and associated potential market reliability-based rule changes should be studied in projected future years given these expected changes.
- Additional demand response (DR) resources are anticipated to be needed as they will play a more critical reliability role in the future as the grid becomes more electrified and the load shape shifts.
- As the grid evolves with State policy, incentives for participation of flexible resources in the real-time energy market may not be adequate.

Potential Barriers

- **As more renewable projects are being sited, both transmission and distribution lines are seeing a reduction in "headroom" which could result in renewable resources being curtailed once built. This can result in renewable projects delaying their project progression to see if transmission upgrades will occur via CARIS, Public Policy, or NYPA priority projects that could improve their project economics, as without this, projects cannot reasonably include these upgrade costs in their bids to State Authorities without being considered too expensive and pushed down the bid stack.**
- **Key Issues:**
  - What distribution level upgrades are needed to facilitate delivery of renewable energy from sites connected at the distribution level and how might they complement or supplant the need for some upgrades on higher voltage components of the system?
  - How to encourage transmission innovations that would reduce the interconnection costs?
  - How to design a market and price signals that encourage innovations across technologies?
  - How to optimize the transmission grid/lines or dedicate new transmission lines to renewables?
  - What cost allocation methods should be applicable under different circumstances?
- **Identified Barriers:**
  - The most common current path for transmission to be built in New York is through reliability needs and Public Policy process. Curtailed energy or not having enough headroom for renewables is not considered a reliability need so this eliminates this process for building out transmission for the purpose of integrating more renewables.
  - Distribution assets (wires, transformers, cap banks, protection, etc.) that might need to be upgraded or reconfigured before distribution-level resources can serve bulk-level needs at a particular location.

Equity

> **Key Issues:**

- How to ensure equal access to clean energy jobs and affordable clean energy solutions?
- How to promote fairness and alleviate any disproportionate burdens?

> **Identified Barriers:**

- Consumer awareness of available opportunities.
- Affordability of solutions, particularly for low-income households, renters, and small businesses.
- Access to clean energy job opportunities.
- Peaking generation units are necessary for reliability, although they are typically the most expensive and polluting units on the system (on an emission rate basis), and are located in disadvantaged communities
- Siting community distributed generation projects outside of urban areas may be a barrier for urban communities because such sites are usually outside of the customer's service area.
- Generation closer to the load centers could reduce the need for transmission but land costs are usually higher.

Impacts of Electrification Presentation (E3)

Energy+Environmental Economics

Impacts of Electrification on New York Power System

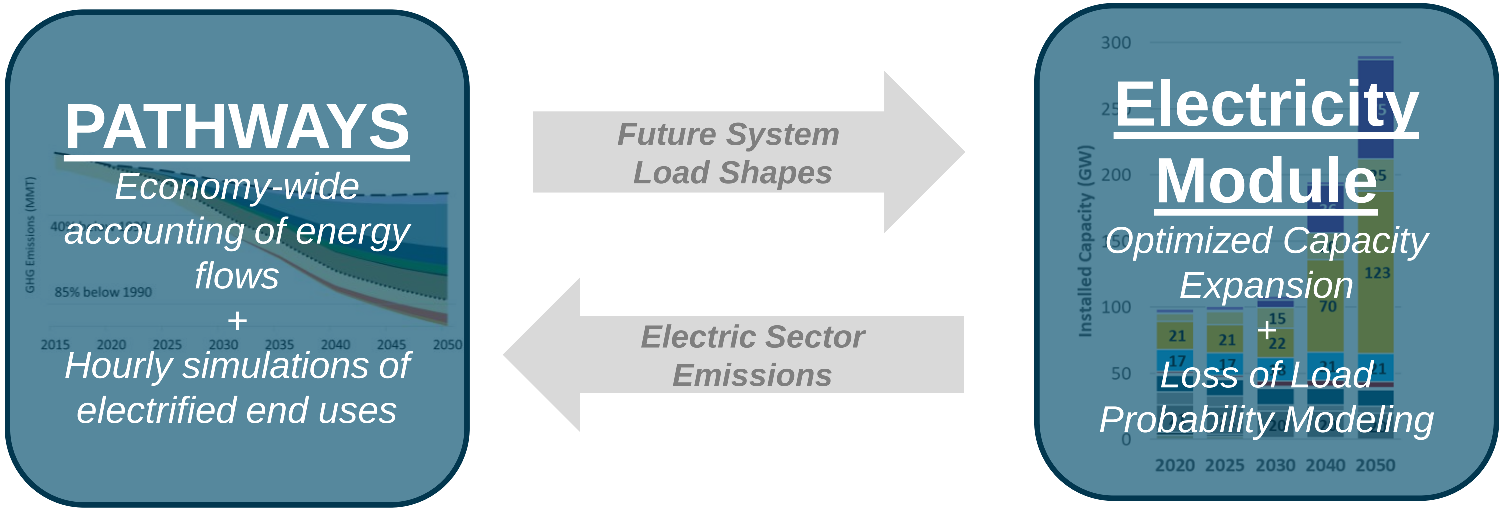
Analytic Approach

11/05/2020

Economy-wide analysis combines detailed energy accounting model and electric sector optimization

E3's integrated analytical framework combines a detailed accounting model of energy supplies and demands across the entire economy with an optimized capacity expansion model in the electric sector

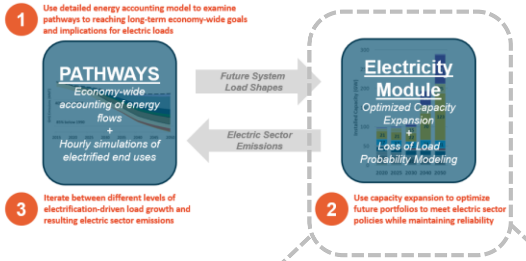
1 Use detailed energy accounting model to examine pathways to reaching long-term economy-wide goals and implications for electric loads



3 Iterate between different levels of electrification-driven load growth and resulting electric sector emissions

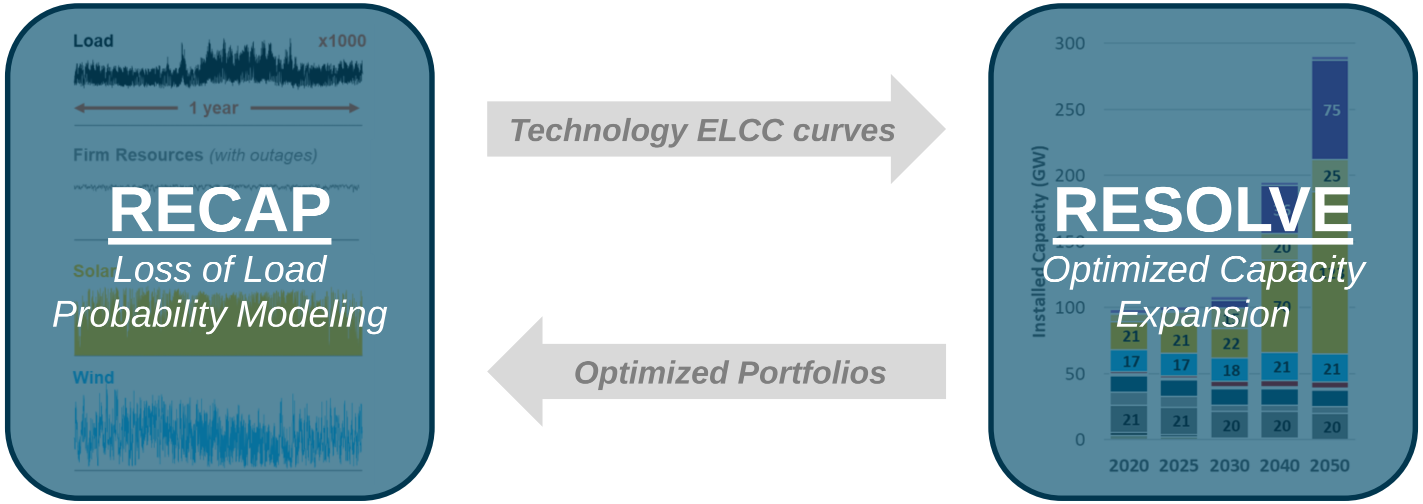
2 Use capacity expansion to optimize future portfolios to meet electric sector policy goals while maintaining reliability

Electric sector module combines capacity expansion and loss-of-load-probability modeling



Pairing a capacity expansion model with loss-of-load-probability modeling provides a framework to capture the detail needed for resource adequacy, without explicitly modeling all conditions in the capacity expansion model

2a Use LOLP model to quantify "effective load carrying capability," which measures contribution of each resource to reliability across 100s of simulations

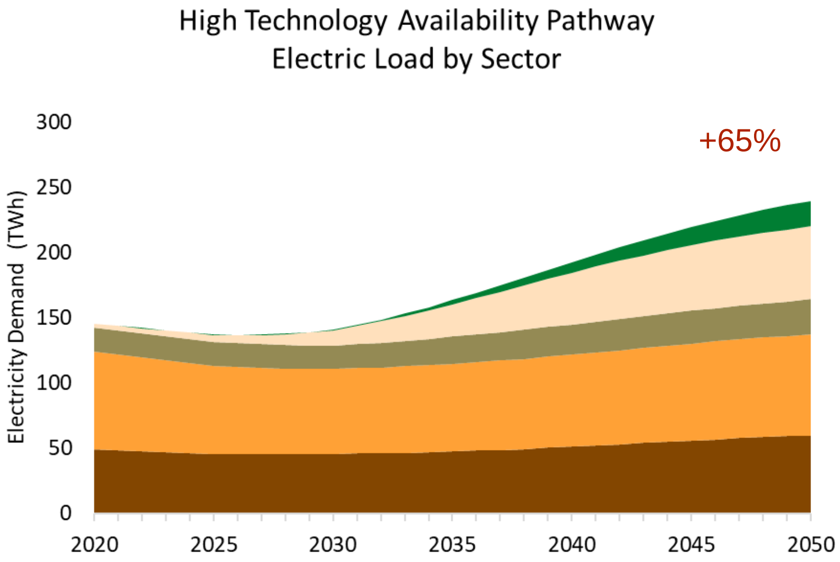


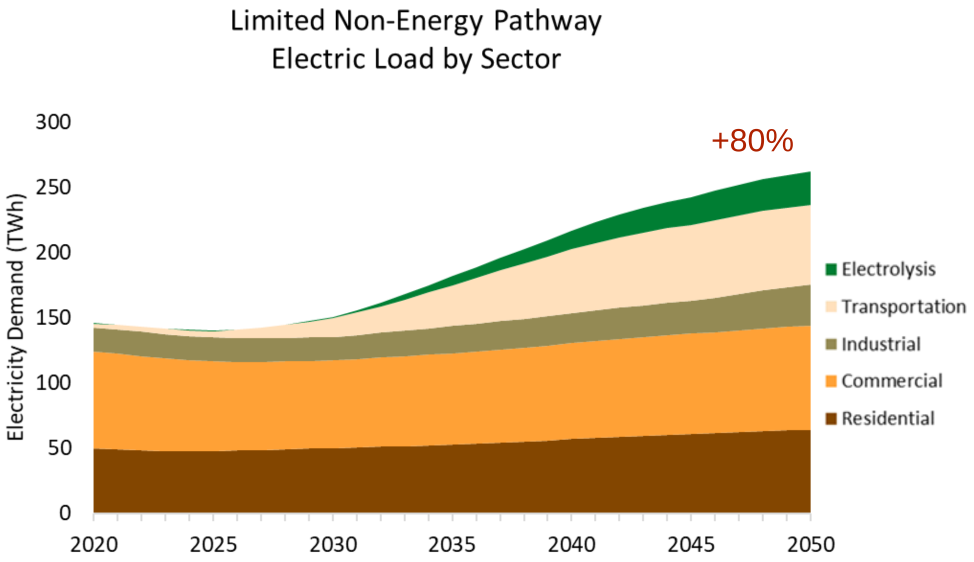
2c Use LOLP model to simulate resulting portfolios across wide range of conditions, validating resource adequacy

2b Use capacity expansion to optimize future portfolios to meet reliability and clean energy goals while minimizing cost

Annual Electricity Demand

+ **Electrification of buildings and transportation drives significant increase in electric load**
  - Analysis within range found in the literature, which project annual load increases ranging 20%-100% by midcentury
  - Range primarily reflects extent and timing of end-use electrification, with some studies assuming lower electrification and larger role for renewable gas and/or renewable transportation fuels



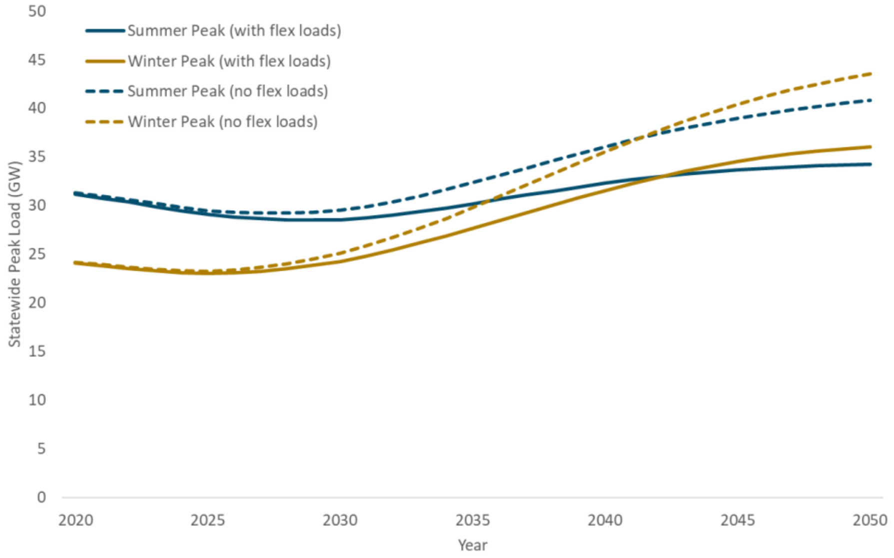


Peak Electricity Demand

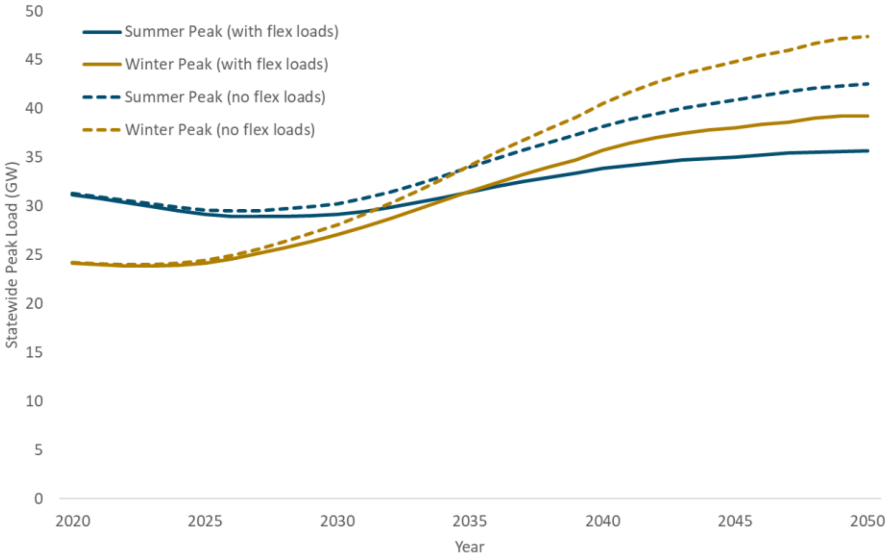
+ New York State shifts from summer peak to winter peak between 2035 and 2040, driven primarily by electrification of heating in buildings and EV battery charging

- Timing of shift to winter peak will depend on the pathway and the timing and technology shares of building and transportation electrification
- Flexibility in electric vehicles and building loads can significantly reduce peak demands and the need for new generation capacity

High Technology Availability Pathway
Peak Electricity Demand



Limited Non-Energy Pathway
Peak Electricity Demand

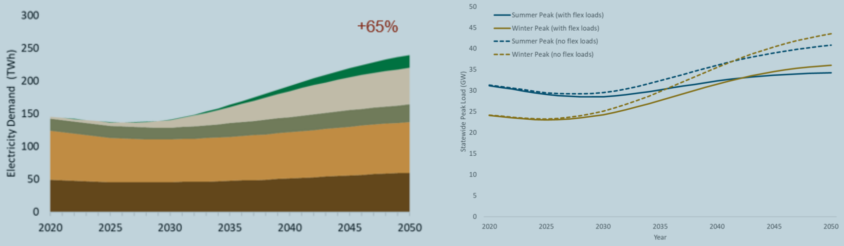


Linkages to Parallel Workstreams

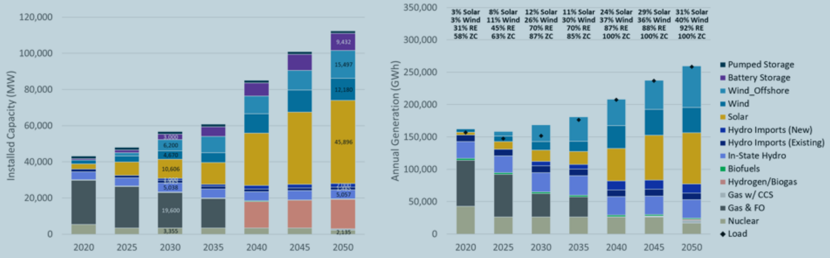
- CLCPA electric sector analysis will draw on insights from other workstreams to more fully understand the impacts of electrification of the buildings and transportation sectors
- Impacts of electrification will depend on technology shares, customer behavior, and complementary policies and strategies

Pathways Framework

Annual and Peak Electricity Demand



Electric Sector Resource Portfolio



Starting Point Pathways →

← *Impacts of Electrification*

Parallel Workstreams

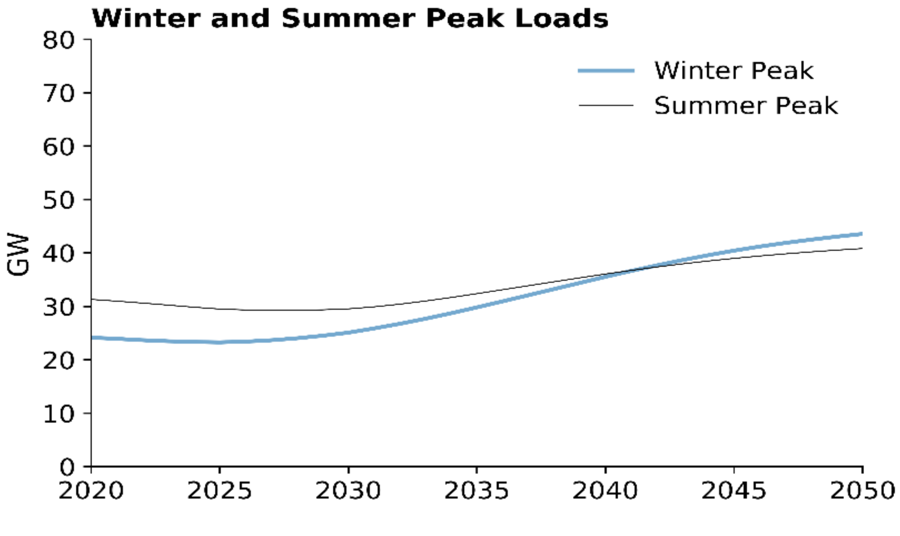
Transportation Roadmap
NYSERDA, Cadmus, Nexant

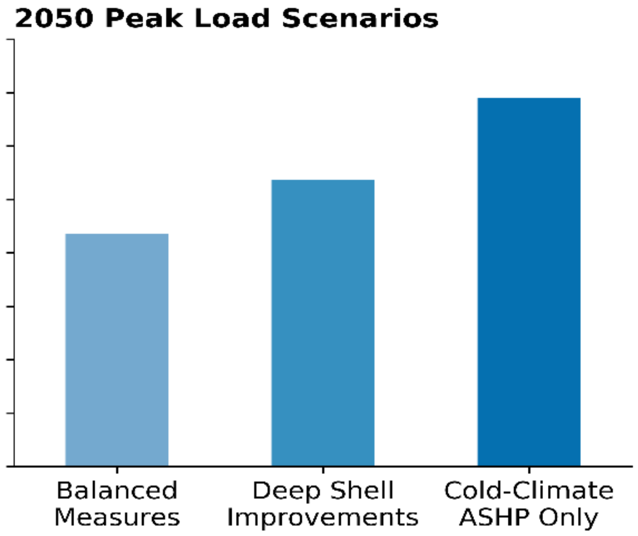
Carbon Neutral Buildings Roadmap
NYSERDA, RMI, NBI

Building Electrification Roadmap
NYSERDA, Cadmus, IEc

Insights from Parallel Workstreams in Buildings Sector

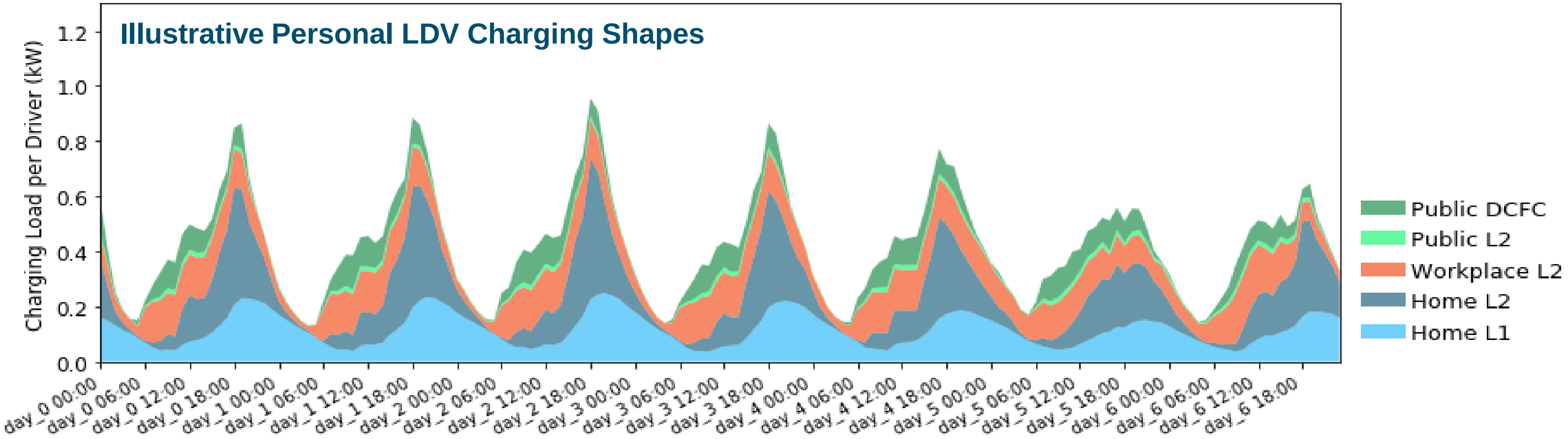
- **The Carbon Neutral Buildings Roadmap examines key questions around the load and resource impacts of heat pump adoption:**
  - What are the hourly and peak load impacts of carbon neutral buildings under different electrification scenarios? What are the impacts of measures that can help mitigate “peak heat” – e.g. building shell improvements, load flexibility, or combustion backup?
- **The Building Electrification Roadmap examines key questions around the timing and economics of heat pump adoption:**
  - What near-term strategies and policies are needed to reach heat pump adoption levels aligned with the CLCPA targets?





Insights from Parallel Workstreams in Transportation Sector

- **The Clean Transportation Roadmap will examine different trajectories to meet New York's transportation sector goals**
  - What are the hourly and peak load impacts of electrified transportation under different vehicle shares for light-duty and medium to heavy-duty vehicles?
  - What are the implications of varying levels of charger deployments and other EV infrastructure investments?
  - How do different EV charging patterns and flexibility incentives affect New York's needs for new electricity supply?
- **The Roadmap analysis will also analyze the impacts of building and transportation electrification on distribution infrastructure**



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Model Inputs, Assumptions, and Updates

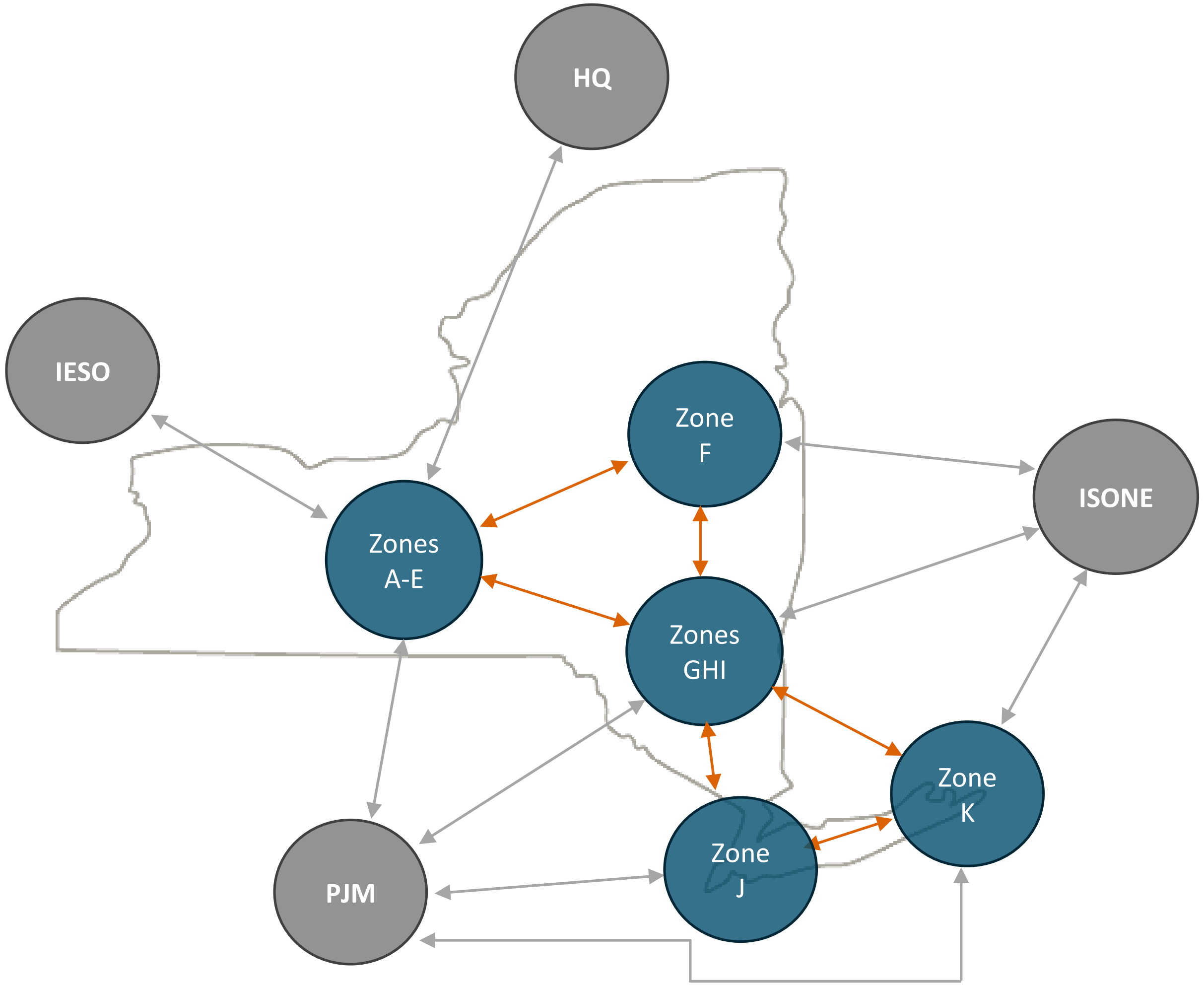
Decarbonization Resources

- **RESOLVE modeling relies on the following key inputs for decarbonization resources:**
  - **Existing and Planned Capacity**
    - NYISO Gold Book
  - **Costs of Candidate Resources:**
    - **Thermal Generators:** NYISO Demand Curve Study
    - **Renewable Generators:** Clean Energy Standard Whitepaper and NREL Annual Technology Baseline
    - **Storage:** Lazard Levelized Cost of Storage, NYSERDA Storage Roadmap, NREL Annual Technology Baseline
  - **Fuel Prices**
    - NYISO CARIS Report, EIA Annual Energy Outlook
  - **Peak Load Impacts and Load Flexibility**
    - Parallel Workstreams

Resource Type	Examples	Data Source
Thermal Generation	• Nuclear • Simple cycle combustion turbines (CTs) or combined cycle gas turbines (CCGTs) utilizing zero-carbon fuels • CCGTs with CCS	• NYISO Gold Book • NYISO Demand Curve Study • NYISO CARIS • EIA Annual Energy Outlook
Renewable Generation	• In-state hydro • Hydro imports • Solar PV (utility-scale and distributed) • Wind (onshore & offshore)	• Clean Energy Study Cost Analysis • NREL Annual Technology Baseline (ATB)
Energy Storage	• Battery storage (>1hr) • Pumped storage (>12hr)	• New York Storage Roadmap • NREL ATB • Lazard Levelized Cost of Storage
Customer Technologies	• Flexible loads	• Parallel Workstreams

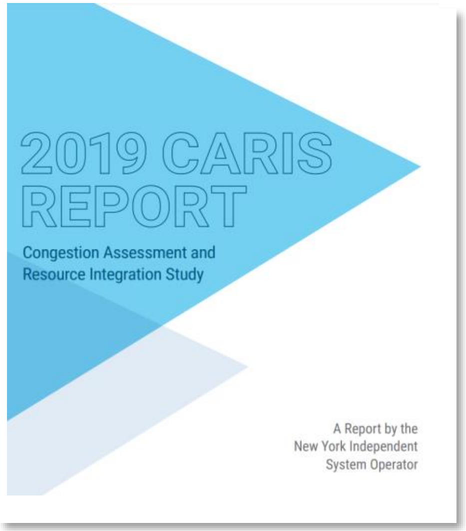
Bulk Transmission

- Updated framework will contain more detailed representation of Downstate NY
- Will capture important local dynamics including CES Tier 4, impacts of offshore wind on zonal capacity requirements
- Costs of Bulk Transmission upgrades are based on AC Transmission docket
- Will incorporate learnings from Power Grid Study



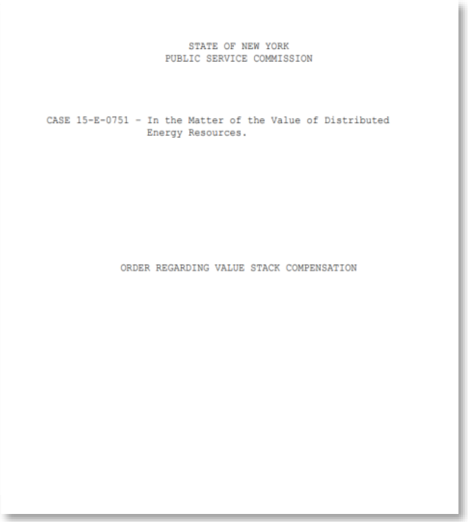
Local Transmission and Distribution

- **Local transmission upgrades will be needed to “unbottle” renewables generation and ensure deliverability**
  - Analysis will seek to draw on findings from CARIS Report and Power Grid Study
- **Distribution infrastructure will need to be enhanced as the electrification of transportation and buildings drives new load growth**
  - Cost estimates based on marginal cost studies and demand reduction value (DRV) identified in Value of DER proceeding
- **Will seek to incorporate learnings from Nexant on implications of electrification on distribution infrastructure**


2019 CARIS REPORT

Congestion Assessment and Resource Integration Study

A Report by the New York Independent System Operator


STATE OF NEW YORK
PUBLIC SERVICE COMMISSION

CASE 15-E-0751 - In the Matter of the Value of Distributed Energy Resources.

ORDER REGARDING VALUE STACK COMPENSATION

Energy+Environmental Economics

Appendix

Insights from Parallel Workstreams in Buildings Sector

+ **The Carbon Neutral Buildings Roadmap and Building Electrification Roadmap will examine different trajectories to decarbonize New York buildings**

How do different electrification strategies impact New York's "peak heat" challenges and its needs for new electric supply?

Refined Annual and Peak Load Impacts

CLCPA Pathways

What levels of heat pump adoption are needed to meet the CLCPA goals?

What near-term strategies and polices are needed to drive customer adoption levels consistent with the CLCPA goals?

Market and Policy Assessment

Heating Needs Under Range of Weather Conditions

What are the implications on overall heating demands of managed electrification strategies, e.g. building shell improvements, load flexibility, combustion backup?

Insights from Parallel Workstreams in Transportation Sector

+ The **Clean Transportation Roadmap** will examine different trajectories to meet New York’s transportation sector goals