



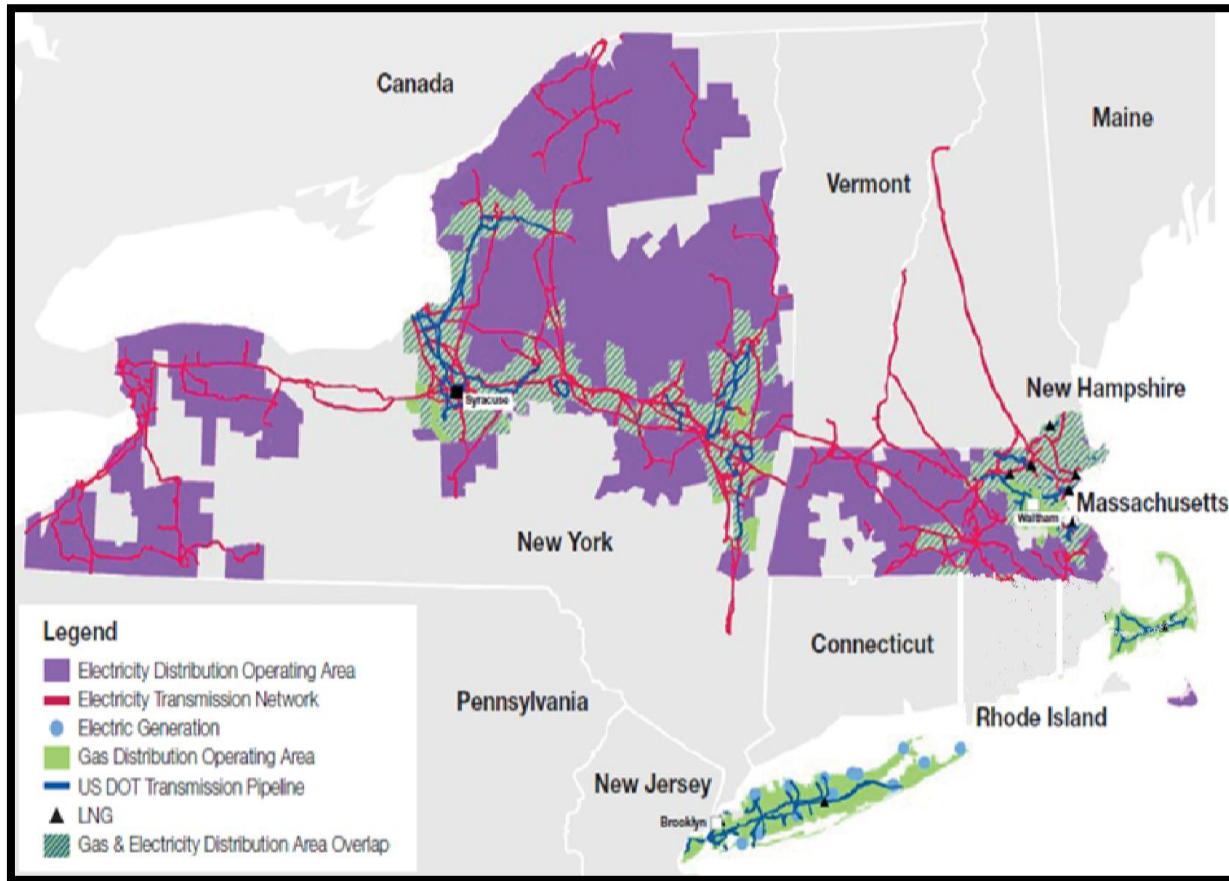
ESIG Fall Technical Workshop

Supporting Electrification Through Cross Commodity
Planning

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nationalgrid



- We own and operate **electricity distribution networks** in upstate New York and Massachusetts.
- We own and operate **electricity transmission facilities** across the Northeast, including upstate New York, Massachusetts, New Hampshire and Vermont.
- We own and operate **gas distribution networks** across the Northeastern US.

National Grid

New York



1.7M Electric Customers

2.5M Gas Customers (UNY-640k, NYC-1.28M, LI - 623k)

Massachusetts

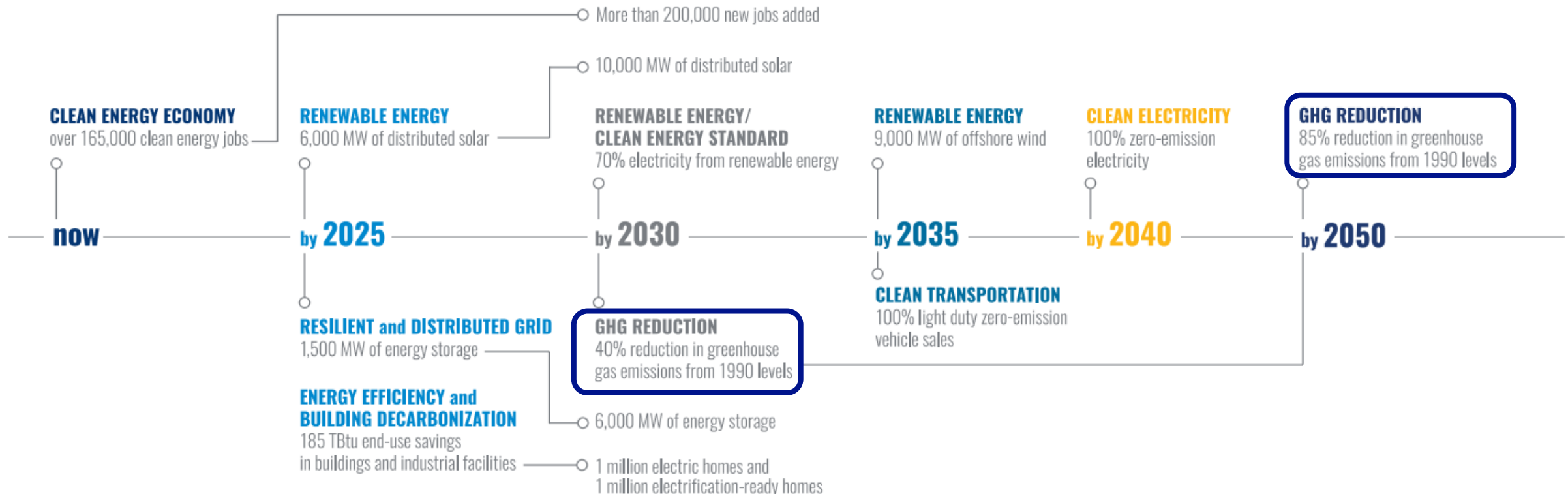


1.3M Electric Customers

0.9M Gas Customers

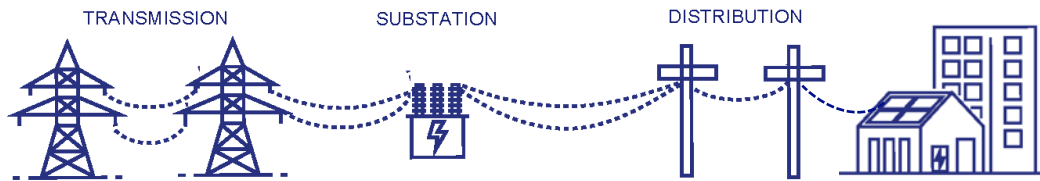
“New York State’s clean energy goals are defined by the Climate Leadership and Community Protection Act (Climate Act). The law calls for 85% reduction in greenhouse gas (GHG) emissions by 2050, and a 40% reduction in emissions by 2030.” ¹

CLIMATE ACT TARGETS AND TIMING¹

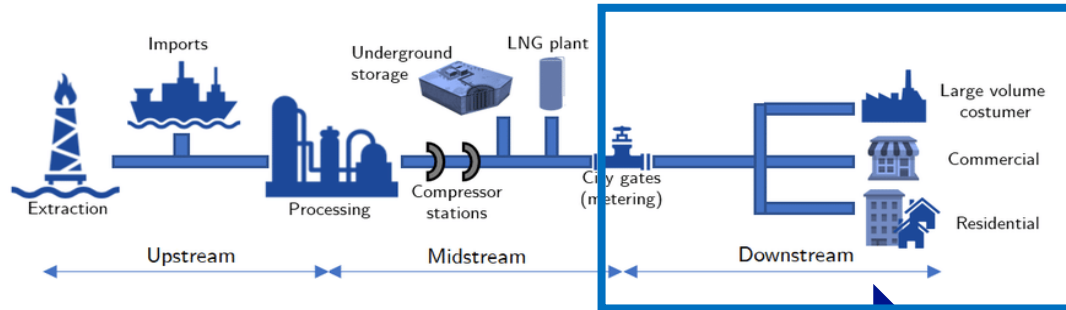


To decarbonize our networks and maintain affordability for our customers, an integrated approach to planning is needed to consolidate gas and electric capex planning and execution

Traditional Energy planning

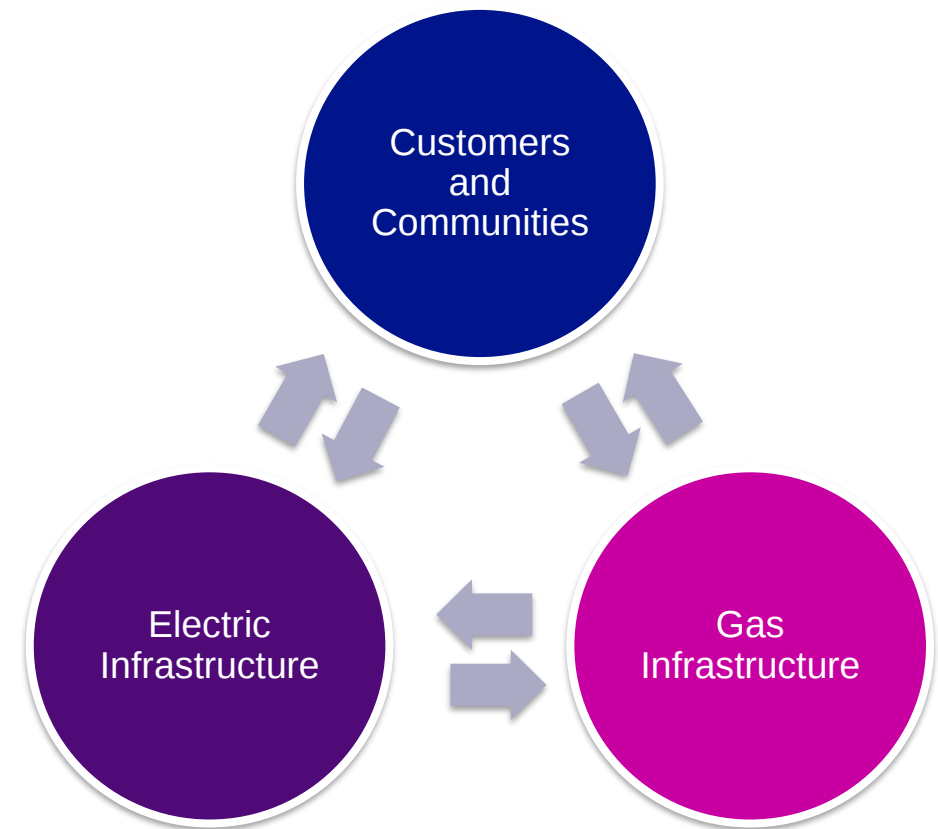


Plan electric network based on projected peak electric demand



Plan gas network based on projected peak gas demand

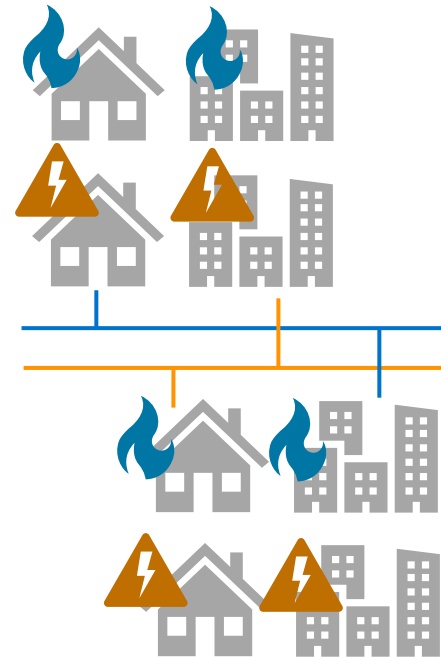
Integrated Energy Planning



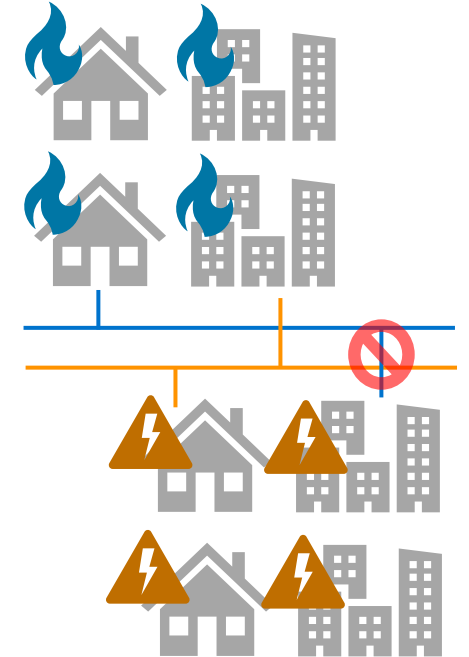
Integrated energy planning can help identify ways to optimize investments, through targeted electrification and reducing stranded asset risk

- ✓ Ability to optimize gas and electric networks
- ✓ Avoidance of future gas network investments
- ✓ Lower overall system costs

Disorderly Electrification (Ad hoc adoption)



Targeted Electrification



IEP impacts several existing processes and business procedures

Data sharing (cross-cutting)

How do we share and manage underlying data exchange required between EDC and LDCs (across NG gas and electric and with other utilities) to implement IEP. Majority of our service territory is “non-overlapping.”

Community Engagement

How do we engage with communities and help build plans with them around their clean energy goals?

How do we administer incentives for electrification adoption most effectively and target those incentives based on our gas and electric investment plans?

How do we use insights from our customer and community teams as input into the feasibility/cost-effectiveness of gas investment alternatives?

Gas Planning

How do we make decisions on the gas network of where/when to invest in leak prone pipe replacement?

How do we evaluate feasibility / cost-effectiveness of alternatives to gas investment?

Electric Planning

How do we adjust/reprioritize our electric network investments based on gas decommissioning plans?

How do we estimate the impact of potential gas decommissioning decisions on electric load?

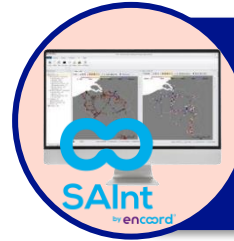
How do we provide input on timing/cost of electric system “alternatives” into the process for evaluating gas system investment

Initiatives to date have focused on developing capabilities, methodology and assumptions internally for engineering analyses and gaining external benchmarking to help inform best practices.



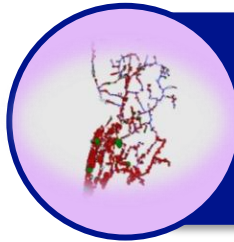
Customer Propensity

Developed approach to **predict where, when, and what** customers will adopt. Develop 5 customer "personas" based on willingness and ability to adopt.



Cross Commodity Planning Tools

Developing tools and processes to **integrate gas and electric modeling** systems into one platform to analyze heat electrification impacts.



Targeted Electrification Engineering Analysis

Conducted targeted electrification **analysis for 35 Company dual fuel locations** (17% UNY gas system) to identify pilot locations; all 35 required electric upgrades.



External Engagement & Benchmarking

Collaboration and benchmarking with external organizations to establish industry best practices, policy changes needed, and provide leadership.

Analysis of 35 dual fuel locations indicated average electrification costs were 5-6x higher than costs to maintain the gas; all locations required upgrades (\$500k - \$200M)

Targeted Electrification

Costs vary significantly, but upgrading of legacy 5kV infrastructure is primary driver of costs and upgrades are not limited to the distribution system.

System Impacts:

- **System:** Increase of 1.5GW of distribution load; current system peak load is ~7GW.
- **Feeder:** 57% (232) doubled in load, with 131 exceeding their winter ratings.
- **Transformer:** 45% (94) doubled in load, with 48 exceeding their winter ratings.

Takeaways:

- **Technology:** Loading assumptions and infrastructure upgrades are significantly influenced by adopted technology (e.g. ASHP, GSHP).
- **Sensitivities:** Resulted in material reductions in costs; however, upgrades were still greater than maintaining the gas systems.

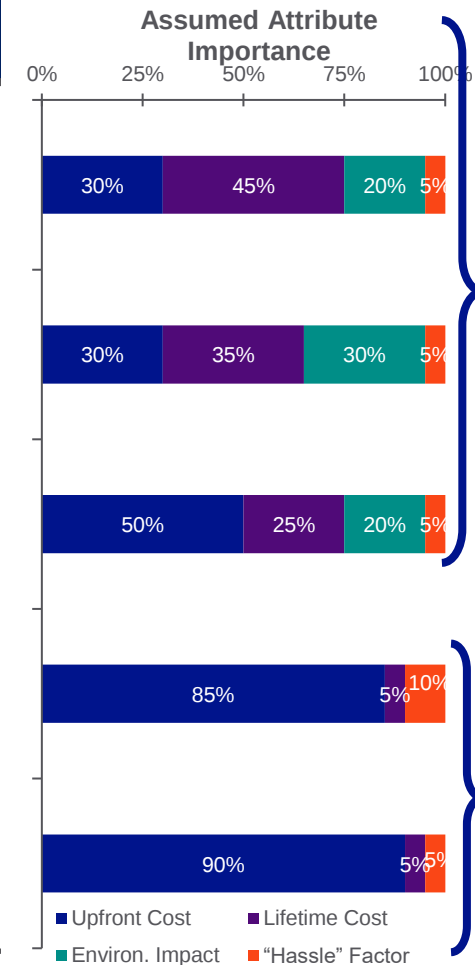
Refine analysis to target subset of 35 areas that require minimal electric upgrades, but still mitigate gas upgrades, to support piloting electrification as a non-pipeline alternative (NPA) solution.



Residential Customer Segmentation System informs factors behind technology adoption decisions quantifying overall propensity

More Likely to Electrify

Residential Customer Segment ¹	Home Ownership	Income Range	Energy Conservation Inclination	EE Program Participation & Other Identifying Criteria
Upscale Seniors 	Mostly Owners	\$75K-\$499K	Medium	- Donate to causes and purchase environmentally friendly products - Participate in NG EE programs
Early Green Adopters 	Mostly Owners	\$75K-\$499K	High	- Want to try new technologies/ appreciate digital channels - Prefer auto-enrollment and do not participate in energy provider programs
Energetic Families 	Rent or Own	\$50K-\$149K	Medium	- Participate in NG EE programs but expect financing and auto-enrollment - Feel the government should be doing more to protect the env. and want to help
Traditional Elders 	Rent or Own	\$10K-\$75K	Low	Do not participate in energy provider programs because they are too expensive, or the programs to do not match their needs
Suburban Strivers 	Mostly Renters	<\$49K	Low	- Managing their bills outweighs ability to act upon their concern for the env. - Expect digital channels, and auto enrollment to participate in programs

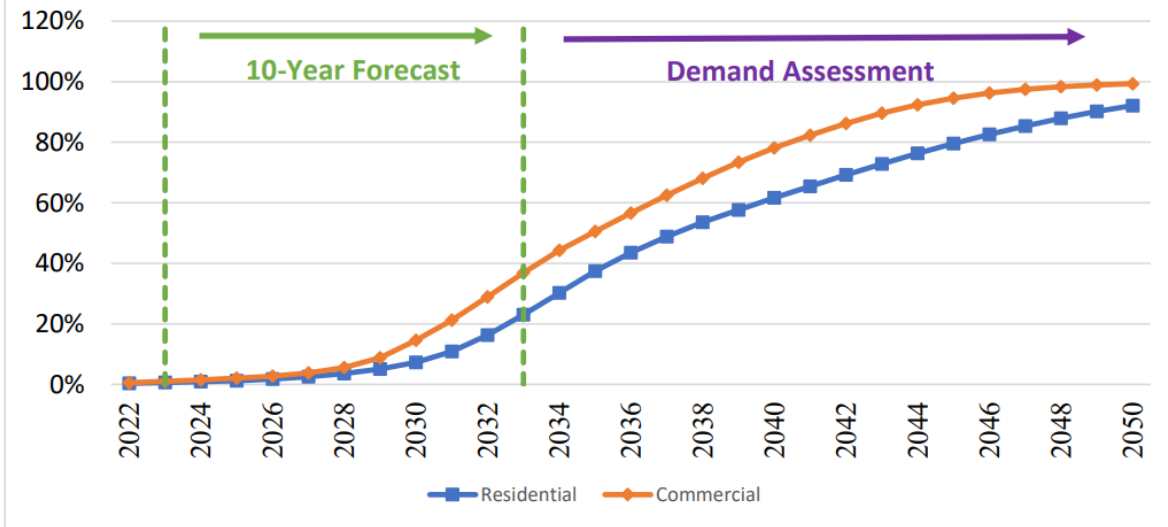


Motivated by lifetime cost & environmental factors, leading to relatively more heat pump adoption

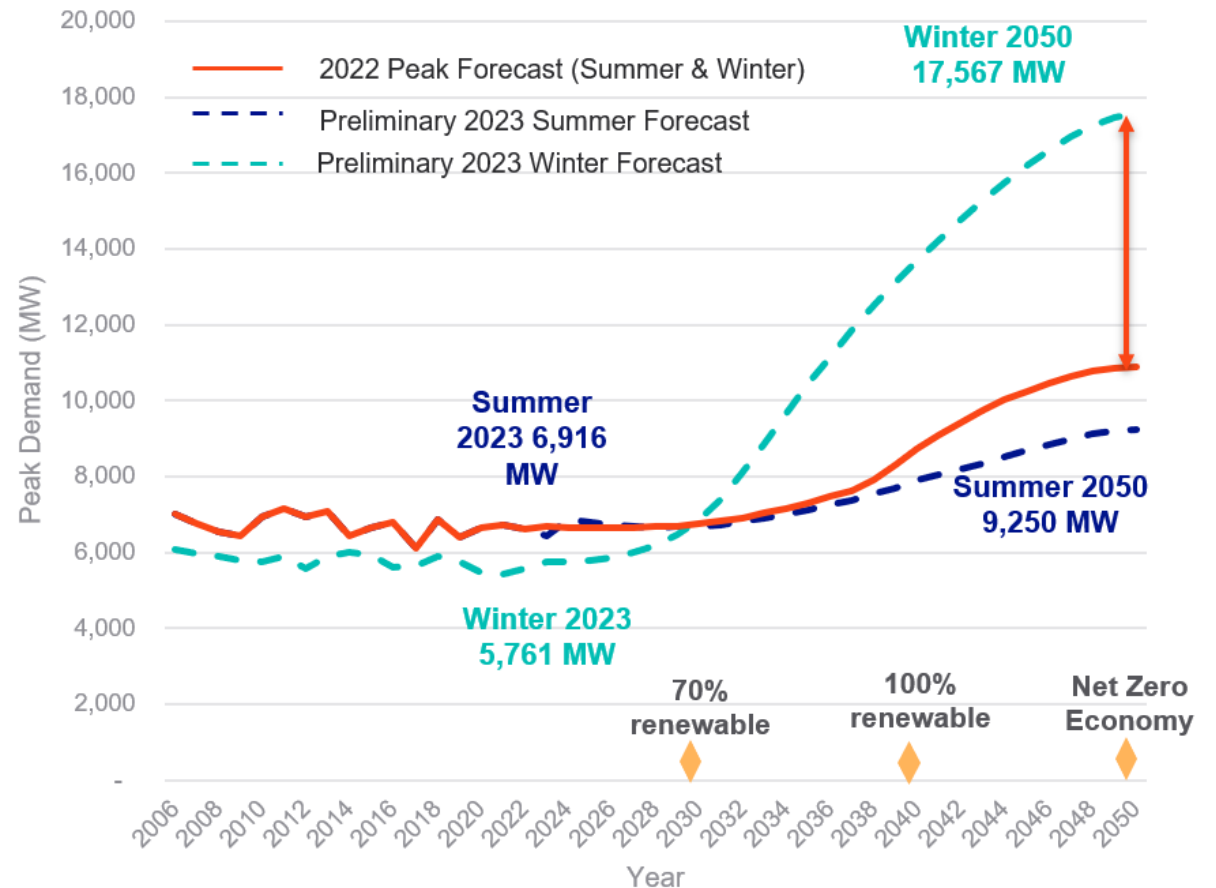
Motivated by upfront cost, leading to relatively more baseline technology adoption

National Grid forecasts system and feeder level seasonal peak load and explicitly models the adoption and peak impact from electrification

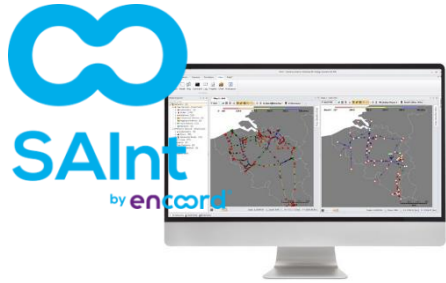
Heat-Pump Penetration by Customer Class



Niagara Mohawk Summer and Winter Peak Demand



National Grid has additional ongoing efforts to better develop our Integrated Energy Planning capabilities



The desktop process to evaluate the impacts of electrification, identifying upgrades and estimating costs, is time consuming and manual.

- Working in collaboration to develop a tool that can model both gas and electric energy systems in one platform enabling modeling of entire electric network from distribution up to transmission.



There is significant uncertainty around the peak load impact of heat pumps, which could vary significantly depending on multiple factors.

- Working to develop tools detailing several realistic customer adoption pathways to full electrification and its impact on customer costs. Significant analysis is needed to identify the most likely pathways.

Other National Grid studies are underway to define industry approaches to targeted electrification, understand regulatory/legal frameworks enabling electrification, and identify best practices for customer outreach and adoption.

There remains many opportunities to study integrated energy planning, test and refine assumptions, and identify necessary new capabilities.