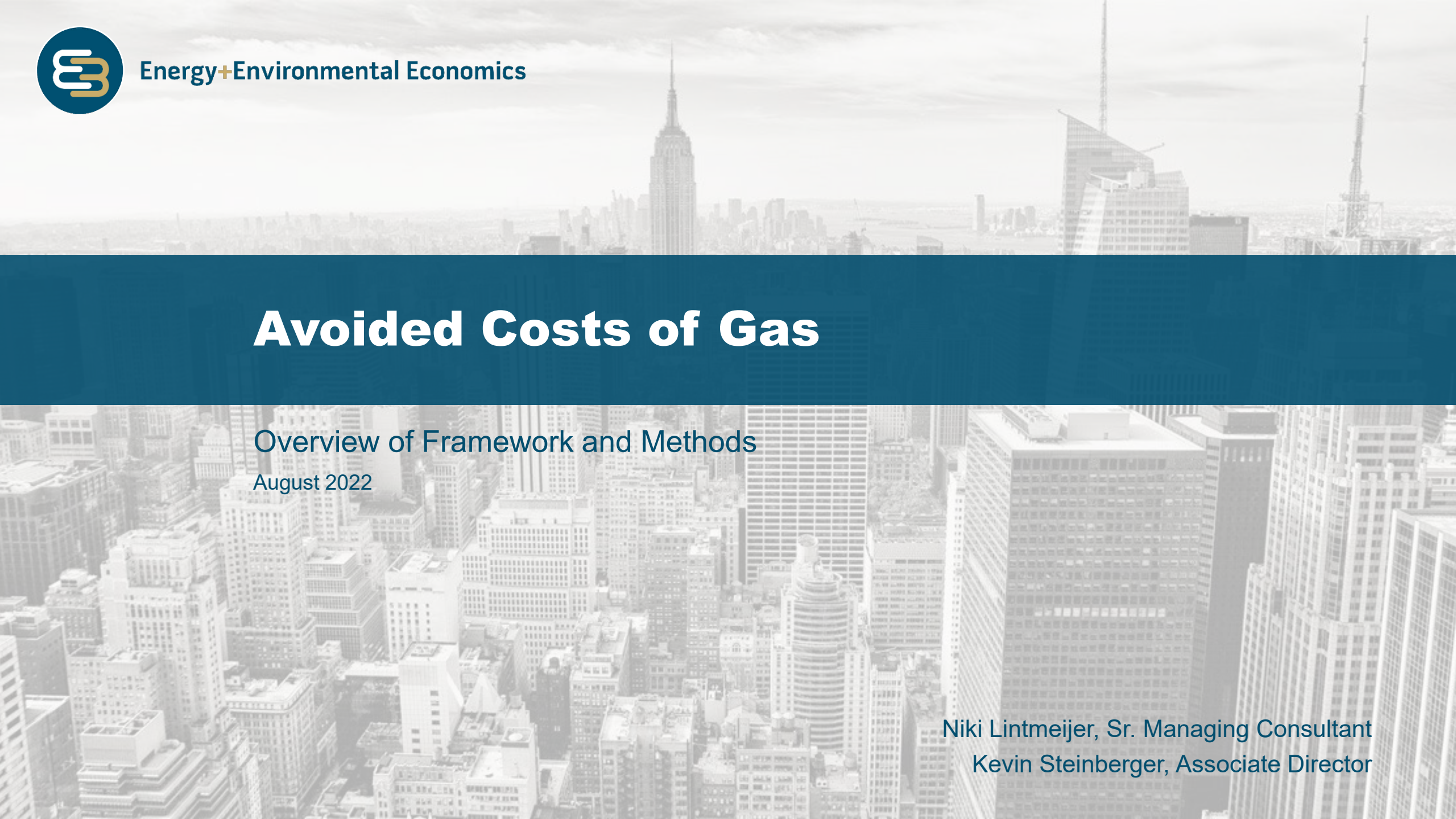

Energy+Environmental Economics

Avoided Costs of Gas

Overview of Framework and Methods

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Overview

+ Purpose of this presentation:

- Provide an overview of the Avoided Cost of Gas framework developed by E3 for NYSERDA and DPS in 2020
- Provide insights into other “Future of Gas” projects E3 has contributed to since 2020 and key similarities/differences with ACG framework

+ Content:

- Overview of Avoided Cost of Gas framework and its key components
- Purpose & Use Cases of ACG framework
- Insight from Massachusetts 20-80 “Future of Gas” work
- Key learnings from “Avoided Cost of Gas” vs. “Future of Gas” framework
- *Appendix – detailed ACG methodology*

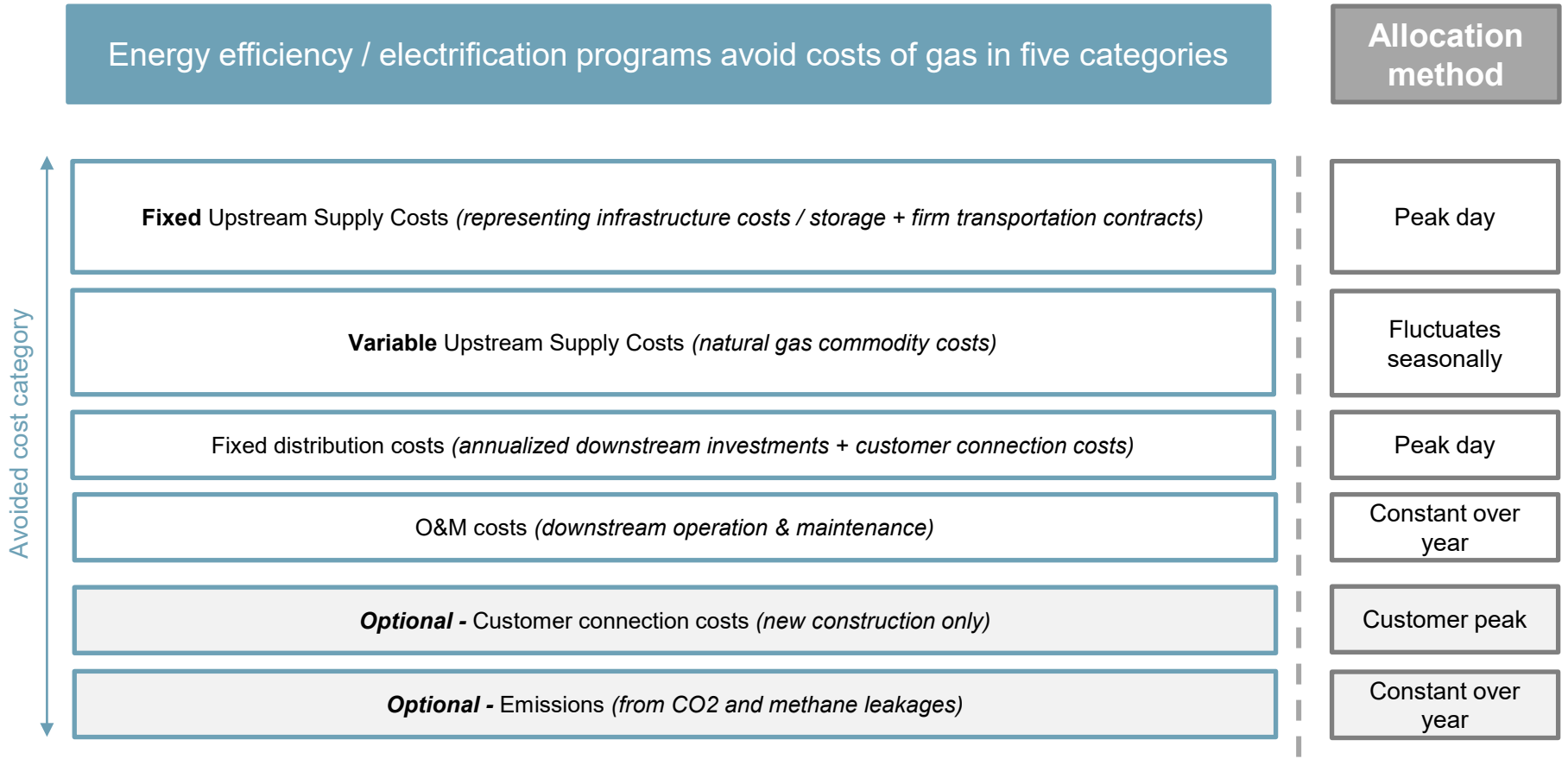
Review of ACG Framework: Scope and Structure

+ **This project set out to examine the benefits of reductions in gas consumption – e.g. through energy efficiency, electrification of thermal loads, etc – through an Avoided Cost framework**

+ **The framework quantifies the following avoided costs with a flexible and customizable framework that reflects the diversity of New York's gas utilities:**
  - Upstream supply costs
  - Leakage rates and other losses
  - "Peak gas" value
  - Local avoided infrastructure costs
  - Avoided GHGs (methane and CO_2)

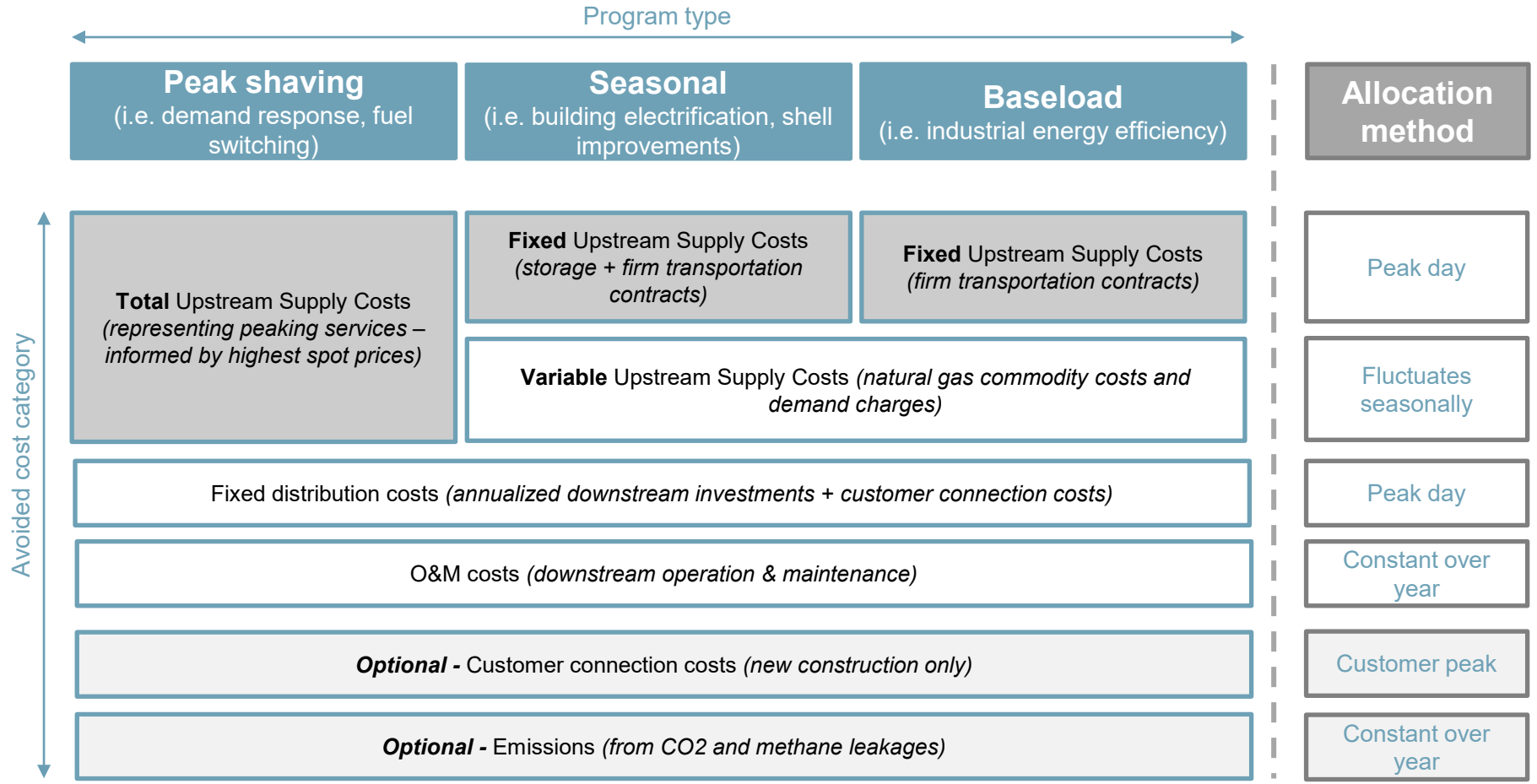
+ **Importantly:**
  - The Avoided Cost framework focuses on a business-as-usual future for the New York gas system
  - The framework does not examine the impacts of the CLCPA on gas throughput and associated implications for gas utilities
  - The framework is based on a marginal approach to avoided costs and as such does not cover potential savings related to i.e. large scale decommissioning

Overview of Avoided Cost Framework



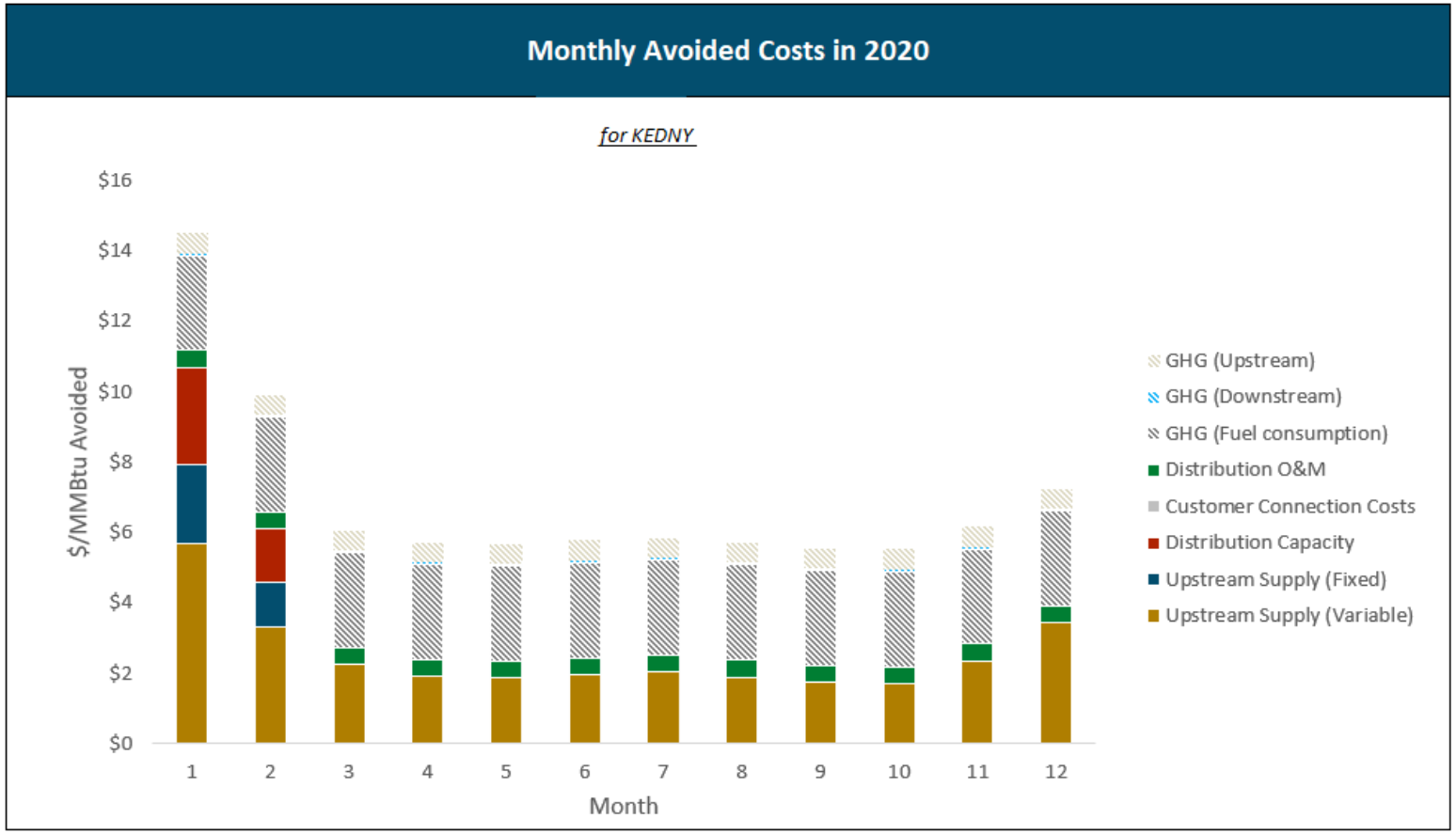
Overview of Avoided Cost Framework

Upstream costs require distinction in program type



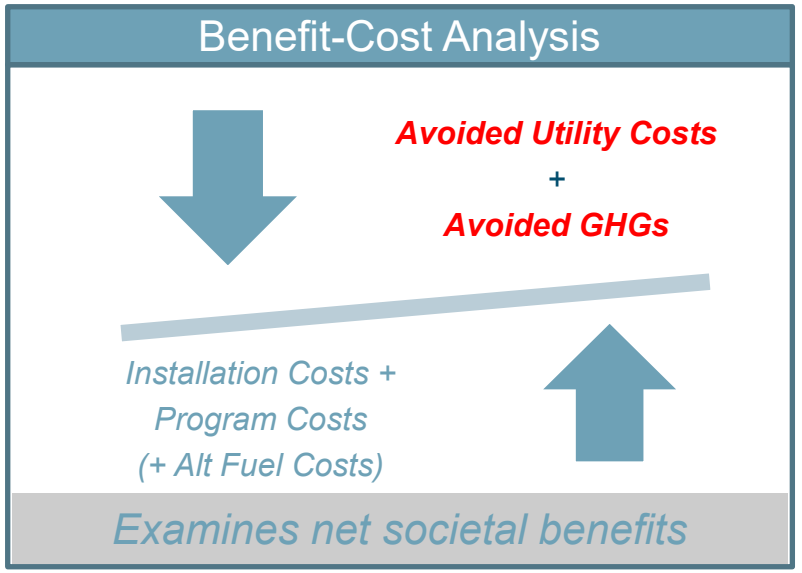
The ACG framework results in a representation of daily and monthly avoided costs of gas by component (example)

- Example on the right shows avoided costs allocated by month for a seasonal program (i.e. building electrification)
- While commodity & O&M costs are avoided throughout the year, fixed costs may be avoided in the months where peak consumption occurs



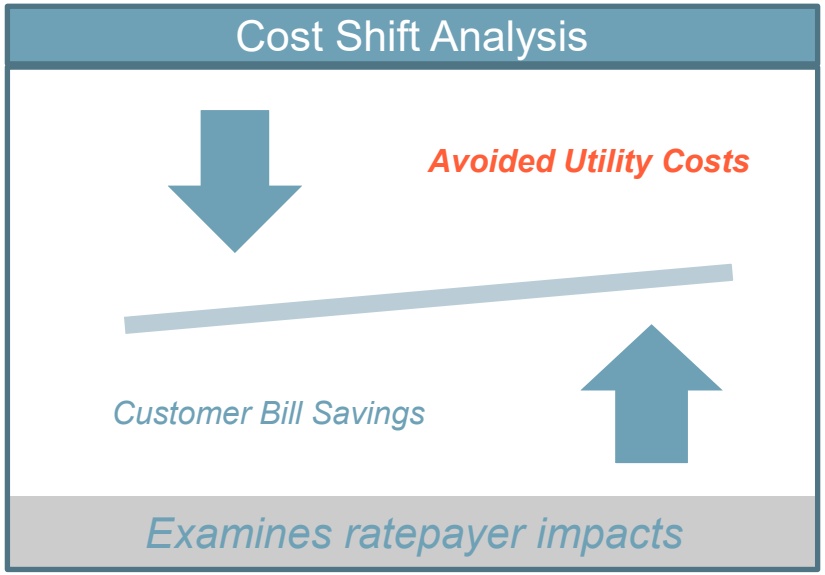
What do Avoided Cost results tell us?
Benefit-Cost Analysis

- **The Avoided Cost framework can be used to perform BCAs on a wide range of measures and programs**
- **Avoided Costs represent one side of the equation**
  - Other workstreams will consider cost side of equation and overall economics
- **This framework differs from previous applications of state-wide avoided gas costs (i.e. more aligned with recent utility BCAs):**
  - Captures seasonal granularity in commodity costs
  - Captures "peak gas" value for infrastructure costs
  - Captures utility-specific costs



What do Avoided Cost results tell us?
Cost Shift Analysis

- **The Avoided Cost framework can be used for Cost Shift Analyses and helps understand longer term ratepayer impacts**
  - When avoided utility costs equal customer bill savings, no cost shift occurs
  - When customer bill savings are higher than avoided utility costs, a cost shift is likely to occur (where 'remaining' ratepayers bear the costs)
  - When avoided utility costs are higher than customer bill savings, an "inverse cost shift" is likely to occur (where 'remaining' ratepayers see bill decreases)
- **With more customers switching to electrification, there is risk of significant cost shift**
  - Embedded costs will need to be collected from a smaller customer base



What do Avoided Cost results tell us?
Limitations and Caveats

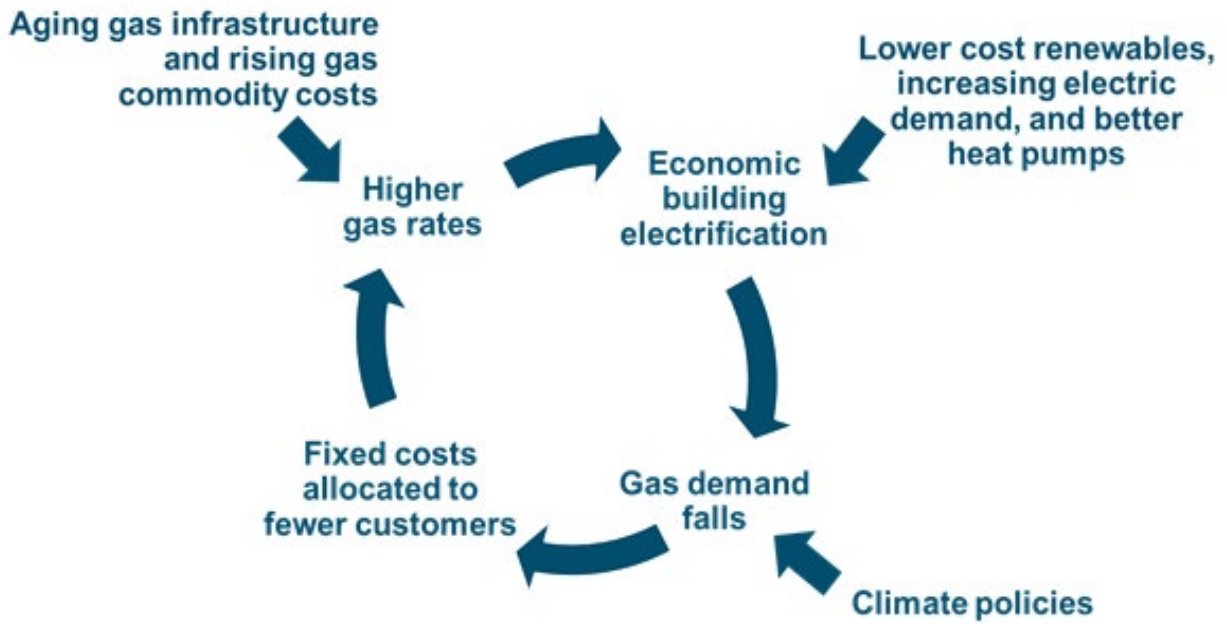
- **Avoided Costs show the monetized utility costs (+ carbon)**
- **Significant non-monetized utility value may result from NPS projects:**
  - Decreased transportation from CNG trucks & decreased street work, etc.
  - Reduced supply risk (e.g. challenging conditions for trucked CNG during winter storms)
  - More granular locational value
- **Additional environmental value may also result, beyond what is captured by SCC:**
  - Progress towards CLCPA carbon neutrality goal
  - Methane leakage
  - Upstream emissions (processing, transport, etc)
  - Local environmental issues
- **Avoided cost framework does not consider potential cost avoidance related to embedded system costs of existing infrastructure**
  - Framework can be used to identify avoided costs or "marginal benefits" of NPA, but is limited in identifying revenue requirement implications of embedded infrastructure costs.

Example: NYSEG Lansing NPA

Although NYSEG found the BCA of the NPA portfolio to be <1, they cited the following reasons to move forward with the portfolio:

1. Increases local reliability
2. Consistent with CLCPA goals
3. Supports Joint Proposal goal of no net increase in gas utilization
4. Supports local environmental advocacy

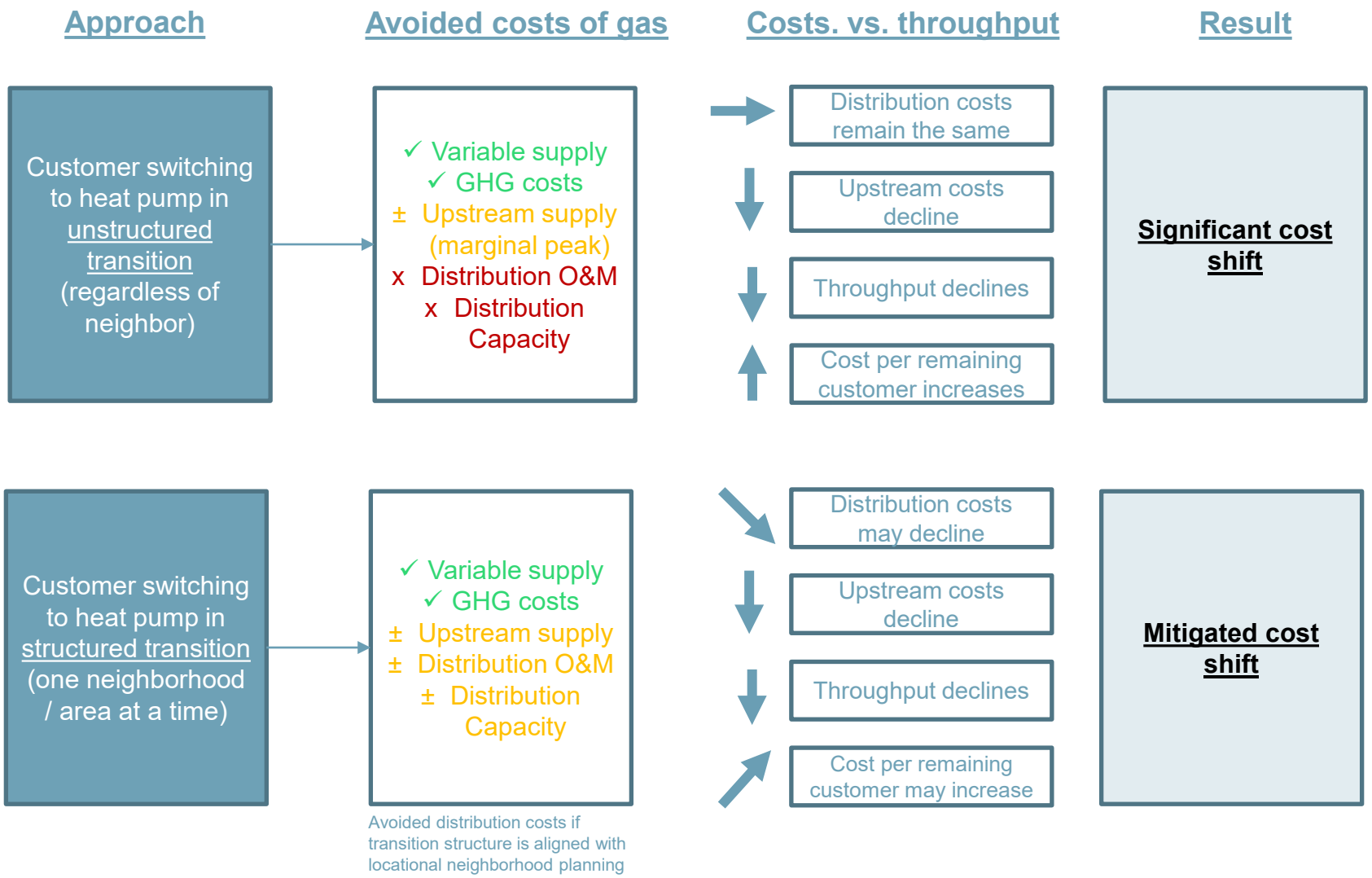
Future work could consider the cost shift impacts under various CLCPA pathways



+ *A "'feedback loop" may develop, driving gas costs higher*
+ ***Customer impacts may be inequitable without a transition strategy***
  - *Burden on those unable to switch away from gas (renters and low-income customers)*

E3, California Energy Commission: "The Challenge of Retail Gas in California's Low-Carbon Future" (2020)

Structured transition can help mitigate the impacts on remaining customers



E3 evaluated cost implications from large-scale transitions in the MA Future of Gas docket (1/2)

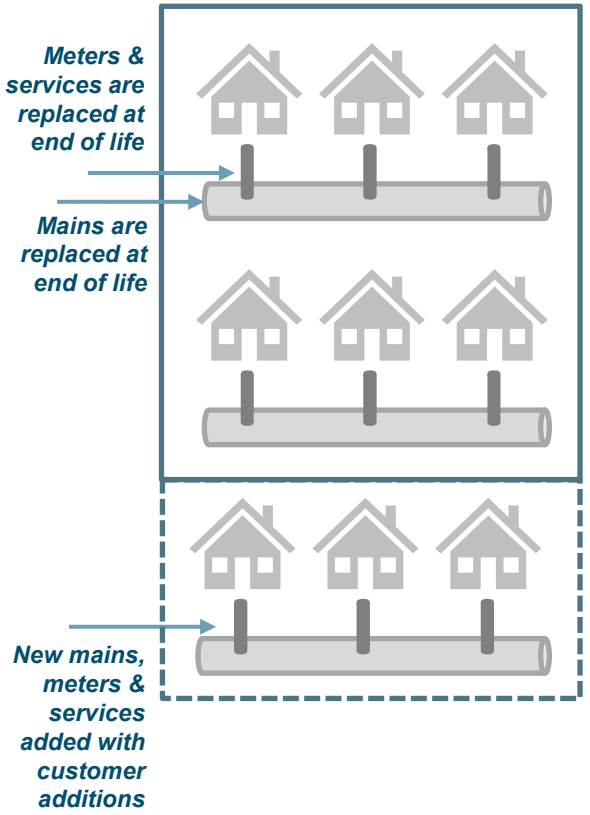
Inspired by the Massachusetts Roadmap and interim 2030 CECP, modified to meet goals of 2021 climate legislation

Alternative 2050 decarbonization scenarios, reflecting stakeholder input

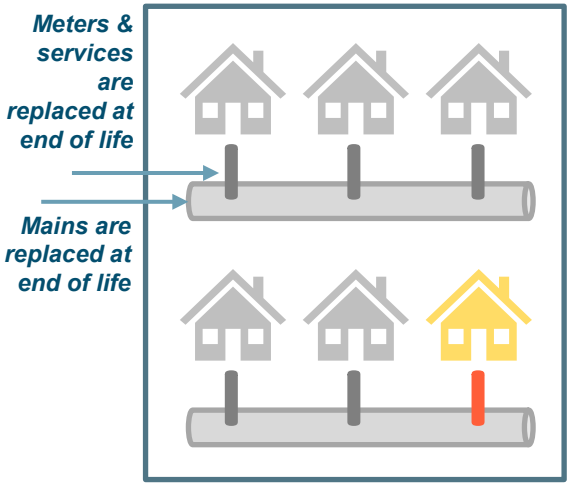
Scenario:	Low Electrification (similar to "Pipeline Gas")	High electrification (similar to "All Options")	Interim 2030 CECP	Hybrid Electrification	Networked Geothermal	Targeted & Optimized Electrification	Efficient Gas Equipment	100% Gas Decom-missioning
Overview:	High electrification in the transportation sector. Buildings partly electrify.	High electrification in both Buildings and Transport-ation sector.	Accelerated electrification & building shell measures based on the interim 2030 building sector target.	Heat pumps are paired with gas or fuel oil backup to mitigate electric sector impacts.	Part of the gas system is strategically replaced by networked geothermal systems.	Part of the gas system is strategically decomm-issioned with customers adopting ASHPs.	Building sector will adopt increasingly efficient gas appliances, supplied by decarbonized gas.	Building sector and Industry will fully electrify, allowing for 100% decommissio ning of the gas distribution system.

E3 evaluated cost implications from large-scale transitions in the MA Future of Gas docket (2/2)

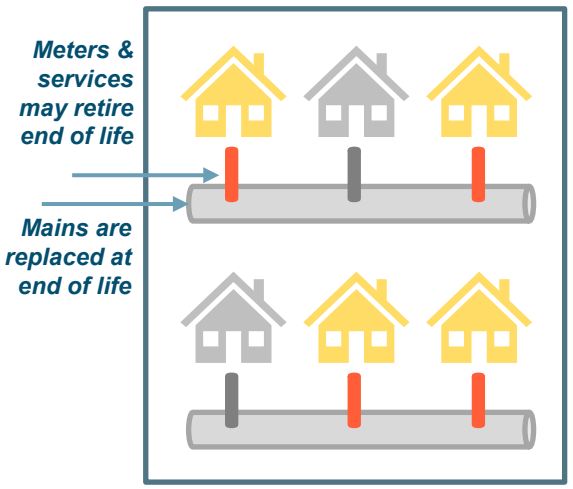
Scenarios with customer additions



Scenarios with stable or reduced customer base

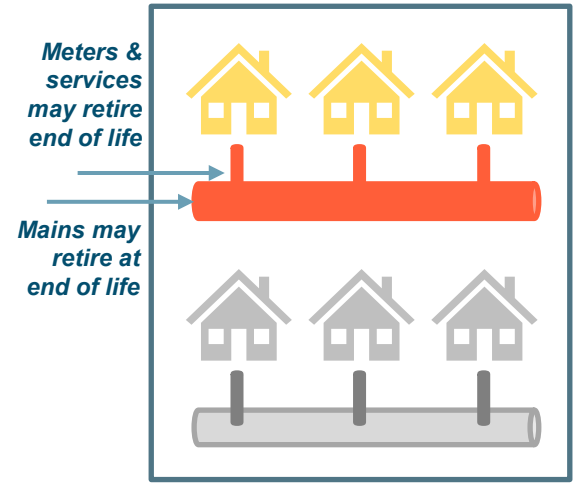


Scenarios with untargeted gas system departures



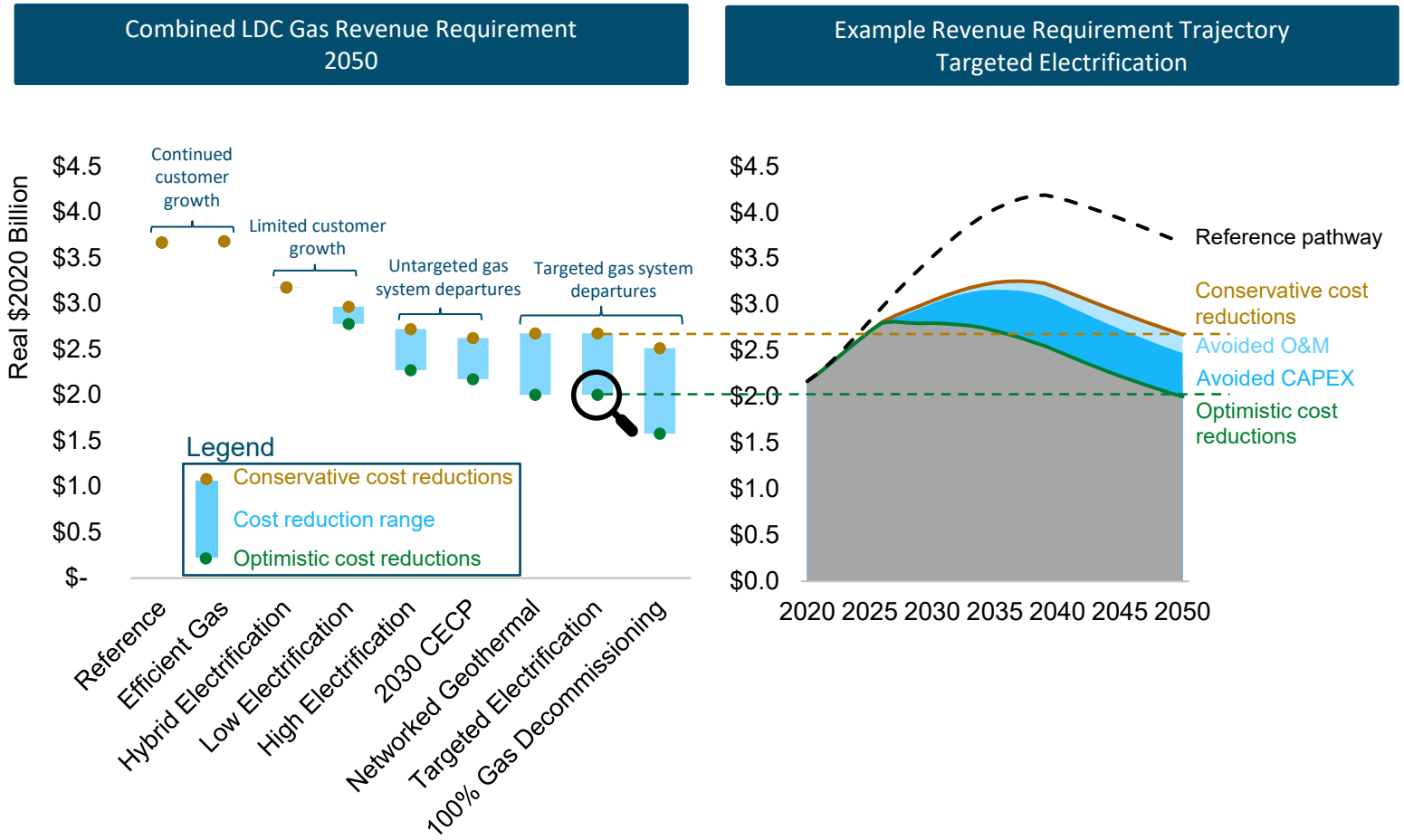
- Implies gas system is maintained in the long term, serving very few customers in 2050

Scenarios with targeted gas system departures



- Requires planning
- Implications for customer choice
- Early retirement of customer equipment likely necessary

E3 found substantial divergence between scenarios that involve “untargeted” vs. “targeted” customer transitions



Decarbonization Pathways Report, figure 29. Range of gas LDC revenue requirements in 2050 and an example of the revenue requirement trajectory in the targeted electrification scenario. This figure does not include gas commodity costs, nor the costs to build and maintain networked geothermal systems.

- **In all pathways, annual LDC revenue requirement increases in the short term as a result of GSEP expenditures**
- **Despite potential cost savings, scenarios with lowest gas system utilization bear the risk of ending up with embedded system costs that can no longer be recovered.**
- **Pathways with targeted gas system departures show the largest opportunity for potential cost savings**
  - Substantial uncertainty exists in estimating the feasibility of this approach

Feasibility implications: targeted electrification and large-scale system cost avoidance

+ **Shifting gas system investments to targeted electrification or networked geothermal hinges on several factors. Enabling conditions include:**
  - **Systems that can be hydraulically separated safely and reliably.** Certain segments of the gas system cannot be removed from service without adversely affecting the safety, reliability or other operational parameters of the system. While it may be easiest to remove "terminal branches" at the edges of the system, targeted projects may occur in more dense and networked regions.
  - **Cost savings are achievable.** Projects will be most attractive where concrete cost savings are achievable on the gas system and the magnitude of those savings exceeds the costs of the alternative, inclusive of decommissioning costs, building retrofits and electric system upgrades.
  - **Consumers choose to convert.** In the case of voluntary conversions, all consumers served by part of the gas system would need to accede to losing gas service. The likelihood that there are no hold-outs is to fall with the scale of project. It may be possible to find 5 customers who are all willing to switch, 500 is likely a different matter.
  - **Alternatively, customers are forced to convert.** Barring widespread shifts in consumer preferences, the nature of LDCs' obligation to serve existing customers may need to change, with implications for customer choice.

+ **In addition to potential cost savings related to targeted electrification, LDCs anticipate potential additional costs of decommissioning not captured in the analysis**

What do you need to "believe" in order for gas system conversions or cost avoidance to be achieved?
- The conditions above are met
- High levels of upfront planning and high levels of constructability & workforce availability; study from Palo Alto Utilities suggests higher workforce needs for decommissioning

Key learnings: Avoided Cost of Gas framework versus "Future of Gas" framework

Avoided Cost of Gas Framework

- + Evaluates avoidance of marginal costs related to specific measures and programs
- + Does not distinguish differences in geographically targeted approaches
- + Useful as input to BCAs to evaluate specific measures and programs
- + Useful to evaluate short-term cost shifts related to specific measures and programs

"Future of Gas" Framework
(implications from large-scale customer transitions)

- + Evaluates long-term revenue requirement implications of large-scale transitions
- + Explores impact of geographically "targeted" vs. "untargeted" customer transitions
- + Useful to evaluate long-term implications of large-scale customer transitions
- + Useful to evaluate long-term cost shifts in the absence of regulatory measures

A combination of frameworks may be useful to evaluate both short and long term implications of decarbonization programs on gas system planning & customer rates; additional utility-specific data may be required to provide a more granular picture of cost avoidance opportunities & limitations across NYS.