

# Benefit Cost Assumptions

*Presented to:*

*Illinois Energy Efficiency Stakeholder Advisory Group*

July 16, 2024



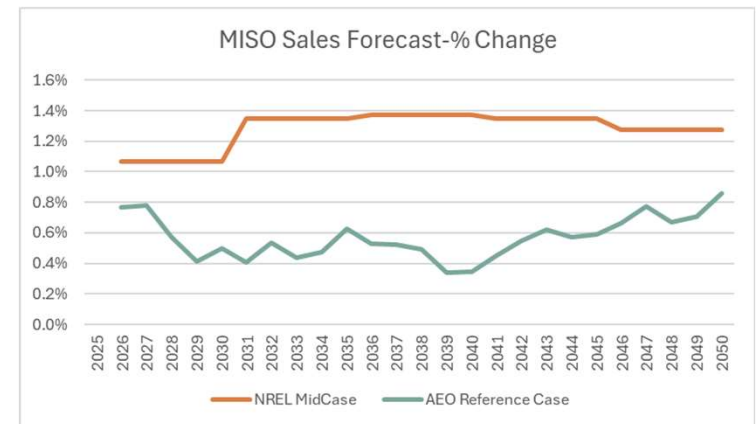
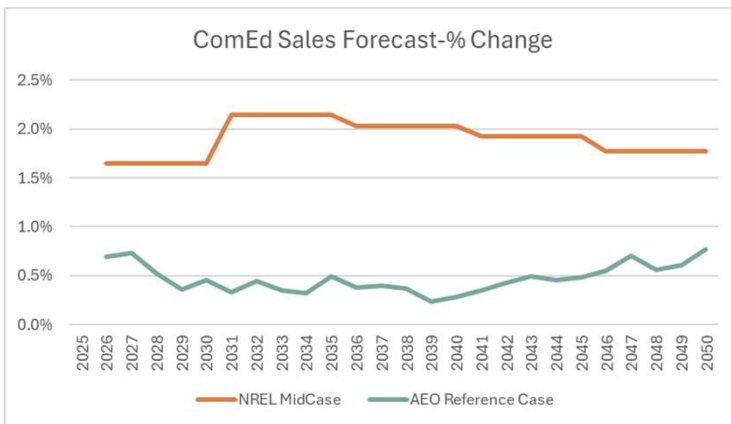
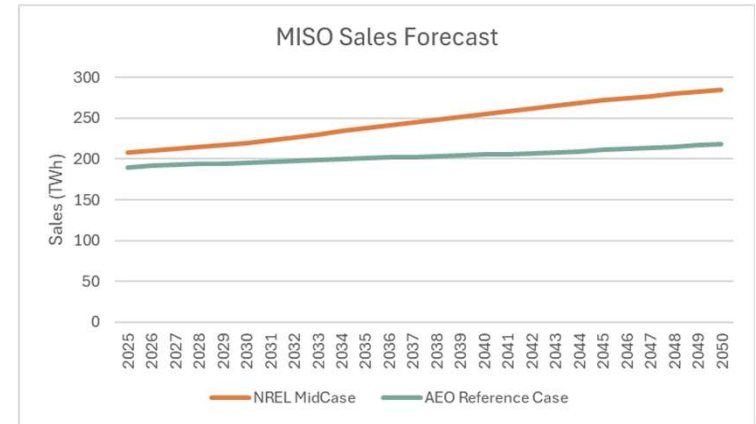
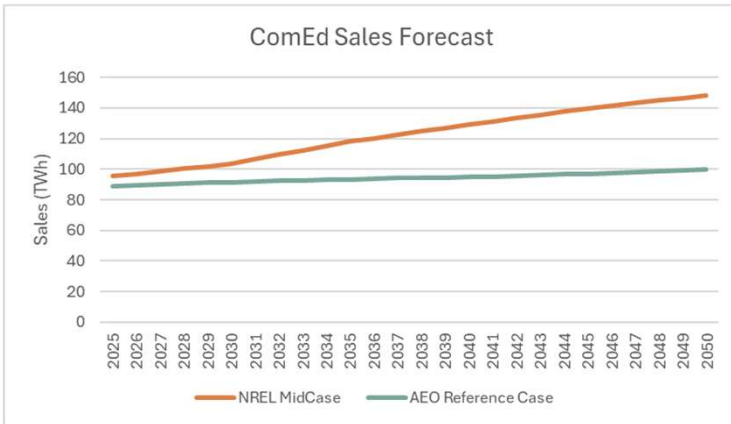
# Overview of Benefit Cost Assumptions

	Scope	Electric	Gas
Avoided Energy Supply Costs	Statewide	✓	✓
Avoided Emissions Costs	Statewide	✓	✓
Avoided Transmission and Distribution Costs	Utility	✓	✓
Avoided Losses	Utility	✓	✓
Other Non-Energy Impacts	Statewide	✓	✓
Economic Inputs	Statewide	✓	✓

# Avoided Energy Supply Costs

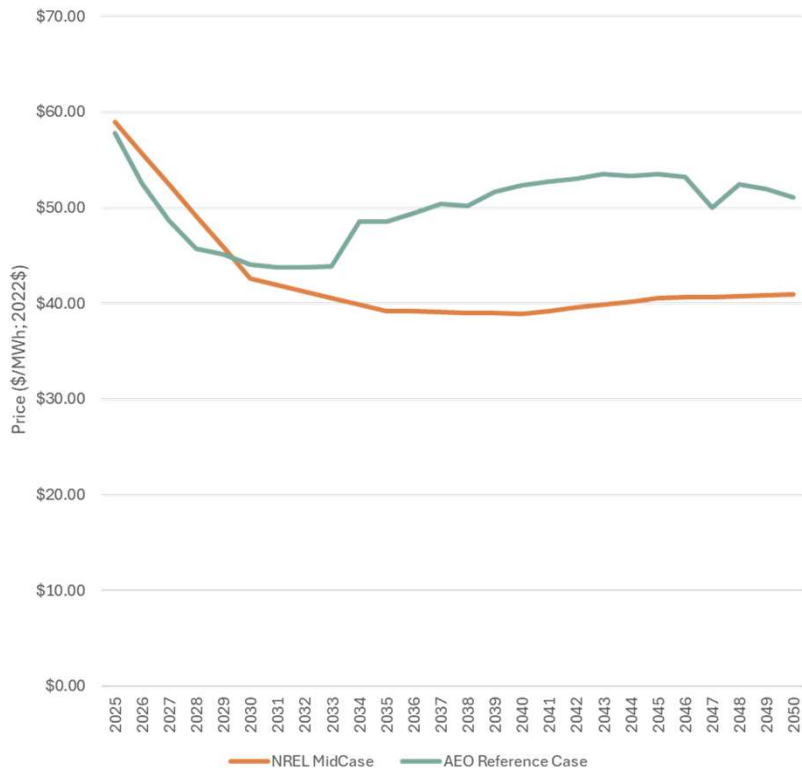
	Electric	Gas
<b>What is it?</b>	<p>Electricity supply costs for electricity delivered to utility customers</p> <ul style="list-style-type: none"> <li>• Fuel/capital costs from changes in building/operating electric grid</li> <li>• Energy costs</li> <li>• Capacity costs</li> <li>• \$/MWh per change in grid output</li> </ul>	<p>Gas supply costs for gas delivered to utility customers</p> <ul style="list-style-type: none"> <li>• Fuel costs for natural gas delivered to city gate</li> <li>• Energy costs</li> <li>• \$/therm of change in gas throughput</li> <li>• Perhaps also some capacity costs for wholesale transmission</li> </ul>
<b>Approaches/ Assumptions/ Adjustments</b>	<ul style="list-style-type: none"> <li>• Capacity expansion models (What gets built?)</li> <li>• Grid simulation models (What gets operated?)</li> <li>• Long-run marginal cost forecasts</li> <li>• Short-run marginal costs forecasts</li> </ul>	<ul style="list-style-type: none"> <li>• Current commodity prices</li> <li>• National commodity market forecasts</li> <li>• Basis adjustments: <ul style="list-style-type: none"> <li>• Delivery to utility city gates</li> <li>• Procurement/hedging strategies</li> </ul> </li> </ul>
<b>Sources</b>	<ul style="list-style-type: none"> <li>• <b>UDDOE/EIA Annual Energy Outlook</b></li> <li>• USDOE/NREL Cambium dataset</li> <li>• Other proprietary forecasts</li> </ul>	<ul style="list-style-type: none"> <li>• <b>UDDOE/EIA Annual Energy Outlook</b></li> <li>• Other proprietary forecasts</li> </ul>
<b>Issues</b>	<ul style="list-style-type: none"> <li>• Which source?</li> <li>• <b>Long-run</b> vs. short-run marginal costs</li> <li>• What is the “base case”?</li> <li>• Shifting peak demand and load shapes</li> <li>• Decrements (EE) vs. increments (electrification)</li> <li>• How big a decrement/increment?</li> <li>• <b>Consistency</b> (emissions, gas supply, inflation)</li> <li>• Overall market vs. individual customer contracts</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Consistency</b> (electric supply, inflation)</li> <li>• Overall market vs. individual customer contracts</li> </ul>

# Electric Energy Demand Forecasts

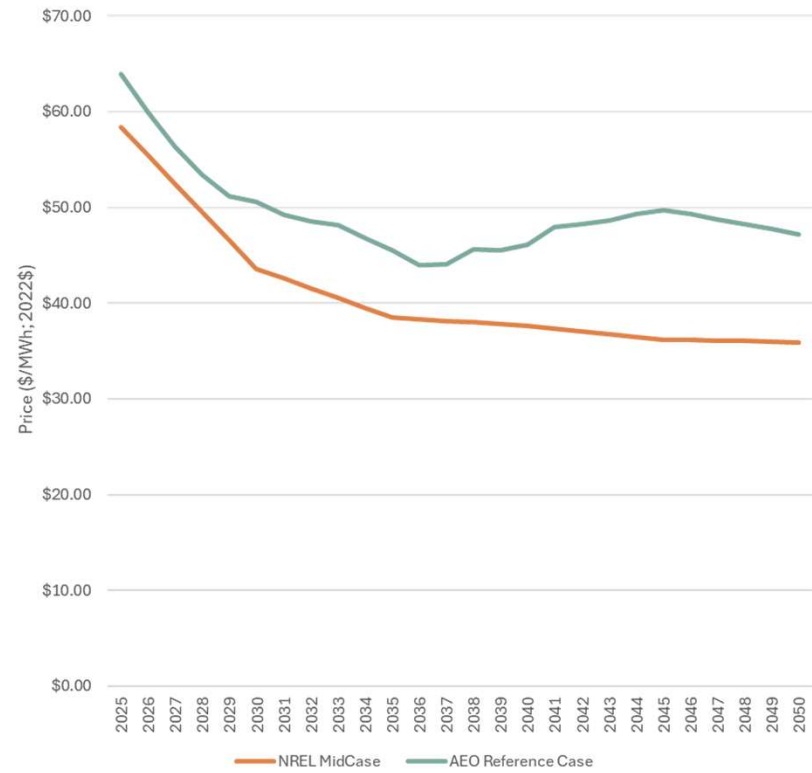


# Electric Generation Price Forecasts

ComEd Generation Prices

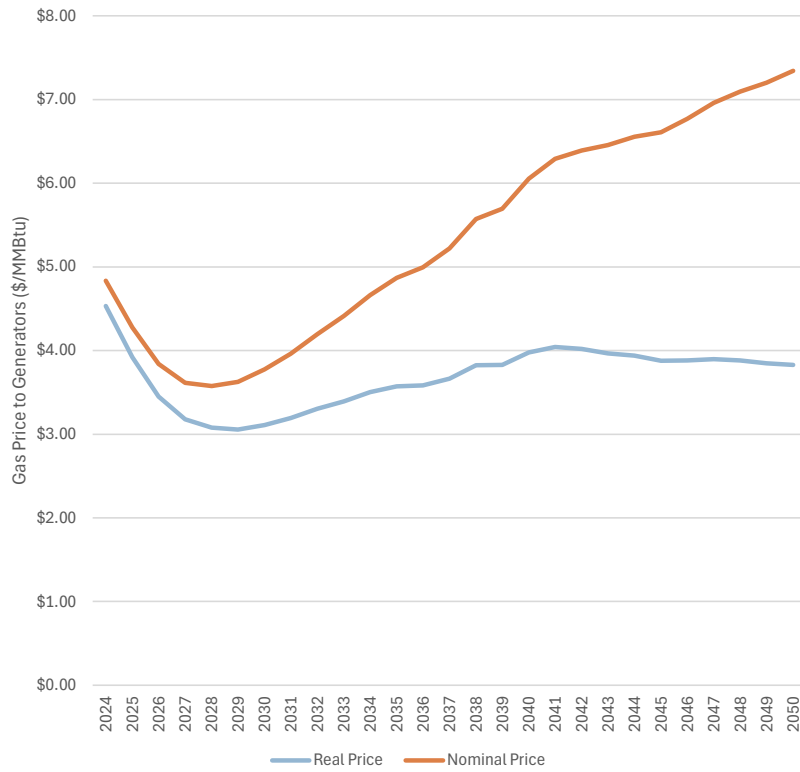


MISO Generation Prices

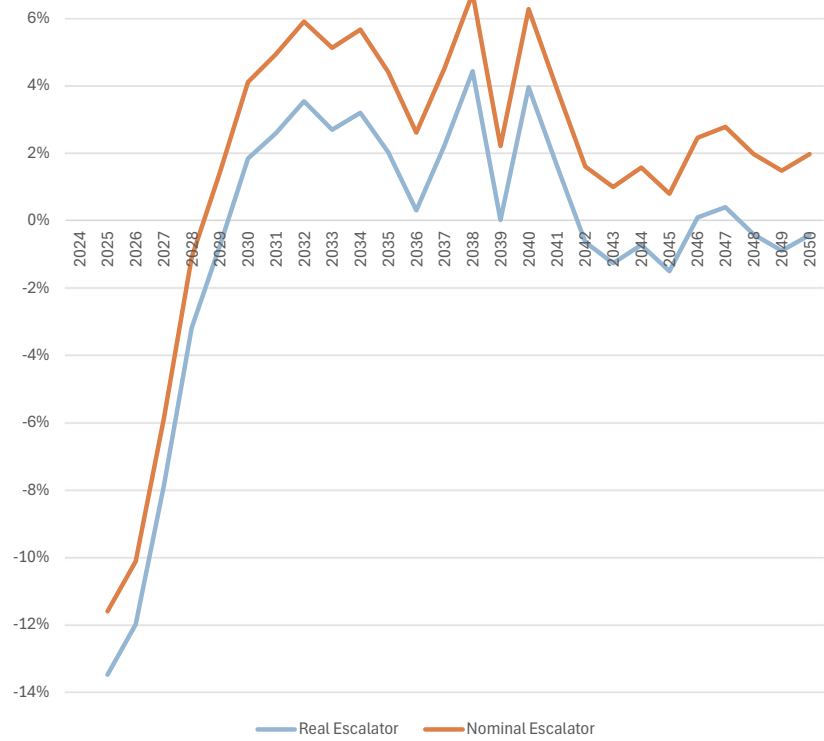


# Gas Price Forecast

AEO Natural Gas Price Forecast



AEO Gas Price Escalation Forecast

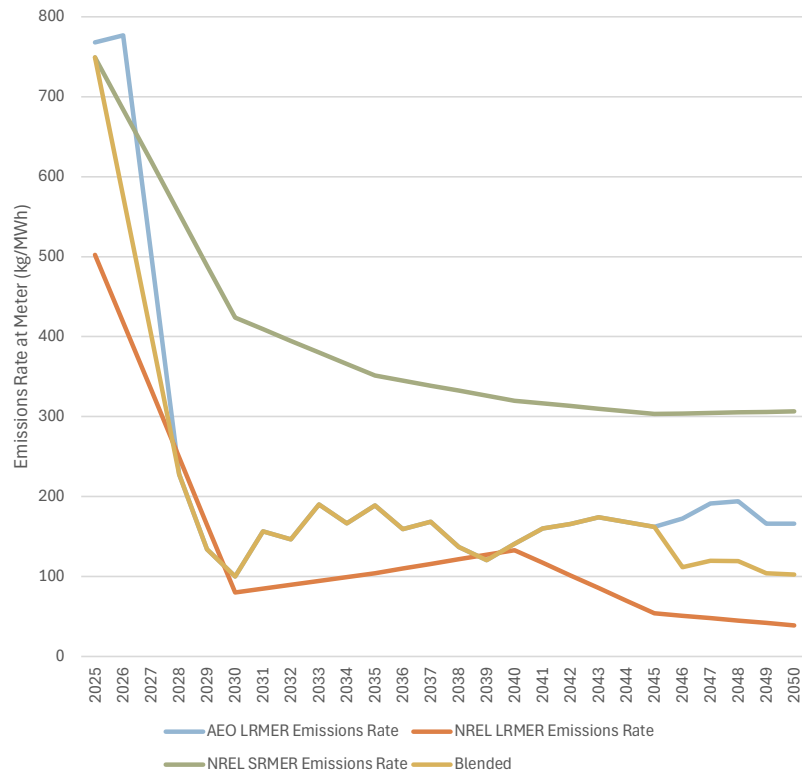


# Avoided Emissions Costs

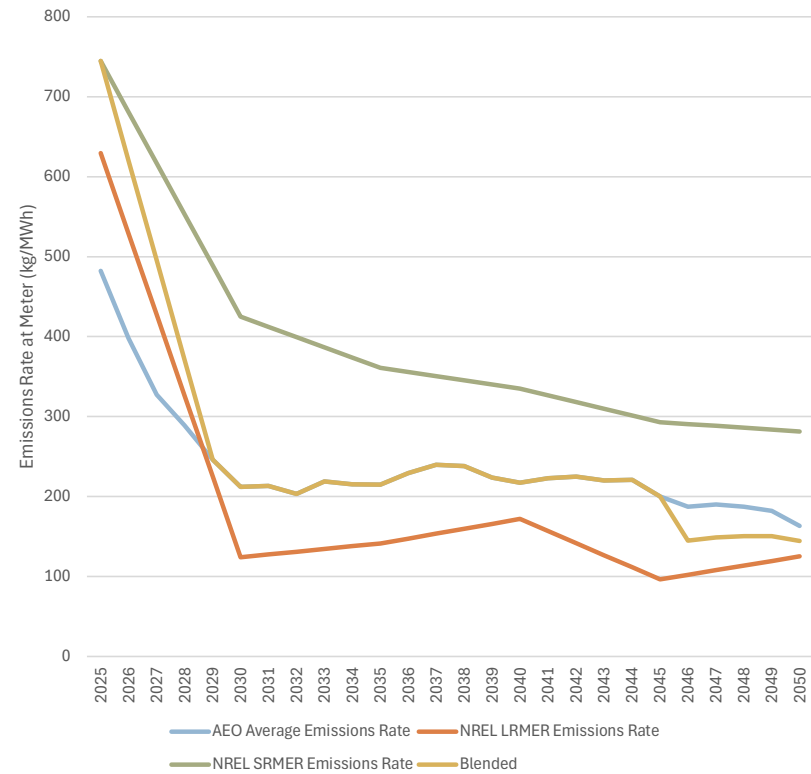
	Electric	Gas
<b>What is it?</b>	<p>Costs associated with electric generation combustion emissions</p> <ul style="list-style-type: none"> <li>Emissions from changes in building/operating electric grid (kg/MWh)</li> <li>Damage associated with emissions (\$/kg)</li> <li>\$/MWh per change in grid output</li> </ul>	<p>Costs associated with gas end use combust emissions</p> <ul style="list-style-type: none"> <li>Emissions from changes combusted gas (kg/therm)</li> <li>Damage associated with emissions (\$/kg)</li> <li>\$/therm per change in grid throughput</li> </ul>
<b>Approaches/ Assumptions/ Adjustments</b>	<ul style="list-style-type: none"> <li>Marginal emissions from same approaches used to estimate electric supply costs</li> <li>Or from EPA AVERT model</li> <li>Social cost of GHG</li> <li>Social cost of criteria pollutants</li> </ul>	<ul style="list-style-type: none"> <li>EPA gas combustion emission factors</li> <li>Social cost of GHG</li> <li>Social cost of criteria pollutants</li> </ul>
<b>Sources</b>	<ul style="list-style-type: none"> <li>UDDOE/EIA Annual Energy Outlook</li> <li>USDOE/NREL Cambium dataset</li> <li>USEPA AVERT model</li> <li>USEPA (Social Cost of Carbon)</li> <li>USEPA (COBRA model)</li> </ul>	<ul style="list-style-type: none"> <li>USEPA (Emissions Factor Hub)</li> <li>USEPA (Social Cost of Carbon)</li> <li>USEPA (COBRA model)</li> </ul>
<b>Issues</b>	<ul style="list-style-type: none"> <li>Same issues as electric supply costs</li> <li>CO2 vs. other greenhouse gases (CO2e)</li> <li>Direct vs. upstream emissions</li> <li>Discount rate for future harm from current emissions</li> <li>Consistency (supply costs; GHG/criteria; inflation)</li> </ul>	<ul style="list-style-type: none"> <li>CO2 vs. other greenhouse gases (CO2e)</li> <li>Direct vs. upstream emissions</li> <li>Discount rate for future harm from current emissions</li> <li>Consistency (GHG/criteria emissions; inflation)</li> </ul>

# Electric Emissions Rate Forecasts

## ComEd Emissions Rates



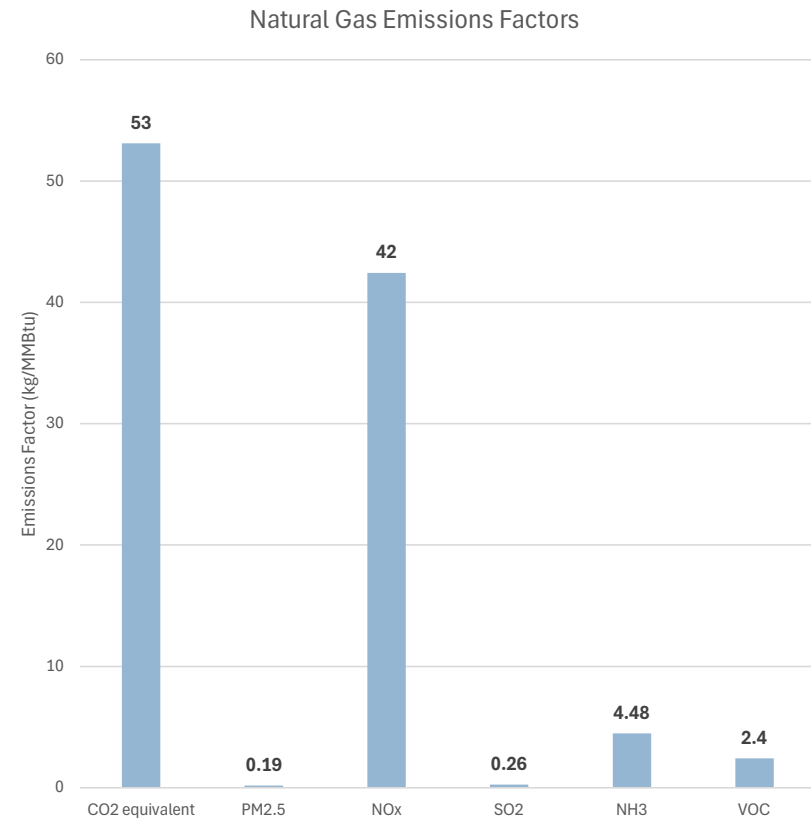
## MISO Central Emissions Rates





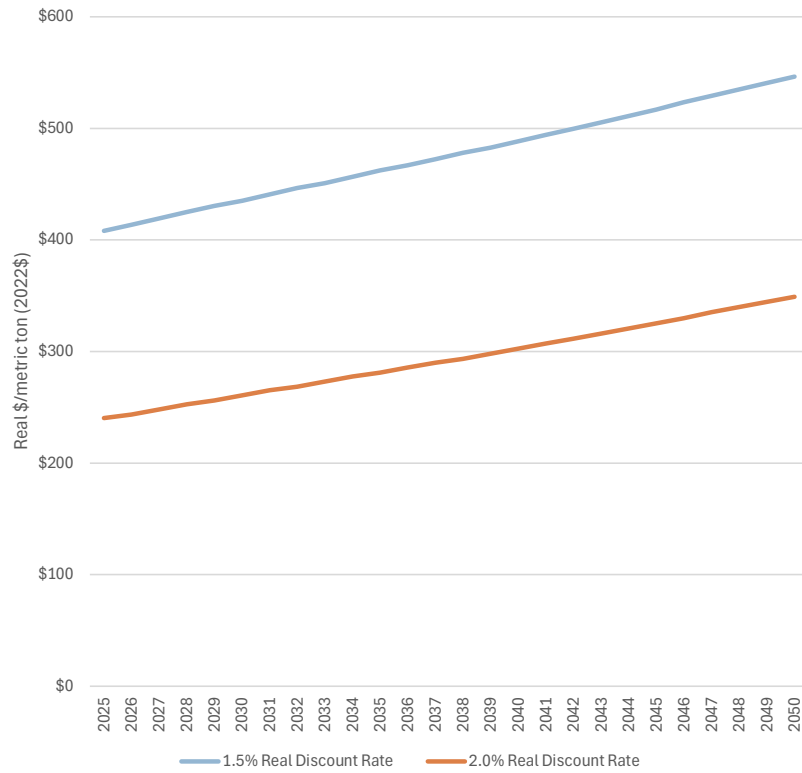
# Gas Emissions Rates

- Sources:
  - GHG: USEPA Emissions Factor Hub
  - Criteria: Guidehouse Nicor Gas NEI Analysis

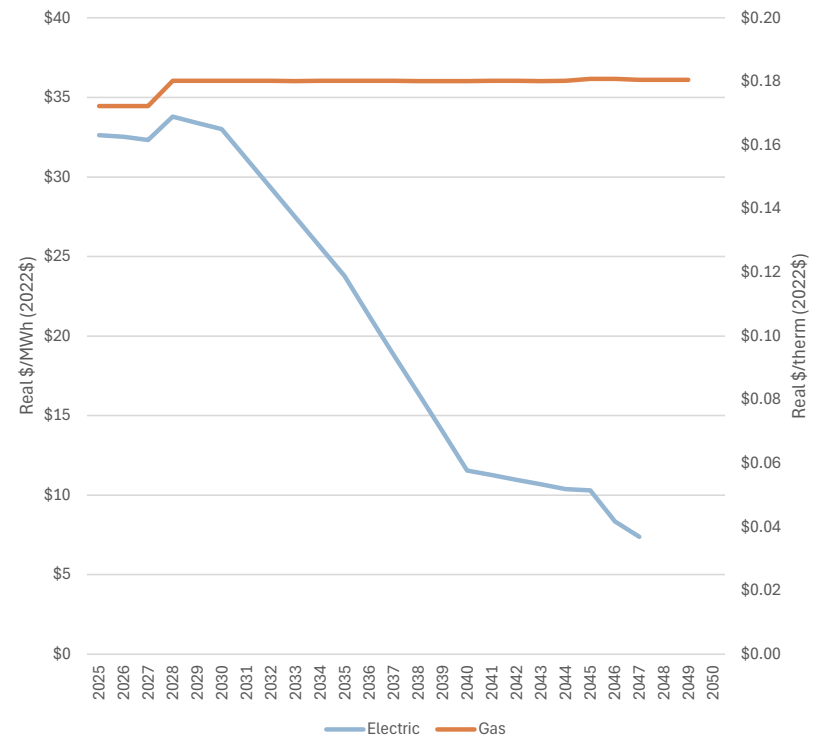


# Social Cost of Emissions

Social Cost of Carbon

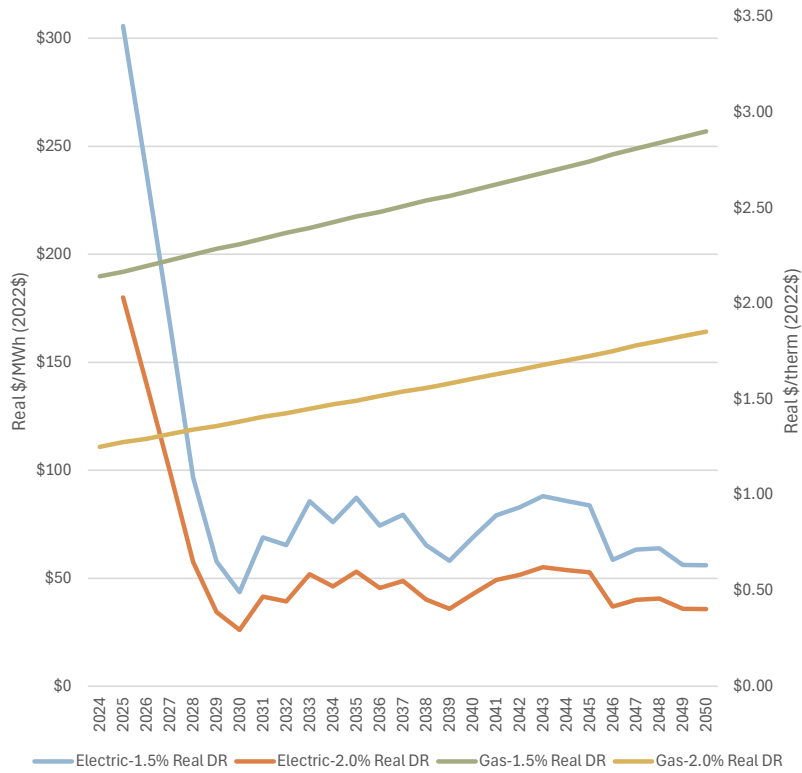


Social Cost of Criteria Pollutants  
(0.43% Real Discount Rate)

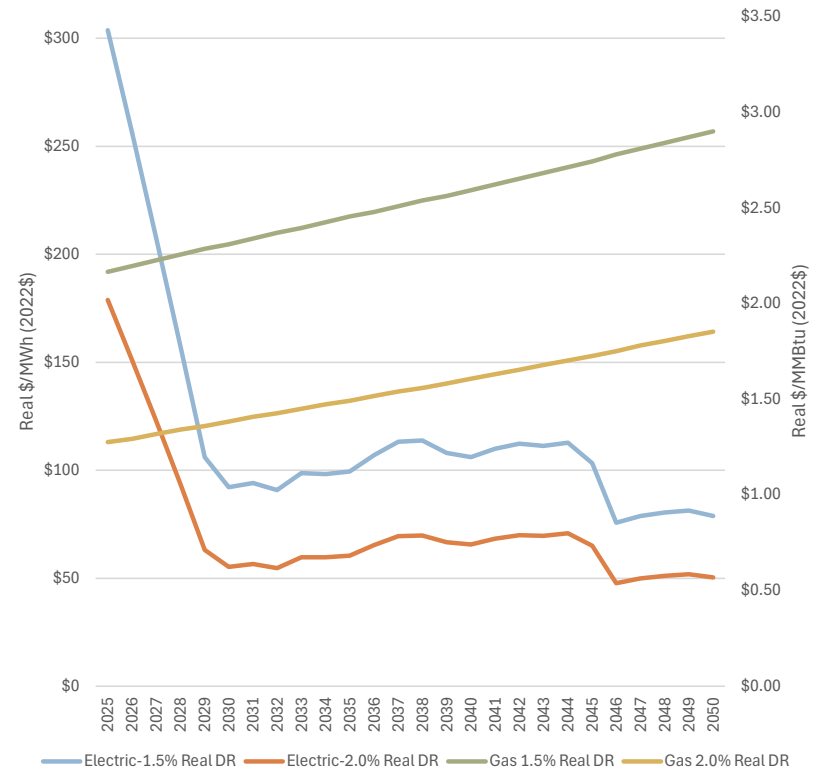


# Social Cost of Carbon per MWh/therm

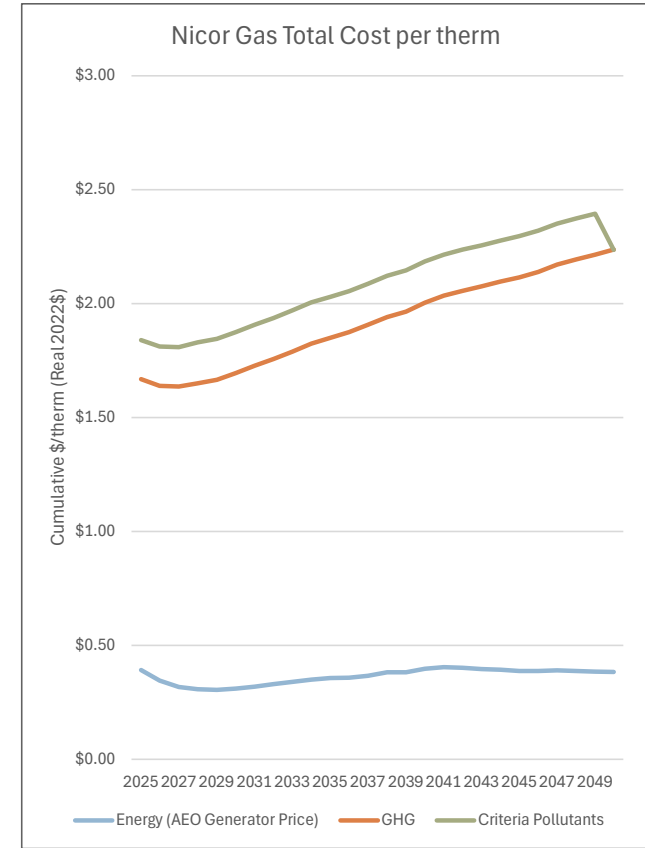
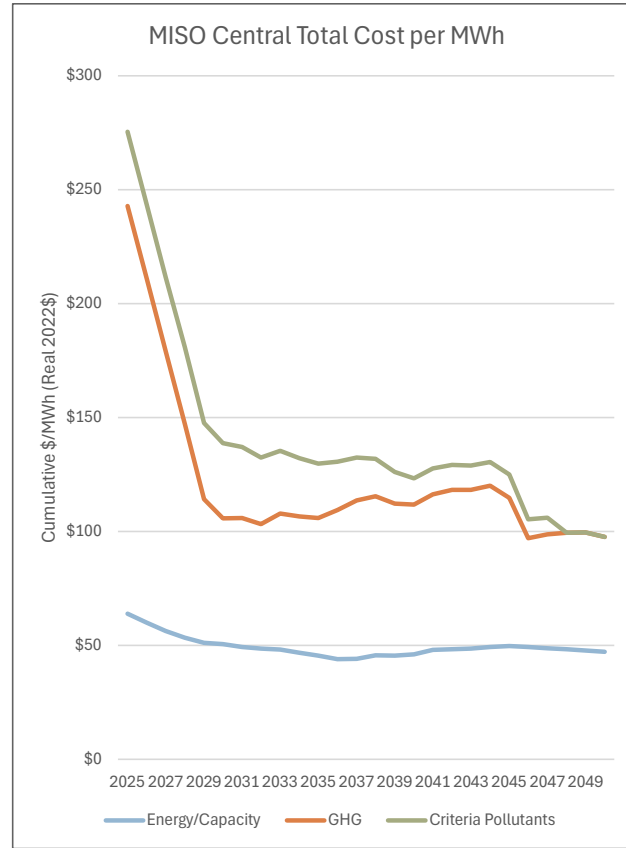
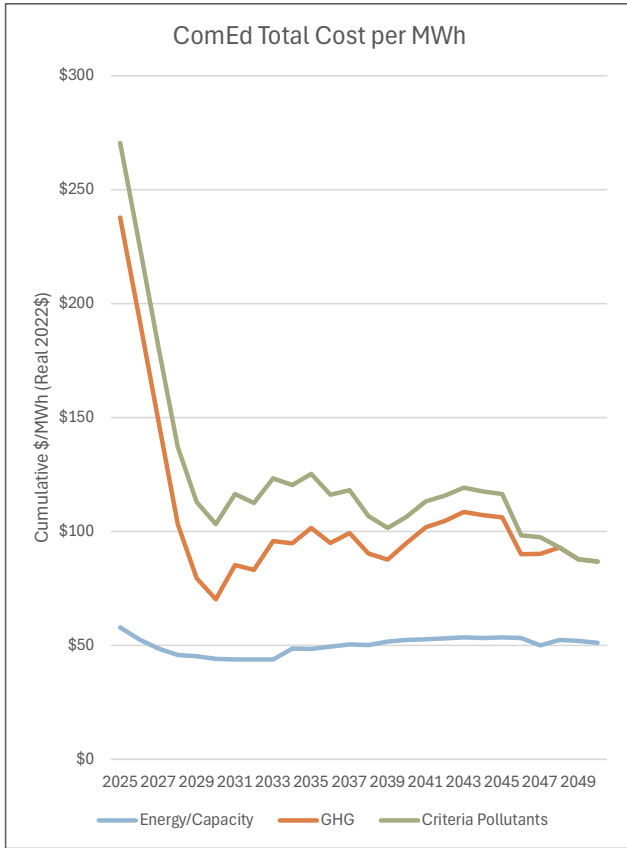
Northern IL Social Cost of Carbon-per MWh/therm



Southern IL Social Cost of Carbon-per MWh/therm



# Total Supply + Emissions Cost per MWh/therm



# Avoided Transmission & Distribution Costs

	Electric	Gas
<b>What is it?</b>	<p>Costs for the transmission &amp; distribution required to deliver electric supply to customers</p> <ul style="list-style-type: none"> <li>• Capacity costs</li> <li>• \$/kW/year per change in grid demand</li> </ul>	<p>Costs for the transmission &amp; distribution required to deliver gas supply to customers</p> <ul style="list-style-type: none"> <li>• Capacity costs</li> <li>• \$/peak-day therm/year per change in grid demand</li> <li>• May be expressed as \$/therm</li> </ul>
<b>Approaches/ Assumptions/ Adjustments</b>	<ul style="list-style-type: none"> <li>• Utility specific engineering/economic studies</li> <li>• Electric grid plans</li> </ul>	<ul style="list-style-type: none"> <li>• Utility cost of service studies</li> <li>• Utility specific engineering/economic studies</li> </ul>
<b>Sources</b>	<ul style="list-style-type: none"> <li>• Utility specific engineering/economic studies</li> </ul>	<ul style="list-style-type: none"> <li>• Utility rate cases</li> <li>• Engineering staff input</li> </ul>
<b>Issues</b>	<ul style="list-style-type: none"> <li>• Which costs are avoidable?</li> <li>• Decrements (EE) vs. increments (electrification)</li> <li>• Consistency (inflation)</li> <li>• Double counting issues with wholesale transmission</li> </ul>	<ul style="list-style-type: none"> <li>• Embedded vs. marginal costs</li> <li>• Which costs are avoidable with lower throughput?</li> <li>• Cost per therm vs. cost per peak-day therm</li> <li>• Consistency (inflation)</li> <li>• Double counting issues with wholesale transmission</li> </ul>

# Avoided Losses

	Electric	Gas
<b>What is it?</b>	<p>Losses incurred in transmitting &amp; distributing electricity to customers</p> <ul style="list-style-type: none"> <li>• % of generated (or delivered) energy</li> <li>• % of generated (or delivered) demand</li> </ul>	<p>Losses incurred in transmitting &amp; distributing gas to customers</p> <ul style="list-style-type: none"> <li>• % of purchased (or delivered) energy</li> </ul>
<b>Approaches/ Assumptions/ Adjustments</b>	<ul style="list-style-type: none"> <li>• Utility specific engineering/economic studies</li> <li>• Electric grid plans</li> </ul>	<ul style="list-style-type: none"> <li>• Utility cost of service studies</li> <li>• Utility specific engineering input</li> </ul>
<b>Sources</b>	<ul style="list-style-type: none"> <li>• Utility specific engineering/economic studies</li> </ul>	<ul style="list-style-type: none"> <li>• Utility rate cases</li> <li>• Engineering staff input</li> </ul>
<b>Issues</b>	<ul style="list-style-type: none"> <li>• Average vs. marginal losses</li> <li>• Losses by time period (or end use load shape)</li> </ul>	<ul style="list-style-type: none"> <li>• Which losses are avoidable with lower throughput?</li> <li>• Double counting issues with wholesale transmission vs. supply</li> </ul>

# Other Non-Energy Impacts

	Water Savings	Health Benefits	O&M Costs
<b>What is it?</b>	Other quantifiable costs or benefits from energy efficiency measures/programs/portfolios <ul style="list-style-type: none"> <li>• Water savings (showerheads and other water savings measures)</li> <li>• Health benefits (low income weatherization)</li> <li>• Avoided/increased O&amp;M costs (specific measures, usually business measures)</li> <li>• Others</li> </ul>		
<b>Approaches/ Assumptions/ Adjustments</b>	<ul style="list-style-type: none"> <li>• Water savings (gallons/year)</li> <li>• Utility rates (\$/gallon)</li> </ul>	<ul style="list-style-type: none"> <li>• Program specific</li> </ul>	<ul style="list-style-type: none"> <li>• Measure specific</li> </ul>
<b>Sources</b>	<ul style="list-style-type: none"> <li>• IL-TRM calculates water savings</li> <li>• Local water utility rates</li> </ul>	<ul style="list-style-type: none"> <li>• Joint evaluator studies on health impacts of weatherization programs</li> </ul>	<ul style="list-style-type: none"> <li>• IL-TRM calculates O&amp;M impacts for some specific measures</li> </ul>
<b>Issues</b>	<ul style="list-style-type: none"> <li>• Forecast of future water rates</li> </ul>		

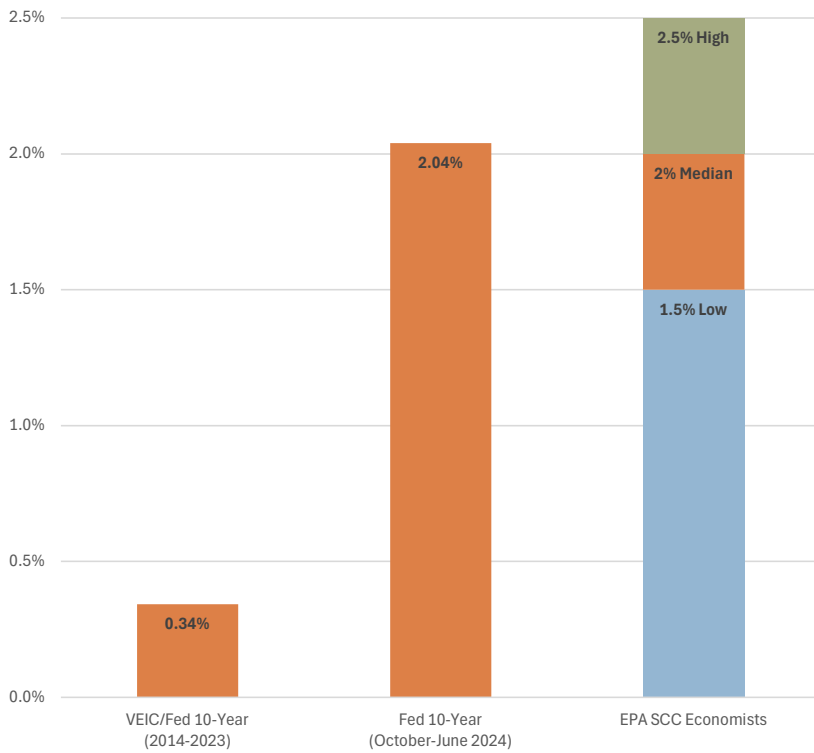
# Economic Inputs

	Discount Rate	Inflation
<b>What is it?</b>	<ul style="list-style-type: none"> <li>Rate for discounting future costs/benefits to evaluate lifecycle cost effectiveness for measures/programs/portfolios</li> </ul>	Projection of changes in costs over and above real price changes <ul style="list-style-type: none"> <li>Labor</li> <li>Other costs</li> </ul>
<b>Approaches/ Assumptions/ Adjustments</b>	<ul style="list-style-type: none"> <li>TRC: societal discount rate, per EE Policy Manual               <ul style="list-style-type: none"> <li>Risk free investment return</li> </ul> </li> <li>UC/RIM (if applicable):               <ul style="list-style-type: none"> <li>Utility weighted average cost of capital</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Social cost of GHG</li> <li>Social cost of criteria pollutants</li> </ul>
<b>Sources</b>	<ul style="list-style-type: none"> <li>US Treasury Bond Yields</li> <li>Academic analyses of “risk free” returns</li> <li>Utility rate cases</li> </ul>	<ul style="list-style-type: none"> <li>UDDOE/EIA Annual Energy Outlook</li> <li>USDOE/NREL Cambium dataset</li> <li>Other proprietary forecasts</li> <li>Utility corporate planning/Treasury</li> </ul>
<b>Issues</b>	<ul style="list-style-type: none"> <li>Covid-driven monetary policy skews recent Treasury Bond rates</li> <li>Historic vs. projected rates</li> <li>Consistency between discount rate and inflation</li> <li>Consistency with other forecasts</li> </ul>	<ul style="list-style-type: none"> <li>Consistency between discount rate and inflation</li> <li>Consistency with other forecasts</li> </ul>

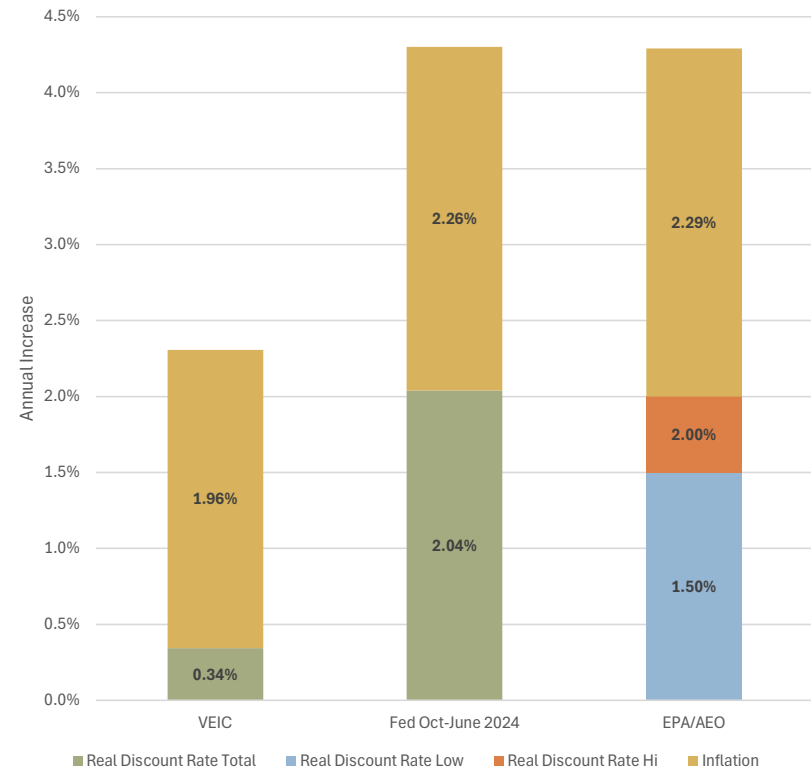


# Discount Rate Estimates

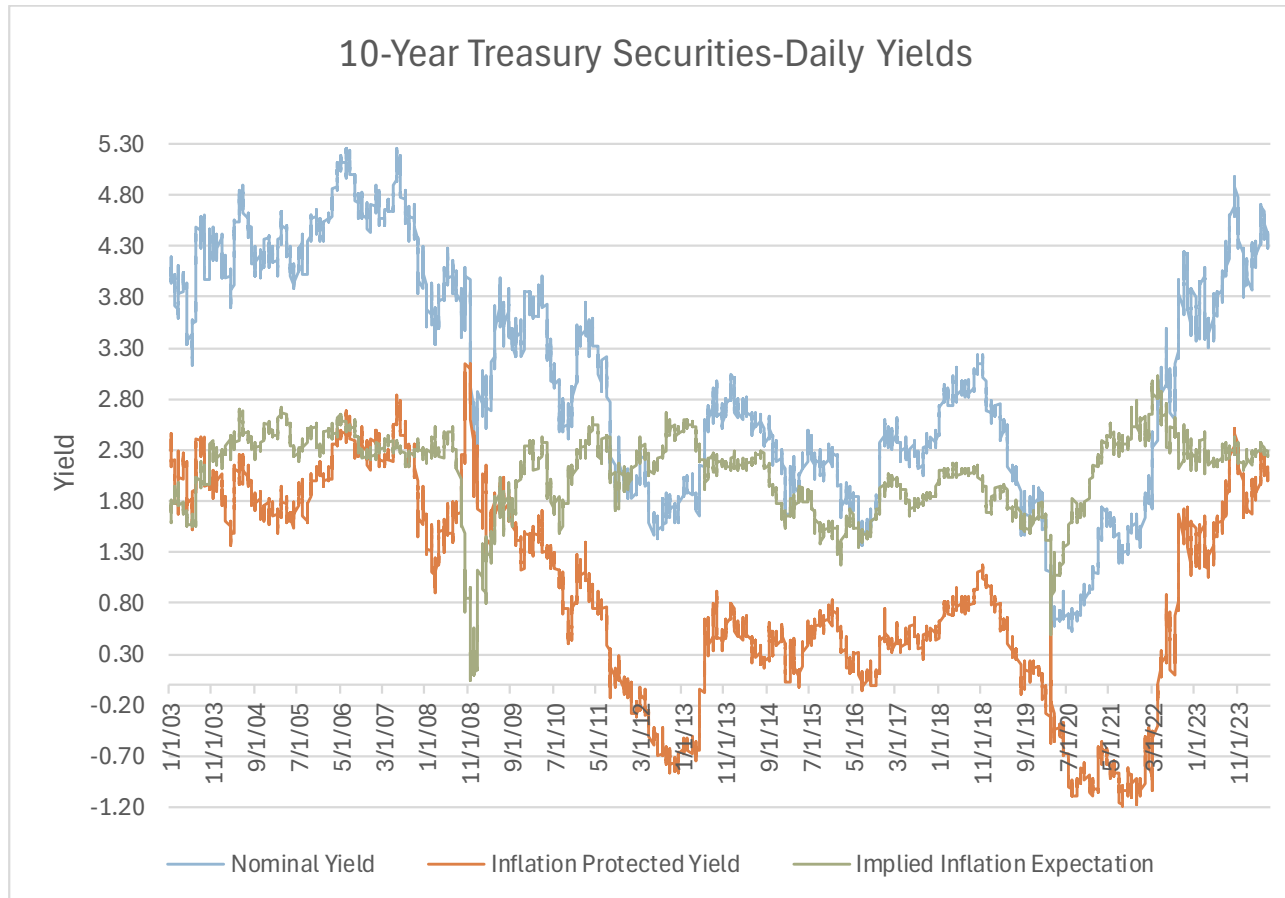
Real Discount Rate Estimates



Nominal Discount Rate Estimates



# Treasury Yields



## Excerpts from EPA Social Cost of Carbon Study

The consideration of more recent versus older data depends on whether the downward trend in real interest rates is due to structural changes in the economy that are expected to persist. Bauer and Rudebusch (2023) estimate the current equilibrium real interest using three empirical models for the interest rate process that allows for an evolution in the equilibrium real interest rate over time. Using a time series of 10-Year Treasury securities they estimate current equilibrium real interest rates of 1.3, 1.9, and 2.4%.<sup>121</sup> When using a longer time series of long-term government securities, Bauer and Rudebusch (2023) estimate current equilibrium real interest rates of 1.5%, 2.3%, and 3.0%.<sup>122</sup>

Other government assessments of consumption interest rates suggest a focus on a similar range. The U.S. Congressional Budget Office's Long-Term Economic Projections forecast real rates on 10-Year Treasury securities that average 1.5% over the next decade and exceed 2% by 2050 (CBO 2022, 2023). The most recent Social Security Administration Trustees report (SSA 2023) uses three projections of the long-run real interest rate from 2035 to 2100 of 1.8%, 2.3%, and 2.8% based on their assessment of historical trends in the real interest rate.

Therefore, considering the multiple lines of evidence on the appropriate certainty-equivalent near-term rate, the modeling results presented in this report consider a range of near-term target rates of 1.5%, 2.0%, and 2.5%. This range of rates allows for a symmetric one point spread around 2.0%.

## Next Steps