Draft IRP Underway / Not Yet Final

  

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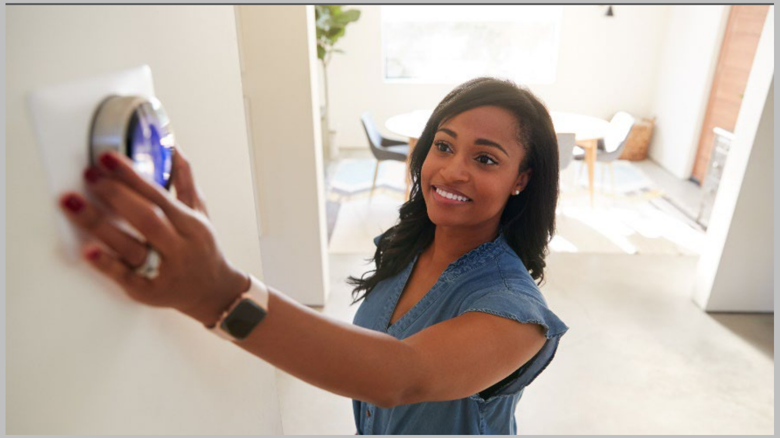
# 2024 NIPSCO Integrated Resource Plan

Second Stakeholder Advisory Meeting

June 24th, 2024
9:00AM-2:00PM CST



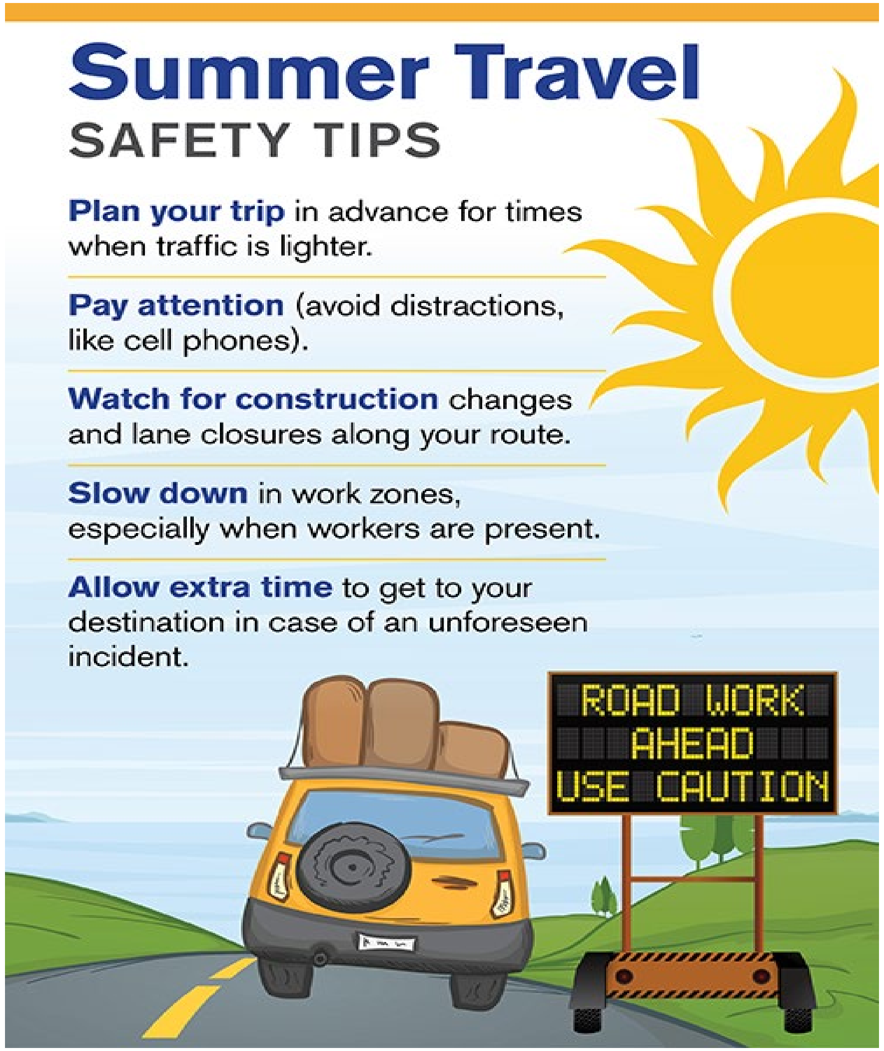
# SAFETY MOMENT – SUMMER HOLIDAY TRAVEL

Gearing up to travel for the Independence Day holiday: enjoy the journey, take breaks and arrive alive

**Indiana State Police Summer Travel Safety Tips:**

- **Drive Safely**
- **Check Your Tires**
- **Keep Kids Safe**
- **Keep an Emergency Kit**
  - Your vehicle emergency kit should include:
    - water
    - food
    - a charged cell phone
    - flashlight
    - fire extinguisher
    - a first aid kit
- **Stay Cool**

Source: https://www.in.gov/isp/driving-safety/summer-travel-safety




Source: http://www.my35.org/summer-travel-safety-tips.htm

# MEETING PROTOCOLS

- **Your input and feedback is critical to NIPSCO's Integrated Resource Plan ("IRP") Process**
- **The Public Advisory Process provides NIPSCO with feedback on its assumptions and sources of data. This helps inform the modeling process and overall IRP**
- **We set aside time at the end of each section to ask questions**
- **Your candid and ongoing feedback is key:**
  - Please ask questions and make comments on the content presented
  - Please provide feedback on the process itself
- **While we will mostly utilize the chat feature in Teams to facilitate comments, we will gladly unmute you if you would like to speak. Please identify yourself by name prior to speaking. This will help keep track of comments and follow up actions**
- **If you wish to make a presentation during a meeting, please reach out to Alison Becker (abecker@nisource.com)**

# AGENDA

| Time (*Central Time) | Topic | Speaker |
|---|---|---|
| 9:00-9:10AM | Welcome & Introduction | Alison Becker, Manager Regulatory Policy, NIPSCO |
| 9:10-9:20AM | Kick Off/Responses to First Stakeholder Meeting | Vince Parisi, President & COO, NIPSCO<br>Fred Gomos, Sr. Director Environmental & Sustainability, NiSource<br>Pat Augustine, Vice President, CRA |
| 9:20-9:30AM | Scenario Analysis Overview | Pat Augustine, Vice President, CRA |
| 9:30-11:00AM | Scenario Analysis: Key Drivers of NIPSCO Load Uncertainty | Vince Parisi, President & COO, NIPSCO<br>Rick Calinski, Director of Public Affairs and Economic Development, NIPSCO<br>Fred Gomos, Sr. Director Environmental & Sustainability, NiSource<br>Pat Augustine, Vice President, CRA |
| 11:00-11:05AM | Break | |
| 11:05-11:30AM | NIPSCO's Supply-Demand Position: MISO Resource Accreditation and Load Obligation Uncertainties | Pat Augustine, Vice President, CRA |
| 11:30AM-12:20PM | Lunch | |
| 12:20-1:05PM | Scenario Analysis: Commodity Prices, Environmental Policy, and MISO Market Outcomes | Pat Augustine, Vice President, CRA<br>Stephen Holcomb, Director Environmental Policy & Sustainability, NiSource |
| 1:05-1:35PM | Stochastic Analysis | Pat Augustine, Vice President, CRA |
| 1:35-1:40PM | Break | |
| 1:40-2:25PM | Preliminary RFP Review | Patrick d'Entremont, Manager Planning Commercial Support - NIPSCO<br>Bob Lee, Vice President, CRA |
| 2:25–2:30PM | 2024 Public Advisory Process Next Steps | Alison Becker, Manager Regulatory Policy, NIPSCO |
| 2:30-2:55PM | Closing & Stakeholder Comments | |

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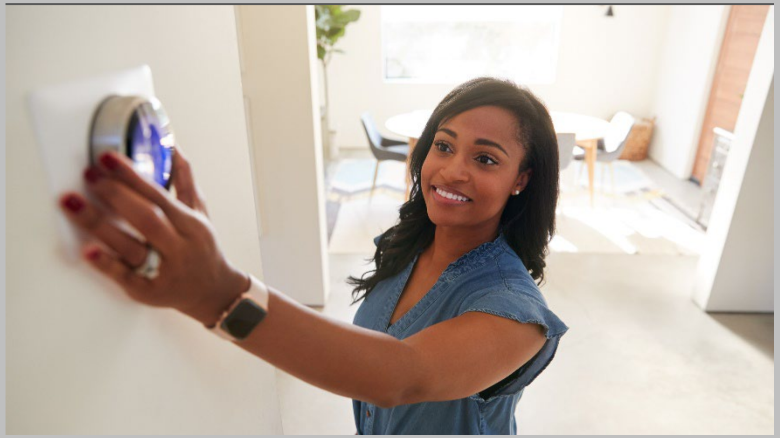
# KICK OFF



Vince Parisi, President & COO, NIPSCO

Fred Gomos, Sr. Director Environmental Policy & Sustainability, NiSource

Pat Augustine, Vice President, CRA

# PILLARS OF OUR ONGOING GENERATION TRANSITION PLAN

This plan creates a vision for the future that is better for our customers and is consistent with our goal to transition to the best cost and cleanest electric supply mix available while maintaining reliability, diversity and flexibility for the technology and market changes on the horizon.

**Reliable and sustainable**

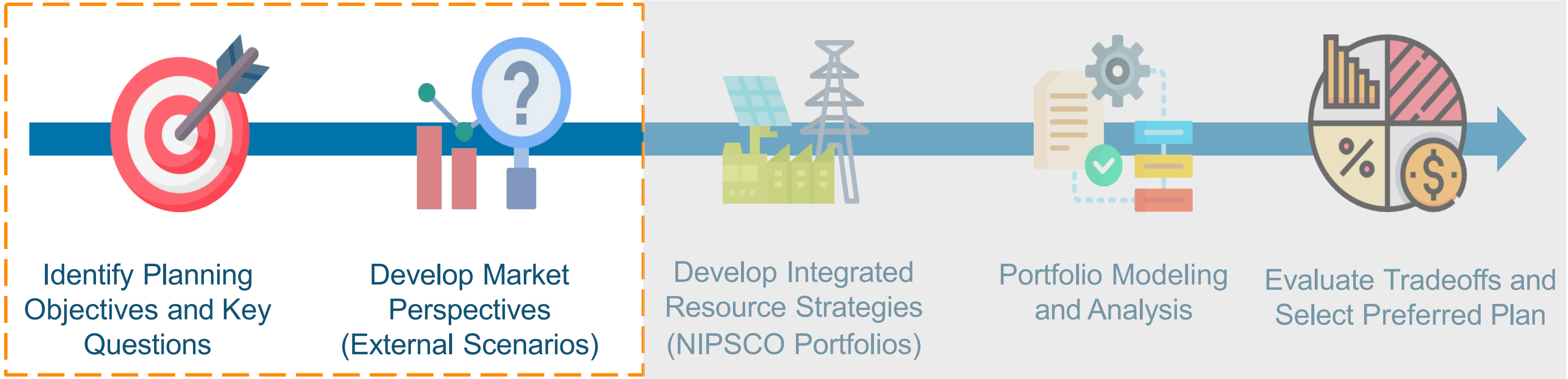
**Flexibility for the future**

**Local and statewide economic benefits**

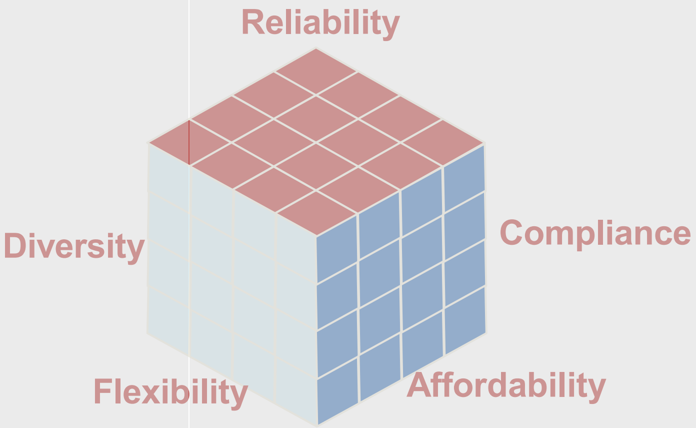
**Best plan for customers and the company**

# APRIL 23 IRP STAKEHOLDER MEETING RECAP

The first IRP stakeholder advisory meeting focused on planning objectives and the process of developing external market perspectives




*Taking into account 5 equally important planning pillars*




*…While considering the implications for*

- *NIPSCO Employees*
- *Environmental regulations and impacts*
- *Local economy (property taxes, supplier spending and employee base)*

# SUMMARY OF STAKEHOLDER FEEDBACK FROM MEETING #1

| Category | Stakeholder Comments | NIPSCO Responses |
|---|---|---|
| **Scorecard Metrics** | • Consider additional metrics associated with Environmental Justice<br>• Consider different metrics for reliability, given NIPSCO is a part of the Midcontinent Independent System Operator, Inc. ("MISO") and not a stand-alone balancing authority | • NIPSCO welcomes Stakeholder feedback on effective long-term planning Environmental Justice/Energy Equity metrics<br>• Probabilistic reliability study to be discussed more today, with revised metric considerations |
| **Distributed Solar** | • Consider Solar for All grant impacts | • Tracking potential impact in the context of broad DER scenarios |
| **Reliability Modeling** | • Reevaluate use of expected unserved energy ("EUE")/loss of load expectation ("LOLE") as metrics and provide more details on input development | • Probabilistic reliability study to be discussed more today, with revised metric considerations |

# SOLAR FOR ALL – POTENTIAL IMPACTS IN INDIANA

- On April 22, 2024, EPA announced that the Indiana Solar for All ("ISFA") coalition was awarded over $117 million in funding through the Greenhouse Gas Reduction Fund's Solar For All program

- At the April 23 Public Advisory meeting, stakeholders expressed interest in potential impacts to NIPSCO's long-term planning in the 2024 IRP

- Specifics on the implementation of the ISFA program are unknown at this time, including;
  - How much funding Gary, Indiana will receive
  - The timeframe for the rollout of the residential solar installations

- To the extent stakeholders can provide additional technical information related to ISFA, specifically in Gary, Indiana, NIPSCO welcomes and encourages that feedback to its IRP team

Indiana Solar For All

*Enabling solar power for all Indiana households with suitable rooftops, including those of low-income residents.*



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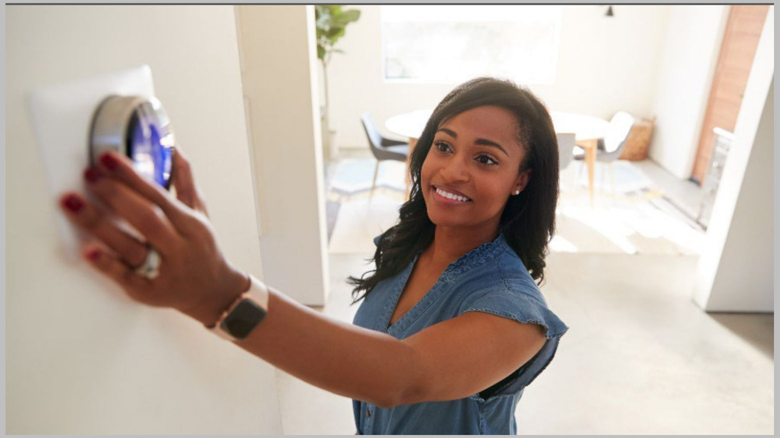
# SCENARIO ANALYSIS OVERVIEW

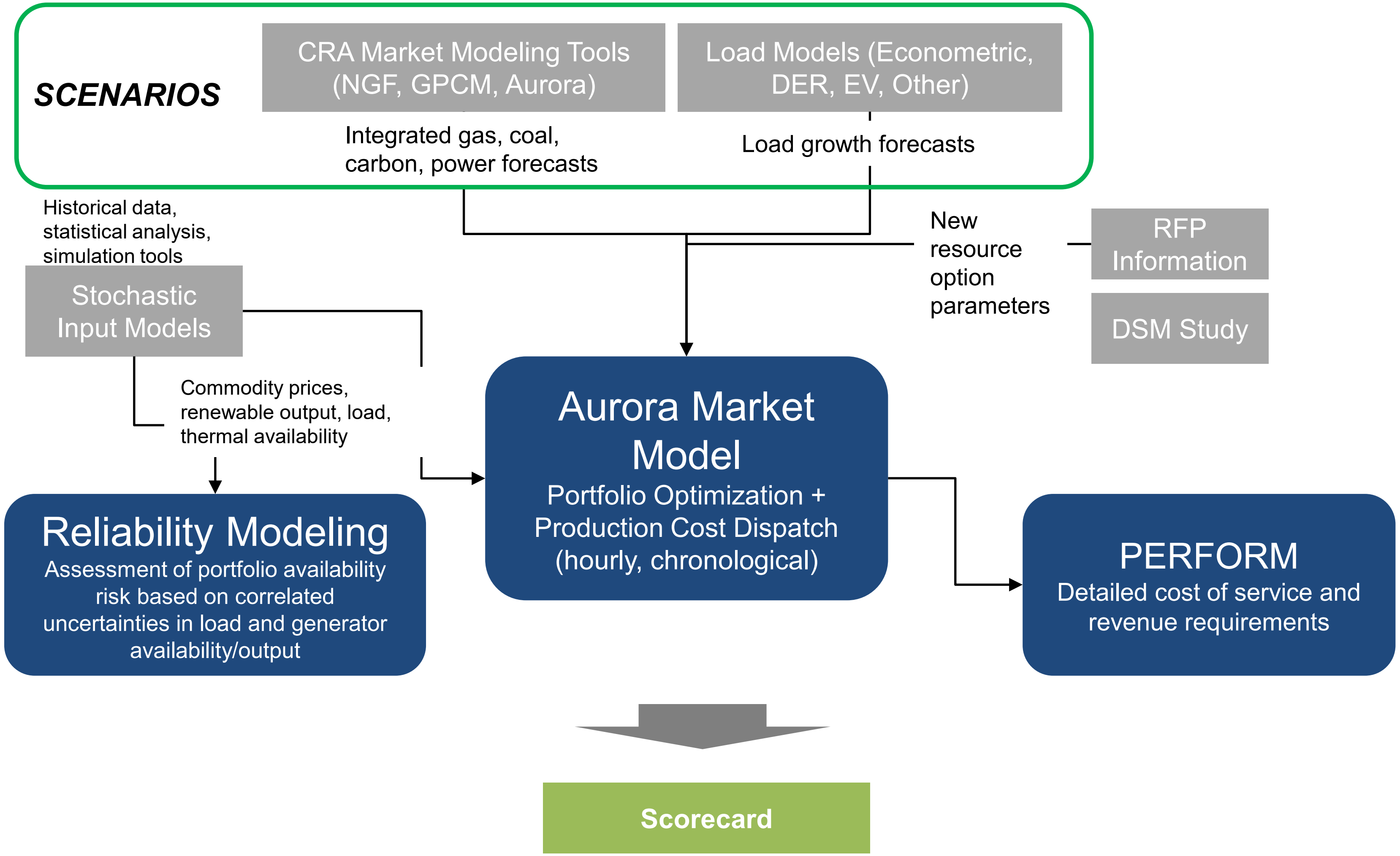
Pat Augustine, Vice President, CRA





# RECAP: RESOURCE PLANNING APPROACH

*Key Modeling and Analysis Tools*




1. Identify key planning questions and approach
2. Develop market perspectives (external scenarios) — *Today's meeting*
3. Develop integrated resource strategies (NIPSCO portfolios)
4. Portfolio modeling and analysis
   - Detailed scenario dispatch
   - Stochastic simulations
5. Evaluate trade-offs and select preferred plan

# RECAP: 2024 IRP SCENARIOS

## Reference Case (“REF”)

- The MISO market continues to evolve based on current expectations for load growth, commodity price trajectories, technology development, and policy change (Inflation Reduction Act “IRA” incentives continue, EPA power sector rules advance, and MISO resource adequacy enhancements proceed)

## Slower Transition (“ST”)

- IRA incentives are reduced or ended early, and EPA power sector rules are overturned or rescinded; natural gas prices remain low and result in new gas additions remaining competitive versus renewables in the broader region, as coal capacity more gradually fades from the MISO market

## Domestic Resiliency (“DR”)

- Continued geopolitical uncertainty and volatility drives a focus on “domestic energy independence”; electric power demand grows because of onshoring and other large loads; gas prices are higher due to strong demand

## Aggressive Environmental Regulation (“AER”)

- Carbon emissions from the power sector are regulated more heavily, including through a $CO_2$ price; restrictions on natural gas production increase gas prices

## Accelerated Innovation (“AI”)

- Federal subsidies continue as a bridge until technology breakthroughs drive broad economy-wide decarbonization (including via electrification); new power sector technologies are commercialized, and DER, EV, microgrid, and EE adoption all increase, transforming wholesale load requirements as “Grid Edge” innovations and enabling policy advance

# DIRECTIONAL SCENARIO VARIABLE INPUTS

| Scenario | Commodity Prices | Carbon Policies | Technology Costs | Demand | Market Design |
|---|---|---|---|---|---|
|  **Reference Scenario** | Baseline | Current Policy, including EPA power sector CO2 emission rules | Baseline | Baseline | Examine alternative capacity accreditation and obligation requirements across alternative market design concepts and based on MISO market outcomes |
|  **Slower Transition** | Low gas price due to abundant resource ↓ | IRA Pull-Back and withdrawn EPA power sector rules ↓ | Slower decline for new tech costs; stable IC costs ↑ | Low DER and EV | |
|  **Domestic Resiliency** | Higher gas price due to strong demand ↑ | Current Policy, including EPA power sector CO2 emission rules ▬ | Higher due to supply chain constraints, onshoring ↑ | High load from new large loads, industrial onshoring, EVs | |
|  **Aggressive Environ. Regulation** | Highest gas price due to production restrictions ↑ | EPA power sector CO2 emission rules *plus* carbon price ↑ | Baseline ▬ | Higher DER and EV | |
|  **Accelerated Innovation** | Lower gas price due to demand erosion ↓ | Current Policy, including EPA power sector CO2 emission rules ▬ | New tech. advancement and decline in costs; IC cost pressures ↓ | High EV and electrification plus new large loads; higher DER | |

**Note that NIPSCO portfolio-level technology costs will be heavily informed by RFP data*

**Note that NIPSCO-specific analysis will incorporate additional demand uncertainty review*



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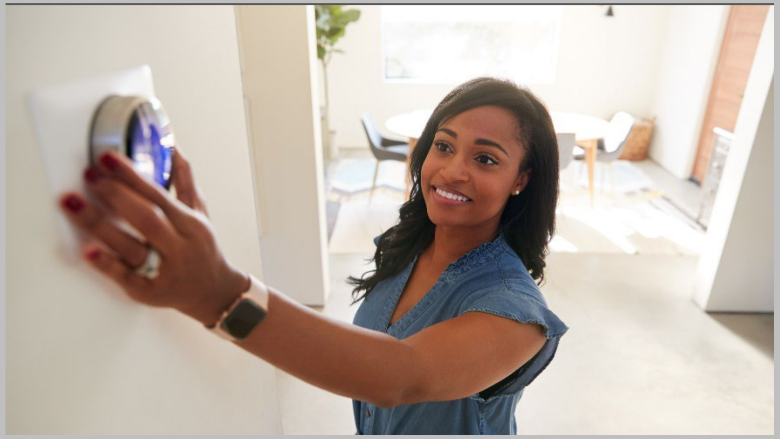
# SCENARIO ANALYSIS: KEY DRIVERS OF LOAD UNCERTAINTY

Vince Parisi, President & COO, NIPSCO
Rick Calinski, Director Economic Development and Major Accounts, NIPSCO
Fred Gomos, Sr. Director Environmental Policy & Sustainability, NiSource
Pat Augustine, Vice President, CRA





# DRIVERS OF LOAD UNCERTAINTY

| | Scenario Name | Description | Economic Growth (C&R, I Count) | EV Penetration | DER Penetration | Electrification (MISO Futures Report) | Large Econ. Development Load |
|---|---|---|---|---|---|---|---|
|  | **Reference Case** | Reference Point | **Base**<br>Moody's Baseline forecast | **Base**<br>Rate of Adoption | **Base**<br>Expected Rate of Adoption | **Limited (Future 1)** | *NIPSCO to discuss current expectations for large loads today.*<br><br>*A separate sensitivity with significant additional economic development load potential, across all scenarios will also be evaluated* |
|  | **Slower Transition** | Environmental policy incentives reduce; economic slowdown in region | **Low**<br>Moody's Low forecast ⬇ | **Low**<br>Rate of Adoption ⬇ | **Lowest**<br>High capital costs, low tax credits, low wholesale prices ⬇ | **Limited (Future 1)** | |
|  | **Domestic Resiliency** | Influx of new economic development load | **Base**<br>Moody's Baseline forecast | **Base**<br>Rate of Adoption | **Lower**<br>High capital costs ⬇ | **Limited (Future 1)** | |
|  | **Aggressive Environmental Regulation** | Aggressive decarbonization policy, moderate electrification | **Base**<br>Moody's Baseline forecast | **High**<br>Rate of Adoption ⬆ | **High**<br>Net metering policy change ⬆ | **High (Future 2)** ⬆ | |
|  | **Accelerated Innovation** | Faster energy transition, high electrification with additional econ. dev. load | **Base**<br>Moody's High forecast | **High**<br>Rate of Adoption ⬆ | **High**<br>Low capital costs, larger installation sizes ⬆ | **Highest (Future 3)** ⬆ | |



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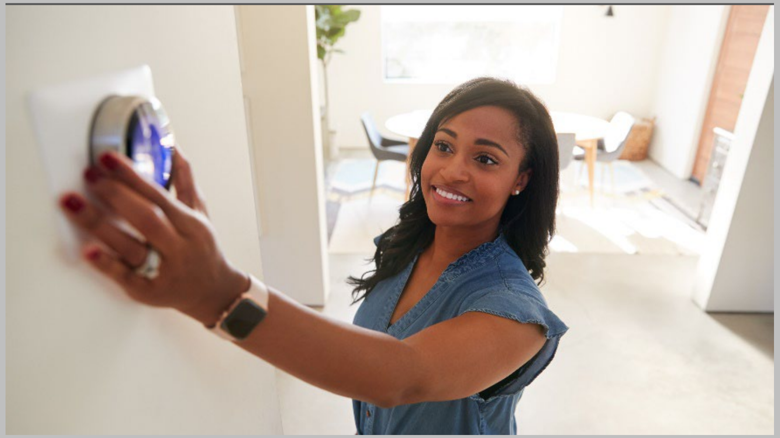
# SCENARIO ANALYSIS: LARGE ECONOMIC DEVELOPMENT LOADS





# RECENT NEWS LEADING TO SIGNIFICANT REFERENCE CASE LOAD UPDATE

- The utility industry is facing a new driver of load growth over the next 3-10 years from data centers and other large demand
- Since NIPSCO's first IRP Stakeholder Advisory meeting on April 23, 2024, there has been a significant increase in data center news in Indiana and specifically in our service territory
- NIPSCO is now releasing an updated Reference Case and a large load sensitivity to incorporate this new potential load to ensure transparency and allow stakeholder feedback on this important development
- NOTE: NIPSCO is not guaranteeing that any amount of new load (referenced in the presentation) will enter our service territory, but we are sharing our current expectations with stakeholders to allow time for feedback as we prepare to conduct our IRP analysis with this significant change

Home > Community > Business News >
Microsoft chooses La Porte as first Indiana data center location


## Microsoft chooses La Porte as first Indiana data center location

June 4, 2024 / By Heather Pfundstein / Leave a Comment

ALERT TOP STORY

## $1.3 billion data center pitched for Chesterton; impact eyed by neighbors

Bob Kasarda May 24, 2024 0

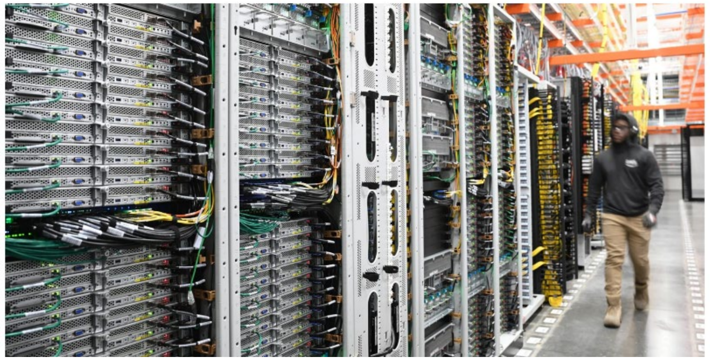
Chesterton DC Plaza

ECONOMY GOVERNMENT & POLITICS

IN BRIEF

## Amazon Web Services to build $11B Indiana data center campus

BY: LESLIE BONILLA MUÑIZ - APRIL 25, 2024 11:09 AM



LOCAL NEWS

## New lakefront Hammond data center at capacity, to expand

Joseph S. Pete | Feb 27, 2024

Just a few years after opening, the lakefront Hammond data center has already reached capacity and plans to expand.

U.S. NEWS

## Google plans to invest $2 billion to build data center in northeast Indiana, officials say

Updated 1:21 PM CDT, April 26, 2024

Share

FORT WAYNE, Ind. (AP) — Google plans to invest $2 billion to build a data center in northeastern Indiana that will help power its artificial intelligence technology and cloud

# STATE OF INDIANA – DATA CENTER INCENTIVES

***Actions by the General Assembly and Governor's Office demonstrate a strong desire for Indiana to be a leader on data centers, and NIPSCO's experience over the last 12 months indicates this is an emerging industry that must be addressed in the IRP***

## DATA CENTER GROSS RETAIL AND USE TAX EXEMPTION

- Provides a sales and use tax exemption on purchases of qualifying data center equipment and energy to operators of a qualified data center for a period not to exceed 25 years for data center investments of less than $750M.
- If the investment exceeds $750M, the Indiana Economic Development Corporation ("IEDC") may award an exemption for up to 50 years.
- This program is established by Indiana Code § 6-2.5-15. Local governments may also provide a personal property tax exemption on qualified enterprise information technology equipment to owners of a data center who invest at least $25M in real and personal property in the facility.

.

## OTHER INDIANA INCENTIVES IN THE AREAS OF:

- JOB CREATION AND BUSINESS INVESTMENT
- REDEVELOPMENT AND QUALITY OF PLACE
- INNOVATION AND ENTREPRENEURSHIP
- RESEARCH AND DEVELOPMENT
- SKILLS TRAINING

# LOAD UPDATE – PLACEHOLDER

- *This slide is a placeholder for NIPSCO's new load expectations for the 2024 IRP scenarios and the large load sensitivity*
- *An updated copy of this presentation with slides on the new load expectations will be published on June 24th prior to the start of the IRP Stakeholder meeting*
- *All published IRP materials including the upcoming June 24th update can be found on NIPSCO's IRP webpage: www.nipsco.com/irp*

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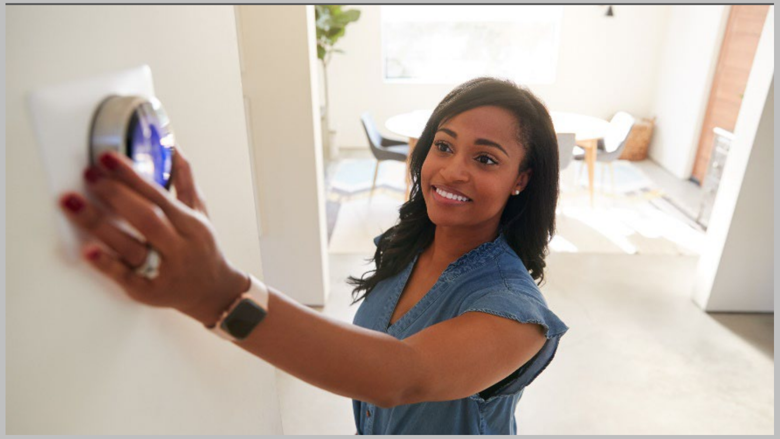
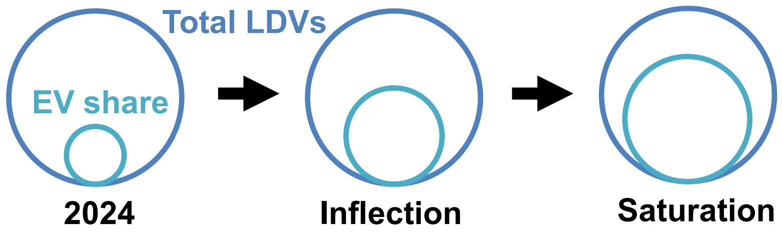
# SCENARIO ANALYSIS: EVs

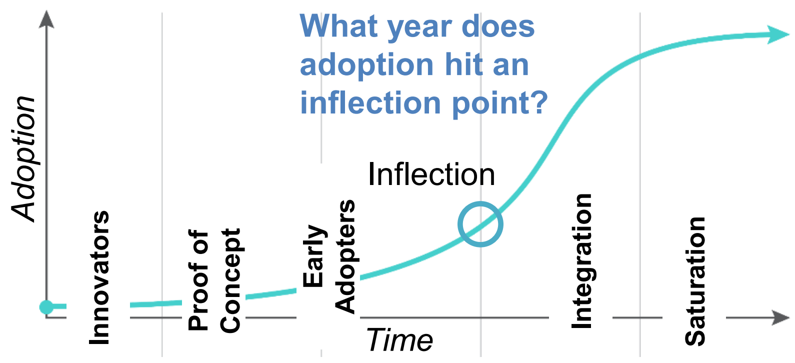


# EV FORECASTING OVERVIEW

| *Penetration Models with Local Datasets* | | *Truck Corridor Charging Tool* |
|---|---|---|
| Light Duty Vehicle ("LDV") | Medium Duty Vehicle ("MDV") | Heavy Duty Vehicle ("HDV") |
| **<10,000 lbs.** | **10,001 – 26,000 lbs.** | **>26,001 lbs.** |

1. Develop growth estimates based on adoption rates applied to S-curve



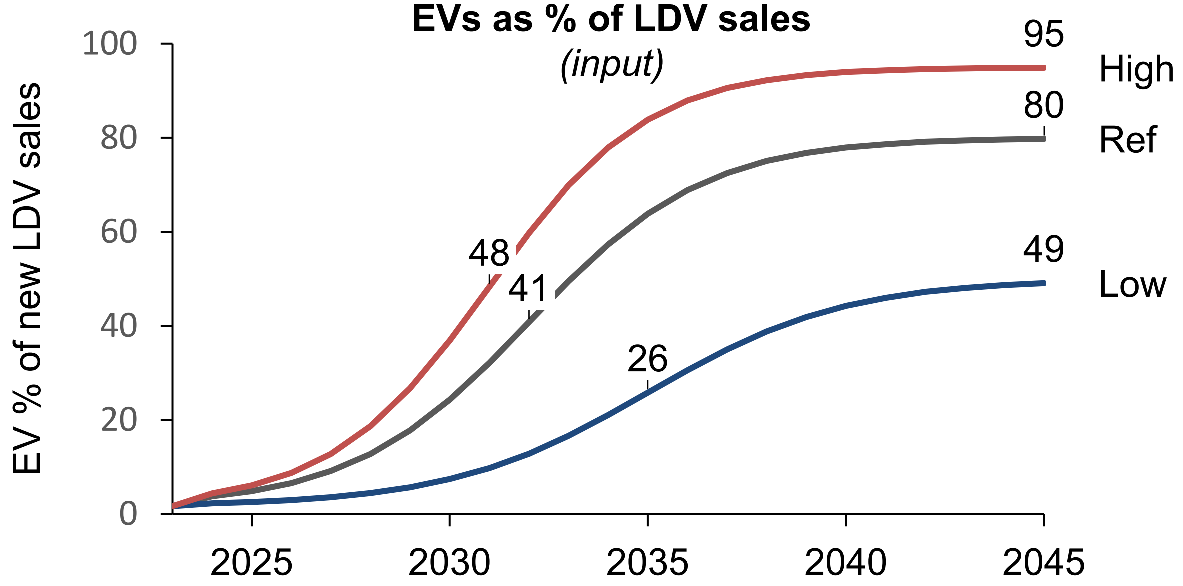

2. NREL's EVI-Pro-Lite tool and other sources to develop hourly shapes

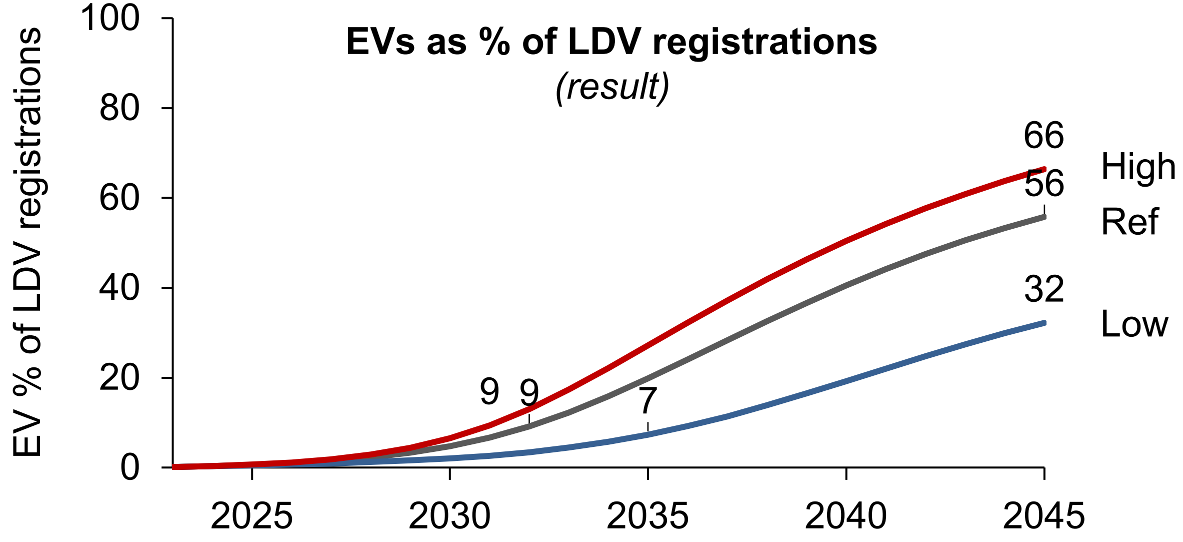
3. Develop final hourly load forecast based on adoption rates, plus temperature, efficiency assumptions, and other variables

Analysis includes data from:

- National Performance Management Research Data Set via U.S. Dept of Transportation
- Highway traffic counts from Indiana Dept of Transportation
- Freight Analysis Framework
- Institute of Transportation Engineers Trip Generation Database

# LDV EV ADOPTION PROJECTIONS



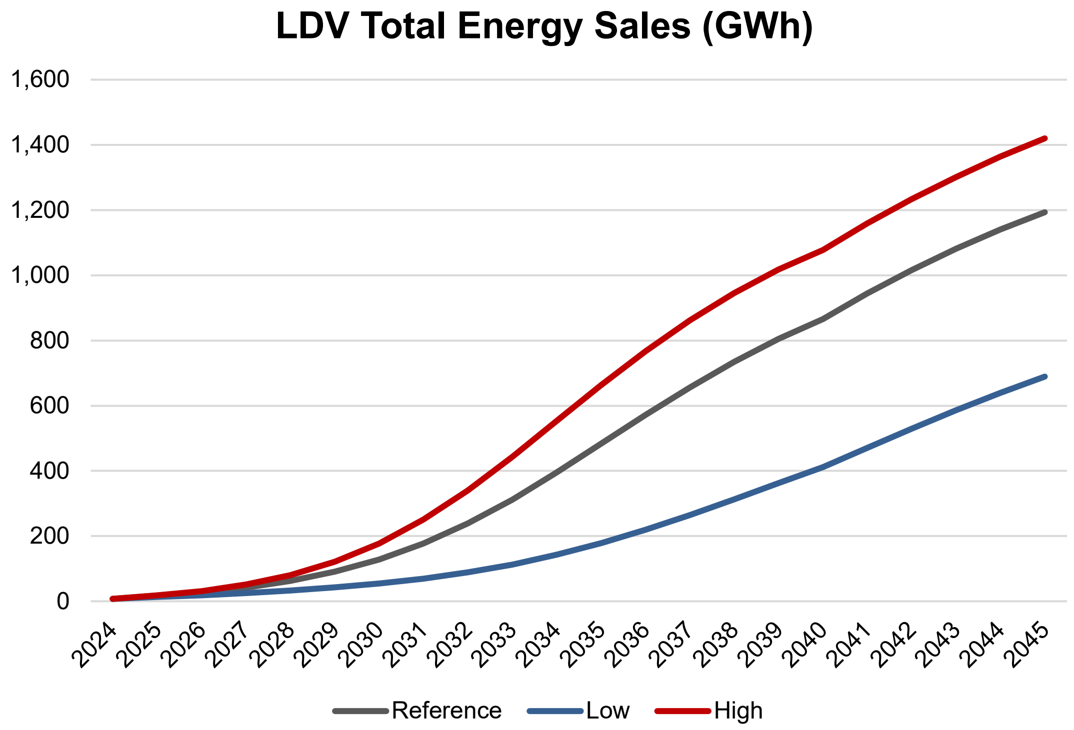



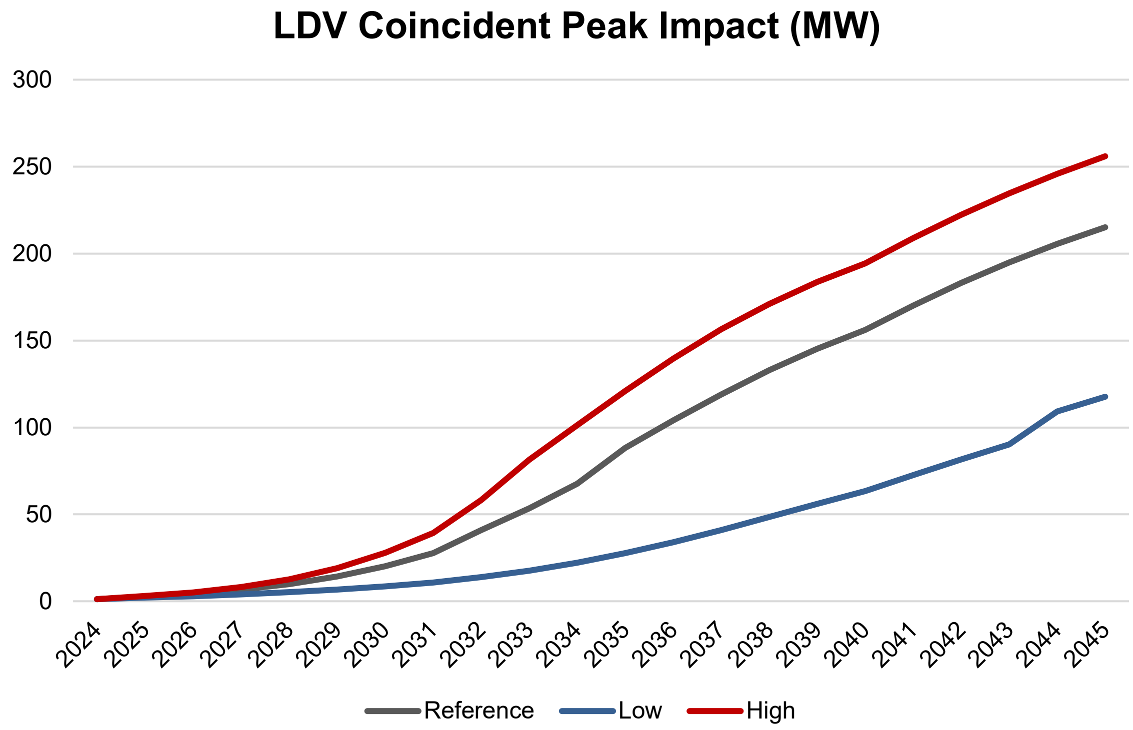

## Adoption Overview

- NIPSCO has now developed Reference, High, and Low adoption scenarios over time, leveraging current EV data and third-party projections
- All scenarios begin at an estimated EV sales penetration of ~1.6% (estimate based on analysis of Indiana Fuel Dashboard data from 2018-2023)
- A sigmoid function is used to create intermediate sales values by year, where scenarios each reach a given % of sales target by 2045
  - Low: 50%
  - Ref: 80%
  - High: 95%

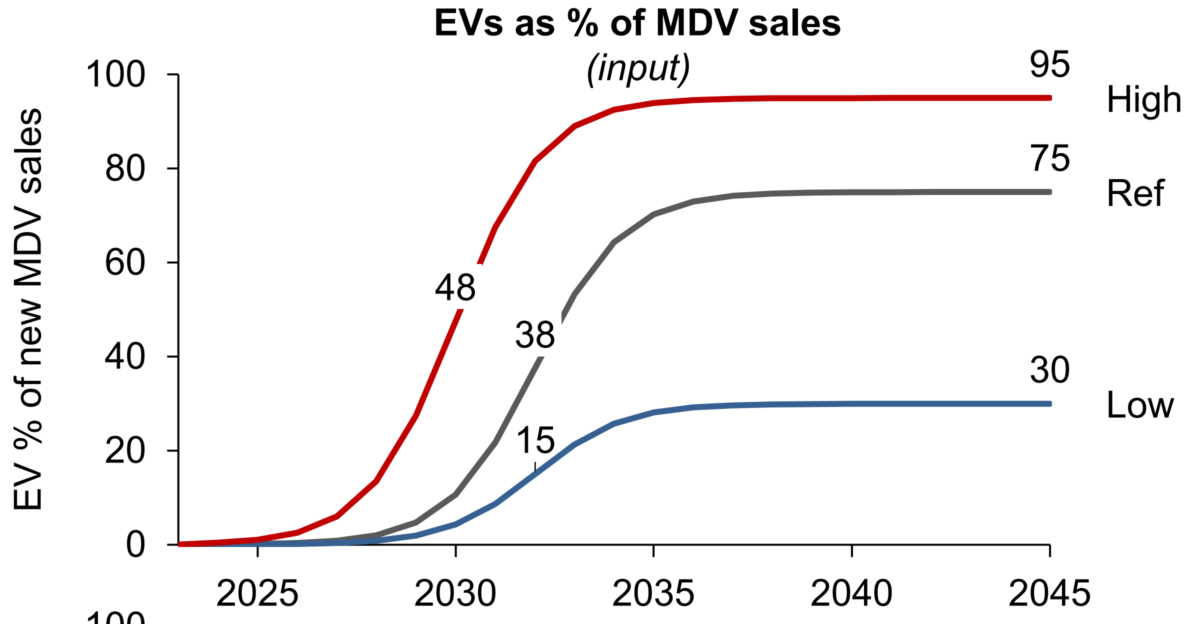
# LDV SALES AND COINCIDENT PEAK IMPACT, ***ASSUMING NO INTERVENTION TO ENCOURAGE MANAGED CHARGING***

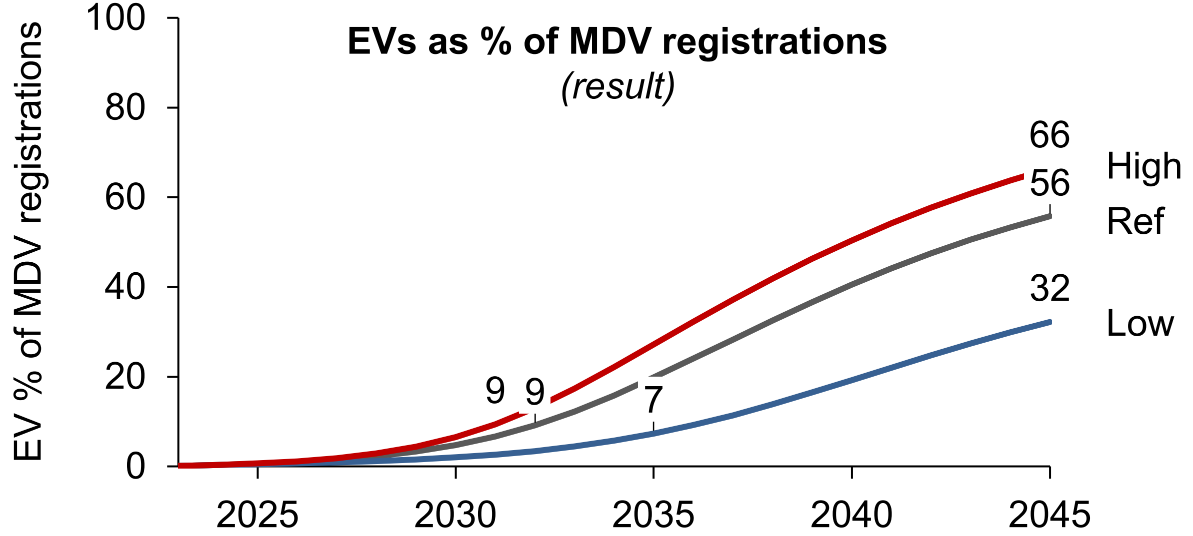
- Relatively modest peak load impacts will be seen across all three scenarios (<50 MW) until 2030, when an inflection in EV sales heightens overall impact of LDV segment
- Steady growth expected to raise peak contributions to more than 150 MW in the reference case and closer to 200 MW in the high case by 2040
- Energy sales roughly mirror peaks, with similar dampening of per vehicle kWh contribution driven by higher vehicle efficiencies



# MDV EV ADOPTION PROJECTIONS



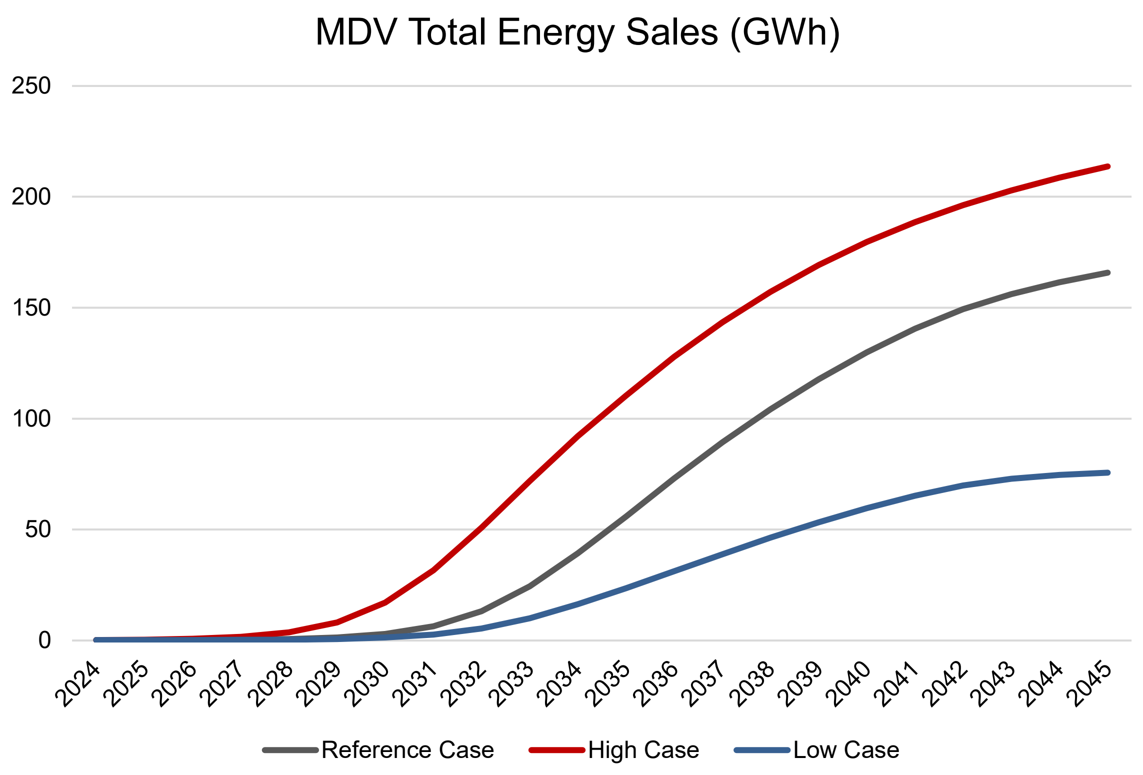



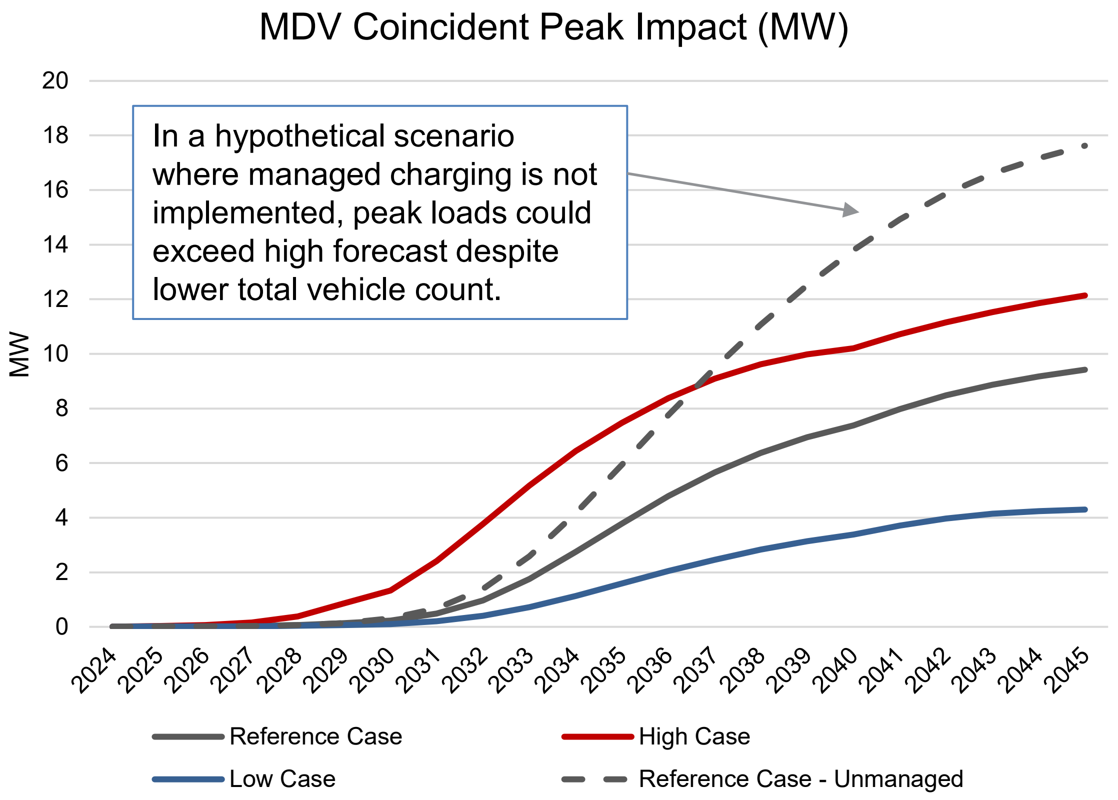

## Adoption Overview

- NIPSCO has utilized Indiana Fuel Dashboard traditional vehicle and EV registration data to develop an estimate of the existing EV penetration and traditional vehicle fleets and has now taken a view on how adoption may unfold over time for three scenarios, leveraging third-party studies
- Current fleet electrification is very small, based on analysis of Indiana Fuel Dashboard data from 2018-2023
- A sigmoid function is used to create intermediate sales values by year, where scenarios each reach a given % of sales target by 2045
  - Low: 30%
  - Ref: 75%
  - High: 95%

# MDV FORECAST: SALES AND COINCIDENT PEAK GROWTH

- MDV are expected to have modest energy sales and load impacts, with roughly 10% of the demand seen in the LDV segment
- Energy sales roughly mirror peaks, with similar dampening of per vehicle kWh contribution driven by higher vehicle efficiencies



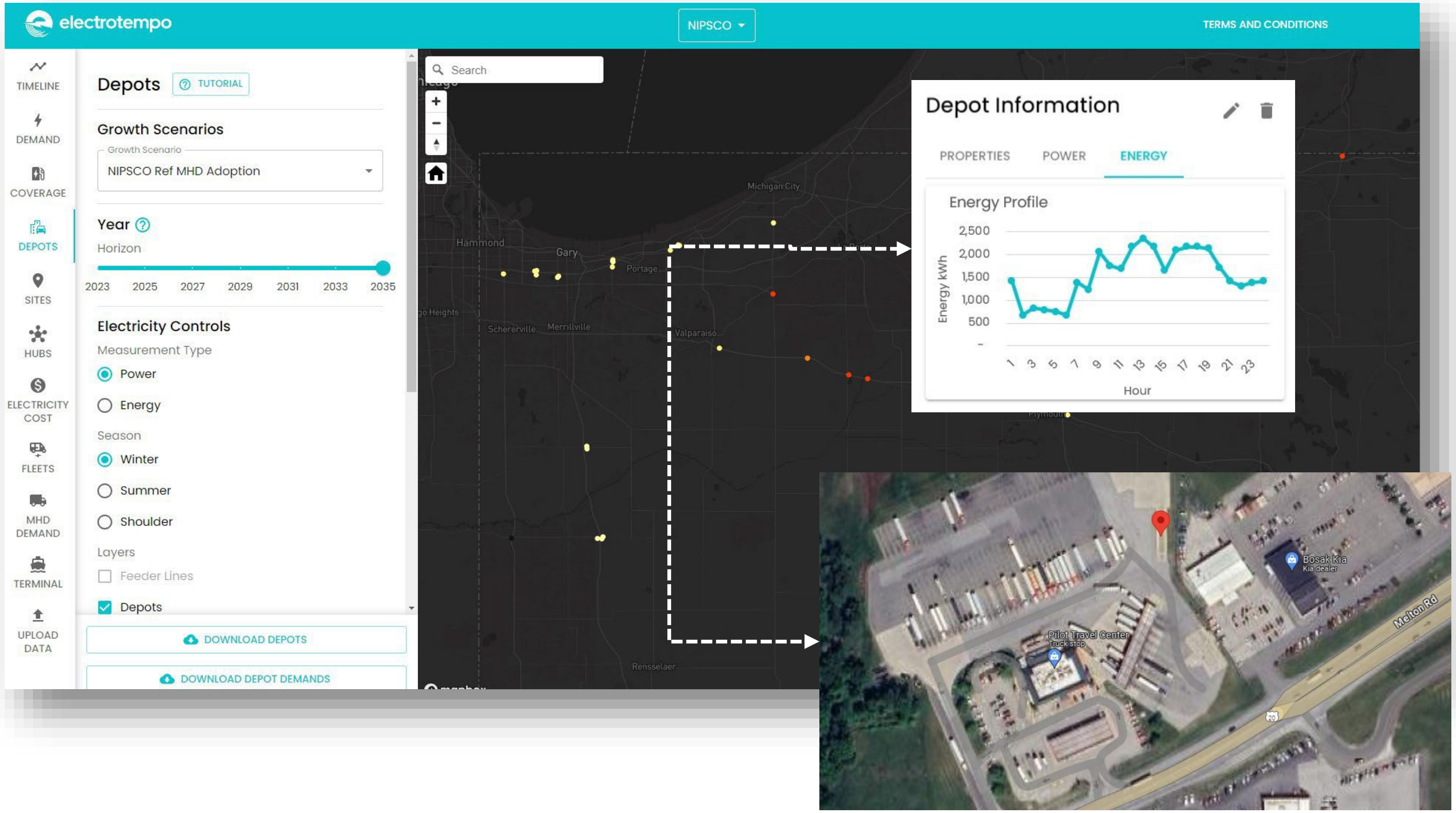



# EV HIGHWAY CORRIDOR CHARGING DEMAND

- ElectroTempo prepared a highway corridor EV charging demand forecast:
  - Identification of potential truck charging locations
  - Average daily 24-hour demand profile for each location
  - Three electrification scenarios
- 2035 EV saturation by class:

| Scenario | MDV | HDV |
|---|---|---|
| Low | 5% | 0% |
| Ref | 14% | 2% |
| High | 27% | 10% |

**ElectroTempo Corridor Charging Data**




Example Truck stop location along I-94

# HIGHWAY CORRIDOR CHARGING METHODOLOGY

1. Identify current truck refueling locations (43)
2. Calculate average annual daily traffic*
3. Apply EV adoption scenario to calculate total EVs^
4. Apply site-specific capture rate and arrival patterns**
5. Calculate energy requirement per arrival
   - State of Charge (SOC) category based on route origin-destination pairs*** - See table to the right
   - Battery capacity by vehicle category (300 kWh for MDV and 600 kWh for HDV)
6. Calculate power based on charger rating assignments
   - MDV: 150 kW
   - HDV: 450 kW

**Distribution of SOC types for example site along I-94**

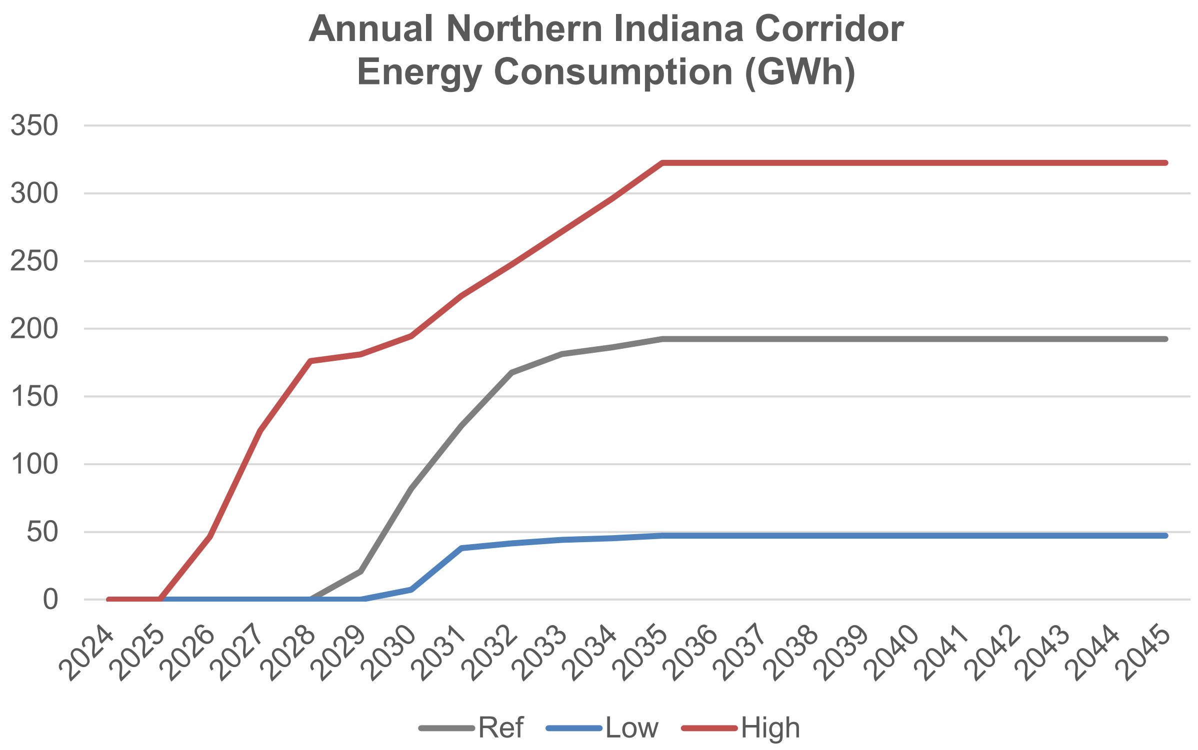
| SOC Cat. | Route Type | Perc. Of Routes | Charging EVs |
|---|---|---|---|
| 1 | Chi <>Det | 23% | 7 |
| 2 | Chi/Det to Other | 6% | 2 |
| 3 | Other to Chi/Det | 11% | 3 |
| 4 | Other to Other | 60% | 18 |

ElectroTempo breaks down overall travel data into key routes originating from outside NIPSCO territory. This is translated to charging demand based on EV adoption scenarios and distance traveled per route

* Highway Performance Monitoring System, US DOT Federal Highway Administration
^ MDV scenarios provided by CRA. HDV Ref based on business as usual adoption, High based on EPA Phase 3
** Institute of Transportation Engineers: Trip Generation Manual, 11th Edition
*** Freight Analysis Framework Version 5 Data Tabulation Tool." Oak Ridge National Laboratory
**** Reference electric vehicles: Volvo VNR Electric Straight Truck/Tractor, Peterbilt Model 220ev, Tesla Semi

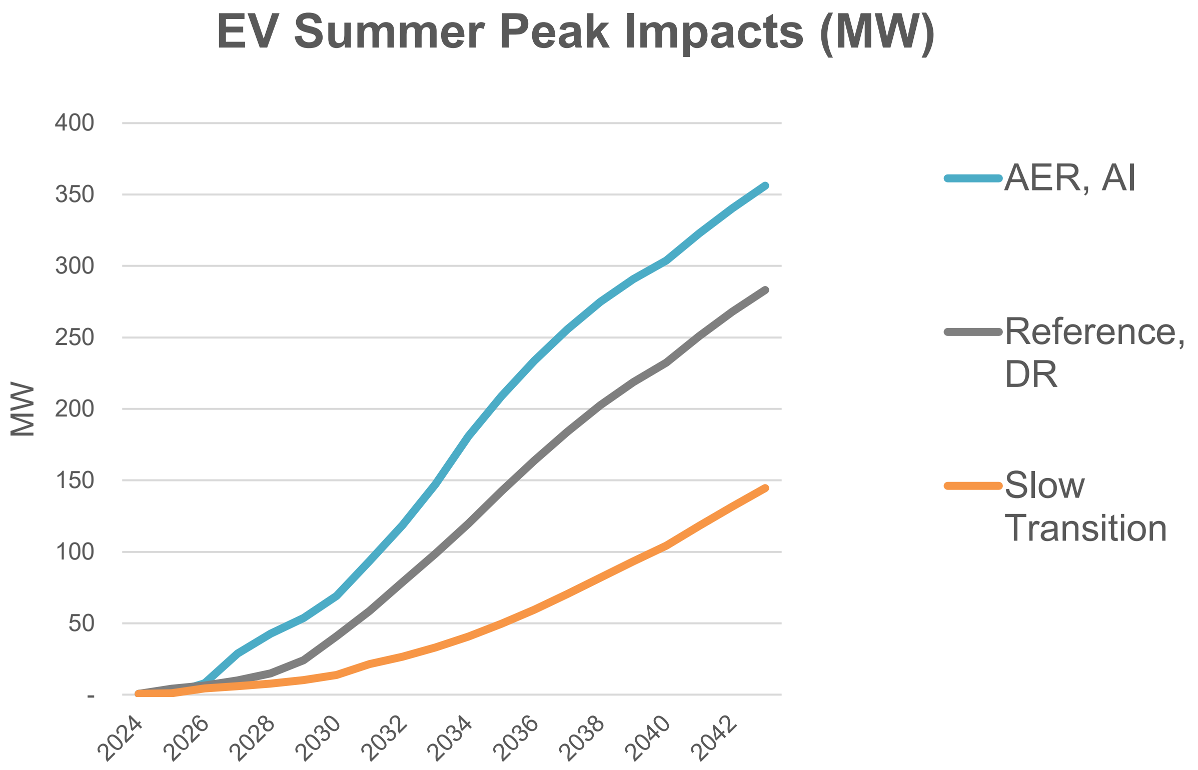
# HIGHWAY CORRIDOR CHARGING SUMMARY AND KEY TAKEAWAYS

- Potential electrification of the HDV fleet could be a significant driver for overall EV demand.
- Highway corridor EV charging could add close to 200 GWh per year by 2035 in the Reference scenario and as high as 300 GWh in the High scenario.
- I-94 and I-69 are the primary corridors, accounting for a combined 60% of corridor demand.

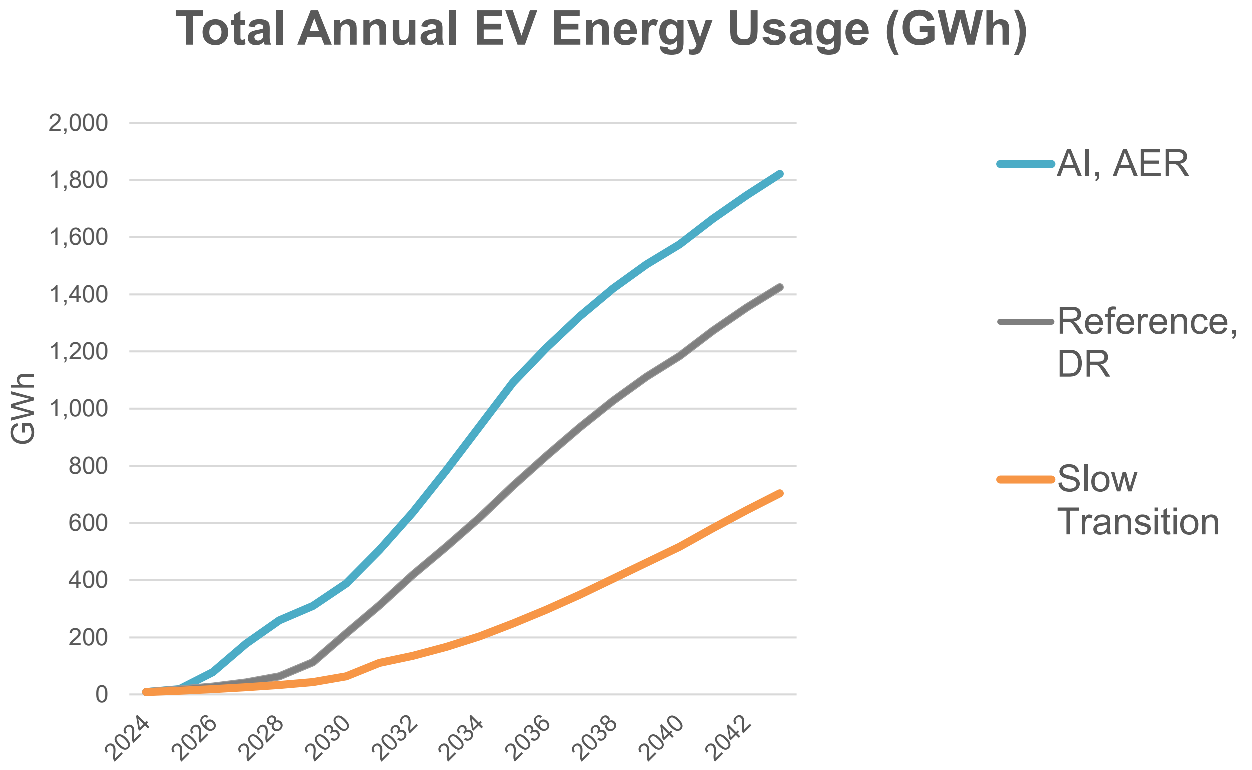


# SUMMARY EV FORECAST BY SCENARIO

- All five scenarios were mapped to a high, medium and low EV penetration trajectory




*Note: AER and AI summer peak demand trajectories diverge in select years due to differences in distributed solar assumptions impacting hours of net peak*



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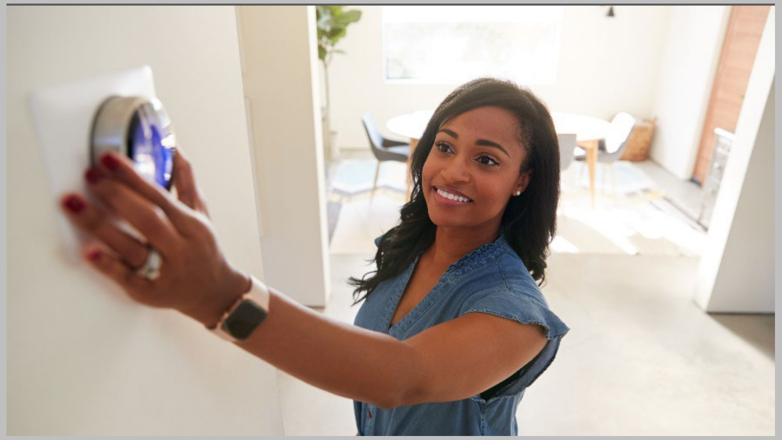
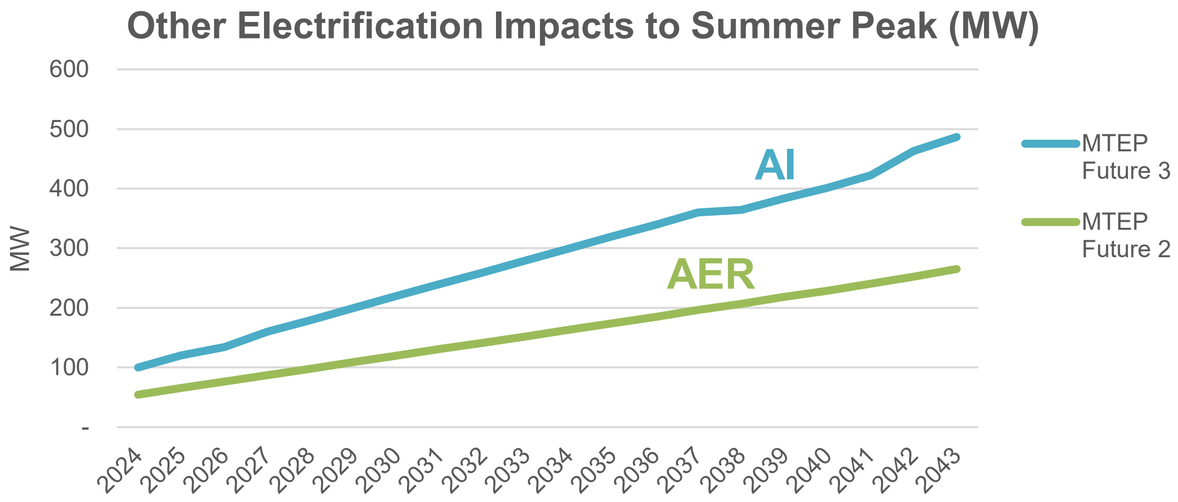
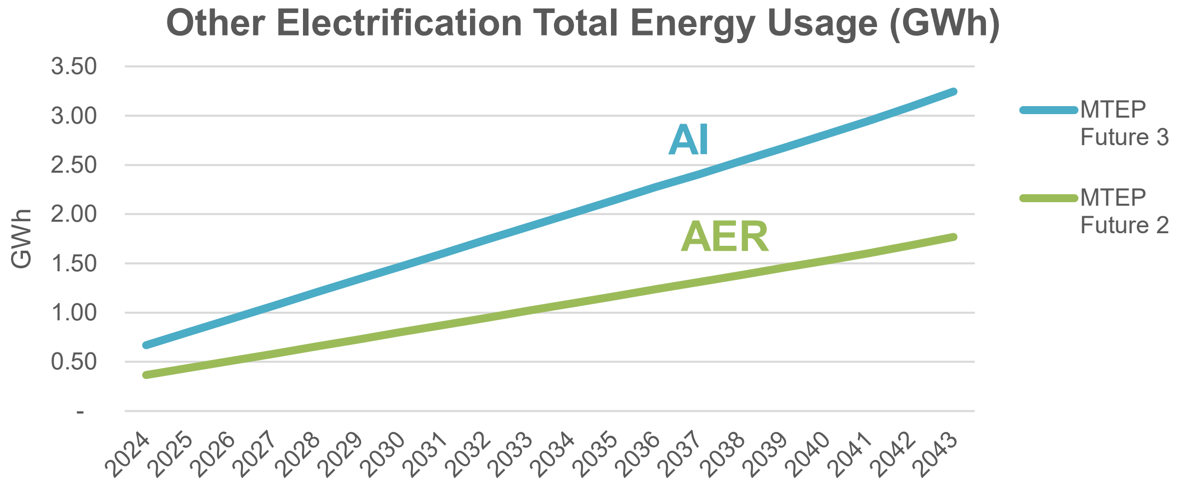
# SCENARIO ANALYSIS: ELECTRIFICATION




# OTHER ELECTRIFICATION

- Aside from electric vehicles, the AER and AI scenarios incorporate long-term impacts associated with electrification of other energy end uses
- NIPSCO drew from MISO Futures Report and Transmission Expansion Plan (MTEP) to develop estimates for growth in energy and peak load needs associated with:
  - Residential HVAC
  - Commercial and Industrial ("C&I") HVAC
  - Residential Appliances
  - Residential water heating
  - C&I water heating
  - C&I Processes

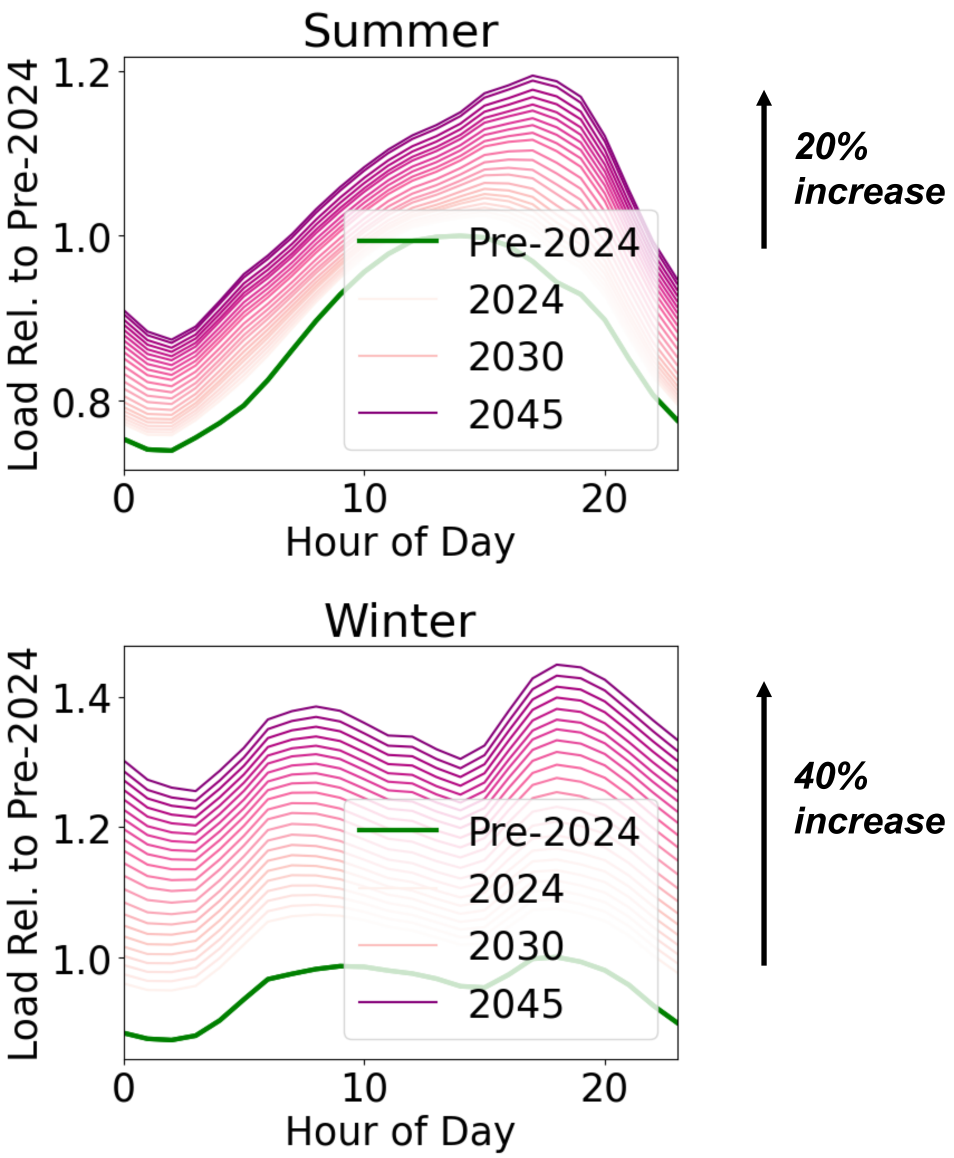



Source: 2021 MISO Futures Report

# OTHER ELECTRIFICATION: PEAK HOUR IMPACTS

- New sources of electrification are expected to increase winter demand more than summer demand
- In high electrification futures (AI), **electrified heating could push annual peak to winter months**
- All peaks have the potential to be pushed to later in the evenings across all electrification futures





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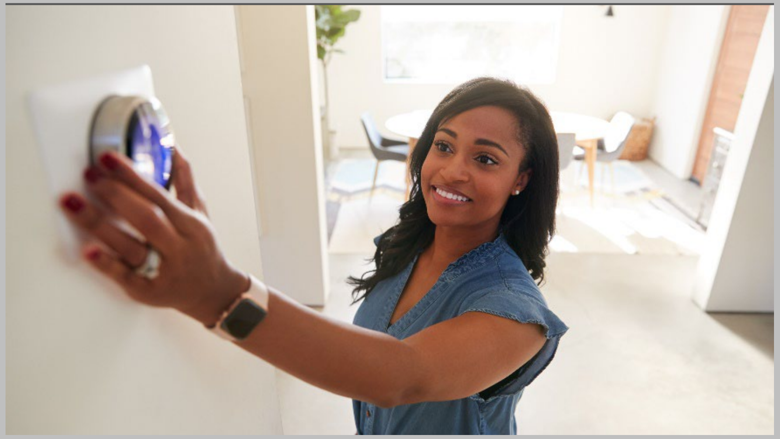
# SCENARIO ANALYSIS: DERs

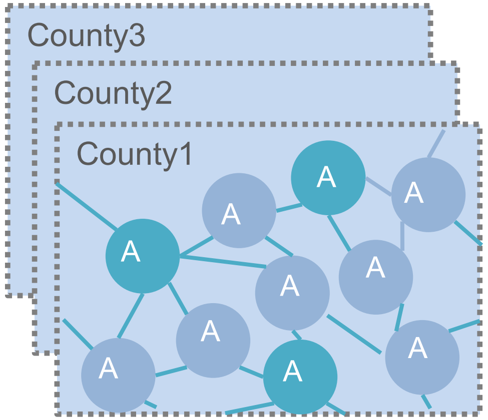




# DER MODELING OVERVIEW: DER PENETRATION (PenDER) MODEL

***PenDER is an agent-based model ("ABM") that considers NIPSCO customer ("agents") characteristics, economic decision-making, and social interactions to drive projections of the adoption of DER systems by county.***

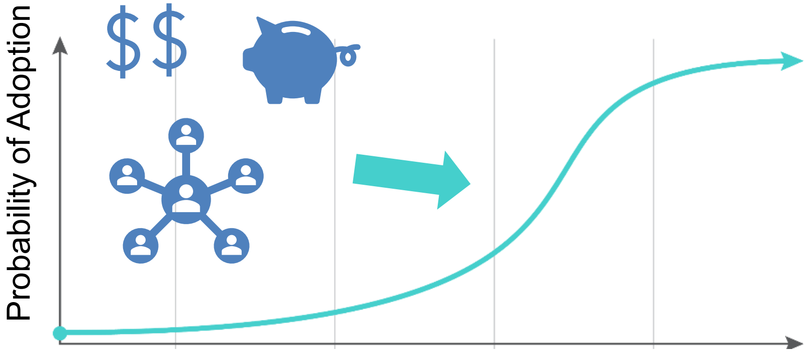
## Agent and Network Representation




Agents defined by:

| | |
|---|---|
| **Customer Level Data** | Individual customer information about DER adoption, location, and customer class (residential, commercial, industrial) |
| **Socio-Economic Data** | Individual customer information on socio-economic status, business type, energy usage |

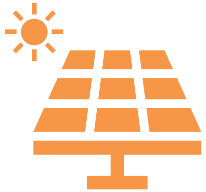
## Adoption Decision




Probability of adoption threshold is met based on:

- Payback period
- Customer budget
- Social network adoption rate

## Cumulative DER Adoption



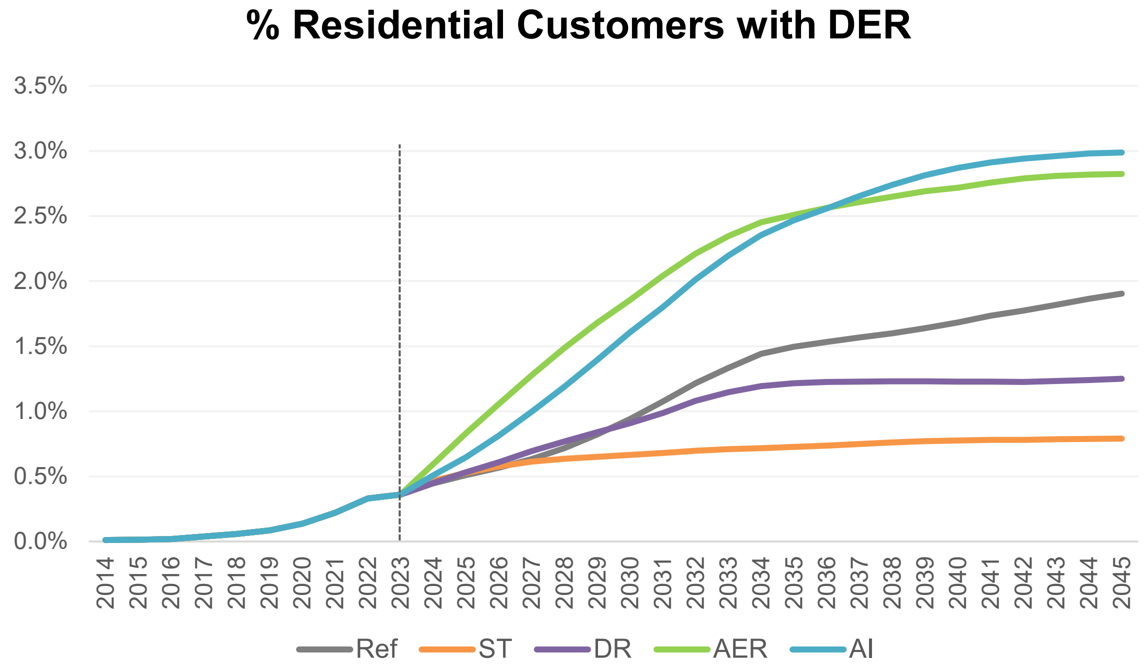
**Individual adoption decisions aggregated to NIPSCO service territory by customer class**

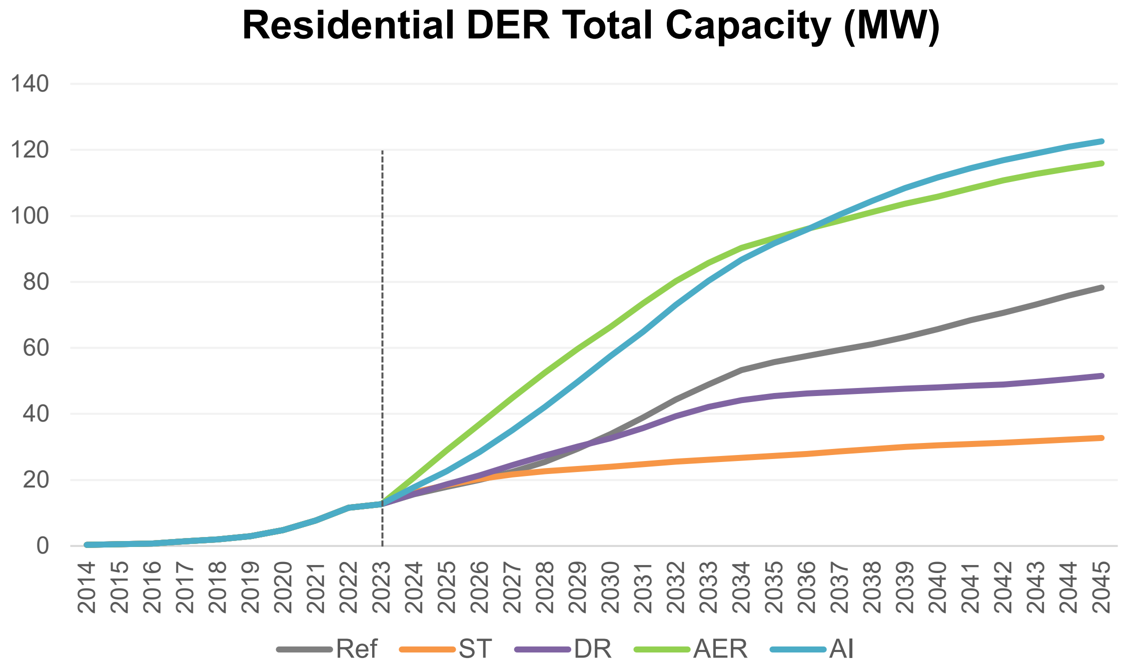
# DER SCENARIO CONSIDERATIONS

| | Scenario Name | Description | Capital Cost for Solar | ITC Incentives | Wholesale Rate Growth | Incentive Structure | DER Installation Size |
|---|---|---|---|---|---|---|---|
|  | **Reference Case** | Reference Point | **Base**<br>*NREL Reference* | **Base**<br>*IRA through 2035* | **Base** | **EDG Program**<br>*Program continues unchanged through the planning horizon* | **Base**<br>*Historic socioeconomic trends continue* |
|  | **Slower Transition** | Environmental policy incentives reduce; economic slowdown in region | **High**<br>*NREL Conservative* | **Low**<br>*IRA phase-out* | **Low**<br>*Lower commodity prices* | **EDG Program**<br>*Program continues unchanged through the planning horizon* | **Base**<br>*Historic socioeconomic trends continue* |
|  | **Domestic Resiliency** | Influx of new economic development load (data center focus) | **High**<br>*NREL Conservative* | **Base**<br>*IRA through 2035* | **High**<br>*Higher commodity prices.* | **EDG Program**<br>*Program continues unchanged through the planning horizon* | **High**<br>*Increasing underlying load growth* |
|  | **Aggressive Environmental Regulation** | Aggressive decarbonization policy, moderate electrification | **Base**<br>*NREL Reference* | **Base**<br>*IRA through 2035* | **Highest**<br>*Highest gas prices; environmental regulation (high $CO_2$ price)* | **EDG → Net Metering**<br>*DER adoption encouraged through net metering, or another innovative design* | **Base**<br>*Historic socioeconomic trends continue* |
|  | **Accelerated Innovation** | Faster energy transition, high electrification with additional econ. dev. (data center) load | **Low**<br>*NREL Low* | **Base**<br>*IRA through 2035* | **Base**<br>*Close to base, but model logic transitions to Net Metering* | **EDG Program**<br>*Program continues unchanged through the planning horizon* | **Highest**<br>*Economy-wide electrification driving larger customer UPC* |

# RESIDENTIAL FORECAST – DER PENETRATION BY SCENARIO

- Across scenarios, penetration is estimated to range from 0.8 – 3.0% of customers and 33 to 123 MW of residential customer-owned solar capacity by 2045

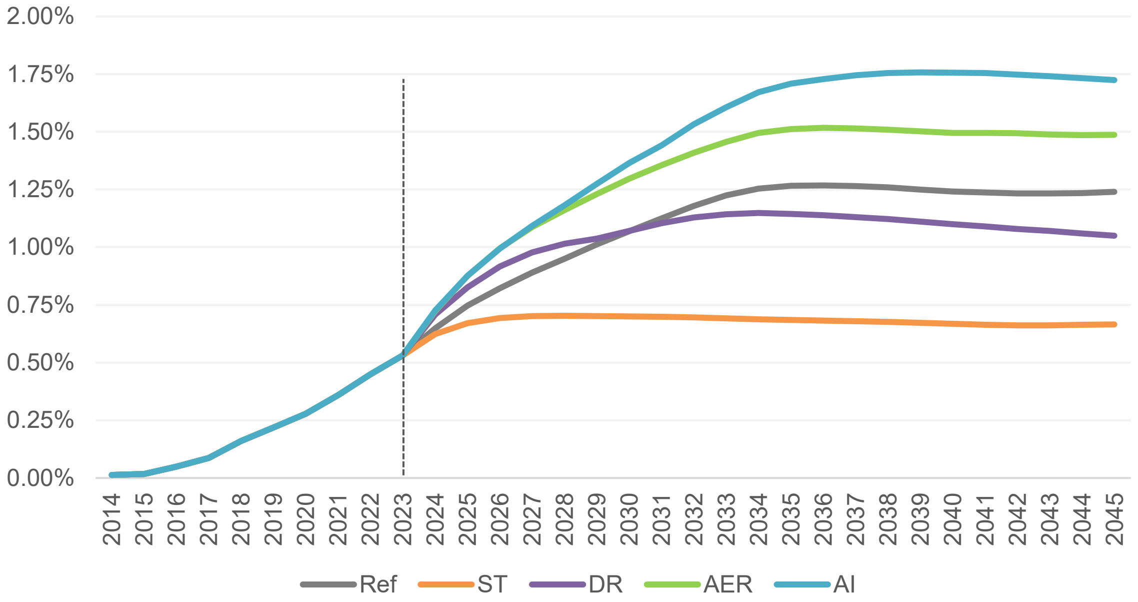


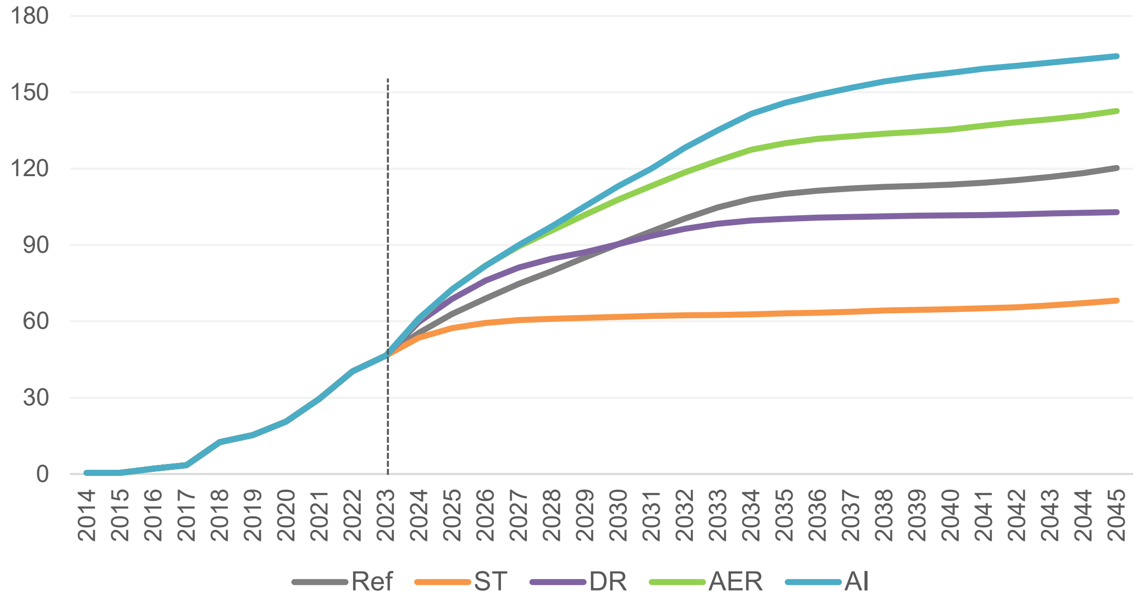
# COMMERCIAL FORECAST – DER PENETRATION BY SCENARIO

- Across scenarios, penetration is estimated to range from 0.7 – 1.7% of customers and 68 to 164 MW of residential customer-owned solar capacity by 2045
- Despite lower overall percentage of customers adopting solar, commercial DERs have far larger system sizes, pushing total installed capacity approximately 50% higher than residential values

**% Commercial Customers with DER**

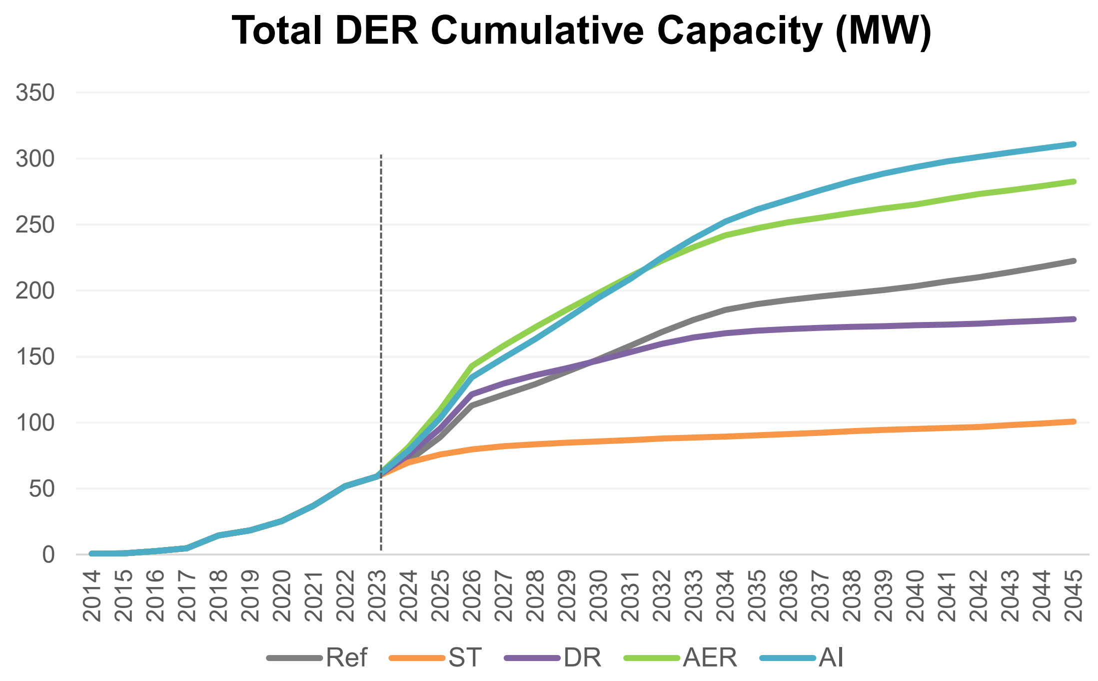


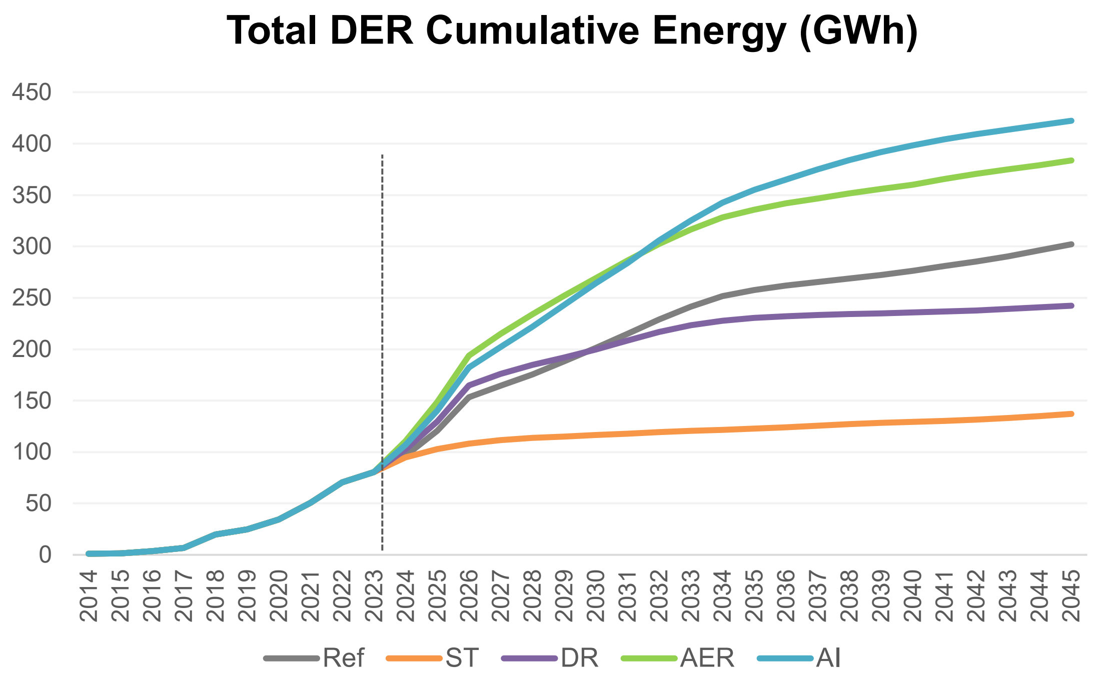

**Commercial DER Total Capacity (MW)**



# TOTAL DER FORECAST

- Total customer-owned solar DER installations across the scenarios range from 100 MW to over 300 MW by 2045, totaling between around 140 GWh to 420 GWh.



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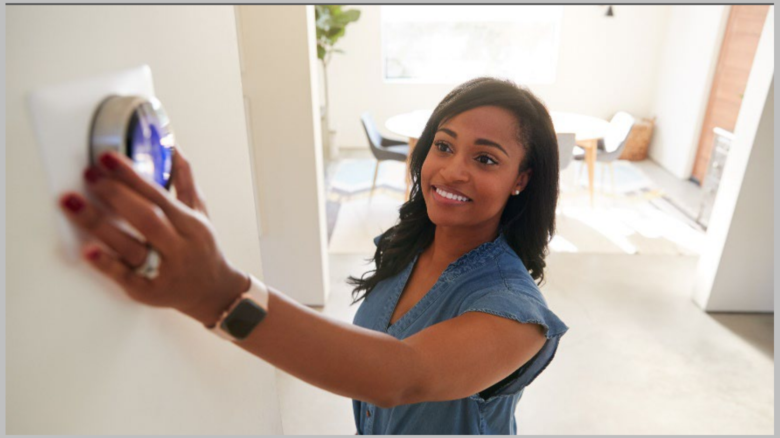

# SCENARIO ANALYSIS: ALL-IN RANGE



# TOTAL LOAD UPDATE – PLACEHOLDER

- *This slide is a placeholder for NIPSCO's new load expectations for the 2024 IRP scenarios and the large load sensitivity*
- *An updated copy of this presentation with slides on the new load expectations will be published on June 24th prior to the start of the IRP Stakeholder meeting*
- *All published IRP materials including the upcoming June 24th update can be found on NIPSCO's IRP webpage: www.nipsco.com/irp*



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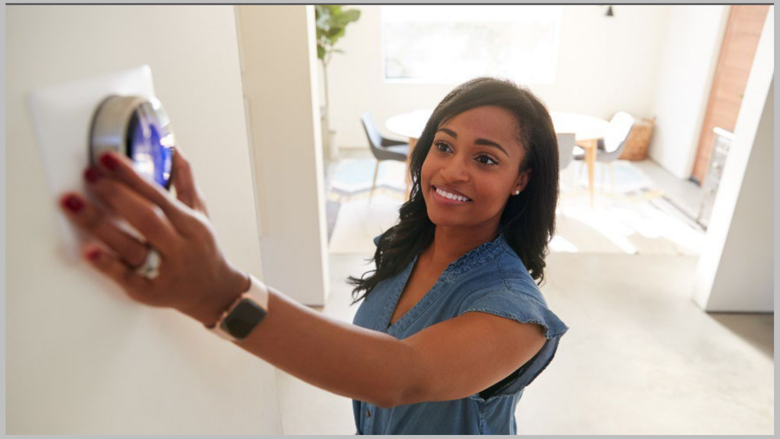
## BREAK







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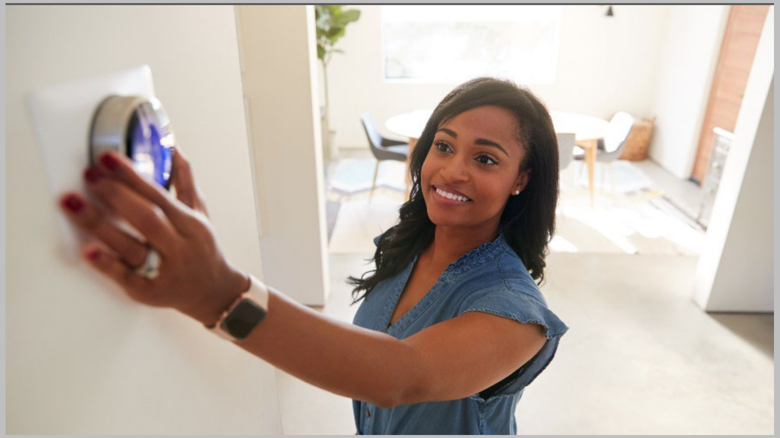
# NIPSCO's SUPPLY-DEMAND POSITION: MISO RESOURCE ACCREDITATION AND LOAD OBLIGATION UNCERTAINTIES



Pat Augustine, Vice President, CRA



# RECAP: MISO'S DIRECT LOSS OF LOAD ("D-LOL") FILING

***NIPSCO's 2024 IRP will evaluate the potential impacts associated with D-LOL implementation***

### MISO made its filing on March 28, 2024

FERC approval is still required, and stakeholders have raised several questions and concerns

### Performance during tight hours will matter more

Strong incentive to perform during hours when net load *and* outages are high

### Highly dependent on LOLE assumptions

Based on historical weather data and may not capture all future trends

### Accreditations will likely change

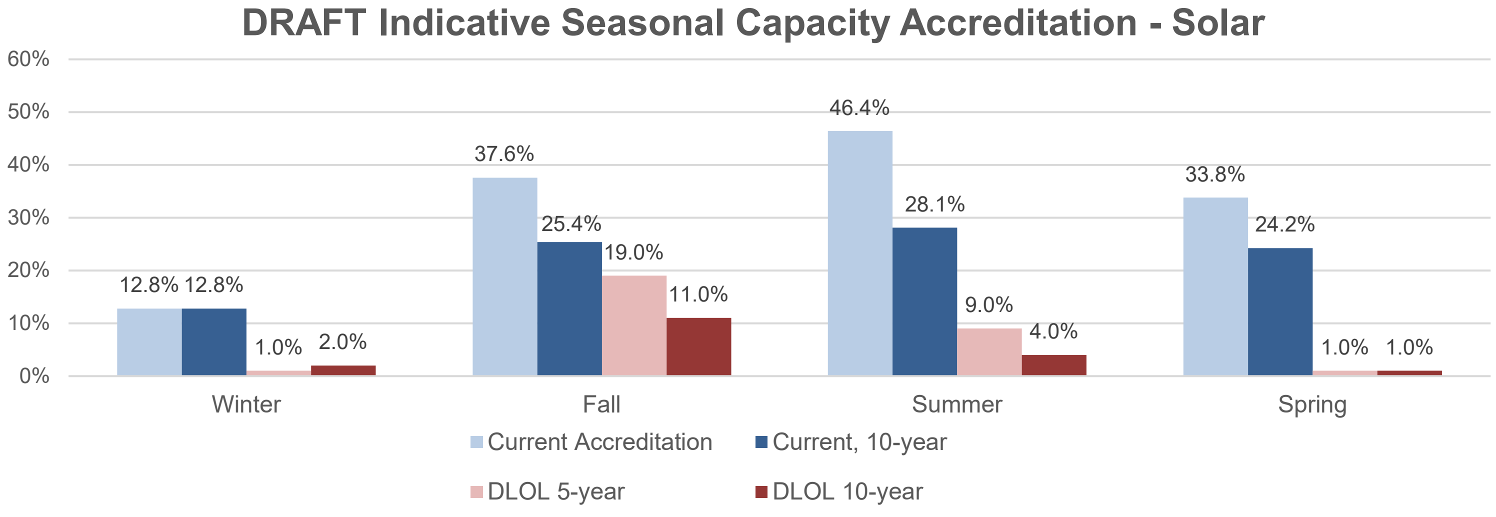
MISO has signaled significant drops for certain technology types, but future market conditions will matter

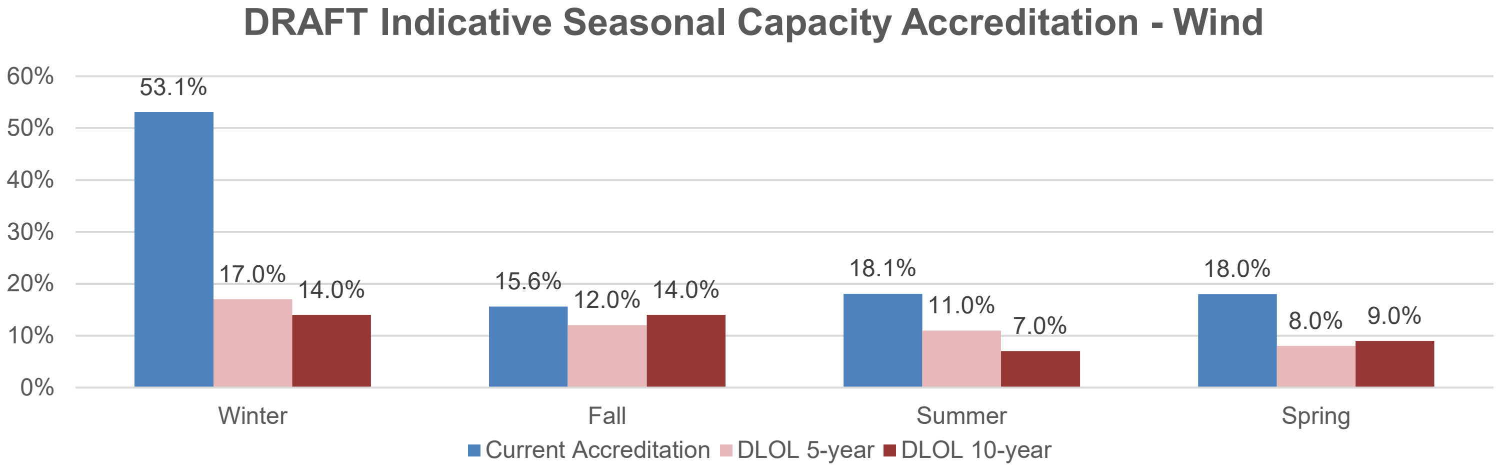
### NIPSCO Obligation likely to decline

Shift in timing of tight hours likely to lead to obligation declines, but magnitude is uncertain

# SEASONAL RESOURCE ACCREDITATION UNDER D-LOL – SOLAR AND WIND

- NIPSCO's existing and under development solar and wind resources provide a significant amount of energy value for the portfolio.
- Although solar capacity accreditation has been expected to decline over time, MISO's *draft indicative* forward-looking D-LOL accreditation projections suggest a more dramatic decline is possible.
- Current wind accreditation is significantly higher in the winter, but D-LOL indications suggest potentially lower values year-round.
- New rules could result in new opportunities to improve capacity accreditation through new storage resources, particularly at existing renewable sites, or other capacity-advantaged resources



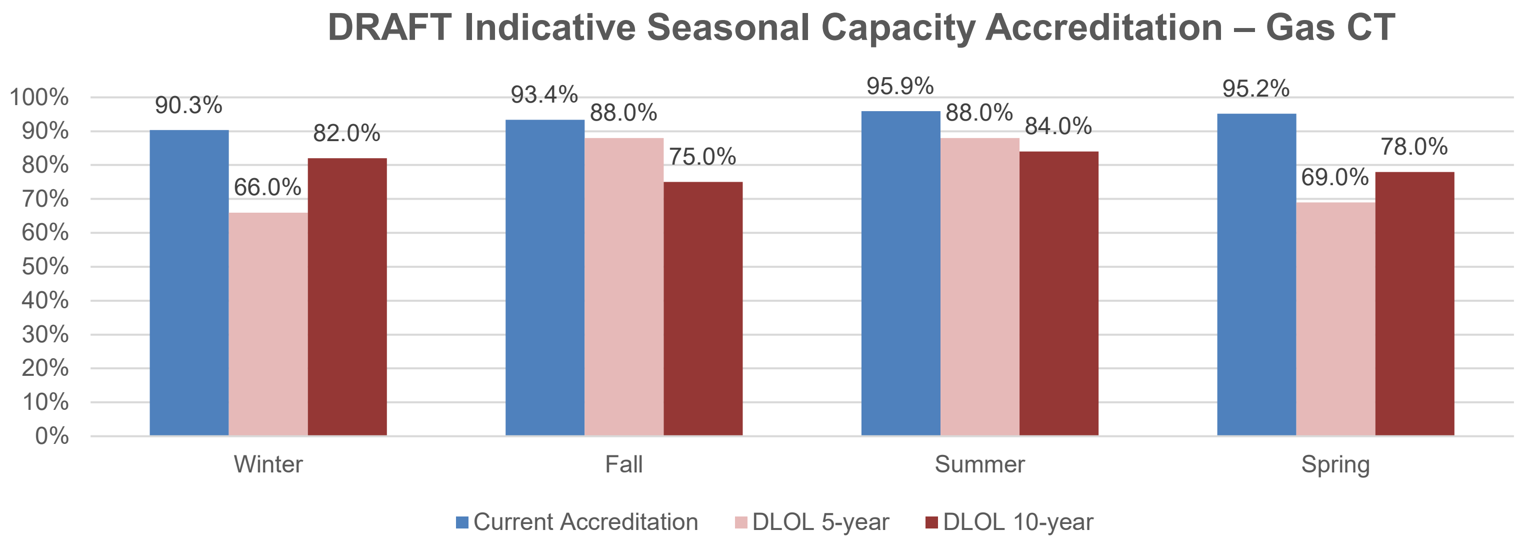

Source: [MISO RASC: Accreditation Reform]

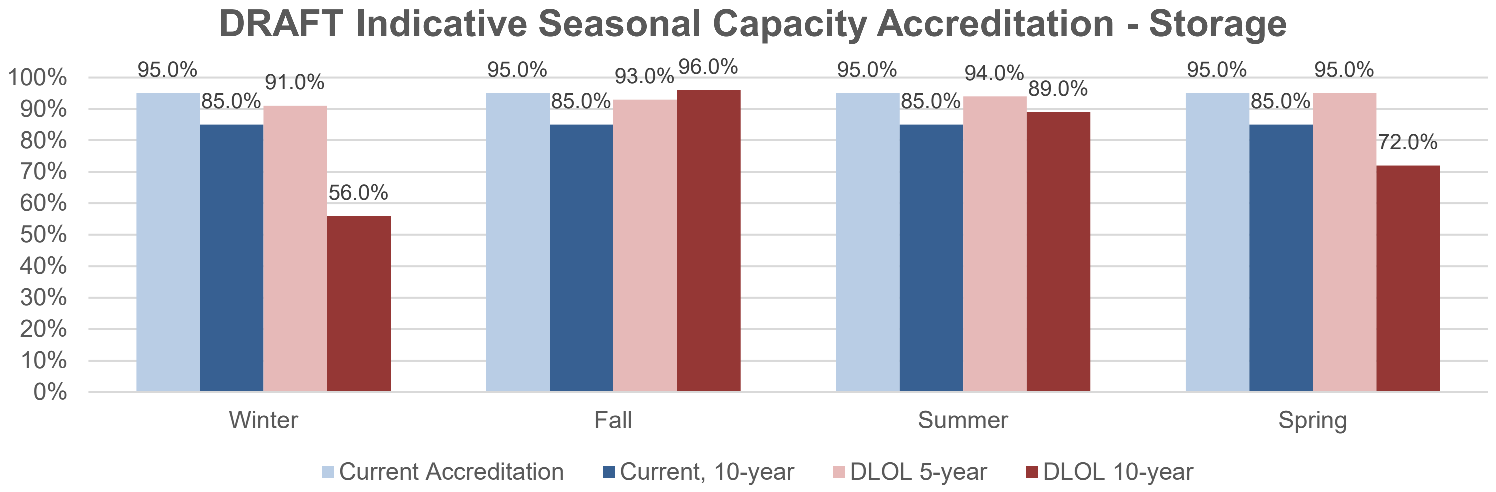
***Actual NIPSCO accreditations will be based on resource-specific performance**

# SEASONAL RESOURCE ACCREDITATION UNDER D-LOL – GAS AND STORAGE

- Gas plant accreditations may be lower than current assumed forced outage rate, depending on performance during stress hours.

- Storage accreditations may fall significantly over time, particularly in the winter and spring seasons.  Longer-duration storage resources are likely to be more resilient to accreditation decline risks.

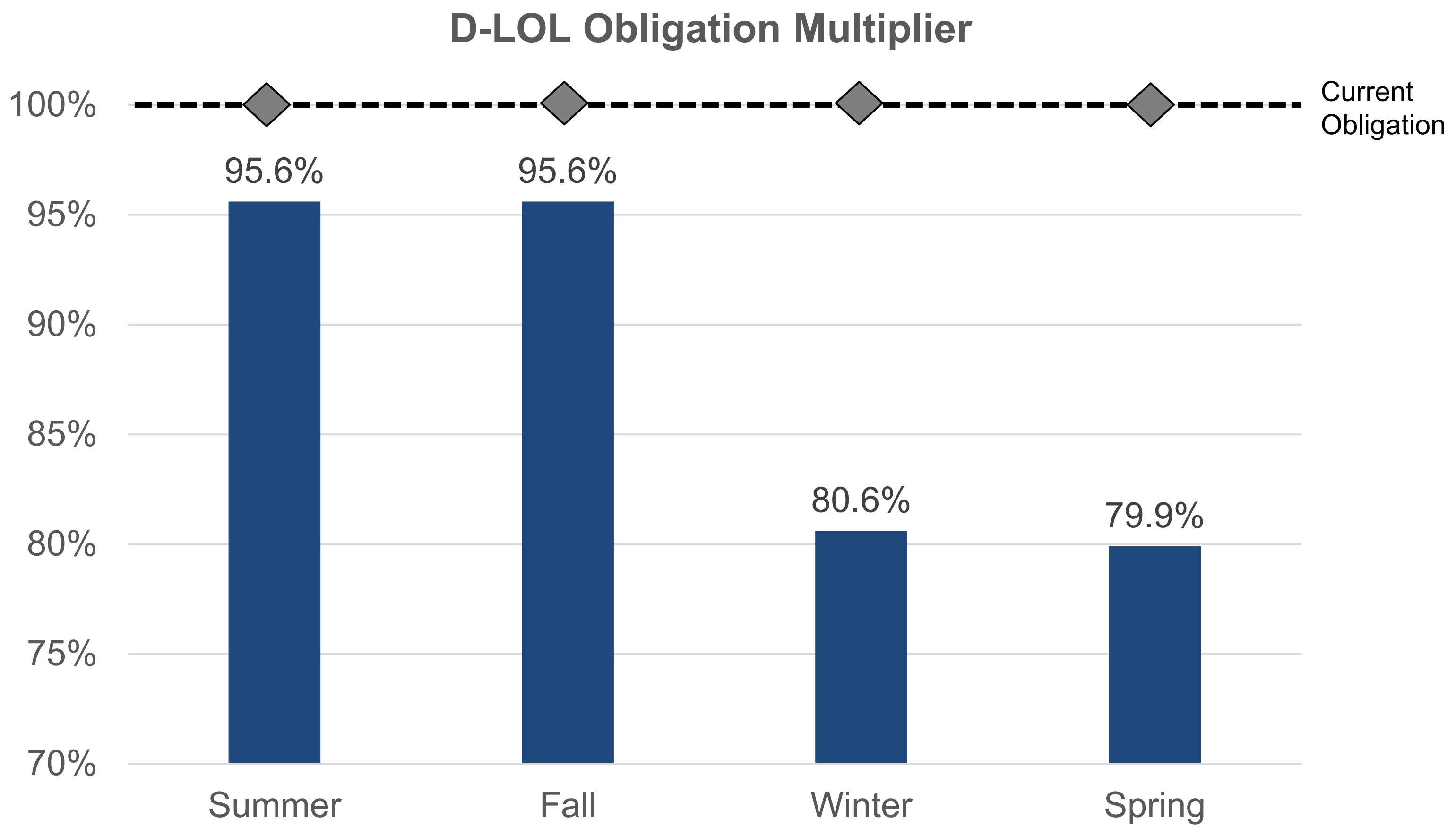



Source: [MISO RASC: Accreditation Reform]

***Actual NIPSCO accreditations will be based on resource-specific performance***

# NIPSCO SEASONAL OBLIGATION IMPACTS FROM D-LOL




**Indicative guidance for planning purposes*

- MISO is anticipating a decrease in the planning reserve margin under D-LOL since hours not aligned with highest overall loads may be identified as having higher risk.
- MISO provided indications to NIPSCO of expected declines under D-LOL for the 2024/25 planning year.
- Significant obligation reductions are possible in winter and spring.

# CAPACITY POSITION – PLACEHOLDER

- *This slide is a placeholder for NIPSCO's capacity position with the new load expectations for the 2024 IRP scenarios and the large load sensitivity*
- *An updated copy of this presentation with slides on the capacity position (including the new load expectations) will be published on June 24th prior to the start of the IRP Stakeholder meeting*
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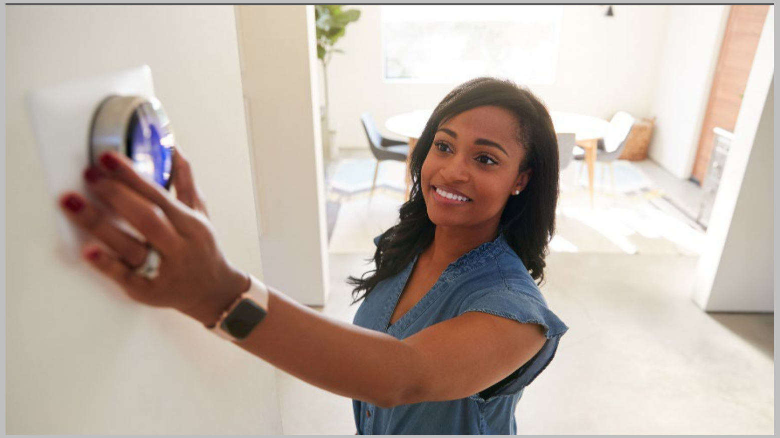
## LUNCH



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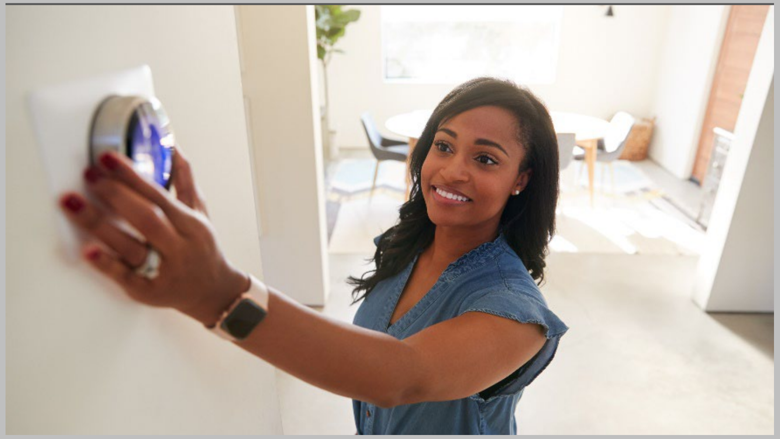
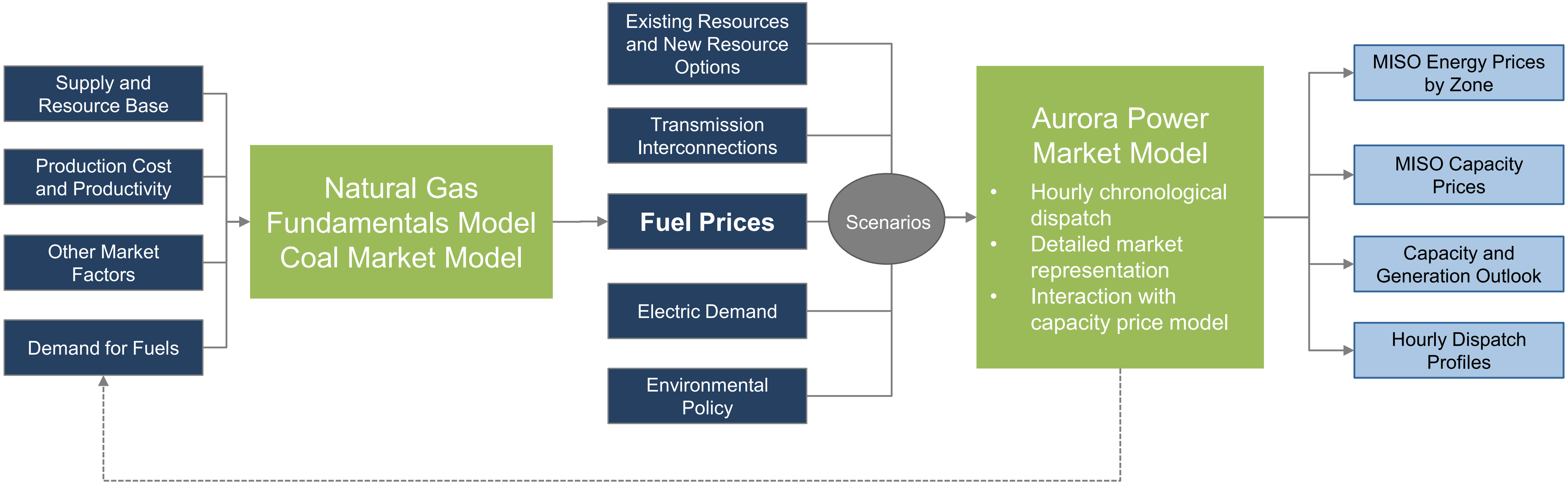
# SCENARIO ANALYSIS: COMMODITY PRICES





# FUNDAMENTAL MARKET MODELING STRUCTURE

CRA's fundamental market models simulate the fuel and power markets to produce integrated outlooks for commodity prices, environmental policy, and power market outcomes




**Note that the Aurora model will also be used in "portfolio" mode to assess NIPSCO-specific portfolio analyses*

# NATURAL GAS MARKET FORECASTING

***Drivers of natural gas pricing and uncertainty change as the forecast progresses in time***

| Years | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

## Markets

Expectations about weather, storage and markets drive gas price expectations in the short term

Due to composition of demand at the point, Henry Hub is now highly linked to demand for natural gas exports

## Fundamentals

The cost of production, price of oil, and composition of demand drive prices in the medium term, as end-use sectors respond to prevailing prices for energy commodities

Corporate activity may also impact prices over this period if different segments of the industry are consolidated

## Policy

Policies that impact economy-wide demand and access to supply will drive gas prices over the longer term

Policies that seek to lower Green House Gas ("GHG") emissions in the residential, commercial, and industrial sectors may have a significant impact on long-term demand

# CRA FORECASTS NATURAL GAS PRICES BASED ON EXPECTATIONS AROUND SUPPLY AND DEMAND

*A fundamental price forecast answers the question: "What gas price is needed to satisfy total demand and make producers whole?"*

## CRA Natural Gas Fundamentals Model (NGF)

### Gas Supply

- Total resource in place, proved and unproven
- Resource growth over time
- Wet / dry product distribution
- Historic wells drilled and ongoing production
- Conventional & associated production
- Existing tight and coal bed methane
- Existing offshore production

### Well Performance

- Drilling & completion costs
- Environmental compliance costs
- Royalties & taxes
- Initial production rates
- Changing drilling and production efficiencies over time
- Productivity decline curve
- Well lifetime
- Distribution of performance

### Gas Demand

- Electric and non-electric sector demand forecast (domestic)
- International demand (net pipeline & LNG exports)

### Other Market Drivers

- Value of natural gas liquids and condensates
- Natural gas storage

# KEY DRIVERS OF THE REFERENCE CASE

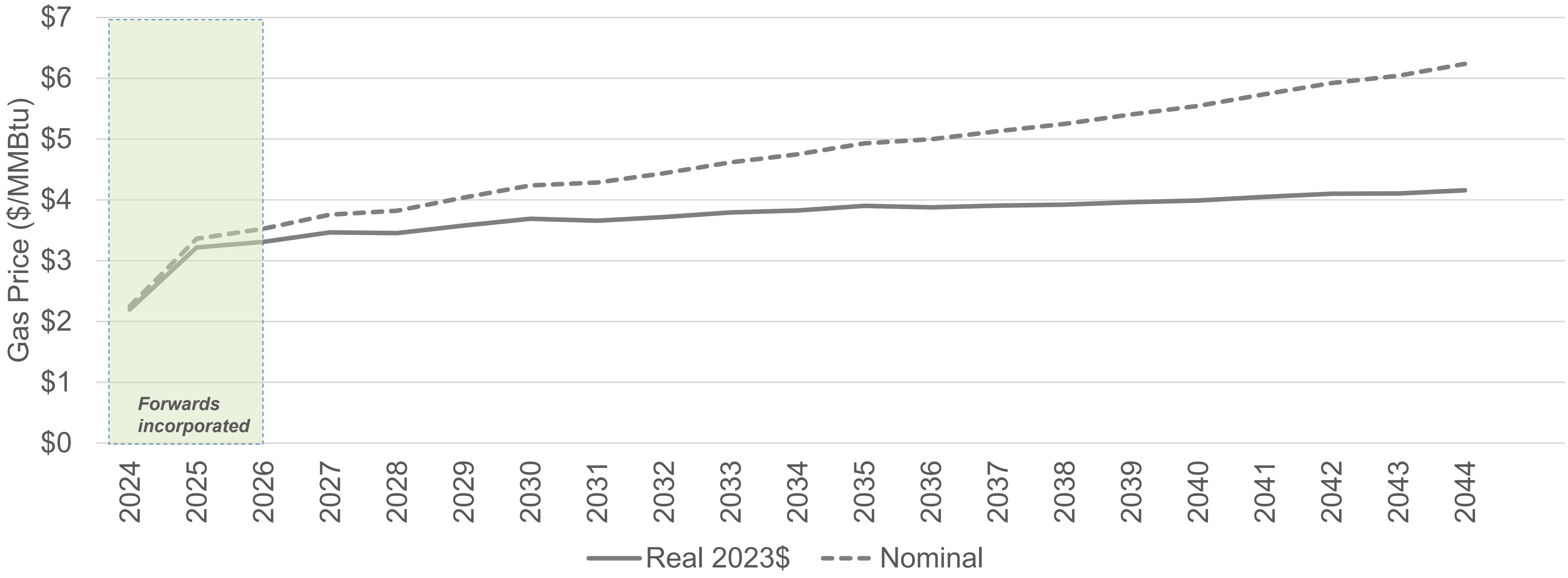
| Driver | CRA Approach | Explanation |
|---|---|---|
| **Resource Size** | • Rely on Potential Gas Committee ("PGC") "Most-Likely" unproven estimates | CRA assumes a starting point of PGC 2022 "Minimum" resource, and grows the resource base to achieve PGC 2022 "Most Likely" volumes by 2050 to reflect pace of incremental discoveries over time. |
| **Well Productivity** | • Initial Production ("IP") rates based on historic drilling data<br>• IP improves as per Energy Information Agency ("EIA") Tier 1 assumptions | CRA bases individual well productivity on historic data analyzed for each producing region; IP rates improve annually, consistent with EIA assumptions. |
| **Fixed & Variable Well Costs** | • Fixed and variable costs based on reported data<br>• Costs improve as per EIA assumptions | CRA starts from drilling and operating costs reported by major producers in each supply basin; cost improvements over time are based on latest EIA assumptions. |
| **Associated Gas Volumes** | • Natural gas from shale and tight oil plays enters the market as a price taker | CRA uses EIA's forecast of domestic oil prices and production; this includes the impact of oil production and environmental regulations associated with flaring. |

# KEY DRIVERS OF THE REFERENCE CASE

| Driver | CRA Approach | Explanation |
|---|---|---|
| **Domestic Demand** | • CRA electric power sector simulation<br>• Other sector natural gas demand synthesized from EIA | CRA expects natural gas domestic demand to be relatively stable to slightly declining under the Reference Case, with power sector declines driving the biggest long-term change. |
| **LNG Exports** | • Based on review of proposed projects<br>• General uptick in under-construction projects completed and total exports | CRA expects no further export capacity beyond projects which are already operating or which have already achieved Final Investment Decision and are under construction, due to increased competition from suppliers with lower production costs or located closer to demand centers. However, existing and new facilities also have the potential to operate at higher utilization rates over time. |
| **Pipeline Exports** | • EIA predictions for Net Imports | CRA expects modest growth in pipeline exports to Mexico as well as deceasing imports from Canada. |

# REFERENCE CASE NATURAL GAS PRICE OUTLOOK

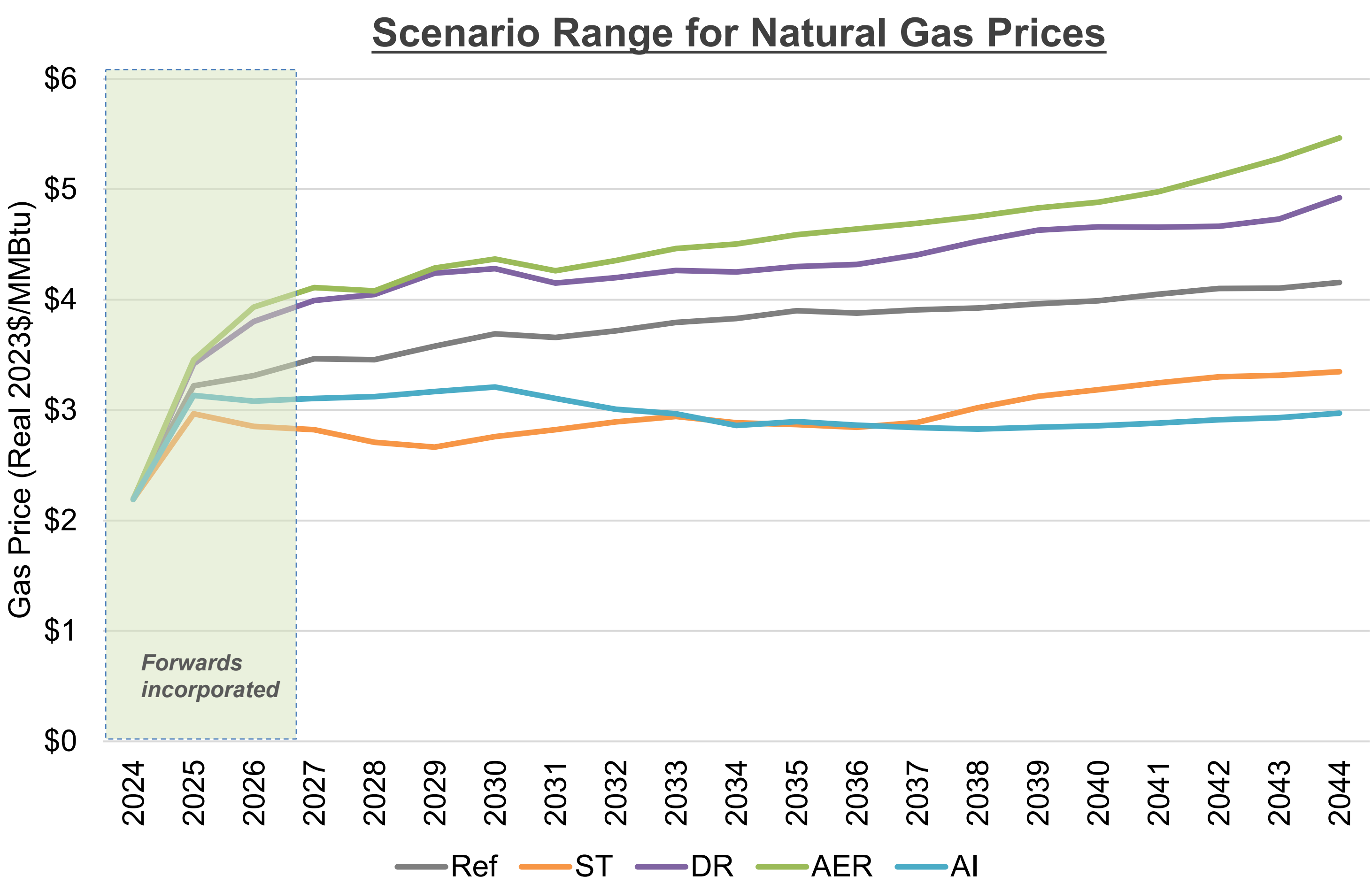
- Beyond the forward period, prices are projected to be in the $3.50-$4.00/MMBtu range (real 2023$) for most of the study period
- Demand is projected to increase gradually through ~2030, largely due to LNG export demand, putting upward pressure on prices
- Thereafter, flattening to slightly declining demand tends to stabilize prices as overall marginal production costs increase slightly



# NATURAL GAS PRICE SCENARIO PERSPECTIVES

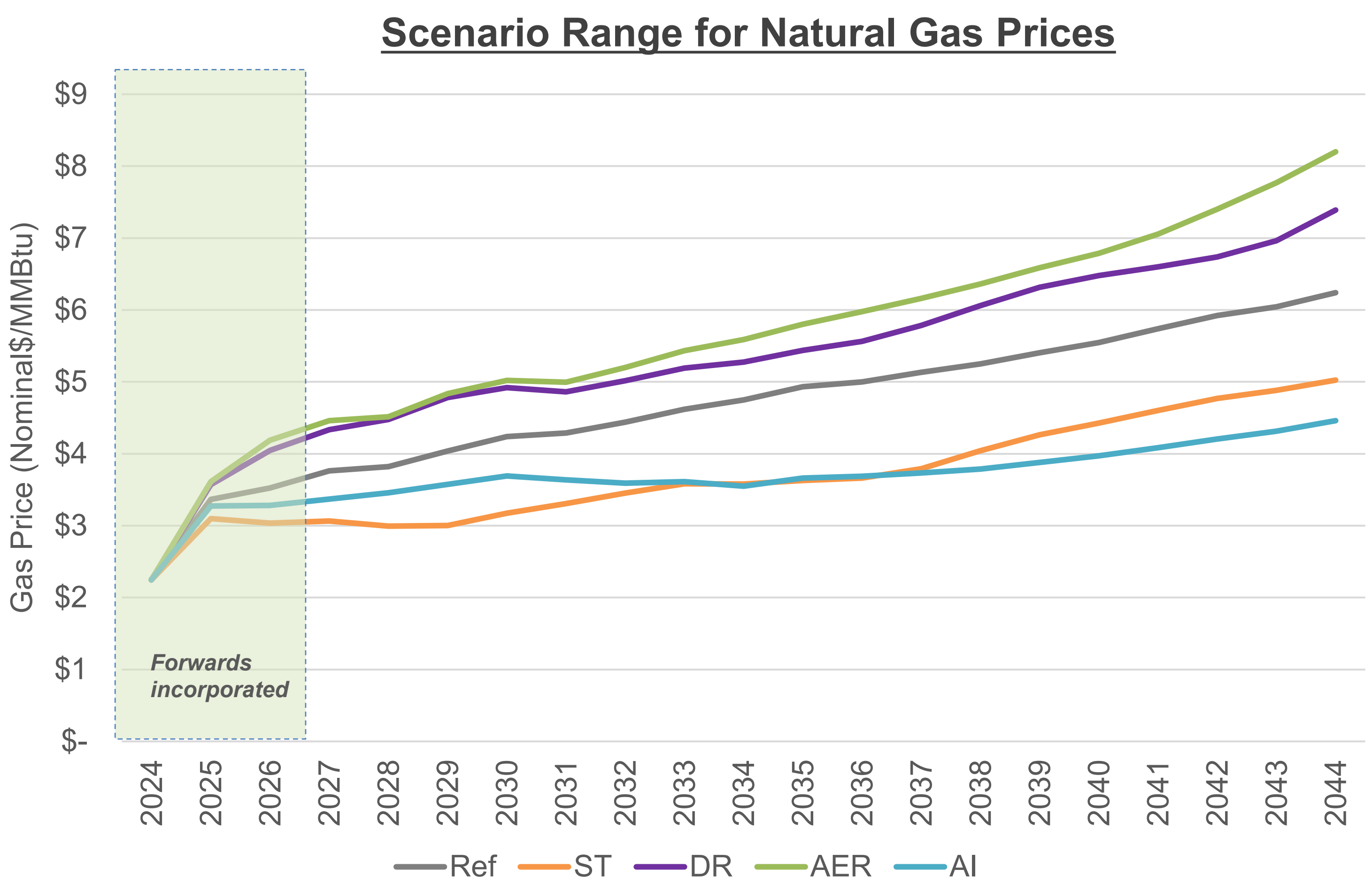
| Driver | Reference Case | ST | DR | AER | AI |
|---|---|---|---|---|---|
| **Resource Size** | • Rely on Potential Gas Committee (PGC) "Most-Likely" unproven estimates | ↑ | | ↓ | |
| **Well Productivity** | • IP rates based on historic drilling data<br>• IP improves as per EIA Tier 1 assumptions<br>• Resource base is "Poor Heavy" | ↑ | | | |
| **Fixed & Variable Well Costs** | • Fixed and variable costs based on reported data<br>• Costs improve as per EIA assumptions | | | ↑ | |
| **Demand** | • Electric demand taken from CRA national Reference Case, RCI demand based on AEO Reference Case | | ↑ | | ↓ |
| **Resulting Price** | — | ↓ | ↑ | ↑ | ↓ |

# NATURAL GAS PRICE SCENARIO RANGE




| | Henry Hub Price (in real 2023$/MMBtu) | | |
|---|---|---|---|
| | 2025 | 2035 | 2043 |
| AER | $3.46 | $4.59 | $5.28 |
| DR | $3.42 | $4.30 | $4.73 |
| REF | $3.22 | $3.90 | $4.11 |
| ST | $2.97 | $2.87 | $3.32 |
| AI | $3.13 | $2.90 | $2.93 |

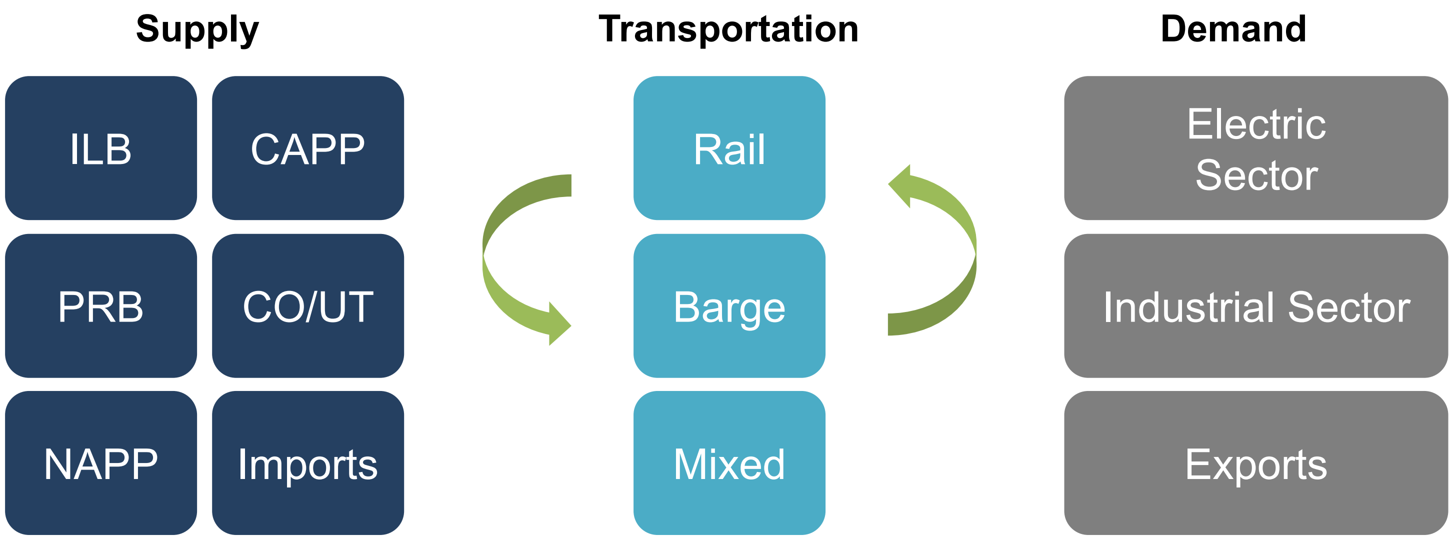
# NATURAL GAS PRICE SCENARIO RANGE




| | Henry Hub Price (in Nominal$/MMBtu) | | |
|---|---|---|---|
| | **2025** | **2035** | **2043** |
| **AER** | $3.61 | $5.80 | $7.77 |
| **DR** | $3.57 | $5.44 | $6.96 |
| **REF** | $3.36 | $4.93 | $6.04 |
| **ST** | $3.10 | $3.63 | $4.88 |
| **AI** | $3.27 | $3.66 | $4.31 |

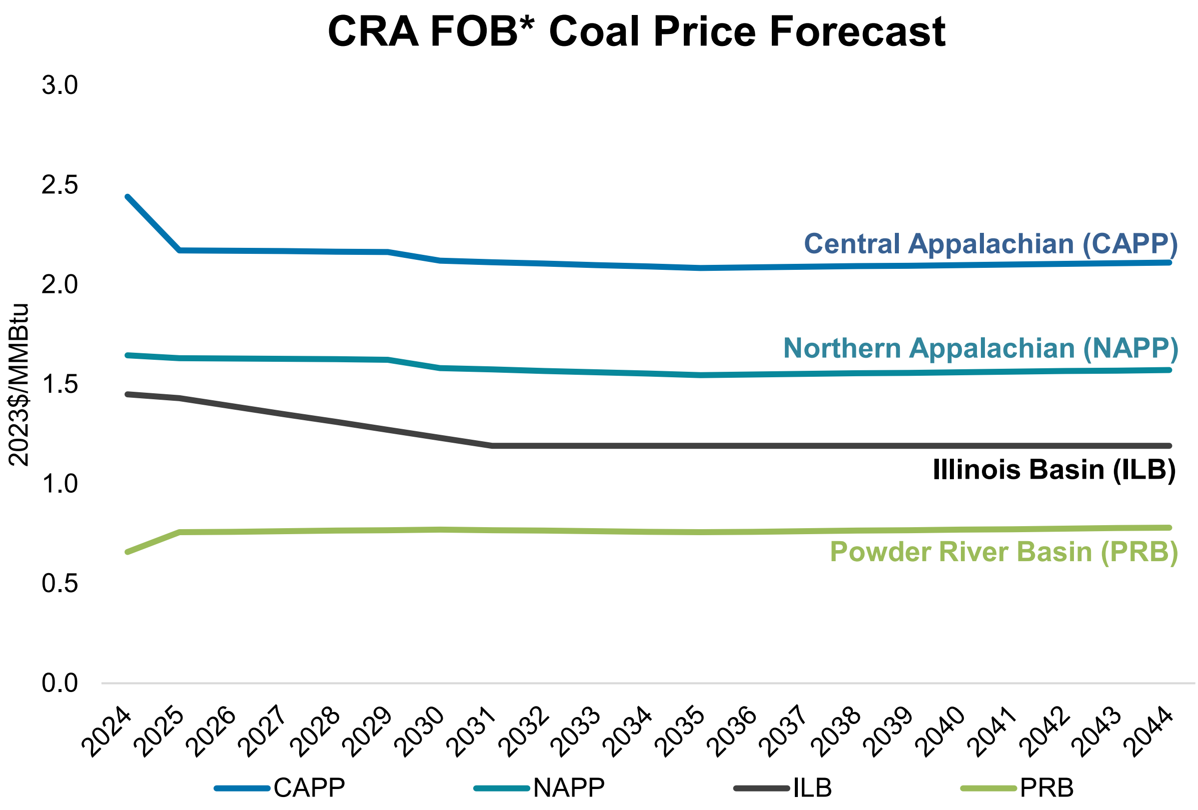
# COAL FORECASTING OVERVIEW

- CRA's process assesses future supply/demand balance for the U.S. coal market based on:
  - Macroeconomic drivers, including domestic and international demand
  - Microeconomic drivers, including trends in mining costs and production trends
- CRA iterates with the Aurora and NGF models to account for electric and gas market feedbacks



# COAL PRICE FORECAST

U.S. coal prices are expected to exhibit flat-to-declining trends over the long-term due to declining demand




*The Free on Board (FOB) price represents the value of coal at the coal mine and excludes transport and insurance costs*

- Spot prices for U.S. steam coal have continued to decline since last year
- Over the long-term, coal prices are expected to be flat to declining due to increasing renewable penetration and the consequent decline in domestic demand for coal.
- Demand for coal exports is also expected to stabilize over the long-term as international markets decarbonize.



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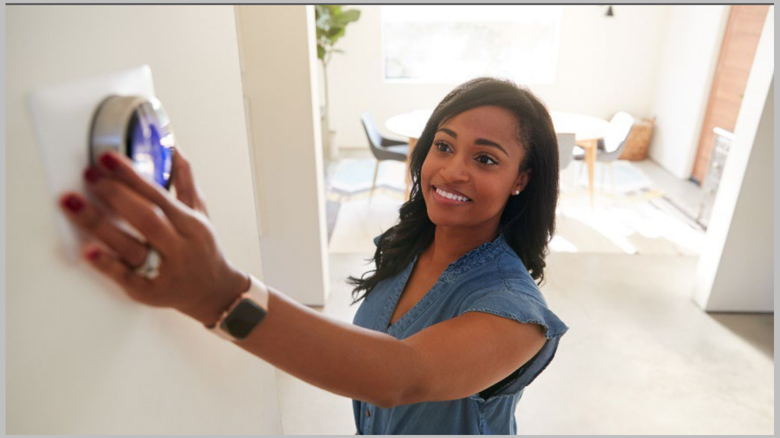
# SCENARIO ANALYSIS: ENVIRONMENTAL POLICY





# CURRENT ASSUMPTIONS REGARDING EPA GHG RULES

- On May 9, 2024, the EPA published final greenhouse gas standards and guidelines for fossil fuel-fired electric generating units. The proposed rule had been published on May 23, 2023, and was reviewed in the last meeting.
- EPA's final GHG Rule will not affect NIPSCO's existing generation, but is expected to impact existing steam generating units beginning in 2030
- As designed by the EPA, and assuming the final GHG Rule survives litigation, new gas generation would be required to meet certain emission limits based on capacity factor. NIPSCO is including the final rule in four of its five scenarios.
- Two of EPA's previous GHG regulations for power plants (i.e., the Clean Power Plan and Affordable Clean Energy Rule) were overturned

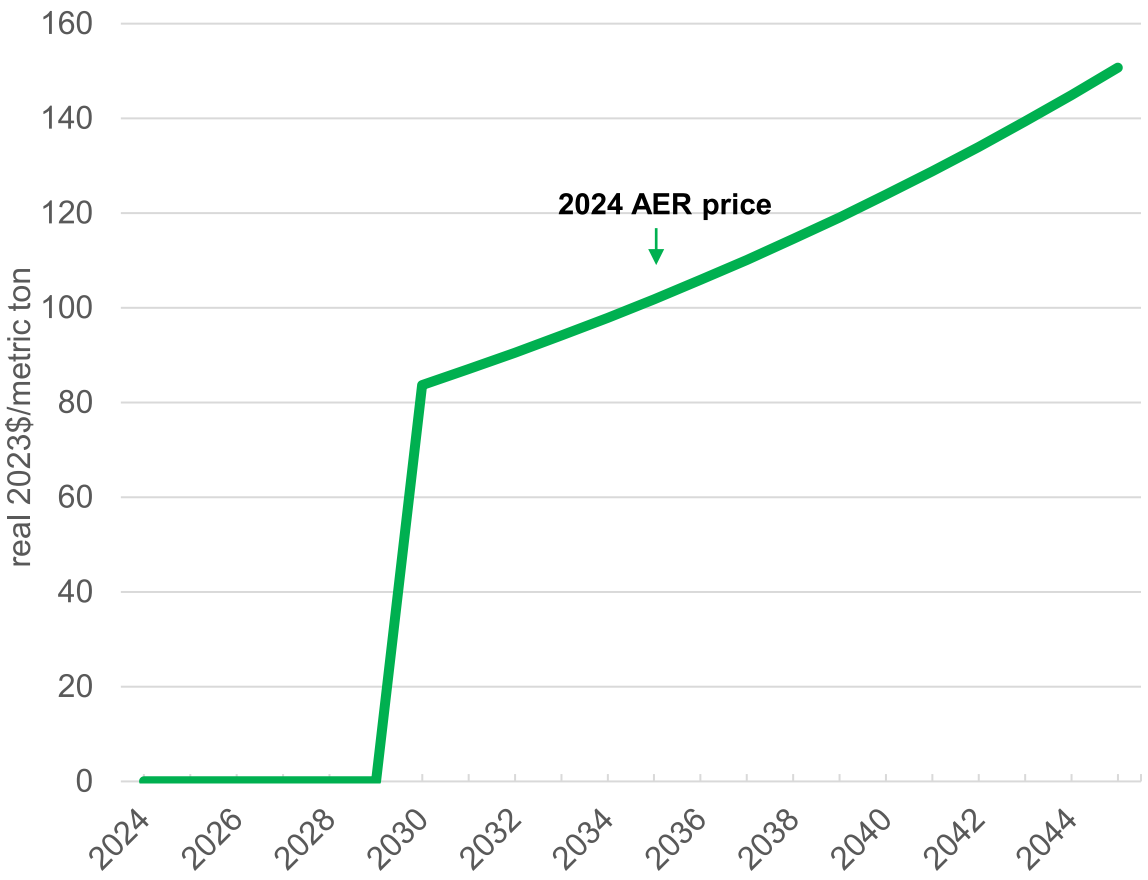
| NIPSCO Resources | Impact of GHG Rule |
|---|---|
| **Schahfer Units 17/18** | • No impact due to planned retirement by 2025. |
| **Michigan City Unit 12** | • No impact due to planned retirement by 2028. |
| **Sugar Creek and Schahfer 16A/B** | • No impact. The GHG Rule does not affect existing gas turbines. A separate rule may be issued in the future. |
| **Planned Schahfer Gas Peakers** | • See chart below for 'Low Load' and 'Intermediate Load' gas turbines. Emission limits are dependent on capacity factor. |

| New Stationary Combustion Turbines | Impact of GHG Rule |
|---|---|
| **Baseload**<br>Capacity Factor > 40% | • Timing of Impact<br>  • Upon Start-up<br>  • By 2032<br>• Limits (CO2/MWh)<br>  • By capacity factor range<br>• Methods of Compliance<br>  • Capacity factor limits<br>  • Best System of Emission Reduction (BSER)<br>  • Decarbonization options |
| **Intermediate Load**<br>Capacity Factor >20 <= 40% | |
| **Low Load**<br>Capacity Factor <= 20% | |

*https://www.epa.gov/*

# THE AGGRESSIVE ENVIRONMENTAL REGULATION (AER) SCENARIO ASSUMES CARBON EMISSIONS FROM THE POWER SECTOR ARE REGULATED MORE HEAVILY

- NIPSCO has applied a carbon price in previous IRPs
- In this IRP's AER scenario, NIPSCO is applying research from the Brookings Institute regarding implicit carbon prices required to meet global targets
- Carbon prices that limit warming to ~2˚C by 2100 provide a bookend for the impact from future potential climate policy
  - The AER carbon price starts at $83 per metric ton (real 2023$) in 2030 and increases at a constant rate of 4% annually
  - The cost trajectory represents a range of potential future environmental policy options that may impact the cost of emitting carbon, rather than an explicit carbon tax policy




*Source: Hansel et al, "Climate Policy Curves: Linking Policy Choices to Climate Outcomes," Brookings Institution, December 2022.*



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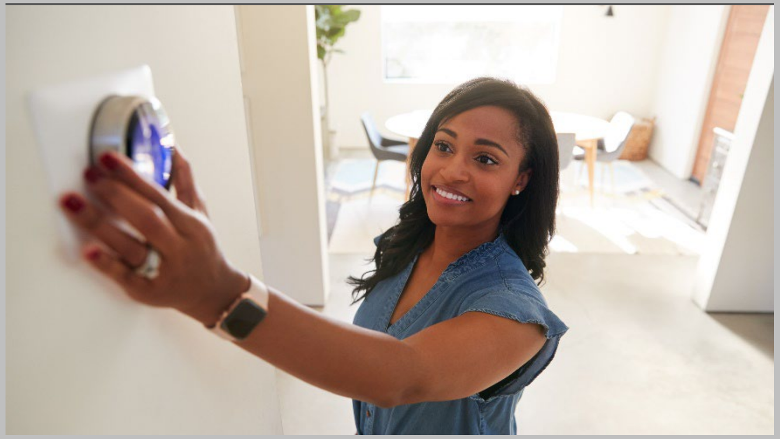
# SCENARIO ANALYSIS: MISO MARKET OUTCOMES







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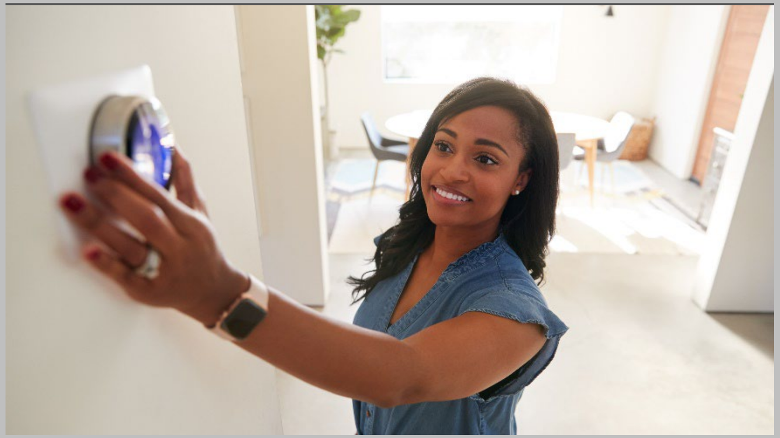
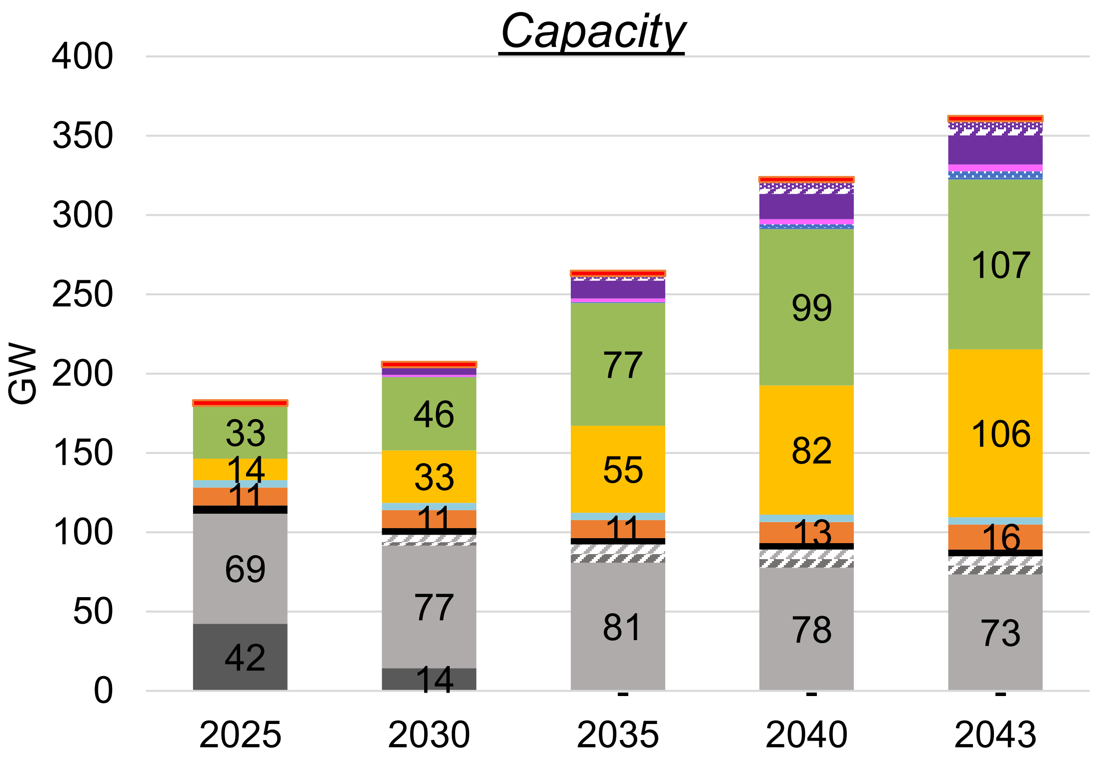
# MISO MARKET OUTCOMES – REFERENCE CASE

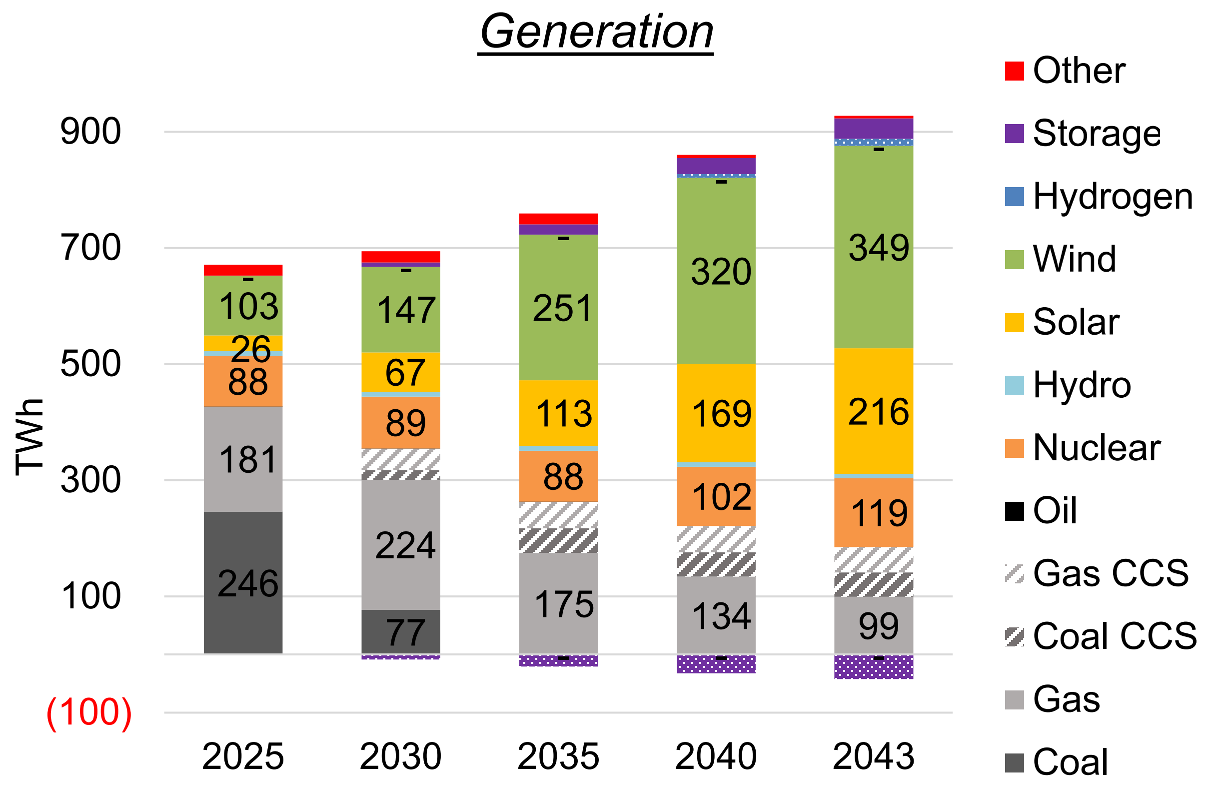




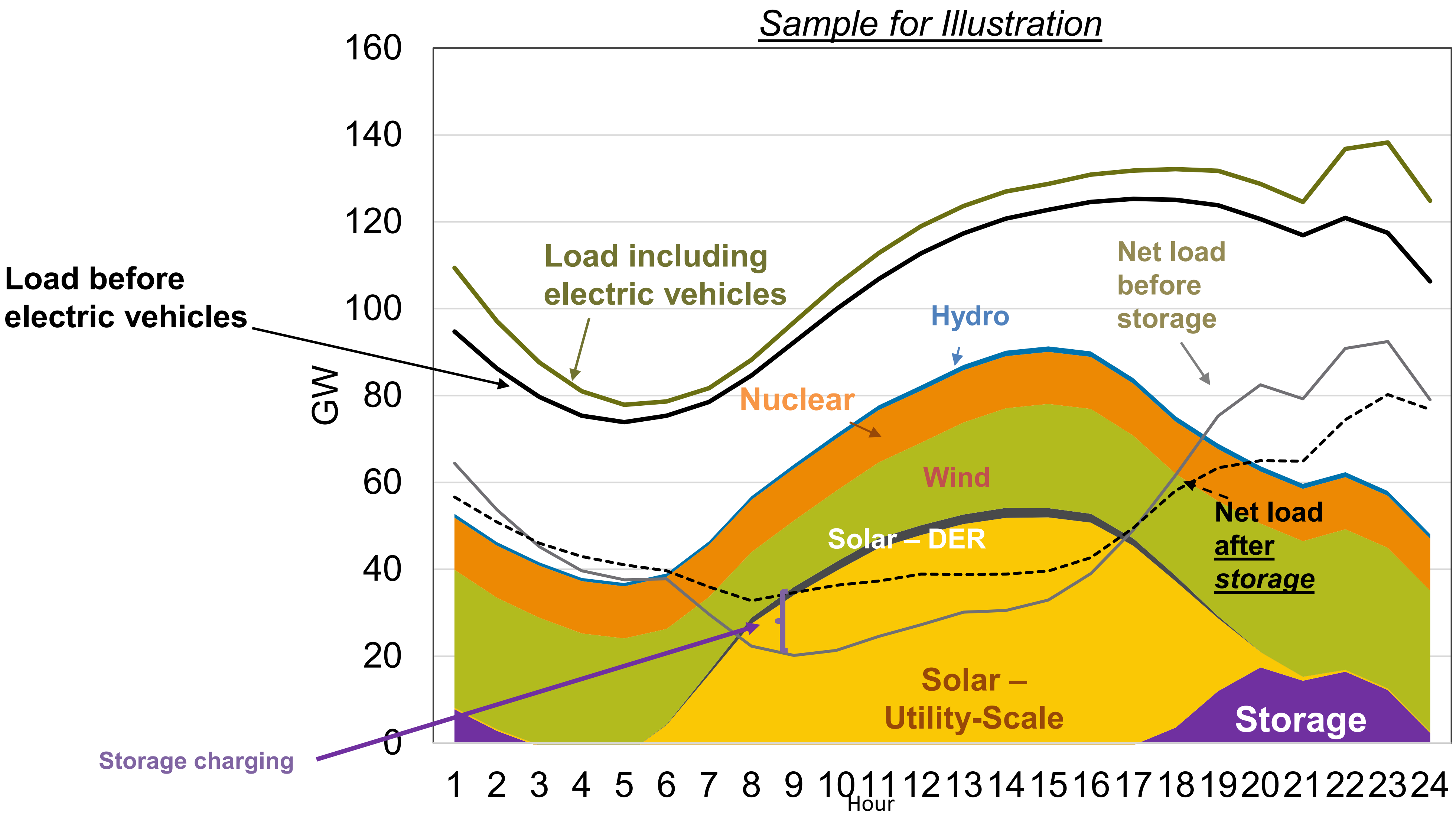
# MISO MARKET EVOLUTION – REFERENCE CASE

- EPA power sector emissions rules are expected to result in coal retirements or conversions and a diverse mix of new resources, including gas (with and without CCS), wind, solar, storage, hydrogen, and some new nuclear
- Wind and solar energy are projected to make up close to two-thirds of the energy across MISO by the mid-2040s



# HOURLY GENERATION MIX PERSPECTIVES




**Net load =**

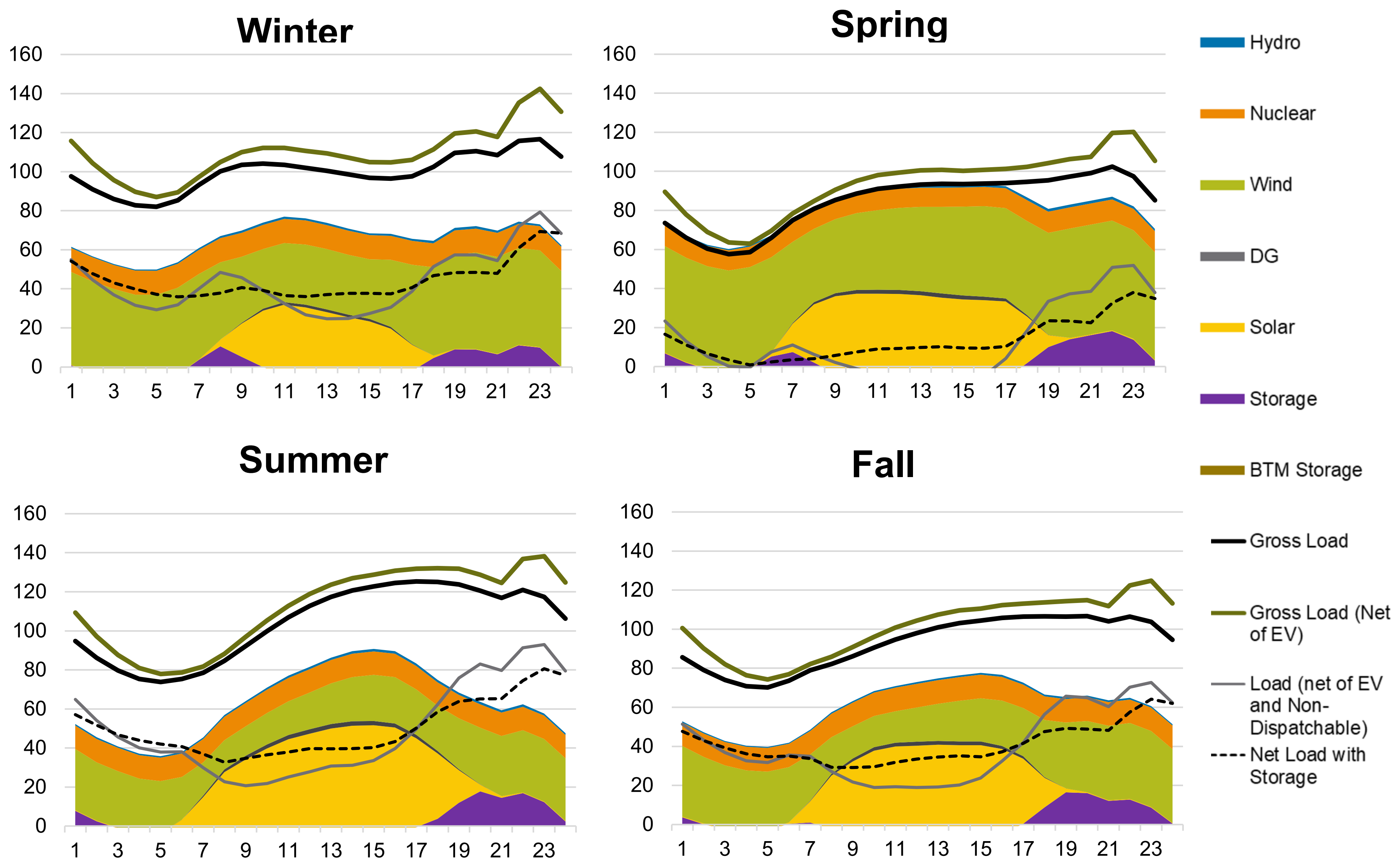
**Load (including EVs)**

***minus***

**Non-dispatchable generation (wind, solar, nuclear, hydro)**

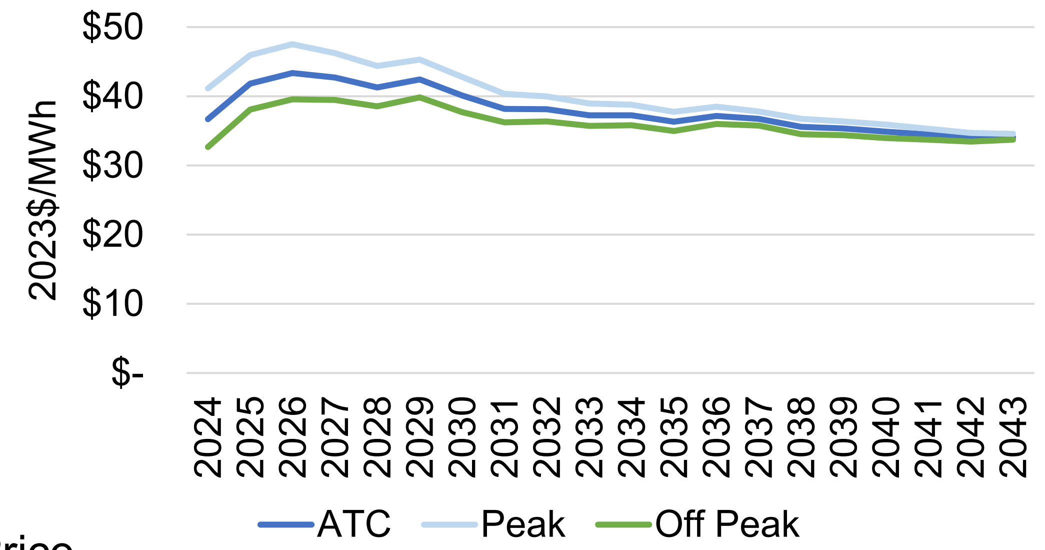
# MISO HOURLY ENERGY PROFILE – 2040 (REFERENCE SCENARIO)

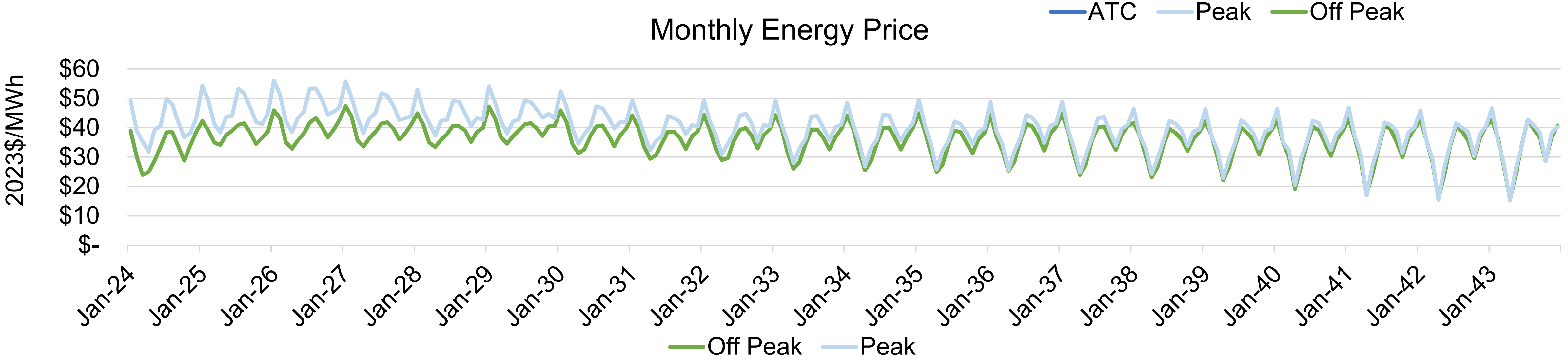
- Renewable penetration will impact resource dispatch and MISO hourly prices over time, with differences by season:
  - Combined with baseload nuclear output, mid-day hours in the spring may have more than sufficient generation output to meet demand
  - Summer evening peaks will require ramping support



# POWER PRICE FORECAST – MISO ZONE 6 (REFERENCE SCENARIO)

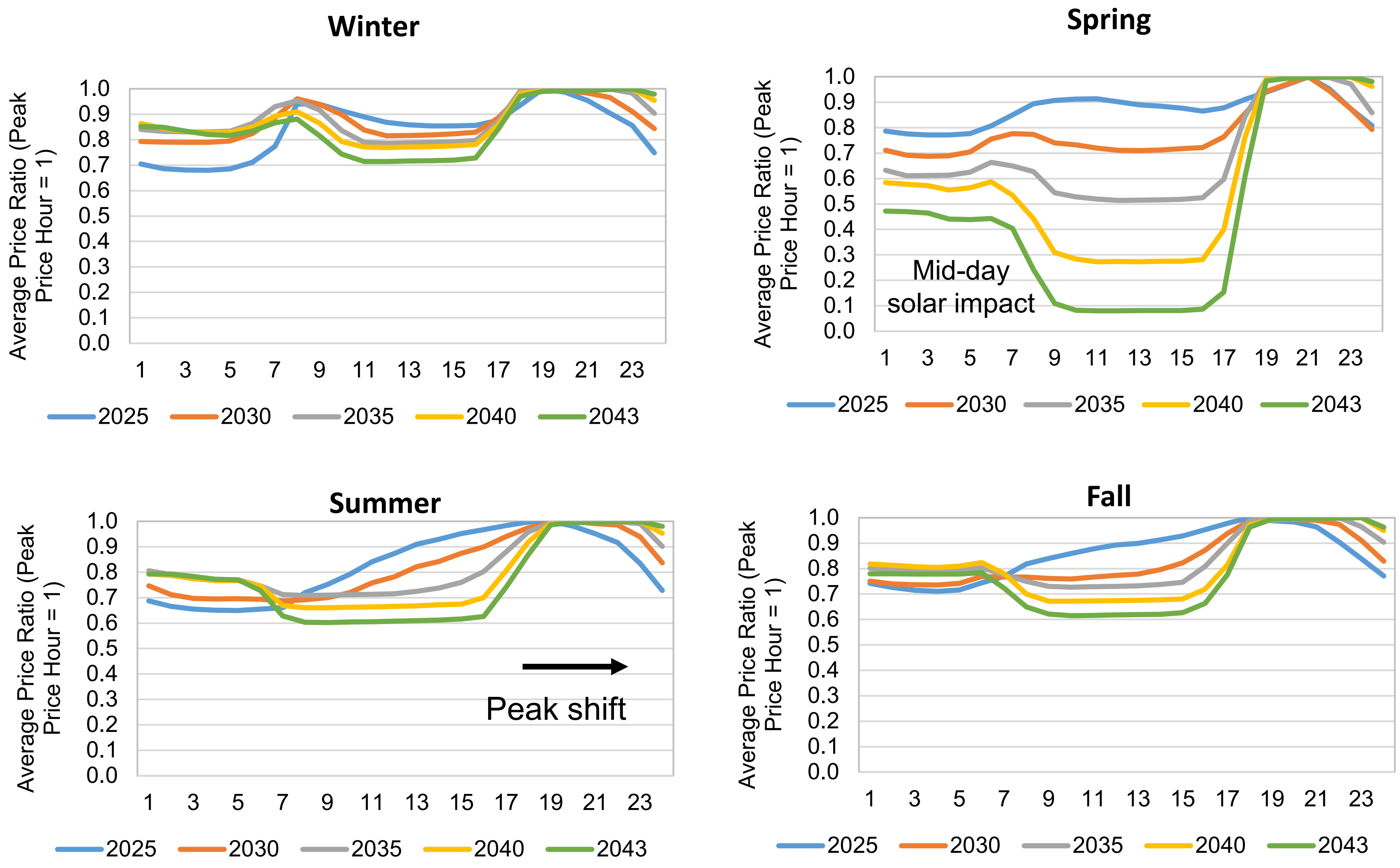
- Power prices are expected to stay relatively flat in real dollars in the near-term, due to expected trends in fuel prices
- Although capacity retirements and load growth may introduce upward pressure on prices, the influx of low variable cost energy is likely to mitigate this impact over time
- Convergence in peak and off-peak prices is expected over time, largely driven by solar penetration



# MISO ZONE 6 HOURLY PRICE SHAPES (REFERENCE SCENARIO)

- Hourly price patterns are expected to change over time, particularly as more renewables enter the system
- Mid-day prices are expected to decline as a result of solar output
- Summer peak price periods are expected to shift from mid-afternoon to evening





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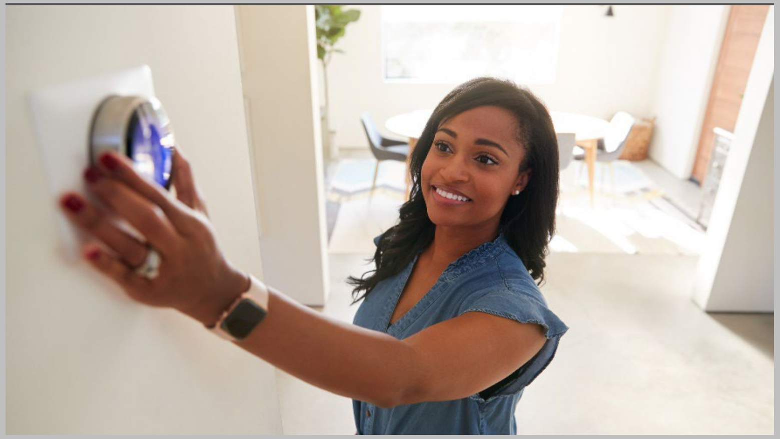
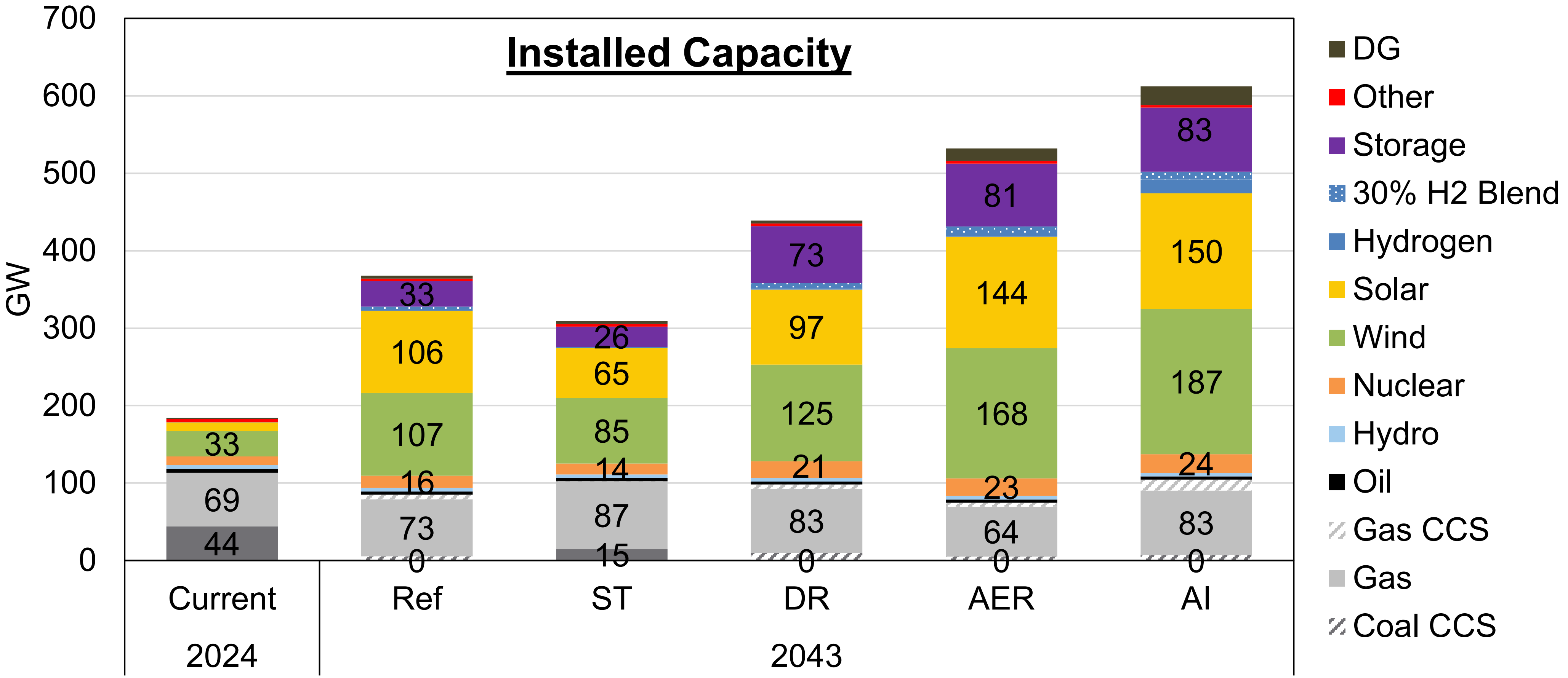
# SCENARIO ANALYSIS: ALTERNATIVE SCENARIOS





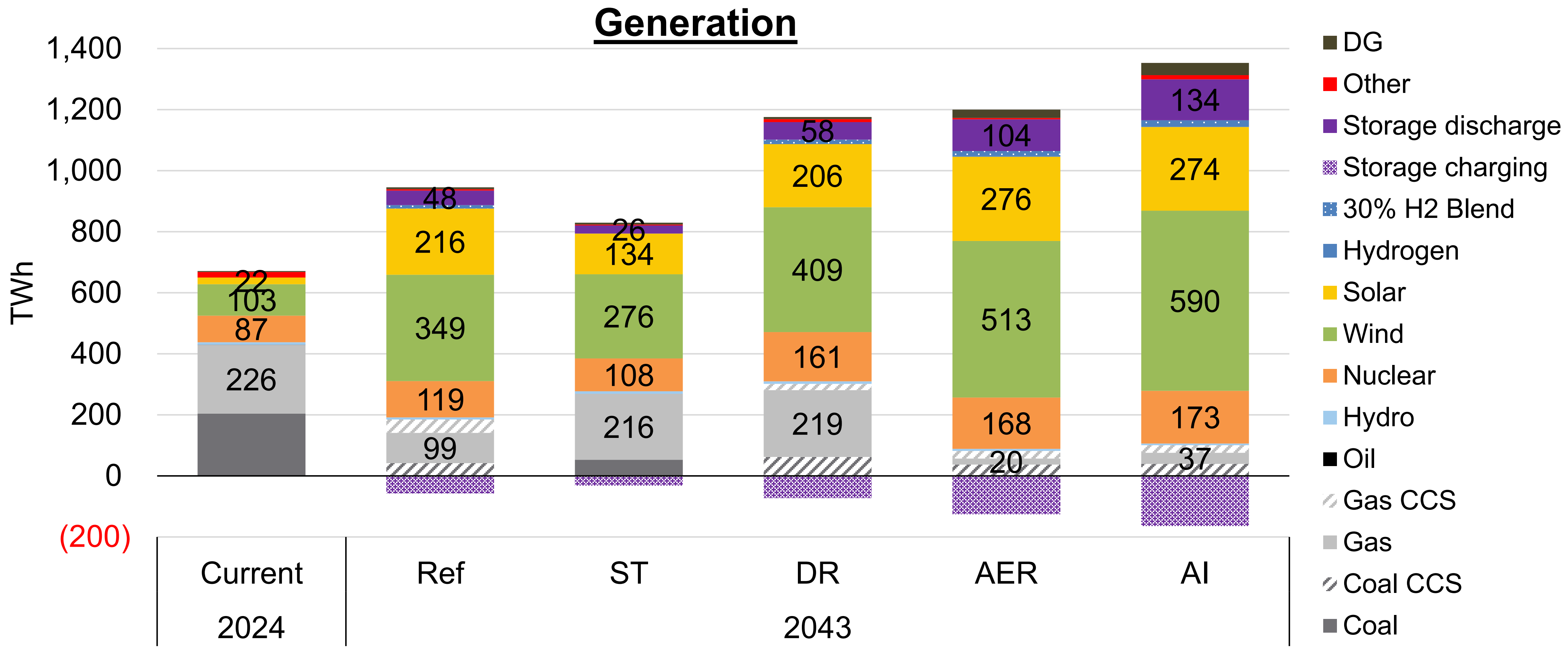
# MISO CAPACITY MIX ACROSS SCENARIOS

- A significant shift towards cleaner energy resources is expected across scenarios, although dispatchable capacity is required
- Load growth, carbon price, and fuel prices impact range of resource additions across scenarios



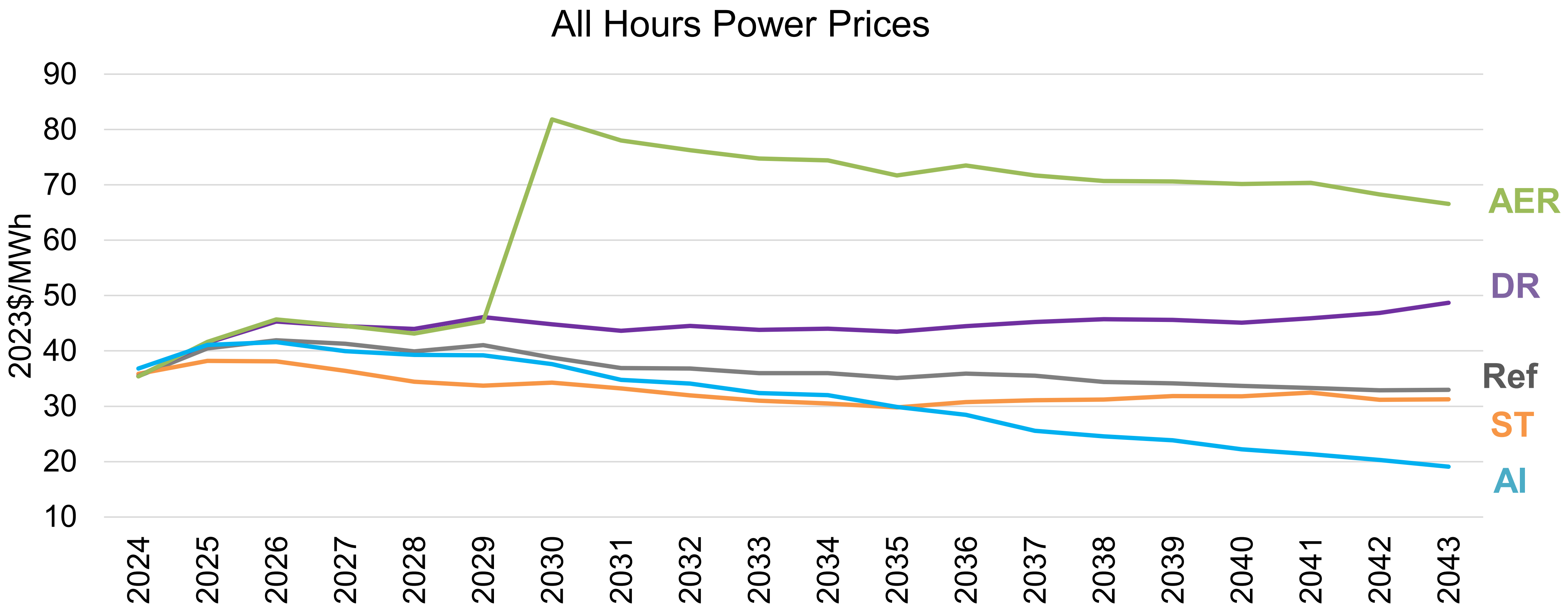
# MISO MIX PROJECTED TO SHIFT SIGNIFICANTLY TOWARDS CLEAN ENERGY

- Clean energy is expected to grow to 75% or higher of total MISO generation in all scenarios except for ST
- Gas generation maintains a larger role in ST and DR due to policy and load growth impacts, while emerging technologies like storage, CCS, and hydrogen have a role when load is high, policy drives CO2 emission reductions, and technology advances



# MISO ZONE 6 POWER PRICES

- Power prices are influenced by natural gas prices, carbon prices, load growth, and the regional supply mix



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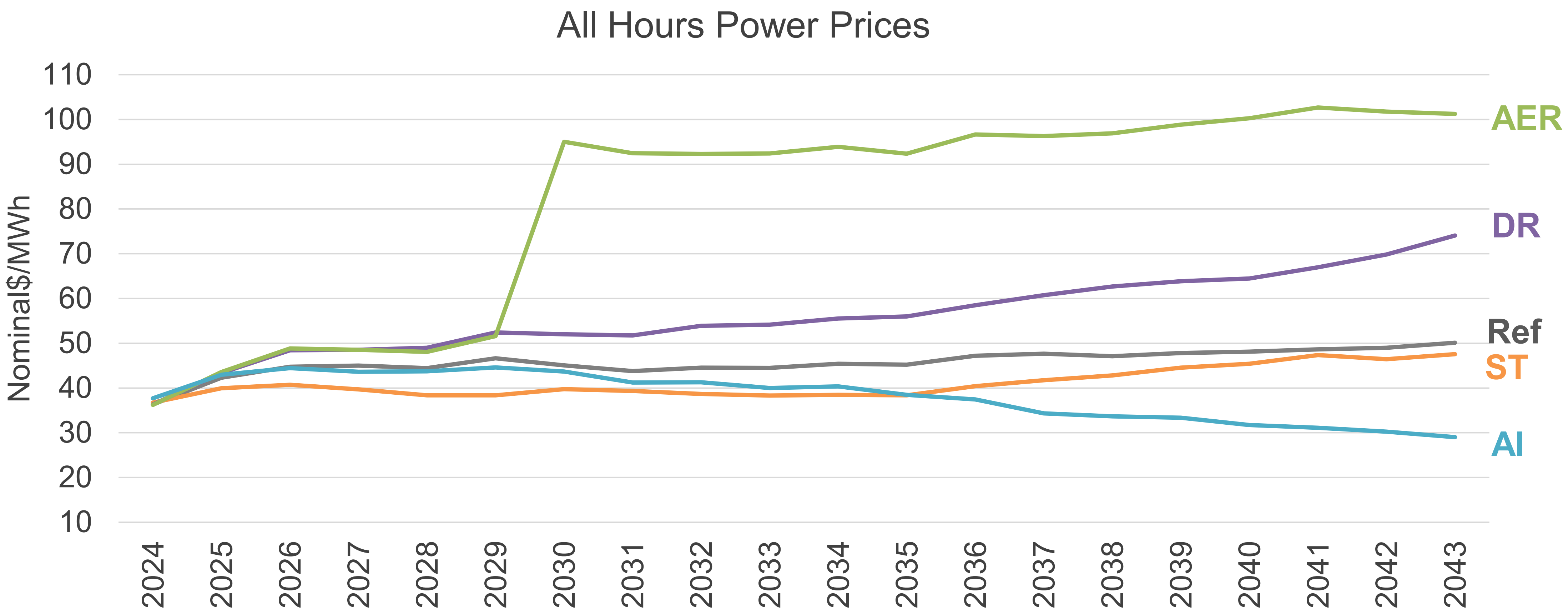
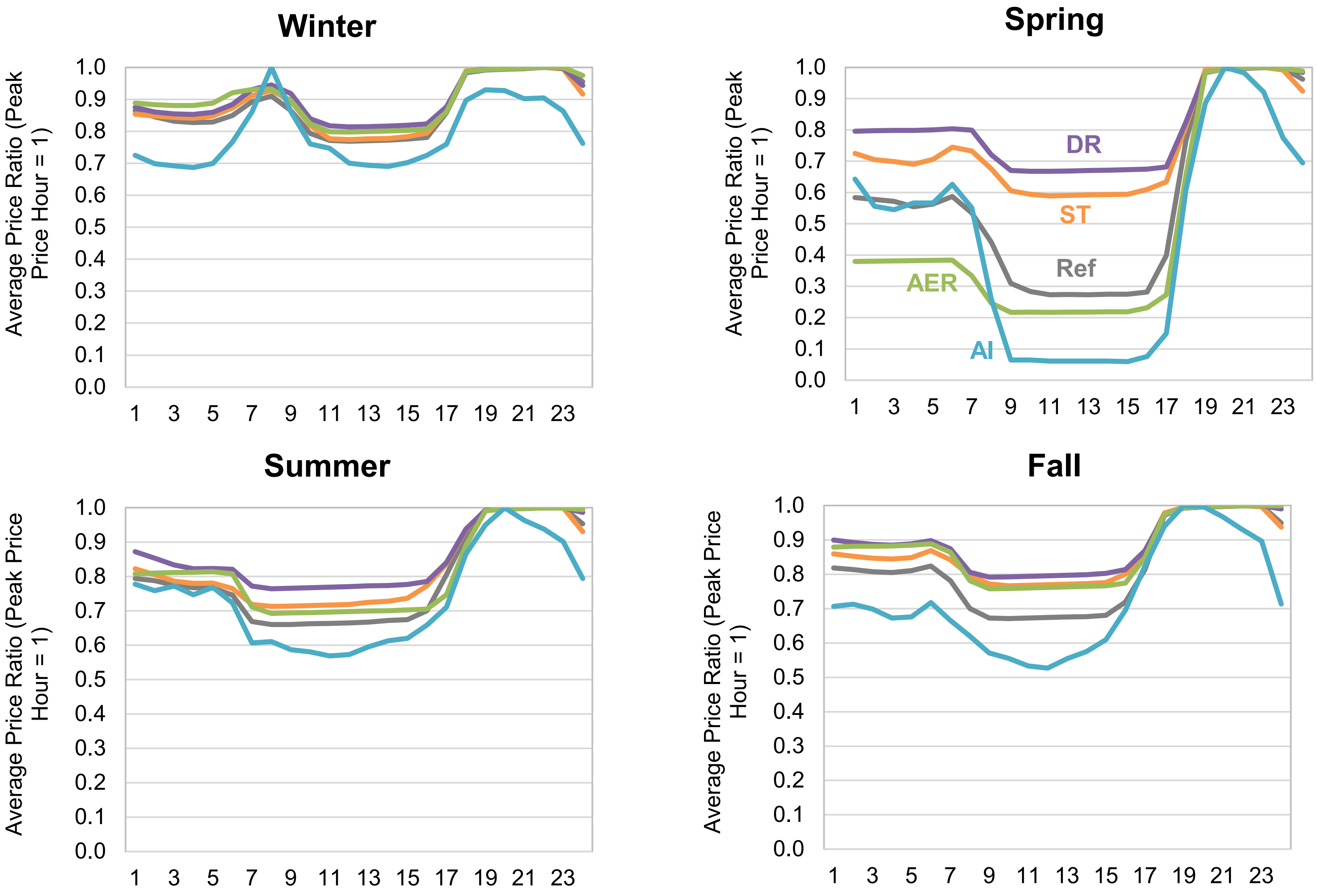


# MISO ZONE 6 HOURLY PRICE SHAPES (2040)

- Hourly price patterns are expected to vary across scenarios, particularly as more renewables enter the system due to different gas price forecasts, policy decisions, load requirements and technology costs
  - AI exhibits the most price variance with mid-day solar-driven drops and evening and early morning spikes, particularly in the winter
  - DR and ST retain more typical seasonal price trends due to natural gas units being more frequently on the margin





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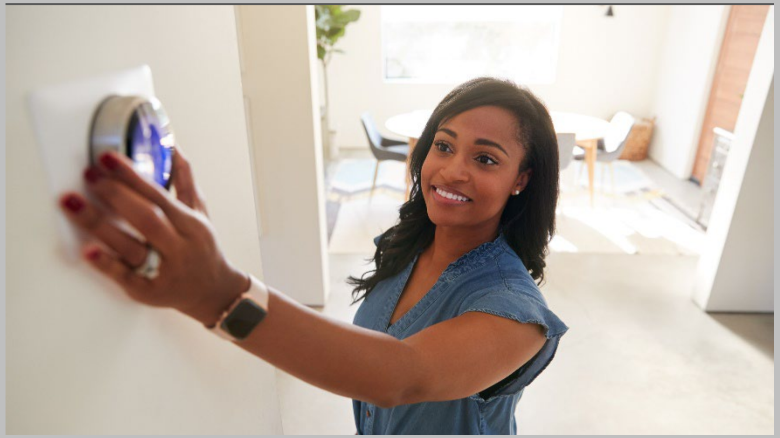
# STOCHASTIC ANALYSIS REVIEW: INPUTS

Pat Augustine, Vice President, CRA

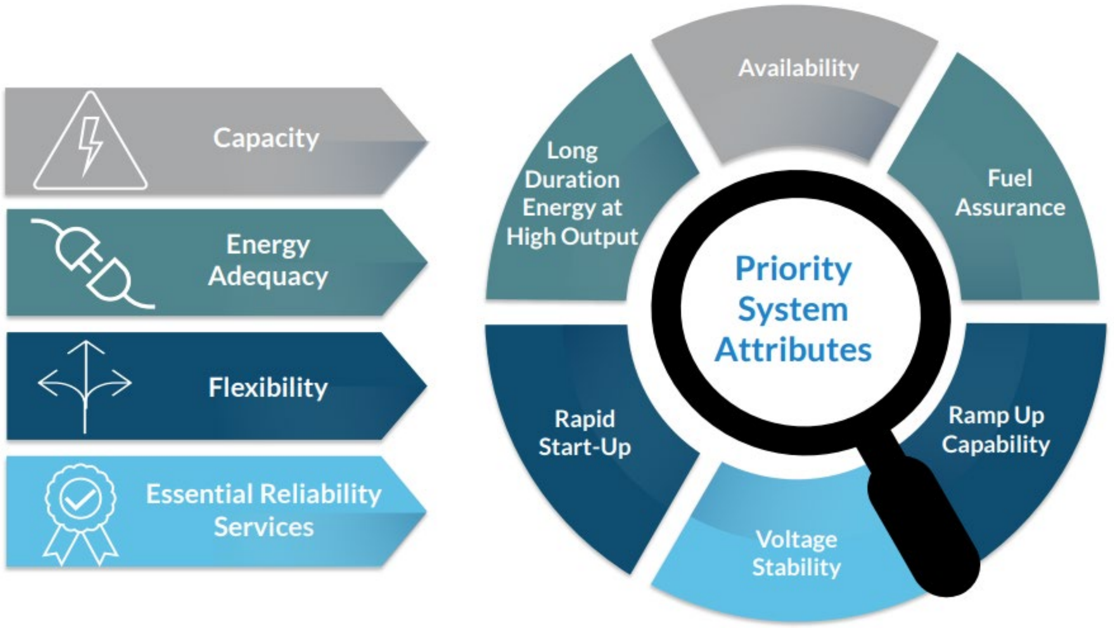




# BACKGROUND CONTEXT

- **To achieve a reliable grid, planners need to address multiple risks, including:**
  - Resource adequacy
  - Operational flexibility
  - Forecasting errors
- **Measuring Reliability and Resilience**
  - There is no single all-encompassing metric, but rather a suite of metrics that may be used to assess the reliability and resilience of a portfolio
- **Uncertainty**
  - All forecasting and planning is highly dependent on the characterization of uncertainty
  - It is important to assess key metrics across a range of possible outcomes

Based on insights, MISO proposes six reliability attributes as initial priorities



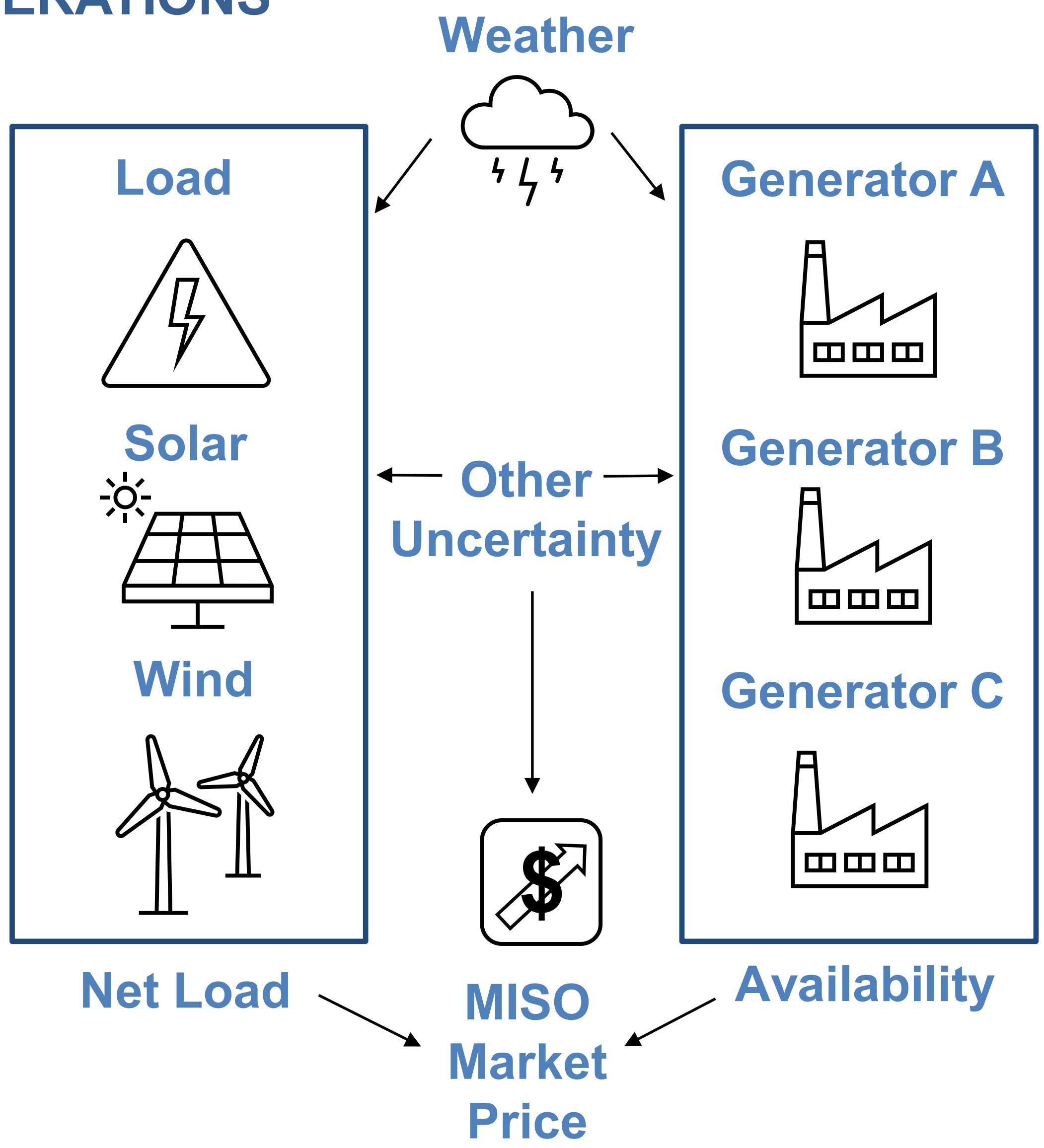

*Source:*
https://cdn.misoenergy.org/20221012%20RASC%20Item%2008b%20System%20Attribute%20Overview%20Presentation626543.pdf

# MOTIVATION FOR EXPANDED STOCHASTIC RELIABILITY ASSESSMENT

- As NIPSCO's portfolio and the wider MISO market add more variable, intermittent renewable resources, system reliability planning will continue to evolve from single peak load assessments towards a more granular review of operating reliability
- MISO (and *not* NIPSCO) is ultimately responsible for setting planning reserve margin targets and capacity accreditation values and balancing the system in real time, but an understanding of emerging NIPSCO portfolio risk exposure can help ensure NIPSCO develops the best portfolio for customers:
  - Provide quantitative support for key emerging reliability metrics
  - Anticipate MISO rules changes that may impact future resource capacity accreditation and/or result in new markets for flexible capacity by assessing how well different portfolio options mitigate market exposure
- Electrification and customer behavior changes may impact typical load shapes and introduce different risk than has been observed only with historical data
  - EVs and behind-the-meter solar will substantially change the net load shape
  - New data center loads or electrification of heating will increase seasonal and hourly demand shapes

# PROBABILISTIC RELIABILITY ANALYSIS CONSIDERATIONS

- Stakeholder feedback from the 2021 IRP and ongoing reliability analysis activities at MISO have influenced NIPSCO's decision to make **enhancements to its stochastic analysis process for the 2024 IRP, focused on economic *and* reliability metrics**
- In addition to key economic metrics associated with cost to customer, NIPSCO's reliability analysis will assess how often NIPSCO *must* rely on external resources to meet load requirements
- Key enhancements to the process will tie net load (system load and wind and solar output) and generator availability back to weather to **capture correlated events**
- Measures of the frequency and duration of forced market exposure, along with economic impacts, will be evaluated across portfolios



# STOCHASTIC ANALYSIS APPROACH

1. **Evaluate historical data and employ machine learning to generate a large number of potential "iterations"**

**Correlated inputs**

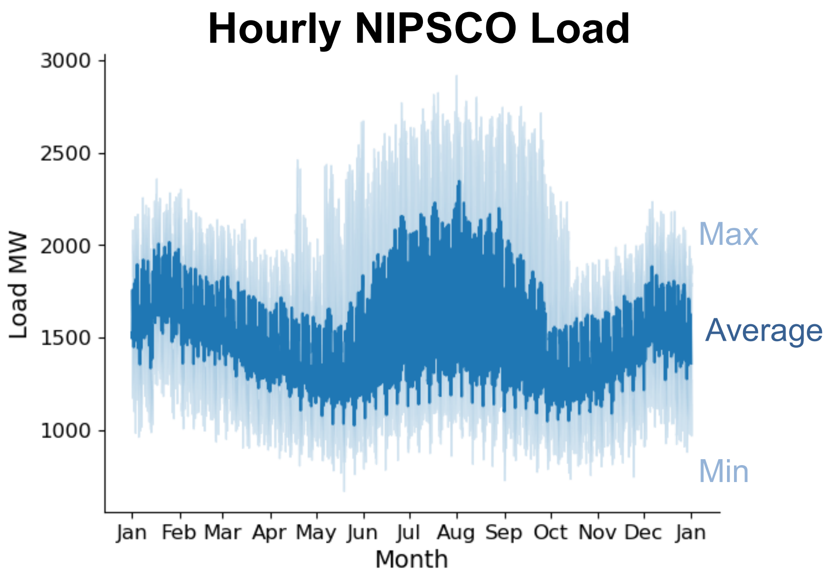
- Wind and solar output
- Energy demand - adjust for possible load futures
- Thermal unit outages
- Integration of commodity price stochastic uncertainty and market pricing data (gas prices and MISO power prices based on fundamental Aurora runs and historical time series analysis)

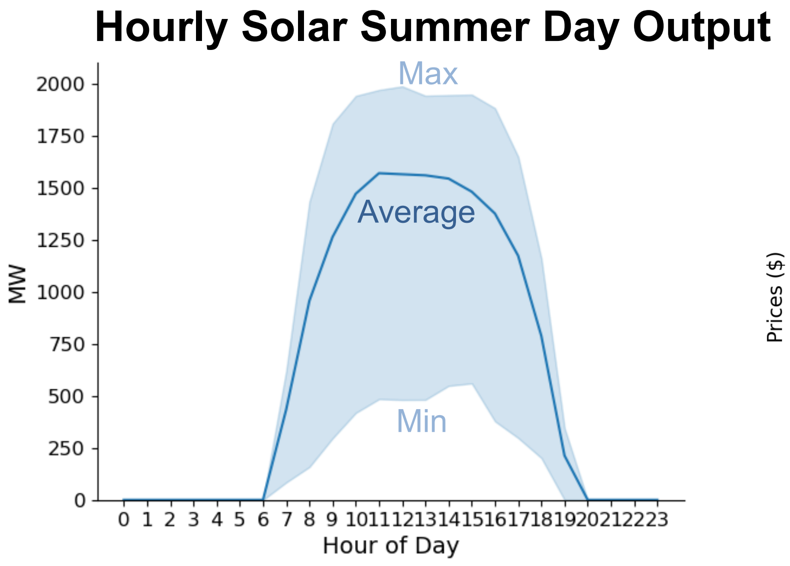
2. **Evaluate performance of candidate portfolios against distributions**

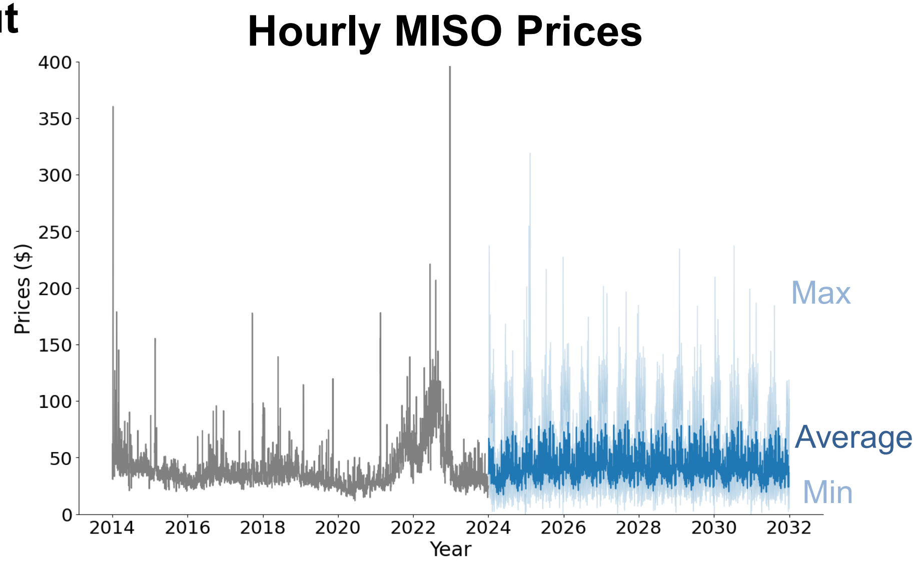
3. **Record key output metrics for the scorecard**

# EXAMPLE INPUT DISTRIBUTIONS

- Historical hourly loads, temperature, wind speed, solar irradiance, and market prices are evaluated
- Stochastic and regression models are developed and deployed to propagate forward distributions, respecting key market correlations, such as:
  - Temperature and other weather conditions with load, renewable output, thermal availability
  - Natural gas and power prices
  - Renewable output and power prices based on fundamental forward scenario simulations
- <u>Example distribution summaries (fuller documentation in appendix):</u>



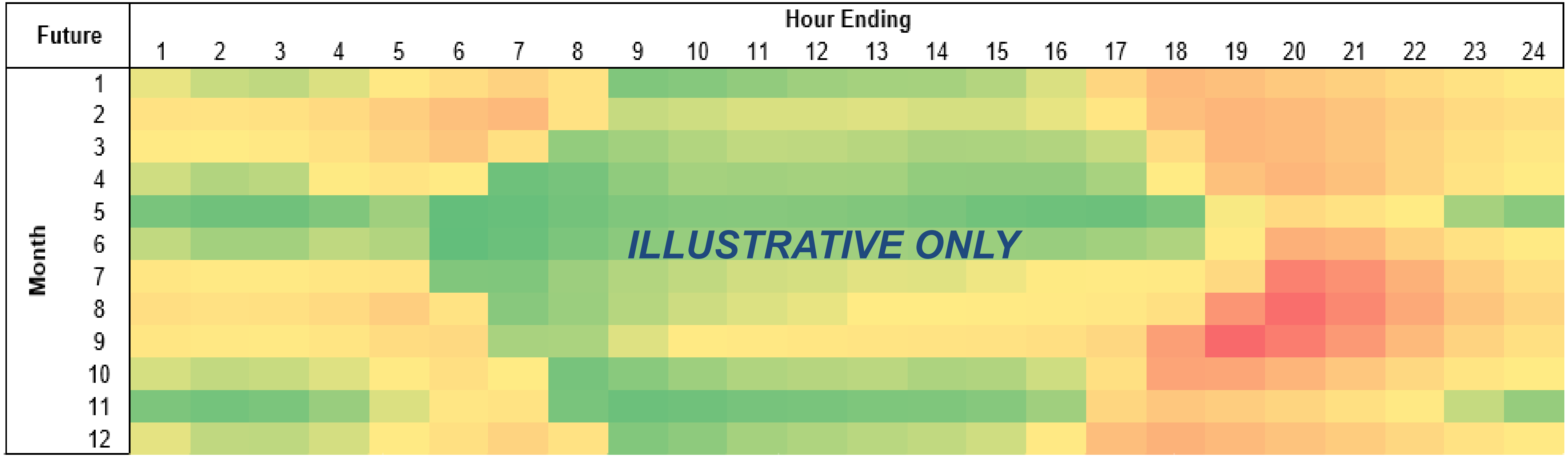
# POTENTIAL SCORECARD METRICS FROM STOCHASTIC ANALYSIS

- "Forced Market Exposure": A measurement of required exposure to the market due to insufficient available capacity in the NIPSCO system to meet load
- Cost Risk: 95th percentile of portfolio cost exposure across the distribution of outcomes
- Note that other metrics associated with Net Load requirements or other ramping needs will be available through the analysis

| | Reliability and Flexibility | Cost Risk |
|---|---|---|
| | Forced Market Exposure | 95th Percentile Cost Risk OR *Value at Risk* |
| *Year Ref.* | *2030* | *2030* |
| *Units* | *MWh* | *$* |
| Portfolio 1 | | |
| Portfolio 2 | | |
| Portfolio 3 | | |
| Portfolio 4 | | |

# VISUAL RISK SUMMARIES CAN ASSESS TIMING OF RISKS VS. BROADER MISO DATA

- Periods of forced market exposure can be visualized by time of year and time of day, with hours shaded green having less exposure to the market and hours shaded in red having the most significant exposure to the market



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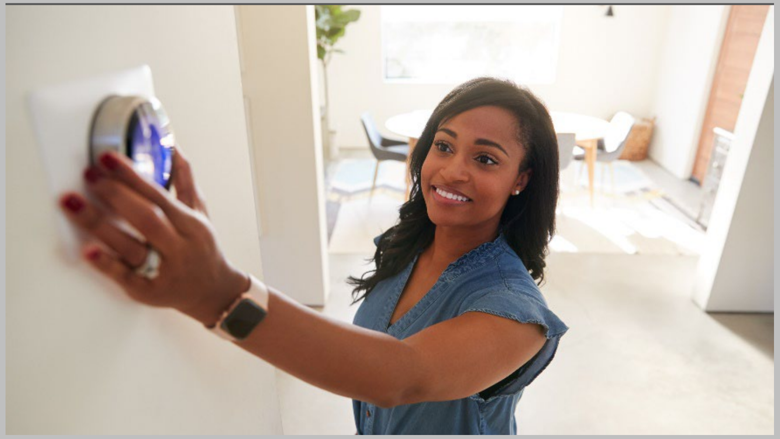
## BREAK



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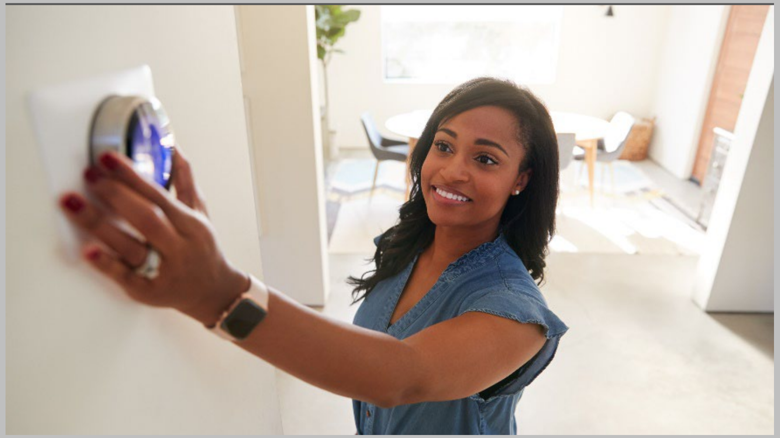
# PRELIMINARY RFP RESULTS REVIEW



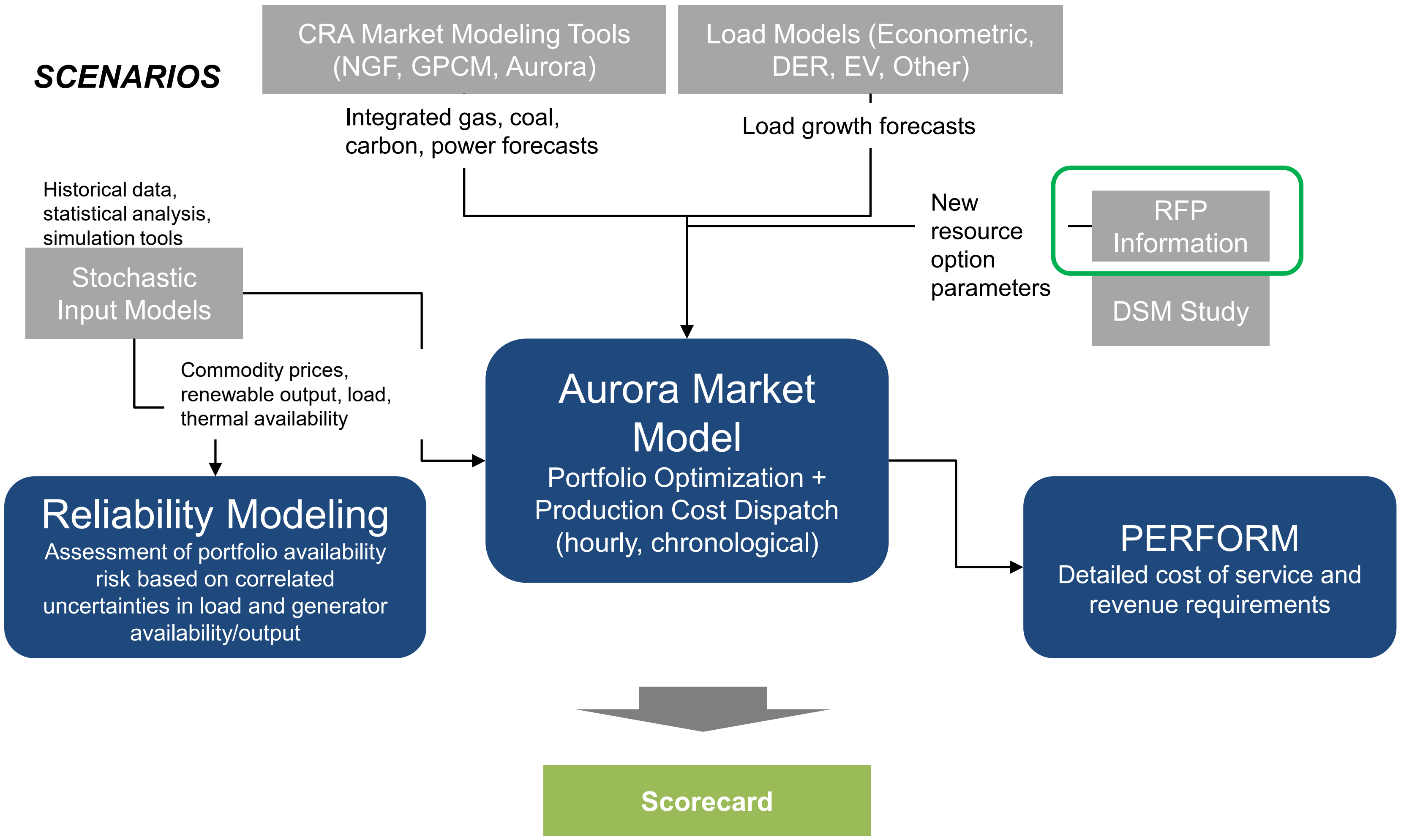

Patrick d’Entremont, Manager Planning Commercial Support - NIPSCO

Bob Lee, Vice President, CRA




# RESOURCE PLANNING APPROACH

***Key Modeling and Analysis Tools***




1. **Identify key planning questions and approach**
2. **Develop market perspectives (external scenarios)**
3. **Develop integrated resource strategies (NIPSCO portfolios)**
4. **Portfolio modeling and analysis**
   - **Detailed scenario dispatch**
   - **Stochastic simulations**
5. **Evaluate trade-offs and select preferred plan**

# RFP – PRELIMINARY UPDATE – PLACEHOLDER

- *This slide is a placeholder for the preliminary RFP results*
- *The preliminary results from RFPs 1-3 were received on June 7th and will be published in an updated copy of this presentation on June 24th prior to the start of the IRP Stakeholder meeting*
- *All RFP results will be analyzed further during the remainder of the IRP process*

| Element | RFP1 – Intermittent | RFP2 – Dispatchable | RFP3 – Bridge Resource | RFP4 – DER |
|---|---|---|---|---|
| Issue RFP | May 1, 2024 | May 1, 2024 | May 1, 2024 | May 1, 2024 |
| Bidder Information Session | May 6, 2024 | May 6, 2024 | May 6, 2024 | May 6, 2024 |
| Pre-Qualification Deadline | May 15, 2024 | May 15, 2024 | May 15, 2024 | May 15, 2024 |
| Notification of Pre-Qualification | May 20, 2024 | May 20, 2024 | May 20, 2024 | May 20, 2024 |
| Proposals Due | June 7, 2024 | June 7, 2024 | June 7, 2024 | June 20, 2024 |



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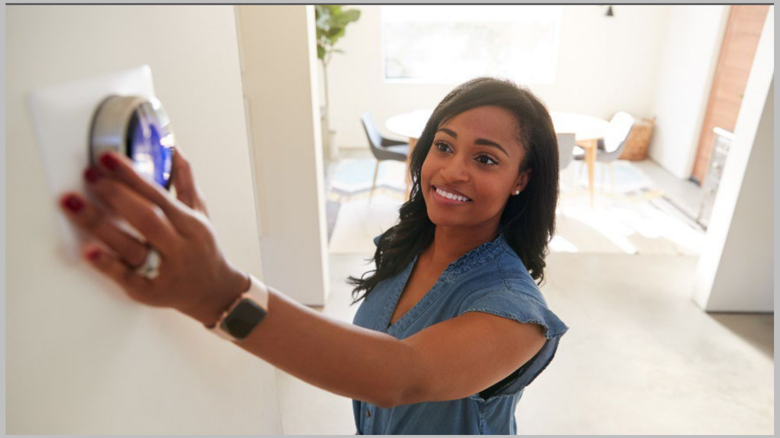

## CLOSING



# 2024 STAKEHOLDER ADVISORY MEETING ROADMAP

| Meeting | Meeting 1<br>April 23 | Meeting 2<br>June 24 | Meeting 3<br>August 21 | Meeting 4<br>September 19 | Meeting 5<br>October 8 |
|---|---|---|---|---|---|
| **Location** | **Fair Oaks Farms,**<br>865 N 600 E, Fair Oaks, IN 47943 | **Fair Oaks Farms**<br>865 N 600 E, Fair Oaks, IN 47943 | **Fair Oaks Farms,** 865 N 600 E, Fair Oaks, IN 47943 | **Fair Oaks Farms,** 865 N 600 E, Fair Oaks, IN 47943 | **Fair Oaks Farms,** 865 N 600 E, Fair Oaks, IN 47943 |
| **Content** | • 2021 Short Term Action Plan Update (Retirements, Replacement projects)<br>• Resource Planning and 2024 Continuous Improvements<br>• 2024 Public Advisory Process<br>• 2024 Policy Update (incl. IRA and EPA)<br>• Update on Key Inputs/Assumptions (core demand forecast, new considerations for demand)<br>• Scenario Themes – Introduction<br>• RFP Overview | • MISO Regulatory Developments and Initiatives<br>• Load scenarios<br>• Update on Key Inputs/Assumptions (commodity prices)<br>• Scenarios and Stochastic Analysis<br>• Preliminary RFP Results | • DSM Modeling and Methodology<br>• DER Inputs | • Modeling Results, Scorecard<br>• DER and Storage Modeling Results, Scorecard | • Preferred replacement path and logic relative to alternatives<br>• 2024 NIPSCO Short Term Action Plan |
| **Meeting Goals** | • Communicate what has changed since the 2021 IRP (incl. IRA changes)<br>• Communicate environmental policy considerations<br>• Communicate updates to key inputs/assumptions<br>• Provide RFP Overview<br>• Communicate the 2024 public advisory process, timing, and input sought from stakeholders | • Communicate resource needs due to potential demand<br>• Common understanding of MISO regulatory updates<br>• Communicate scenario themes and stochastic analysis approach, along with major input details and assumptions<br>• Communicate commodity prices impacts<br>• Communicate preliminary RFP results | • Common understanding of DSM modeling methodology<br>• Explain next steps for portfolio modeling | • Develop a shared understanding of economic modeling outcomes and preliminary results to facilitate stakeholder feedback | • Respond to key stakeholder comments and requests<br>• Communicate NIPSCO's preferred resource plan and short-term action plan<br>• Obtain feedback from stakeholders on preferred plan |



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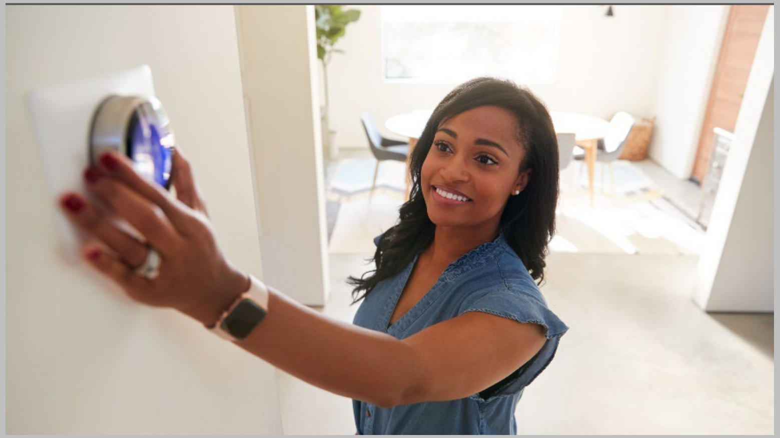
# APPENDIX: NIPSCO LOAD SCENARIOS





# STATE OF INDIANA – DATA CENTER SALES TAX EXEMPTION

## DATA CENTER GROSS RETAIL AND USE TAX EXEMPTION

- Provides a sales and use tax exemption on purchases of qualifying data center equipment and energy to operators of a qualified data center for a period not to exceed 25 years for data center investments of less than $750M.
- If the investment exceeds $750M, the Indiana Economic Development Corporation ("IEDC") may award an exemption for up to 50 years.
- This program is established by Indiana Code § 6-2.5-15. Local governments may also provide a personal property tax exemption on qualified enterprise information technology equipment to owners of a data center who invest at least $25M in real and personal property in the facility.

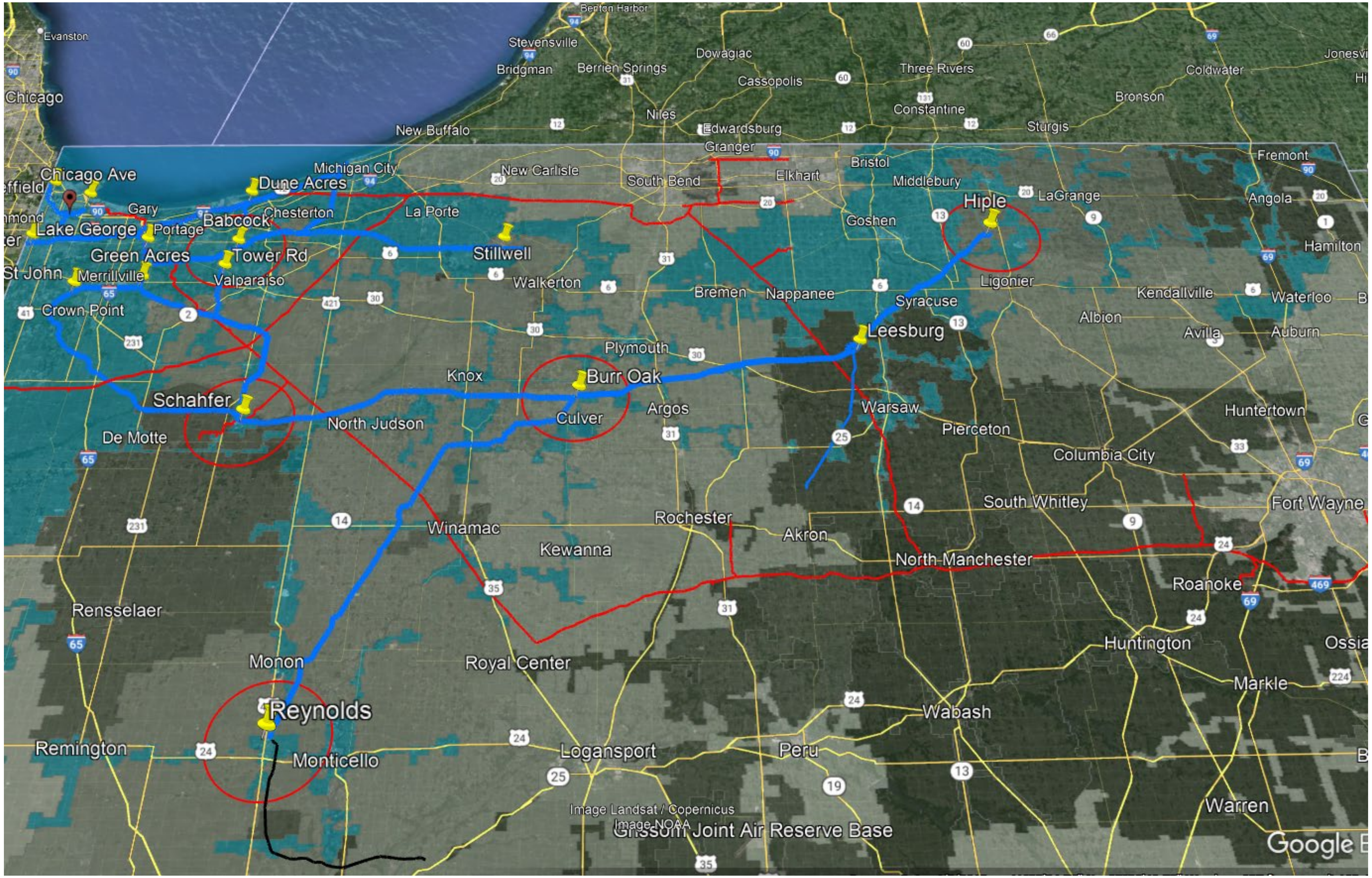
## ELIGIBILITY

- To qualify for the exemptions, data centers must reach a certain threshold for investment within 5 years of receiving an exemption certificate from the Indiana Department of Revenue. The minimum investment required is determined by the population of the county in which the qualified data center is located:
  - $25M in counties with less than 50,000 people
  - $100M in counties between 50,000 and 100,000 people
  - $150M in counties with 100,000 or more people
- Equipment that is eligible for the exemption includes the servers and related computer equipment or software purchased or leased for the processing, storage, retrieval or communication of data, as well as other equipment essential to the operation of the data center. This includes electricity used in qualified data center operations. Prior to qualifying for an exemption, the IEDC must approve all planned data center equipment purchases.

## OTHER INDIANA INCENTIVES IN THE AREAS OF:

- JOB CREATION AND BUSINESS INVESTMENT
- REDEVELOPMENT AND QUALITY OF PLACE
- INNOVATION AND ENTREPRENEURSHIP
- RESEARCH AND DEVELOPMENT
- SKILLS TRAINING

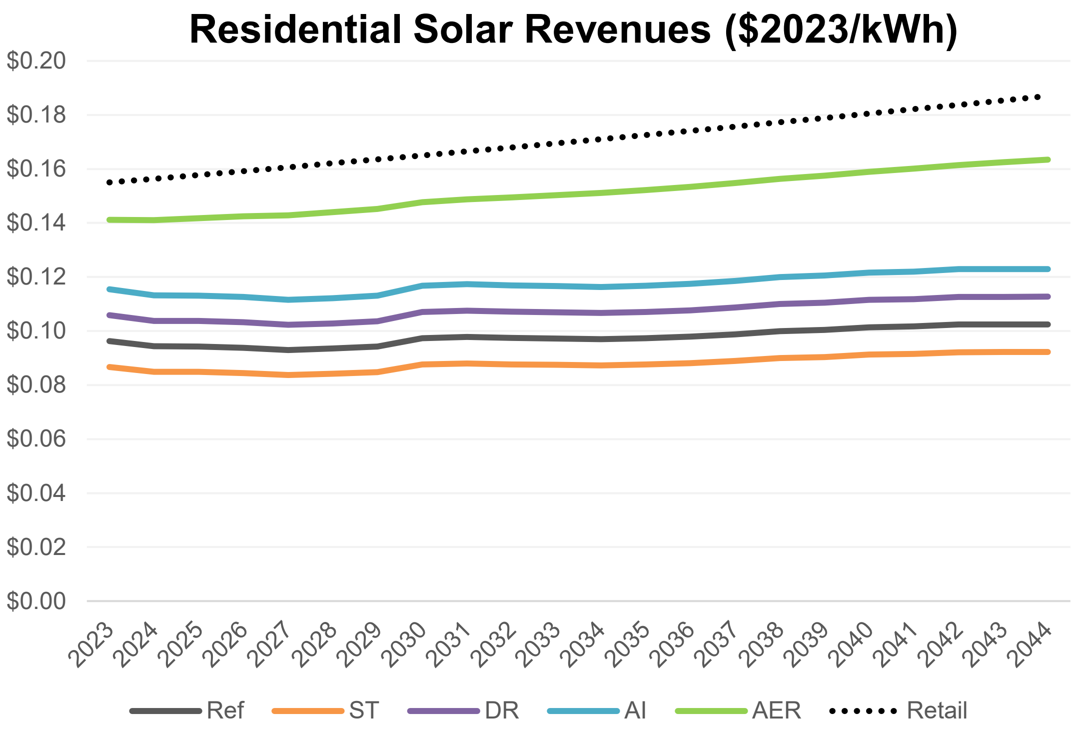
# STATE LEVEL OVERVIEW OF RECOMMENDED SITES

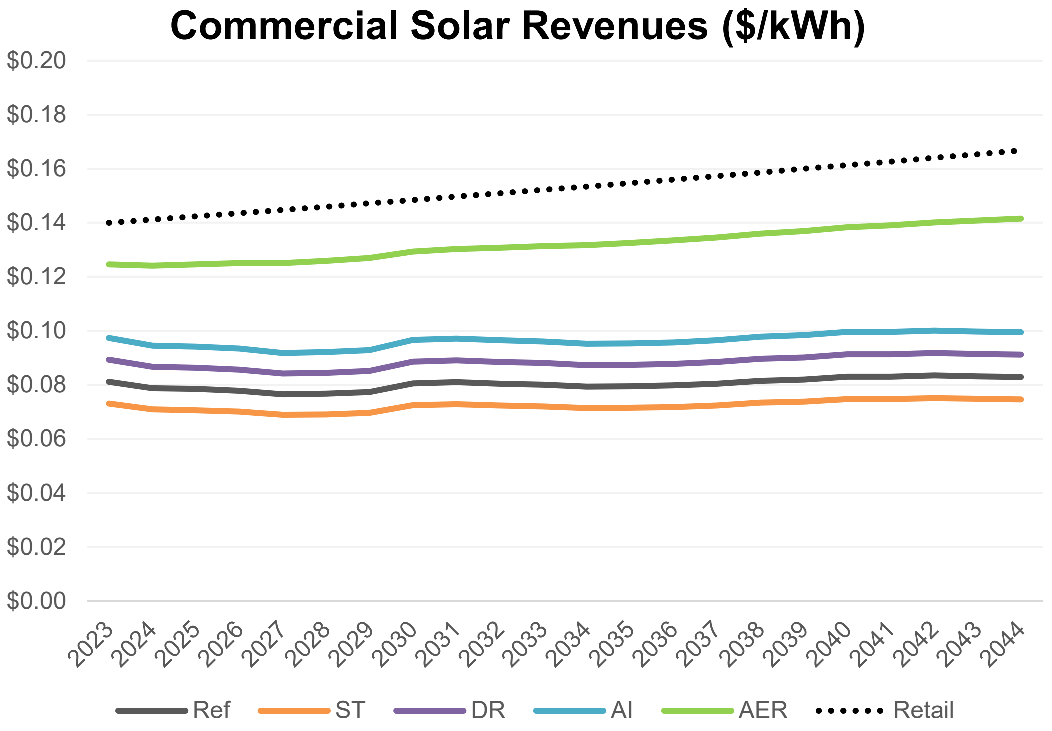



- Blue shaded area indicates NIPSCO electric service territory
- Blue lines represent 345kv circuits
- Yellow pins represent large transmission substations
- Red lines represent large transmission gas lines
- Red circles indicates 5-mile radius around substations = Strategic Target Areas

# DER SCENARIO ASSUMPTIONS – SOLAR AVOIDED COSTS / REVENUES

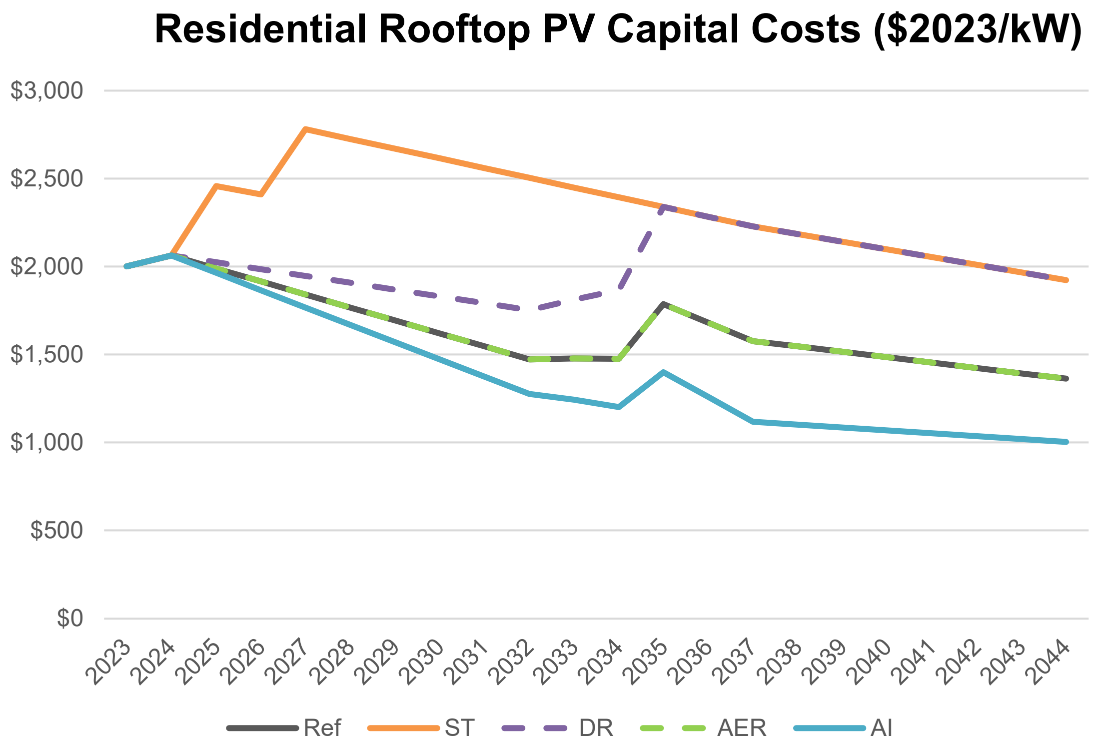
- Both avoided retail rate costs and wholesale rate revenues (EDG compensation) are relevant to customer economics
- For modeling purposes, a range of assumed wholesale energy prices were estimated to develop an all-in avoided cost/revenue projection for residential and commercial customers

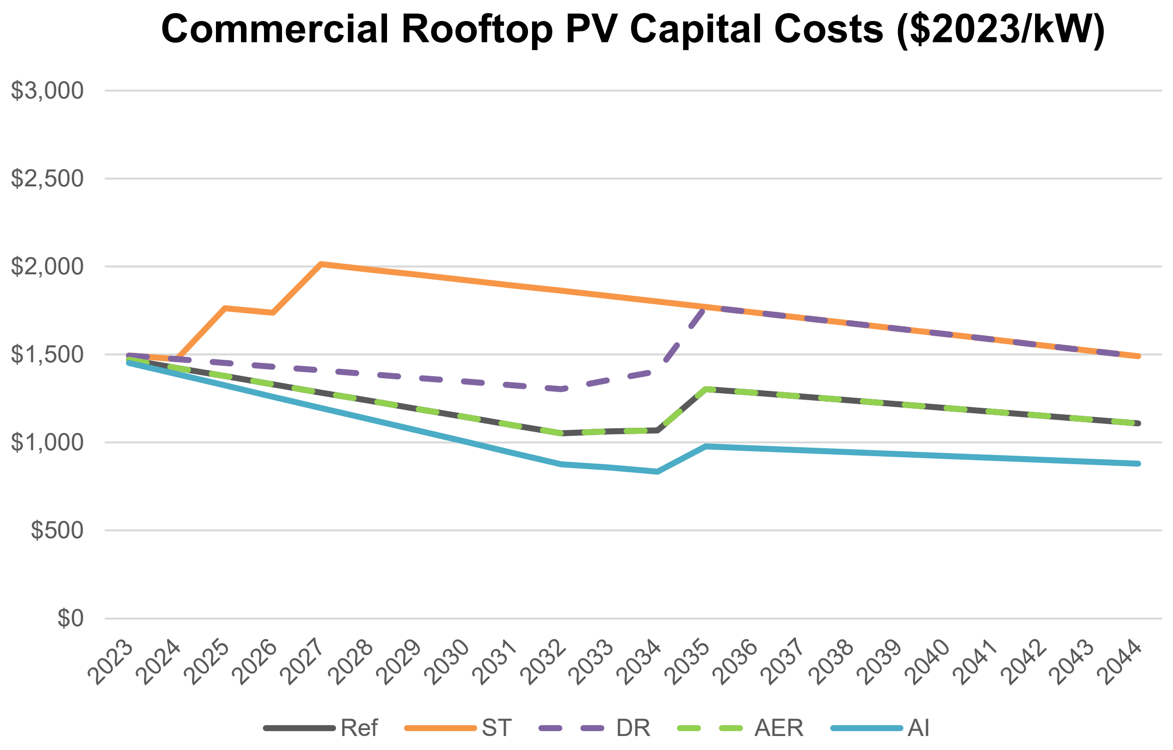


# DER SCENARIO ASSUMPTIONS – PV SYSTEM CAPITAL COSTS

- 2023 NREL Annual Technology Baseline was used for DER capital costs:
  - **Reference and AER:** NREL ATB moderate forecast with IRA ITC
  - **AI:** NREL ATB advanced cost forecast with IRA ITC
  - **DR:** NREL conservative cost forecast with IRA ITC
  - **ST:** NREL conservative cost forecast with near-term IRA phase-out



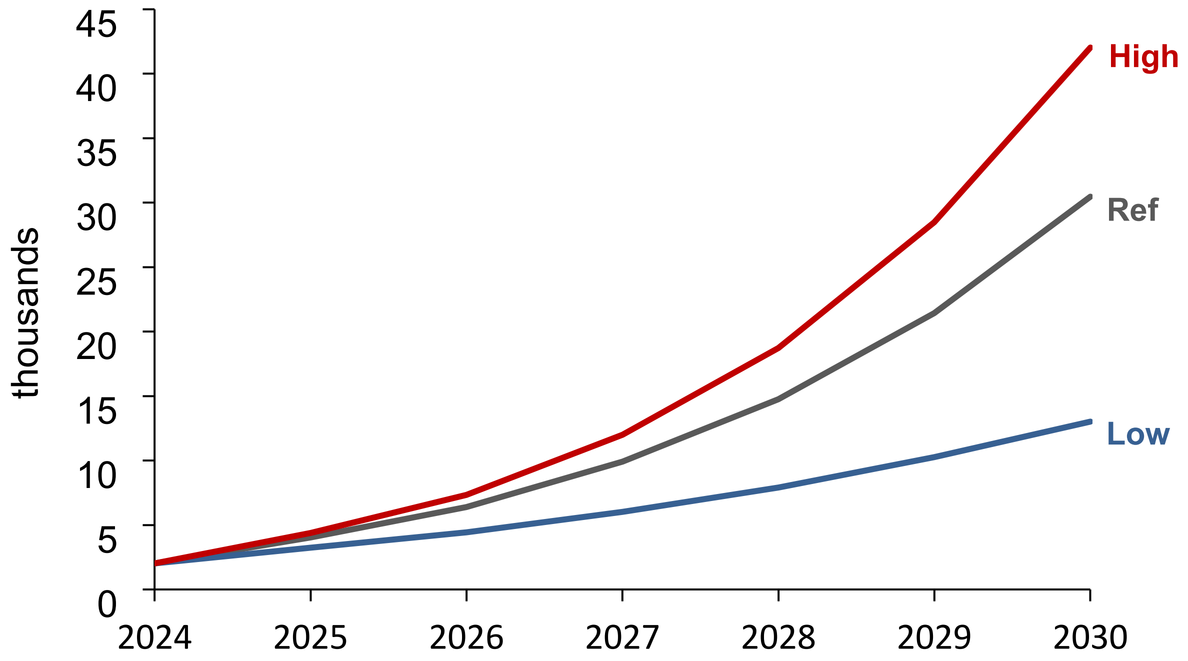



# HIGH AND REFERENCE LDV ADOPTION SCENARIOS MEET NEW EPA TARGETS

- Scenarios are crafted to pulse the inflection year and final share of EVs as a % of new LDV sales
- Reference and High cases would meet U.S. EPA standards announced in March 2024

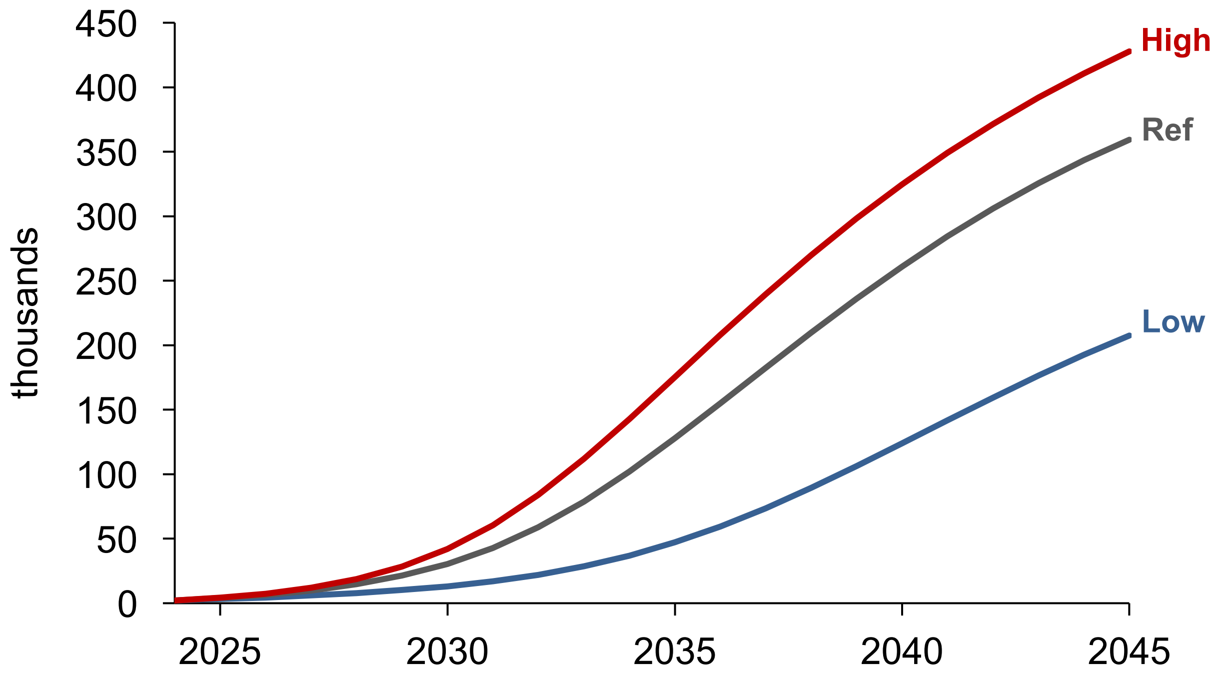
**Number of EVs registered**

*’24-’30 timeframe detail*




**Number of EVs registered**

*Full forecast period*



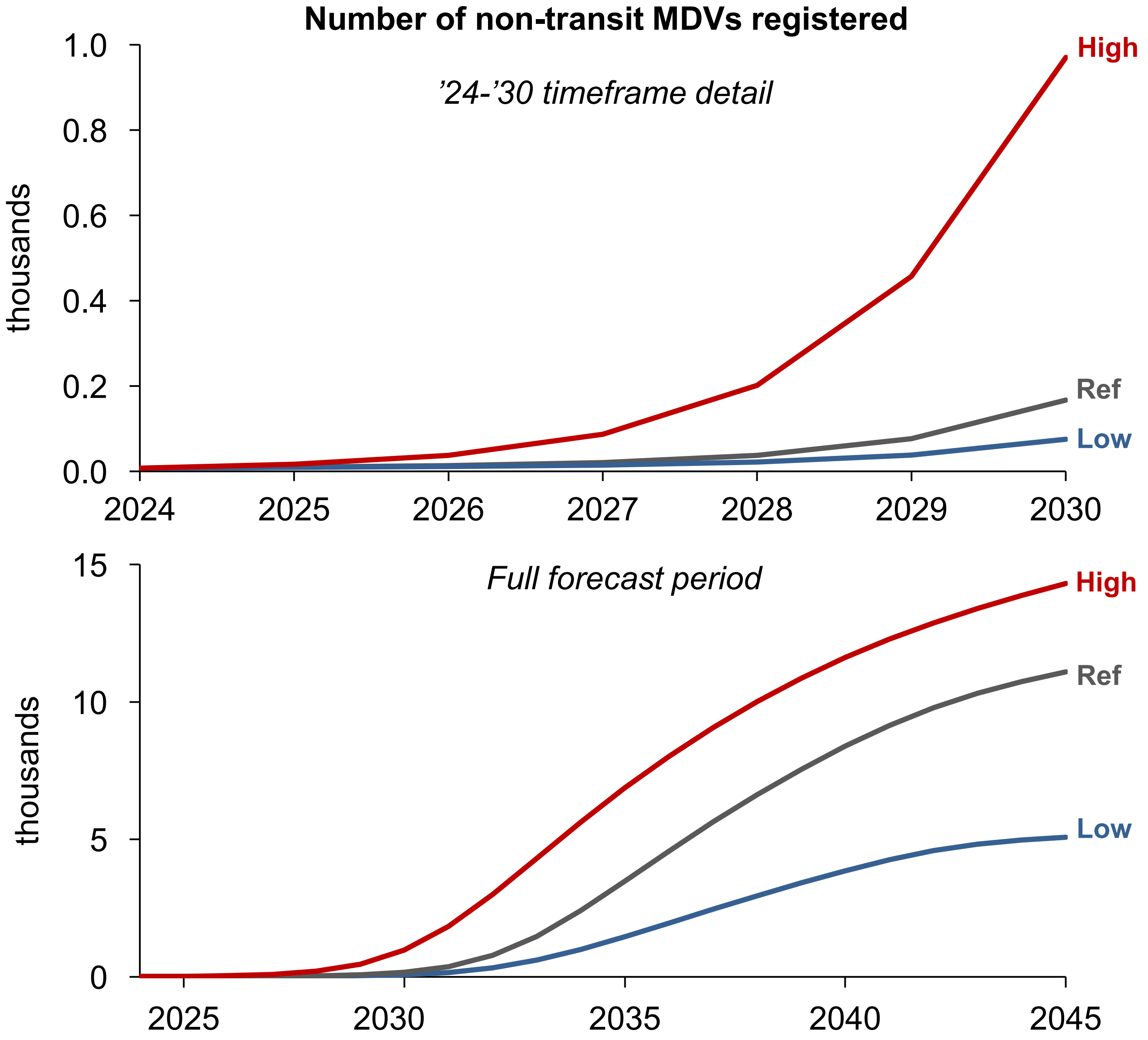
# MDV (NON-TRANSIT) EV FORECAST

## Near-term Trends

- NIPSCO has baselined the existing MDV fleet using EV registration data from the Indiana Fuel Dashboard
- NIPSCO has crafted an approach that uses ICE vehicle turnover (assuming 10-year avg lifespan) and EVs as a % of new MDV vehicle sales to estimate the number of EVs on the road in a given year.
- Scenarios are crafted to pulse the inflection year and final share of EVs as a % of new MDV sales

## Long-term Trends

- NIPSCO anticipates moderated adoption compared to LDVs, as some MDVs may be difficult to decarbonize with limited EV options available



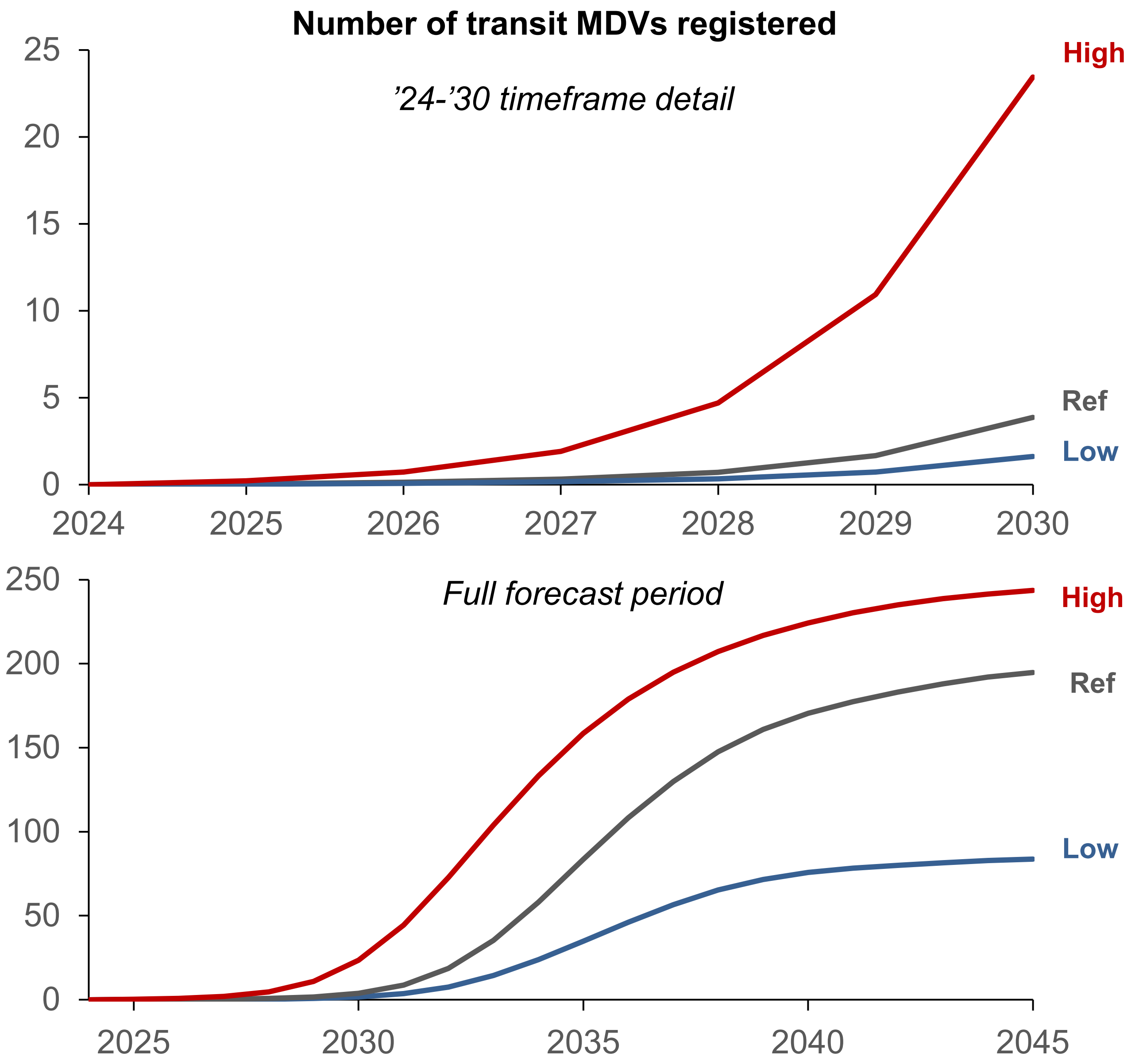
# MDV (TRANSIT) EV FORECAST

## Near-term Trends

- NIPSCO has baselined the existing transit fleet using the 2022 National Transportation Database (NTD)
- NIPSCO has crafted an approach that uses ICE vehicle turnover (assuming avg lifespan by vehicle type from NTD) and EVs as a % of new MDV vehicle sales to estimate the number of transit EVs on the road in a given year.
- Scenarios are crafted to pulse the inflection year and final share of transit EVs as a % of new MDV sales

## Long-term Trends

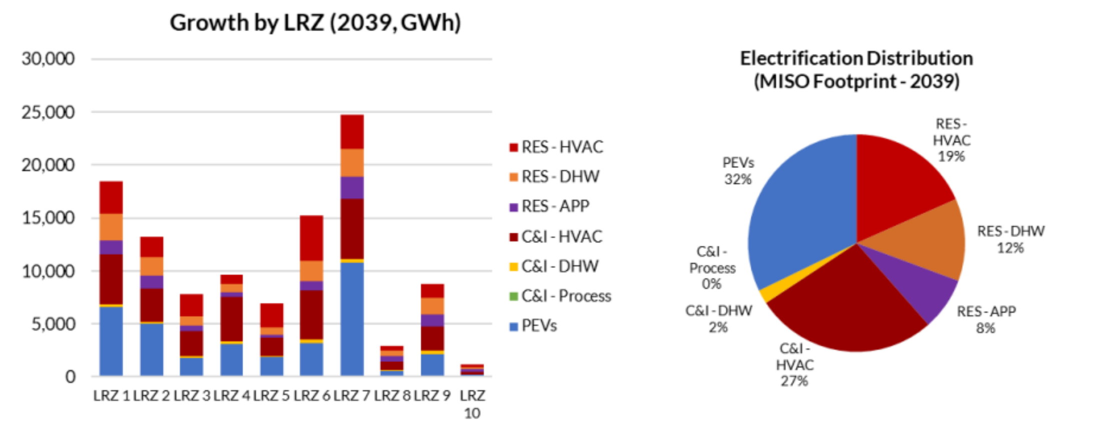
- NIPSCO anticipates moderated adoption compared to LDVs, as some MDVs may be difficult to decarbonize with limited EV options available



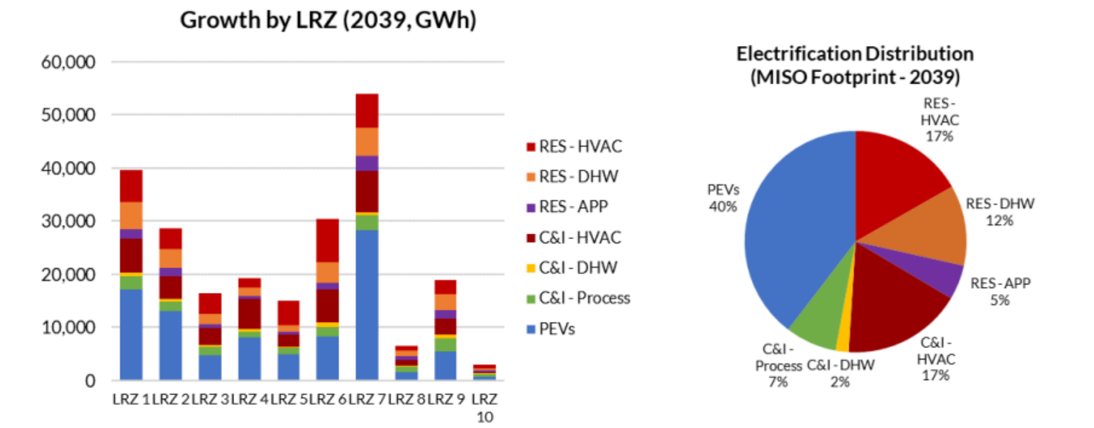
# OTHER ELECTRIFICATION

- Aside from electric vehicles, the AER and AI scenarios incorporate long-term impacts associated with electrification of other energy end uses
- NIPSCO drew from MISO Futures report and Transmission Expansion Plan (MTEP) to develop estimates for growth in energy and peak load needs associated with:
  - Residential HVAC
  - C&I HVAC
  - Residential Appliances
  - Residential water heating
  - C&I water heating
  - C&I Processes

**Future 2 Electrification by End-Use (Cumulative per Year) – Entire MISO Footprint**




**Future 3 Electrification by End-Use (Cumulative per Year) – Entire MISO Footprint**




Source: 2021 MISO Futures Report



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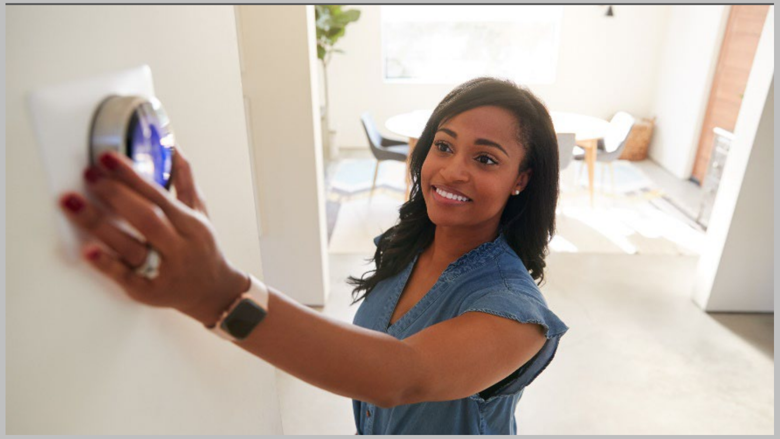
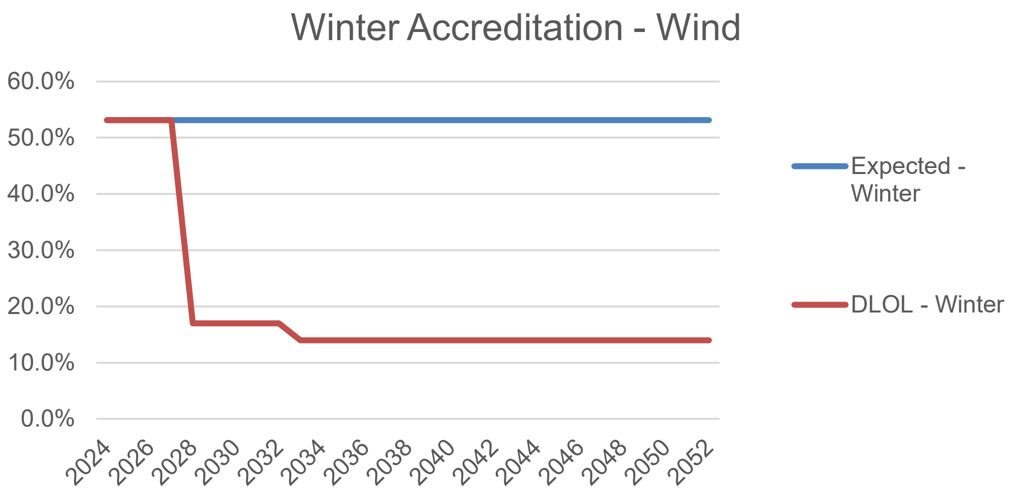
*We exist to deliver safe, reliable energy that drives value to our customers*

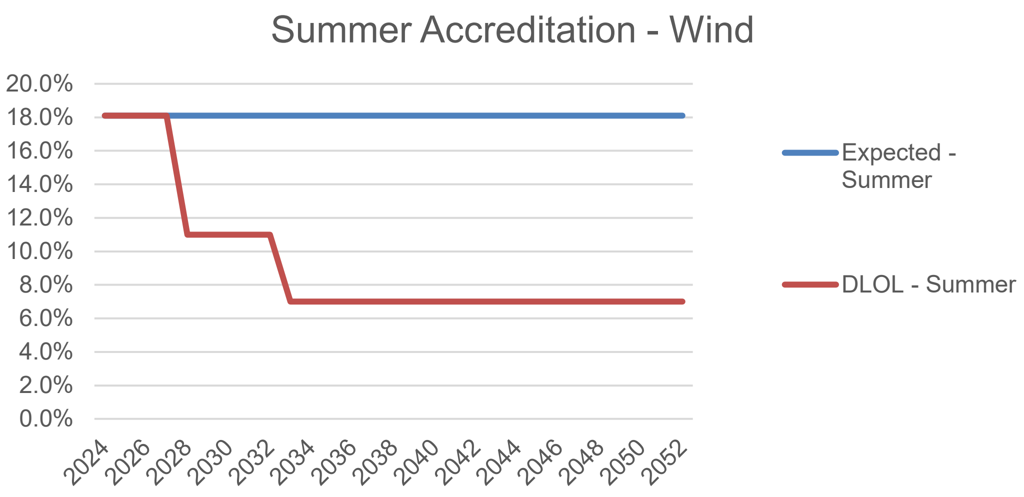
# APPENDIX: CAPACITY ACCREDITATION AND NIPSCO OBLIGATION DETAILS

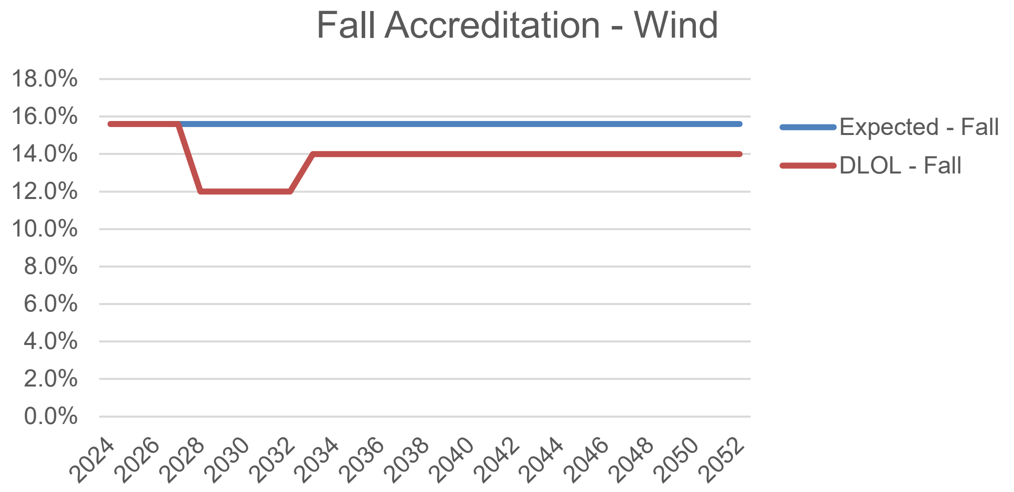


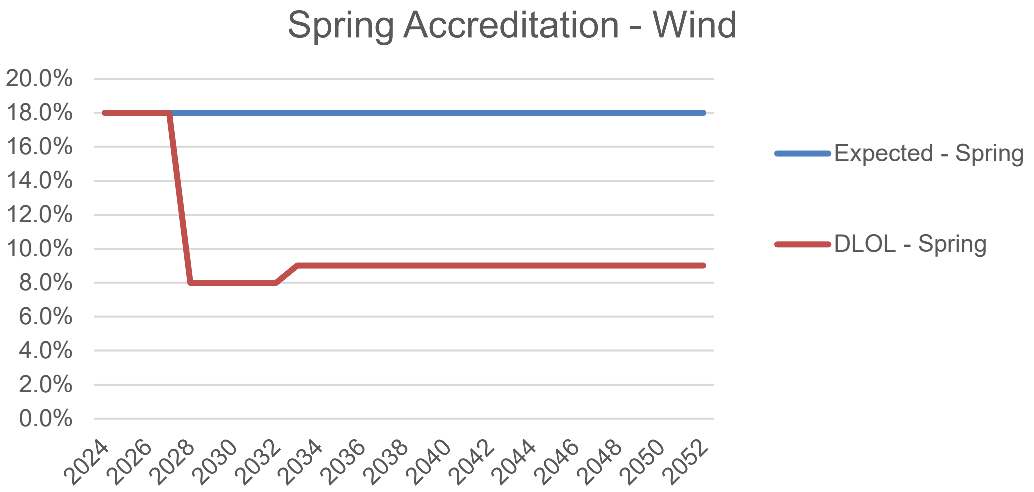


# SEASONAL WIND ACCREDITATION

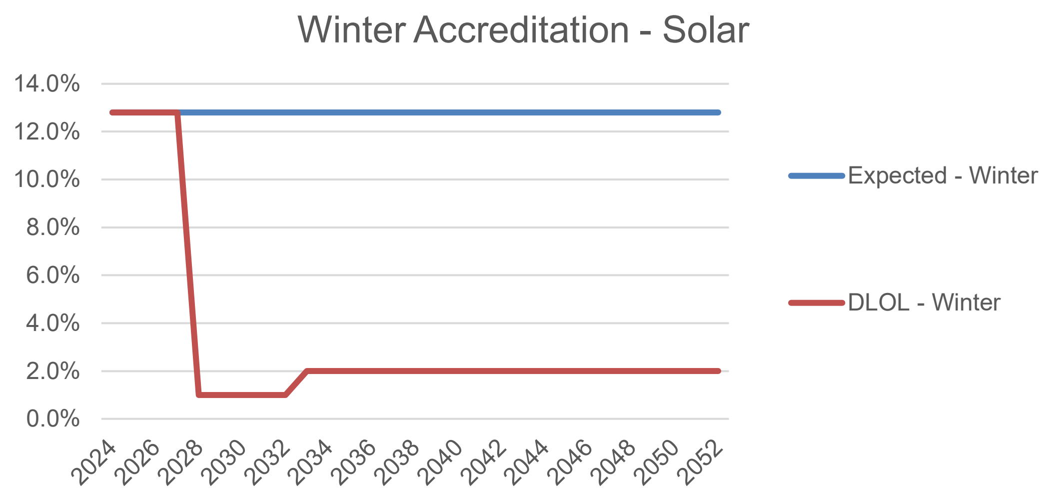


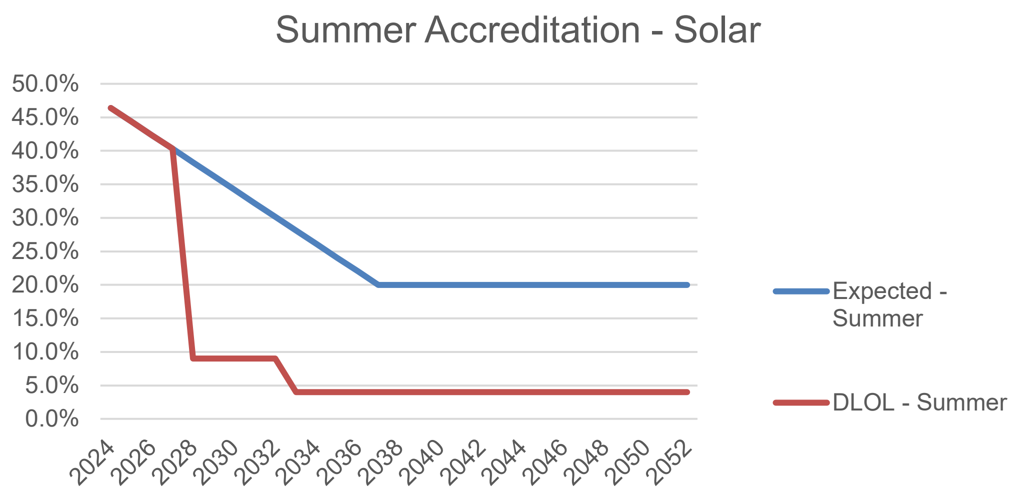



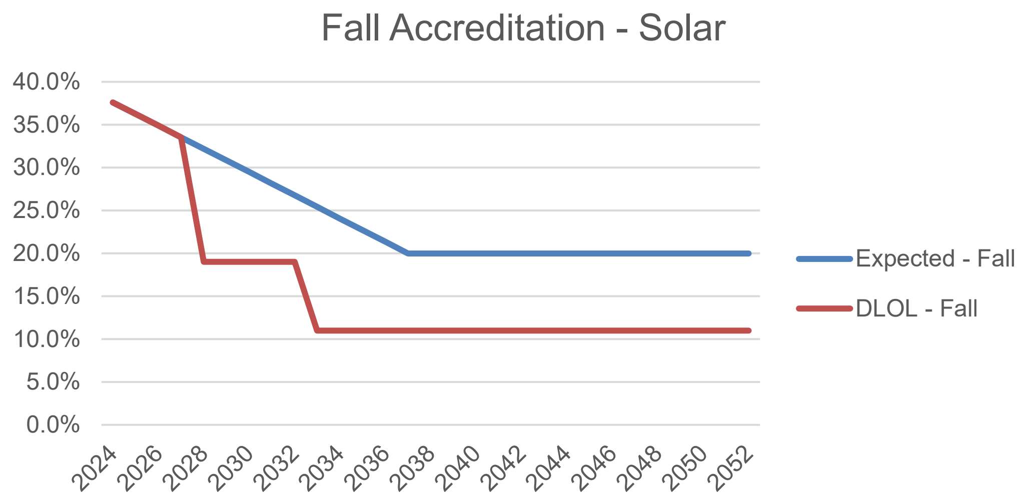



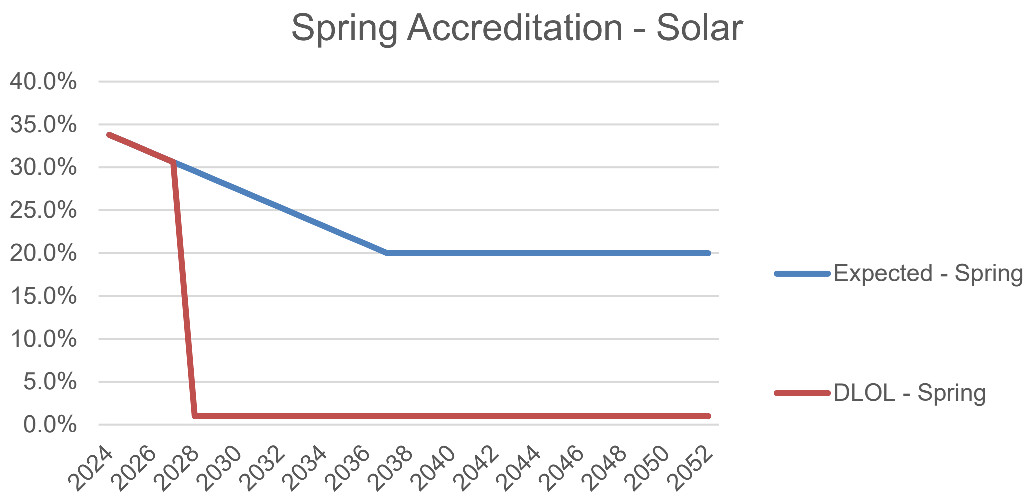



# SEASONAL SOLAR ACCREDITATION

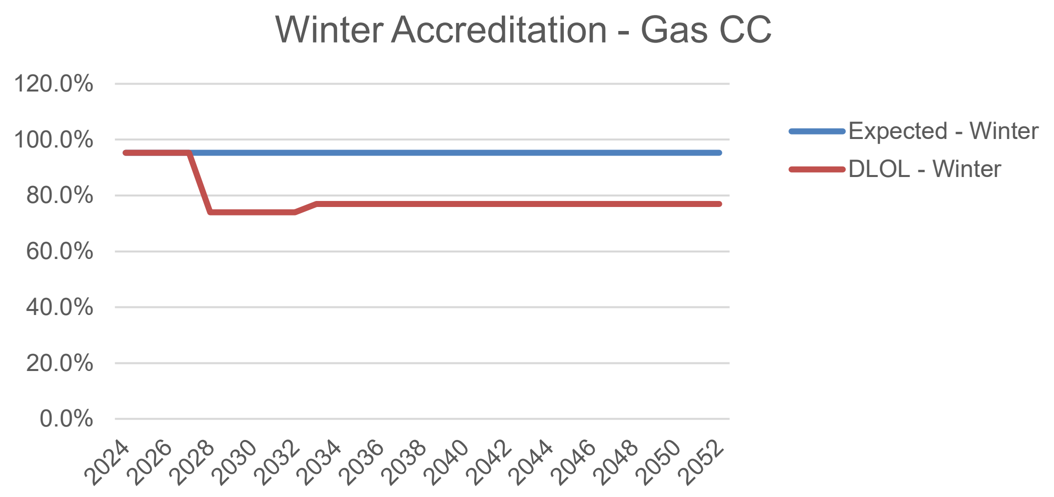


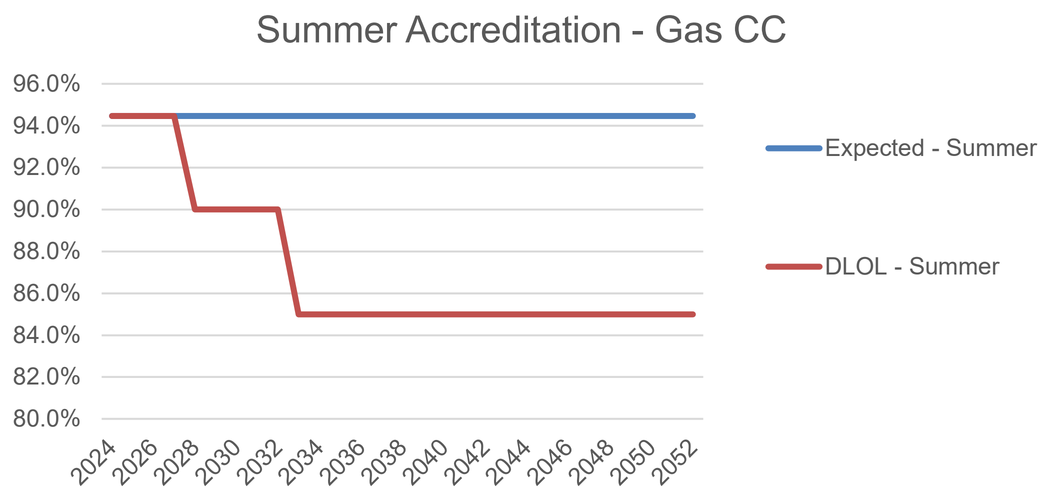



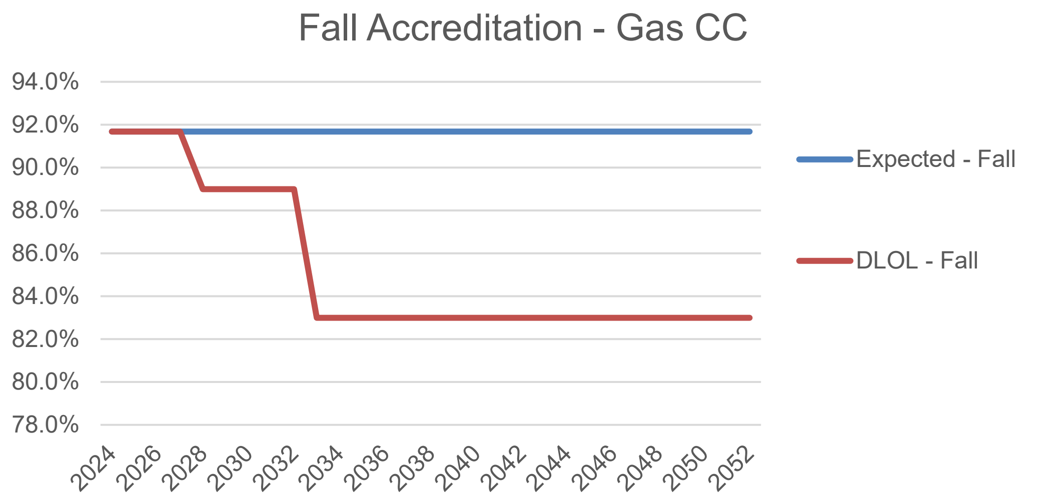



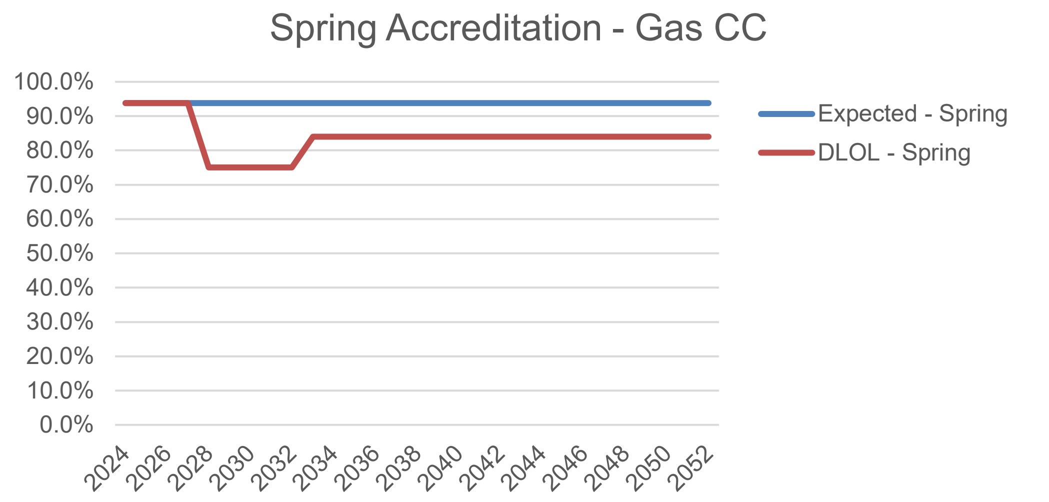



# SEASONAL GAS CC ACCREDITATION

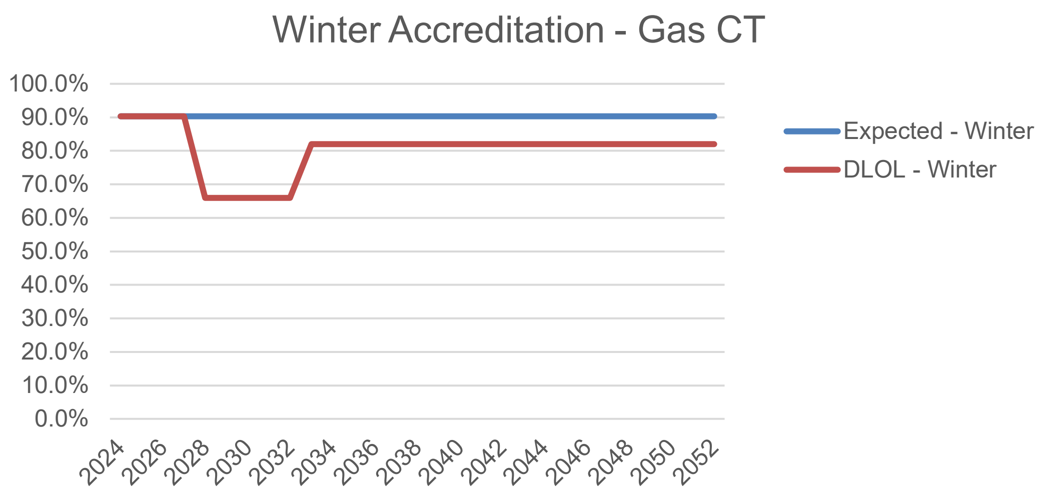


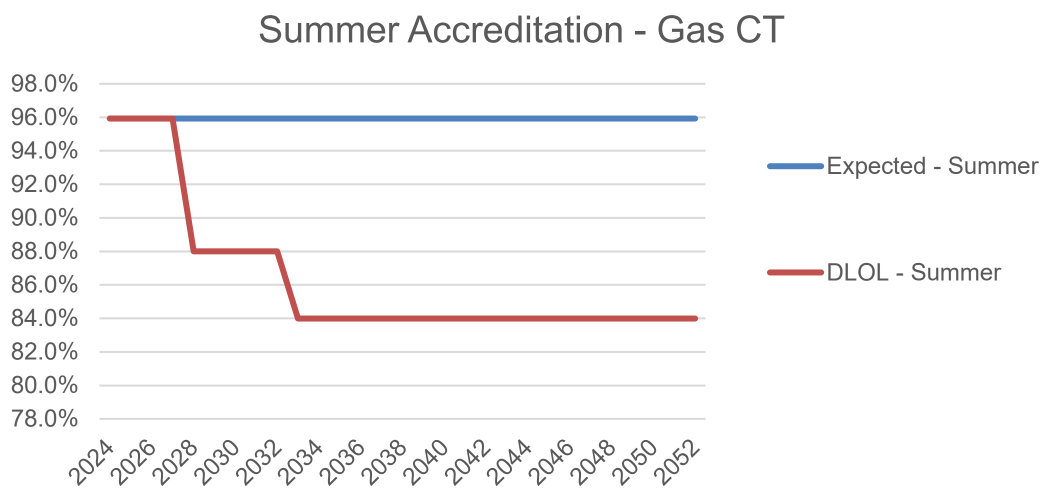



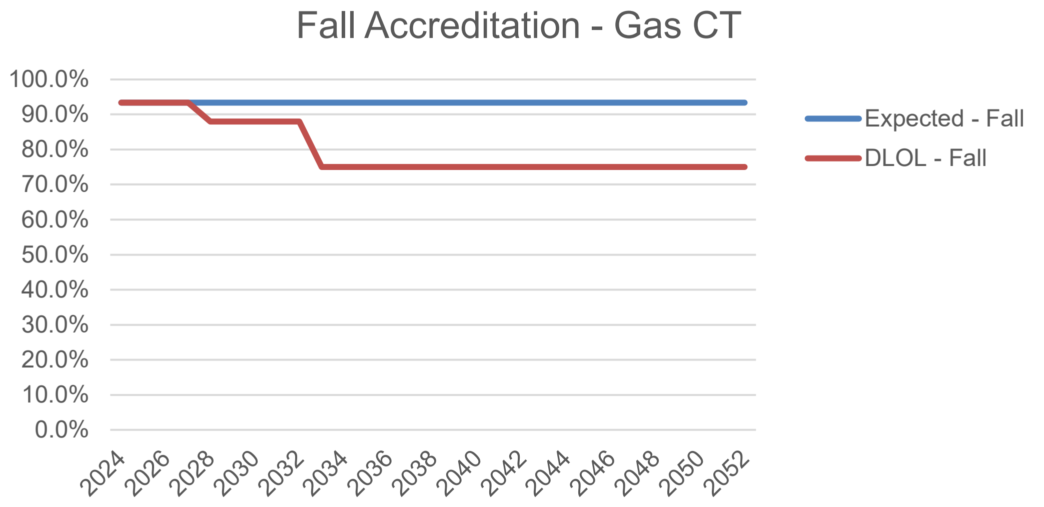



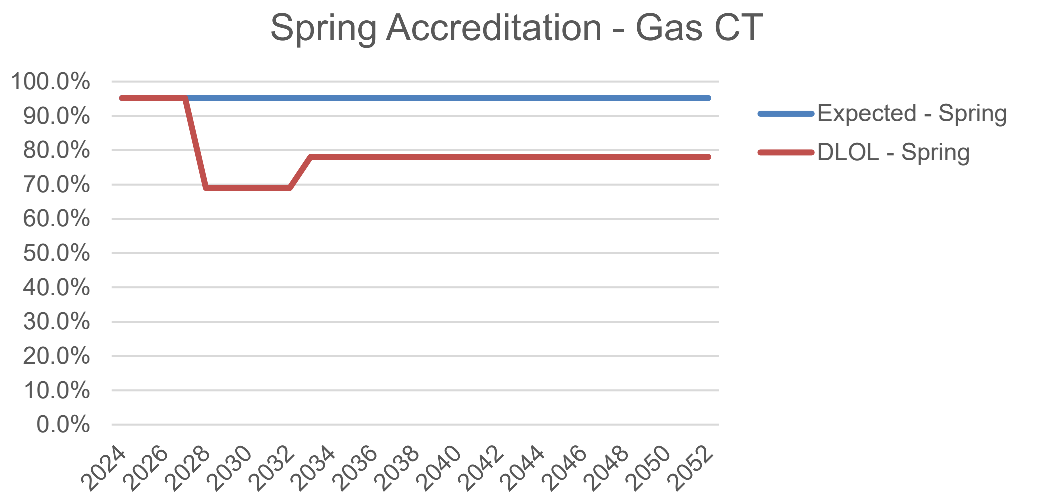



# SEASONAL GAS CT ACCREDITATION

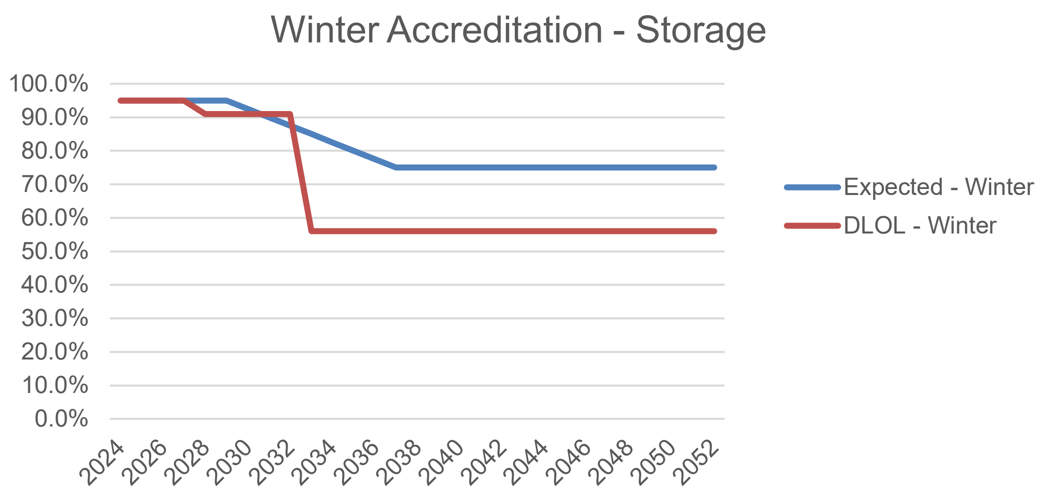


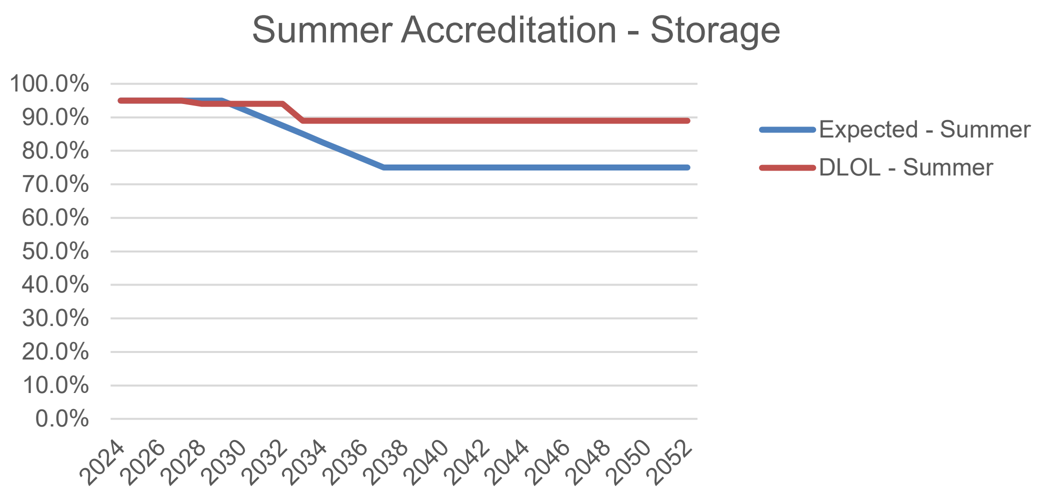



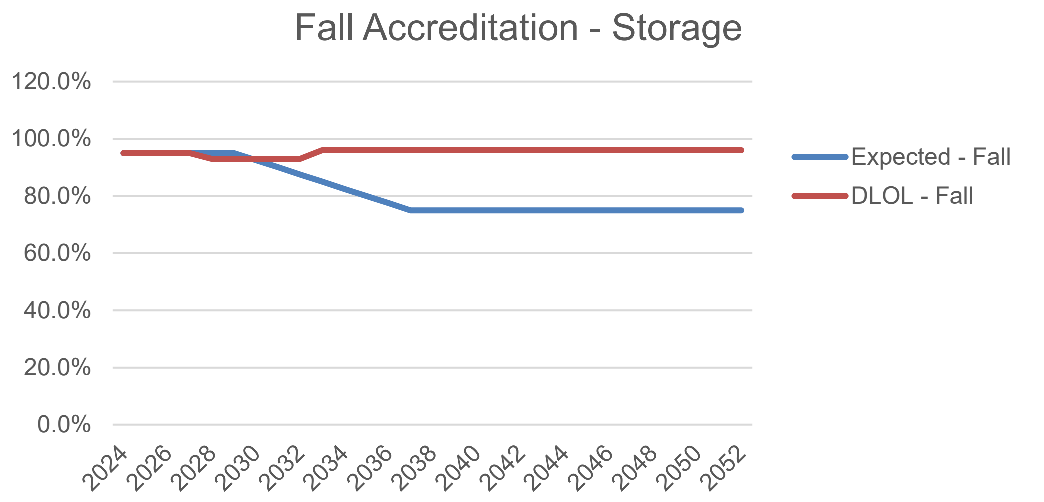



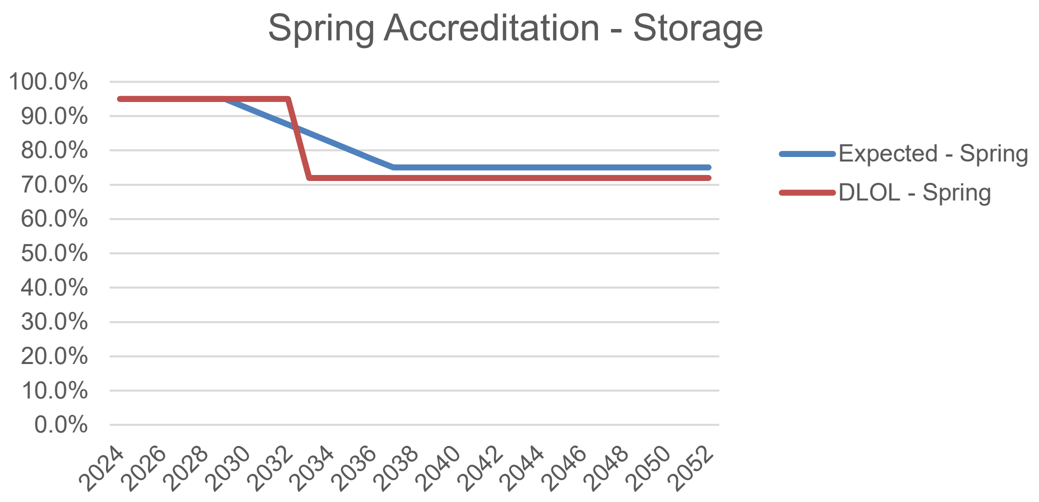



# SEASONAL STORAGE ACCREDITATION

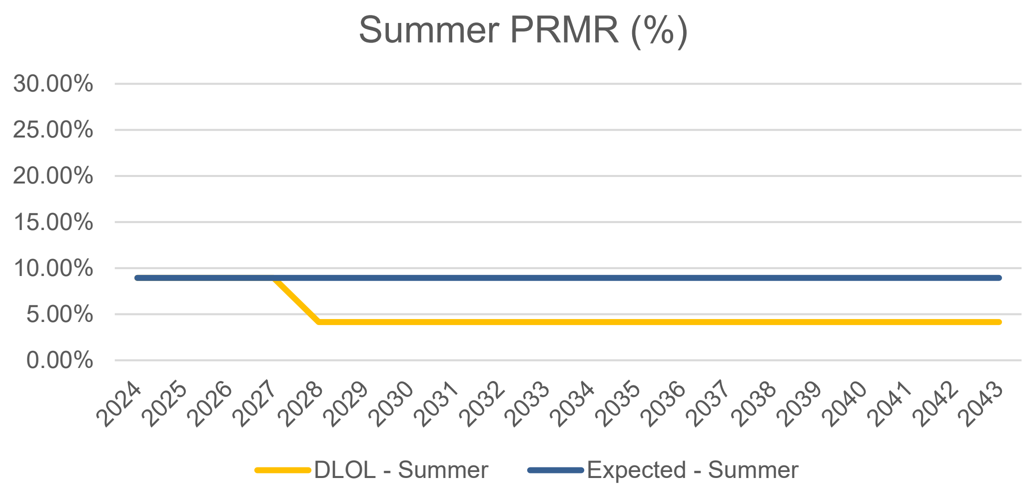


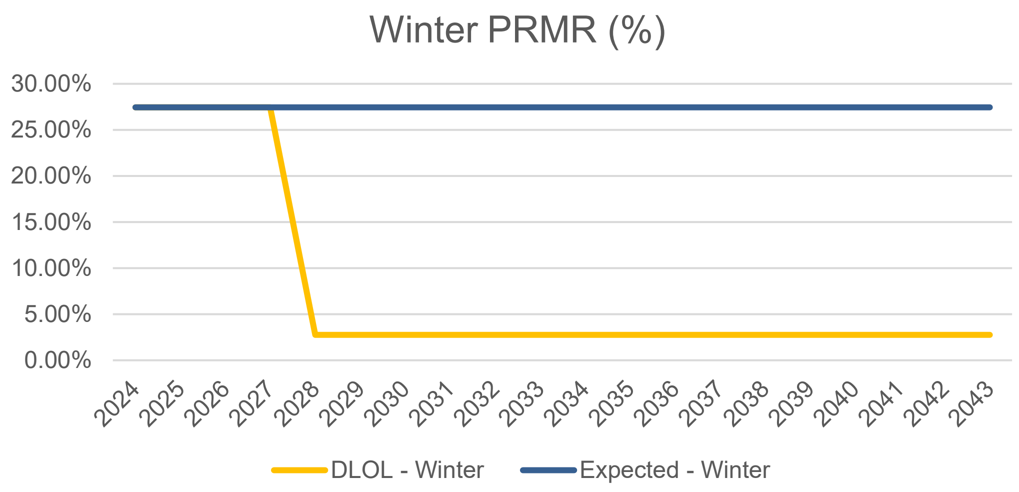



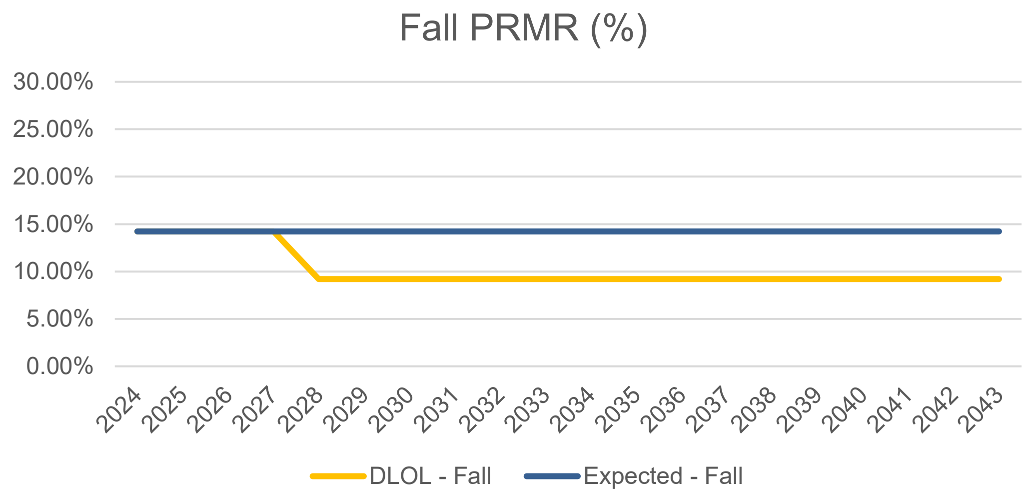



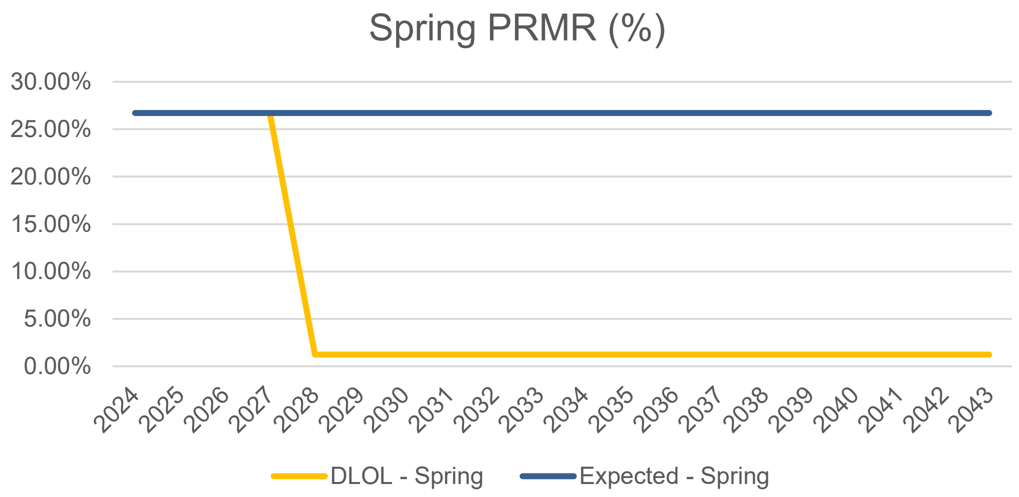



# NIPSCO SEASONAL OBLIGATION IMPACTS FROM D-LOL



# CAPACITY POSITION – PLACEHOLDER

- *This slide is a placeholder for NIPSCO's capacity position with the new load expectations for the 2024 IRP scenarios and the large load sensitivity*
- *An updated copy of this presentation with slides on the capacity position (including the new load expectations) will be published on June 24th prior to the start of the IRP Stakeholder meeting*
- *All published IRP materials including the upcoming June 24th update can be found on NIPSCO's IRP webpage: www.nipsco.com/irp*



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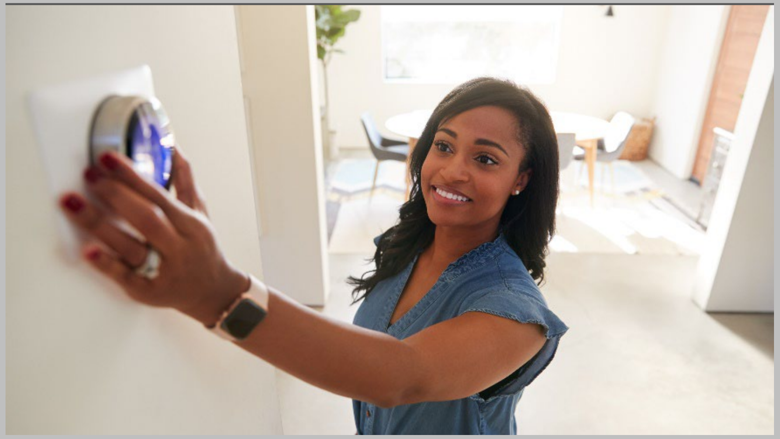
# APPENDIX: COMMODITY MARKET SCENARIO DETAILS





# NATURAL GAS MARKET OVERVIEW – SHORT-TERM DRIVERS

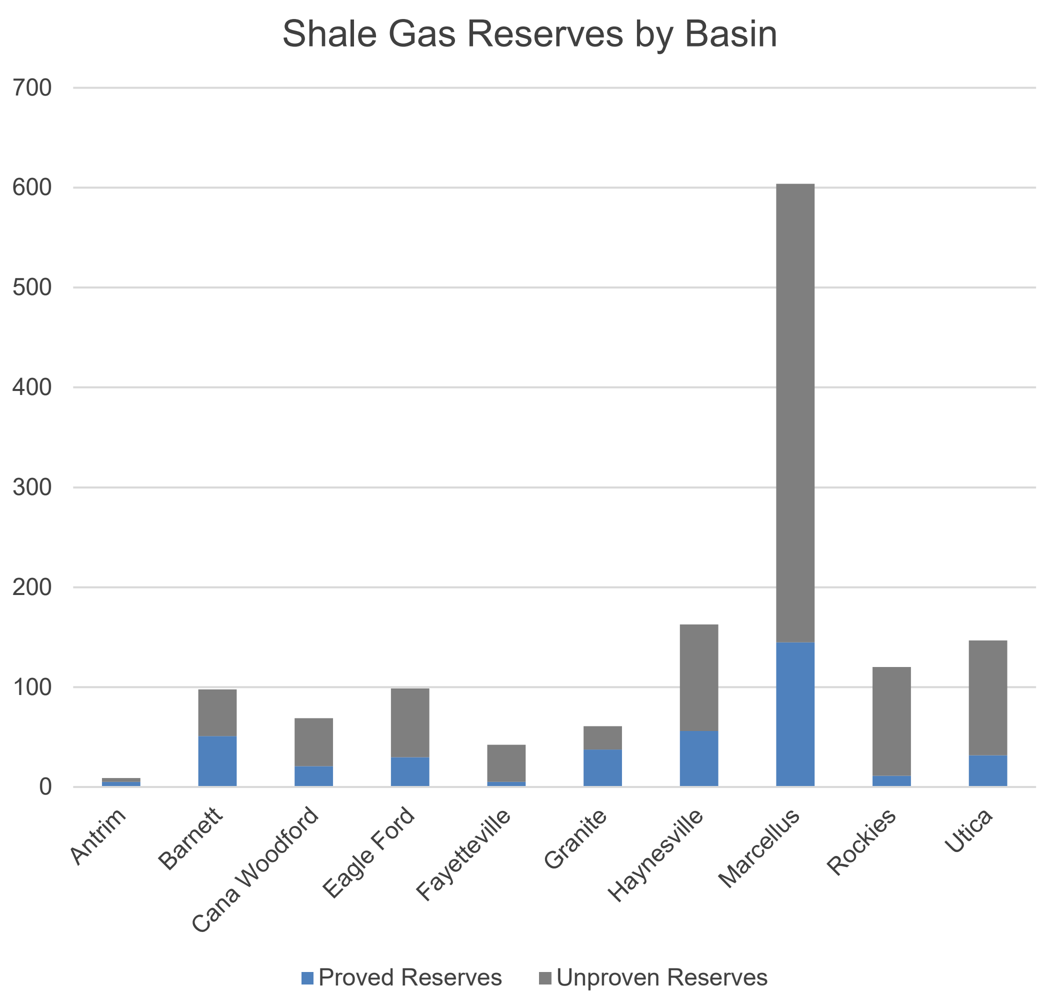
- The forward curve has fallen significantly since Fall 2023 as storage inventories have reached historic highs and LNG demand has fallen about 2 Bcf/d.
- Economic headwinds may cause E&P companies to "tap the brakes" on drilling programs. However, as the Mountain Valley Pipeline (MVP) nears completion, some additional capacity could be provided once it comes online.

***Short-Term Market Trends***

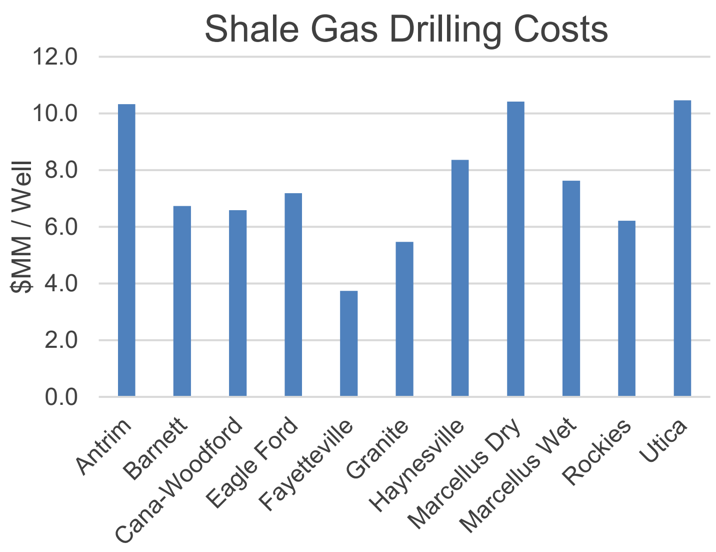
| | |
|---|---|
| **Natural Gas Supply** | ▪ Continuous modest increases in US production (now around 102 Bcf/d) have sustained lower prices in the shorter term, but gas-focused rigs have declined (down 17% compared to this time last year).<br>▪ Now that both the Transco Regional Energy Access Project & Mountain Valley Pipeline (MVP) have been greenlighted for completion, there may be some relief for Northeast Pennsylvania prices.<br>▪ After MVP and Transco's REA Project, there are no new infrastructure projects in the queue, and another round of constraint-driven discounting may be around the corner. |
| **Natural Gas Demand** | ▪ Feedgas LNG is marginally down ~2 Bcf/d from the winter and is averaging around 12.5 Bcf/d. The next incremental feedgas is expected in the 2025-2027 timeframe. US exports (via LNG and pipeline) remain significant in the first quarter of 2024, reaching an average of 19.1 Bcf/d, up nearly 1 Bcf/d over the same period for 2023.<br>▪ Exports to Mexico remain similar to exports over the same period last year and are averaging 5.0 Bcf/d YTD.<br>▪ Storage inventories are significantly higher than 2023 and 5-Year average levels for this time of year. |

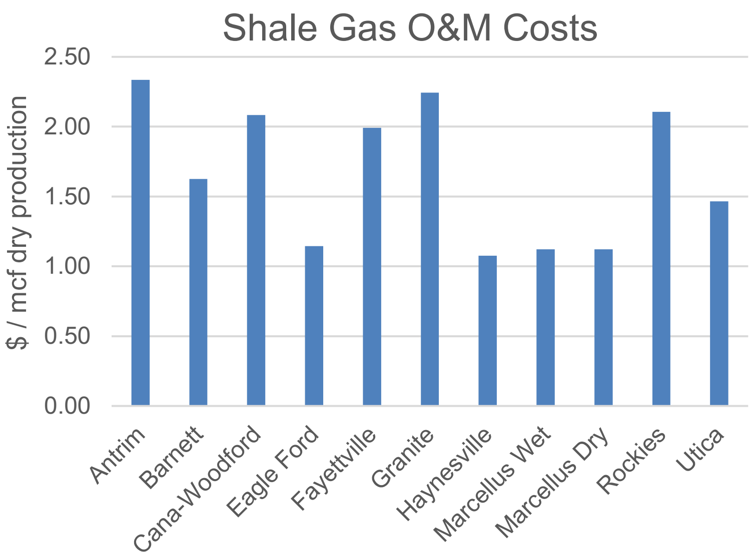
# CRA RELIES ON THE POTENTIAL GAS COMMITTEE'S (PGC) "MIN" AND "MOST LIKELY" VIEWS OF UNPROVEN RESSERVES

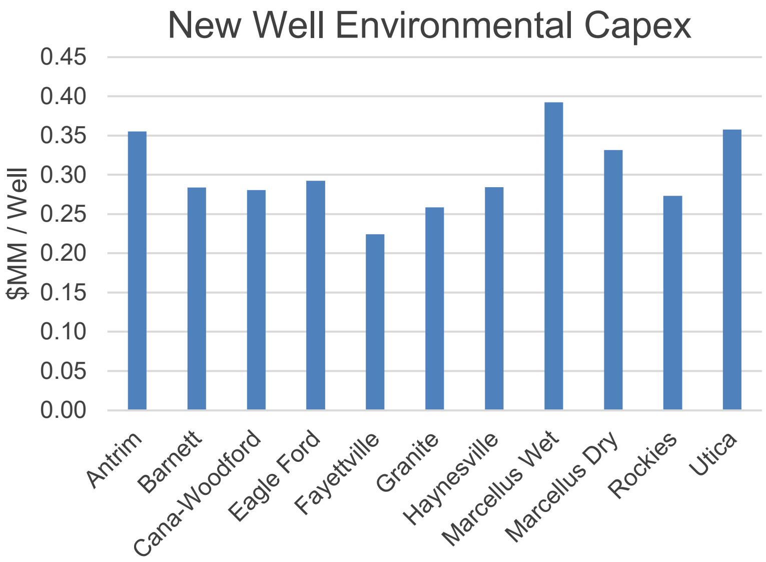
- **CRA combines Unproven reserves from PGC with Proved reserves from EIA**
  - "Proved" reserves are a known quantity and would not vary between the Reference case and alternative scenarios.
  - The quantity of "Unproven" reserves is uncertain and could vary across CRA natural gas price scenarios.
- **PGC assigns resource to three probability categories:**
  - Minimum – 100% probability that stated resource is recoverable.
  - Most Likely – what is most likely to be recovered, with reasonable assumptions about source rock, yield factor, and reservoir conditions.
  - Maximum – the quantity of gas that might exist under the most favorable conditions, close to 0% probability that this amount of gas is present.



# CRA USES DRILLING-RELATED CAPEX FIGURES BY PLAN TO DETERMINE CAPITAL COSTS OF NEW WELL PRODUCTION



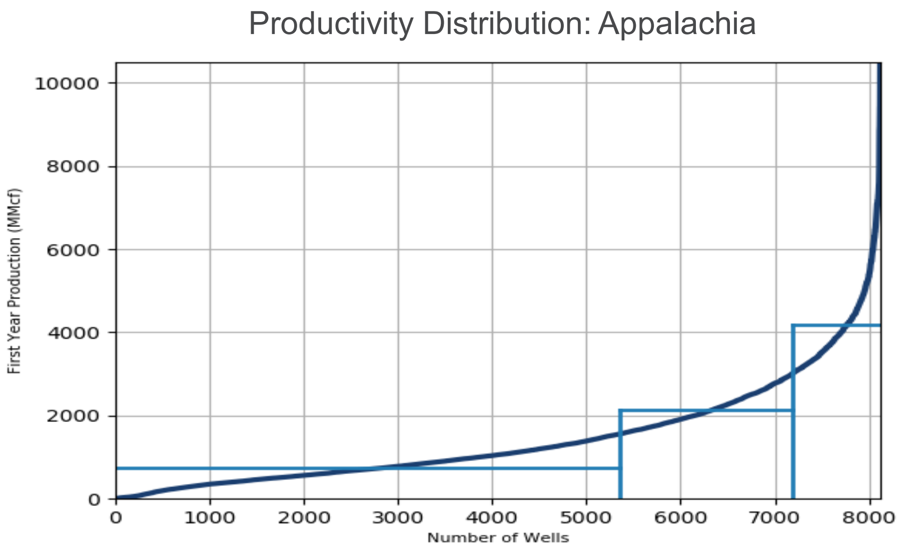



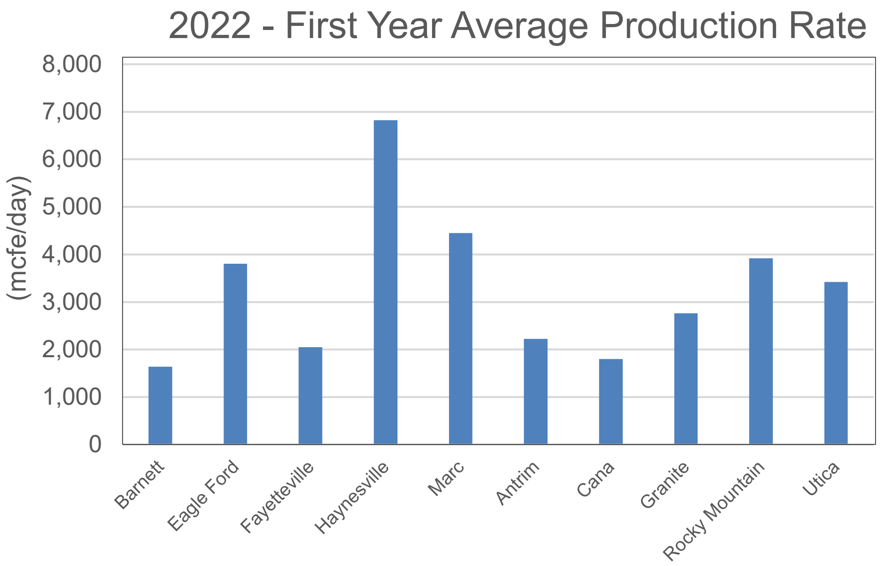

- Current elevated costs of capital apply upward pressure on drilling costs.
- Still, producers across most basins have demonstrated improvements in drilling and O&M costs. CRA assumes that these improvements continue.  Artificial Intelligence has the potential to reduce drilling costs and produce better exploration outcomes, but this has not yet been reflected in recent numbers.
- Environmental Capex is a function of well size, location and policy. As environmental restrictions mount, costs are likely to increase.

Despite current upward pressure, **CRA** expects production costs to decline in the long term, due largely to technological innovation.

# PRODUCTION DYNAMICS ARE USED TO DETERMINE THE YEAR-OVER-YEAR OUTPUT OF WELLS DRILLED

- CRA's view is that historical data has a bias towards higher producing sub-regions
  - Wells that are completed and ultimately produce gas do not reflect a random sampling of the underlying geology in each basin.
  - Rather, these wells reflect areas where producers expected to find favorable geology and wells where the cost of completion was justified by the flow.
- We therefore divide each basin into "Poor", "Average", and "Prime" sub-regions and adopt a "Poor-Heavy" distribution.
  - This reflects the notion that remaining resource is more likely to be of lower quality over time as the premium acreage is depleted in each basin.

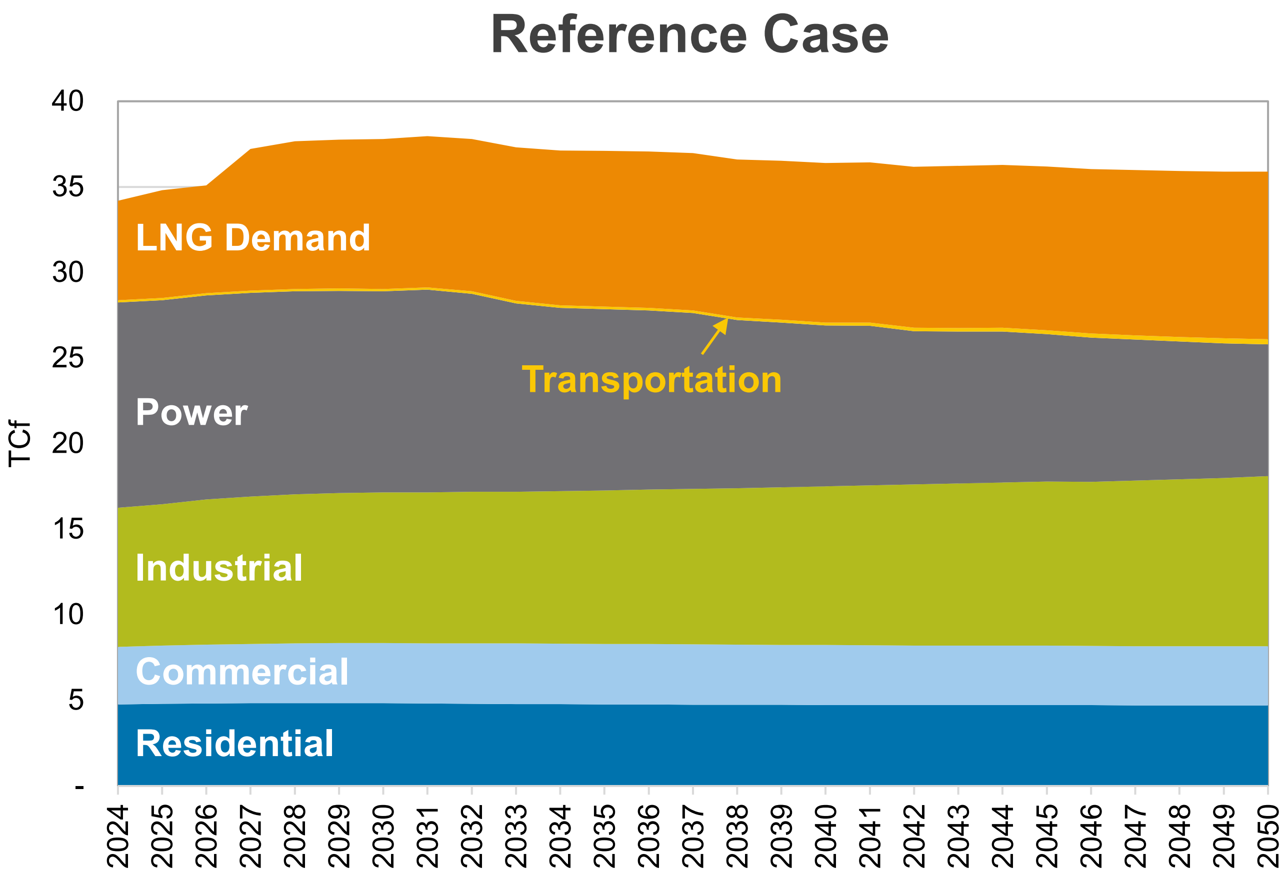


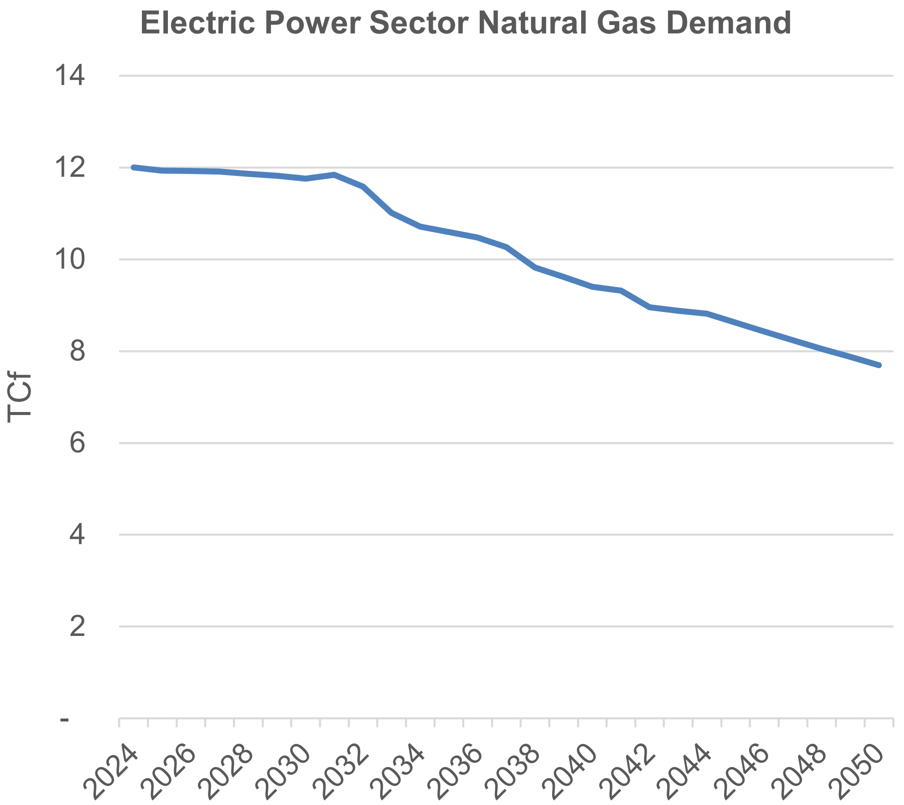

**CRA relies on historical drilling for completed shale wells to develop our view of basin productivity**

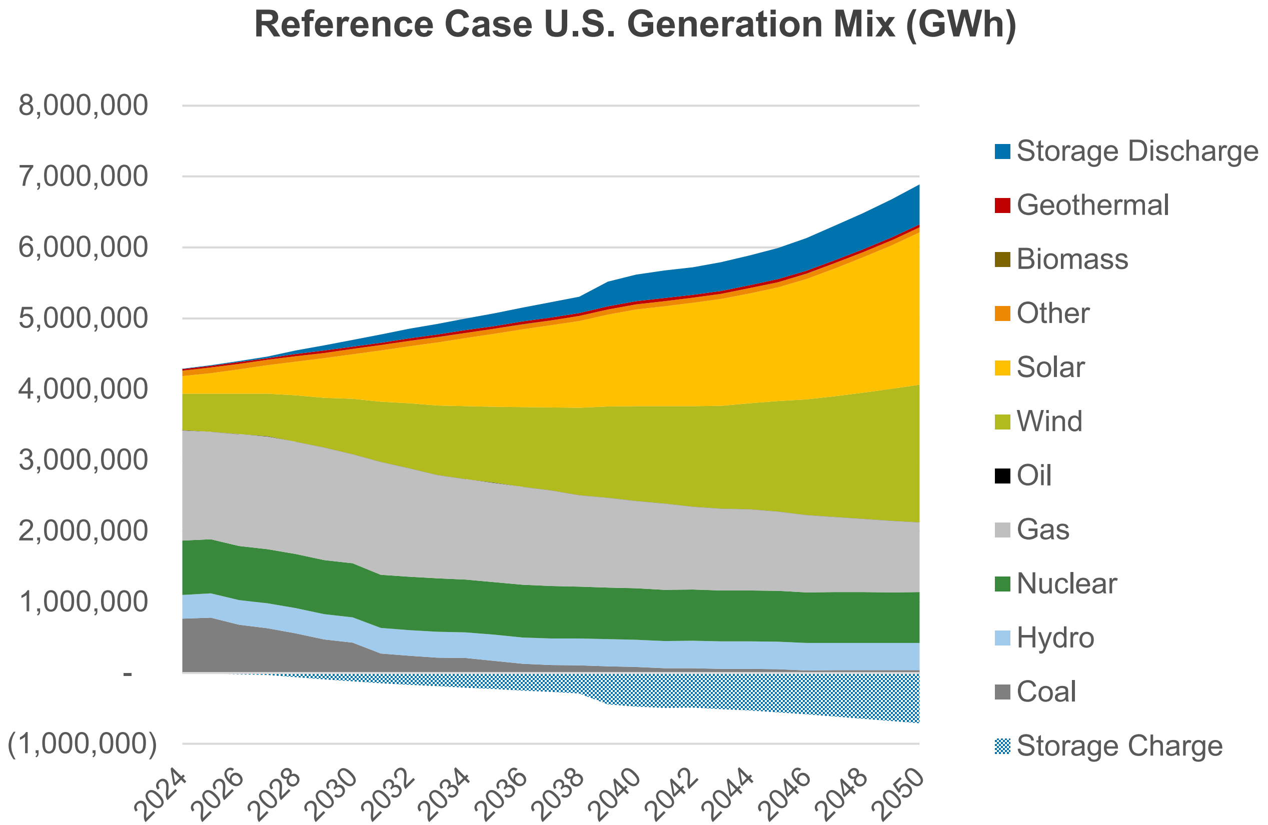
# NATIONAL NATURAL GAS DEMAND PROJECTIONS

- Power sector steadily decarbonizes (based on CRA's national power sector outlook), although natural gas retains a significant market share over the long term in the Reference Case.
- The residential and commercial sectors are projected to be relatively flat, with industrial demand growth of ~0.8% per year over the long-term (all based on the AEO base case).
- LNG demand is expected to increase over time, especially in the near-term as under construction projects enter into service.



# POWER SECTOR GAS DEMAND AND NATIONAL GENERATION MIX

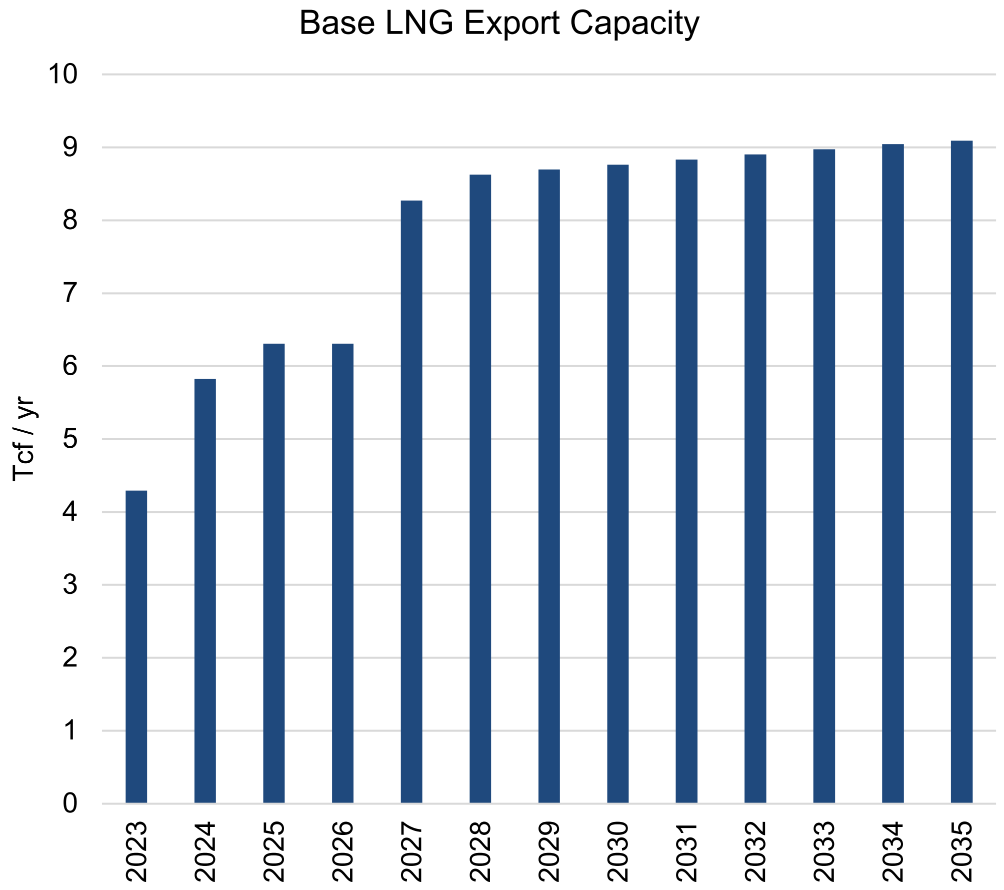


# LNG EXPORT DEMAND IS ESTIMATED THROUGH A REVIEW OF PROPOSED AND EXISTING PROJECTS

- LNG export expectations have increased in recent years as additional projects have come online and started construction.
- AEO's long-term view of exports reflects that high demand for US LNG has terminals operating at higher capacity factors than have been observed in recent years.

**CRA** notes a surge in LNG export demand expectations this year and through 2027, which will likely exert upward pressure on prices.

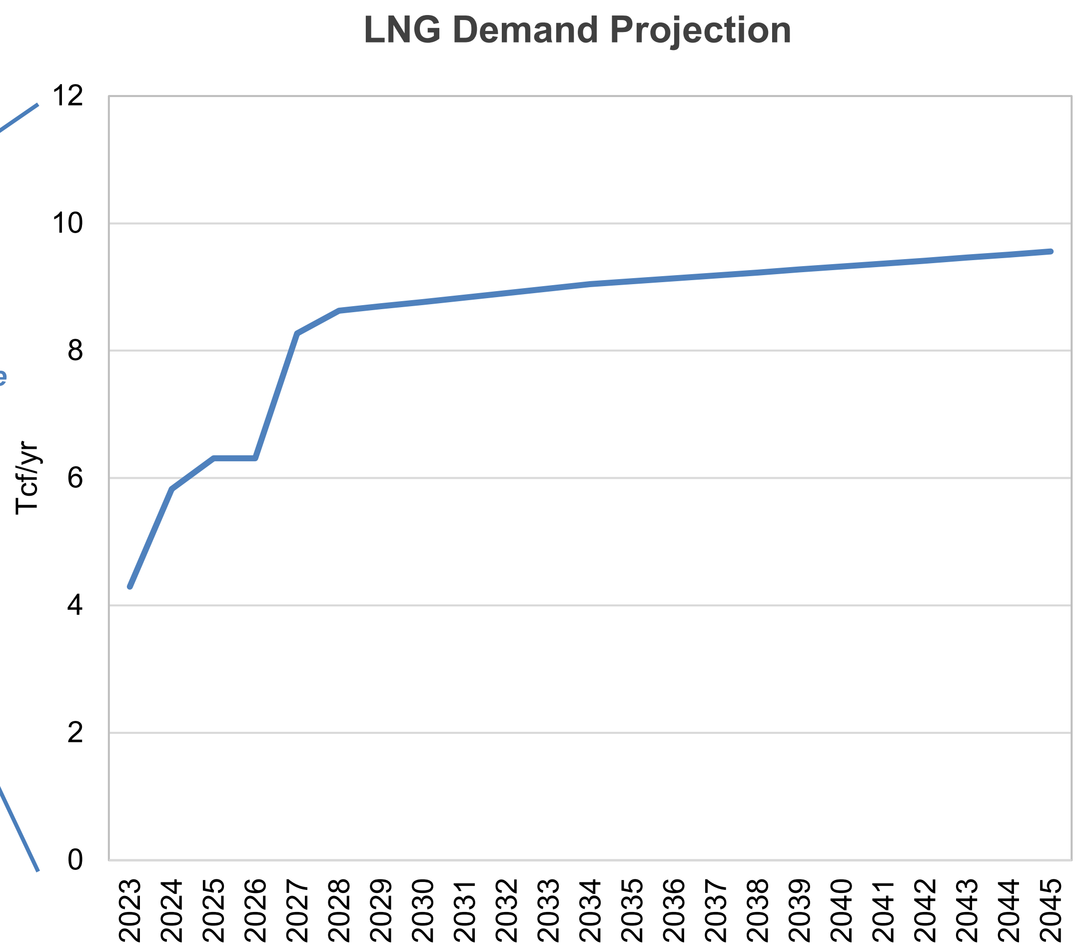


# LNG PROJECT LIST

| Project | Status | Date | Capacity (Bcf/d) |
|---|---|---|---|
| Sabine (T1-T6) | Operating | 2023 | 4.55 |
| Kenai | Operating | 2023 | 0.20 |
| Cove Point (Full Terminal) | Operating | 2023 | 0.79 |
| Sempra Cameron (T1-T3) | Operating | 2023 | 2.06 |
| Elba/Southern LNG (T1-T10) | Operating | 2023 | 0.35 |
| Freeport (T1-T3) | Operating | 2023 | 2.38 |
| Corpus Christi (T1-T3) TX | Operating | 2023 | 2.40 |
| Cameron Parish (Units 1-4) | Operating | 2023 | 1.11 |
| Plaquemines Parish Phase 1 | Under Const. | 2024 | 1.76 |
| Plaquemines Parish Phase 2 | Under Const. | 2025 | 1.56 |
| Cameron Parish (units 7-9) | Under Const. | 2024 | 0.61 |
| Calcasieu Parish Phase 1 | Under Const. | 2027 | 3.81 |
| Golden Pass | Under Const. | 2024 | 2.57 |
| Corpus Christi TX | Under Const. | 2027 | 1.58 |
| Port Arthur (T1) | Under Const. | 2027 | 0.93 |
| Port Arthur (T2) | Under Const. | 2028 | 0.93 |
| Lake Charles LNG | In Development | | 2.27 |
| Commonwealth LNG | In Development | | 1.21 |
| Magnolia LNG | In Development | | 1.22 |
| Sempra Cameron (T4-T5) | In Development | | 0.93 |
| Freeport (T4) | In Development | | 0.74 |
| Jacksonville | In Development | | 0.13 |
| Texas LNG Brownsville | In Development | | 0.62 |
| Rio Grande LNG Brownsville | In Development | | 3.73 |
| Gulf LNG Liquefication | In Development | | 1.50 |
| Nikiski | In Development | | 2.76 |
| Port Arthur (T3-T4) | In Development | | 1.86 |
| Delfin FLNG | In Development | | 1.80 |

*Assumed in CRA Reference Case*

*Excluded*



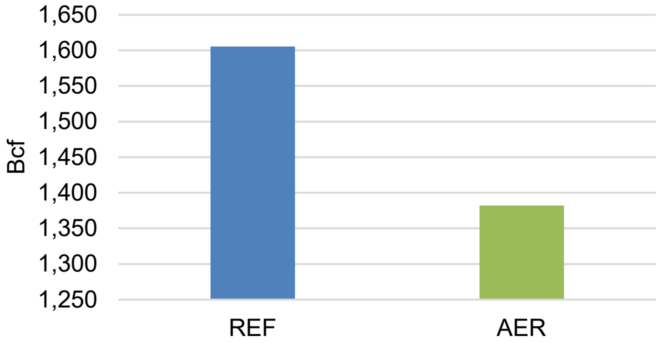

**Assumes 85% utilization through 2028, with 0.5% increase in demand thereafter*

# FUNDAMENTAL NATURAL GAS PRICE DRIVERS ACROSS SCENARIOS

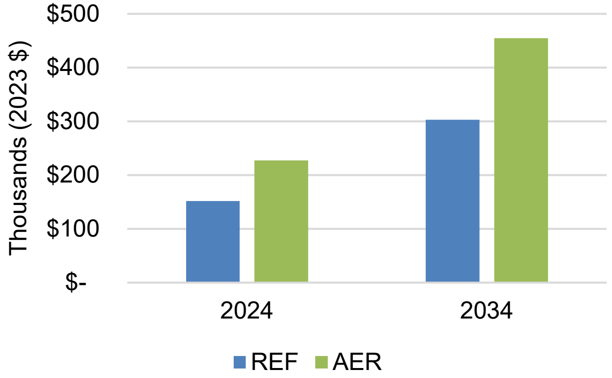
## Aggressive Environmental Regulation (AER)

~1.5 multiple applied to environmental capex; PGC min resource value used to simulate fracking ban or other production restrictions.

Total unproven resources



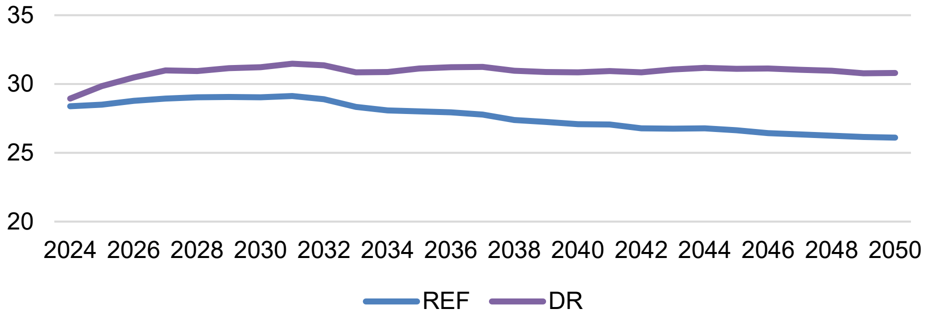

Environmental Capex comparison




## Domestic Resiliency (DR)

AEO "high oil supply, high gas supply" demand trajectory used instead of AEO reference case. This is the highest of their ~20 trajectories.

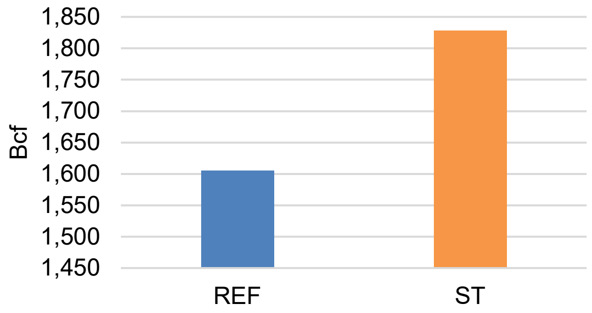
Gas Demand Trajectory REF vs DR



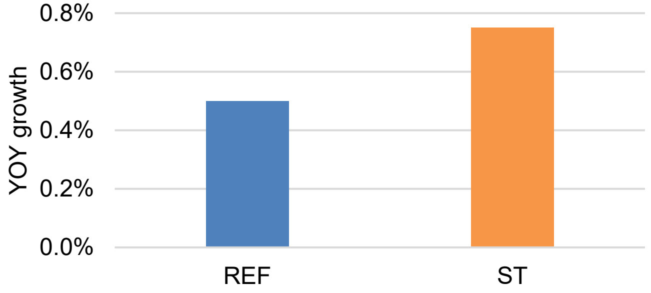

## Slower Transition (ST)

PGC unproven resource size increases from Reference; well productivity rates increase due to more focus on gas as opposed to other power sources.

Total unproven resources

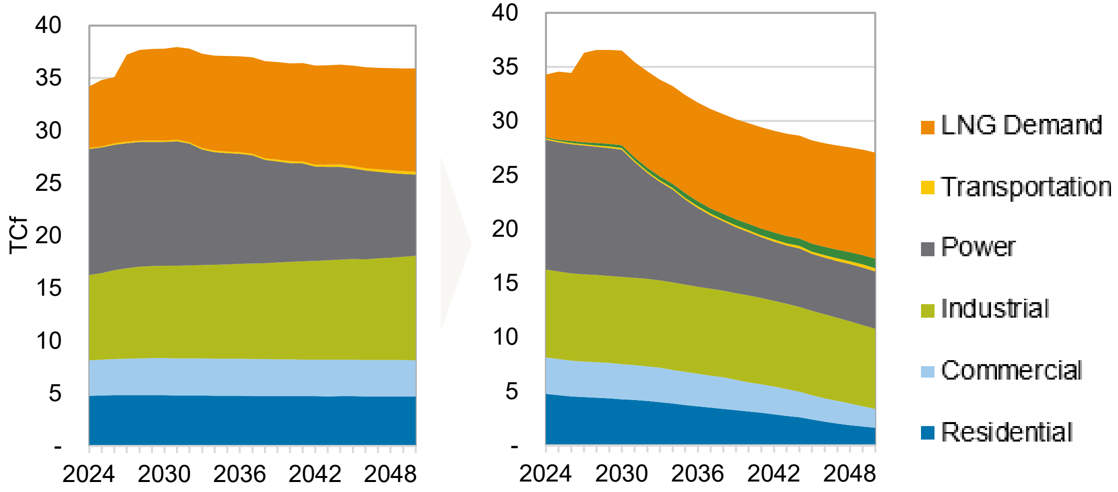



Resource growth YOY




## Accelerated Innovation (AI)

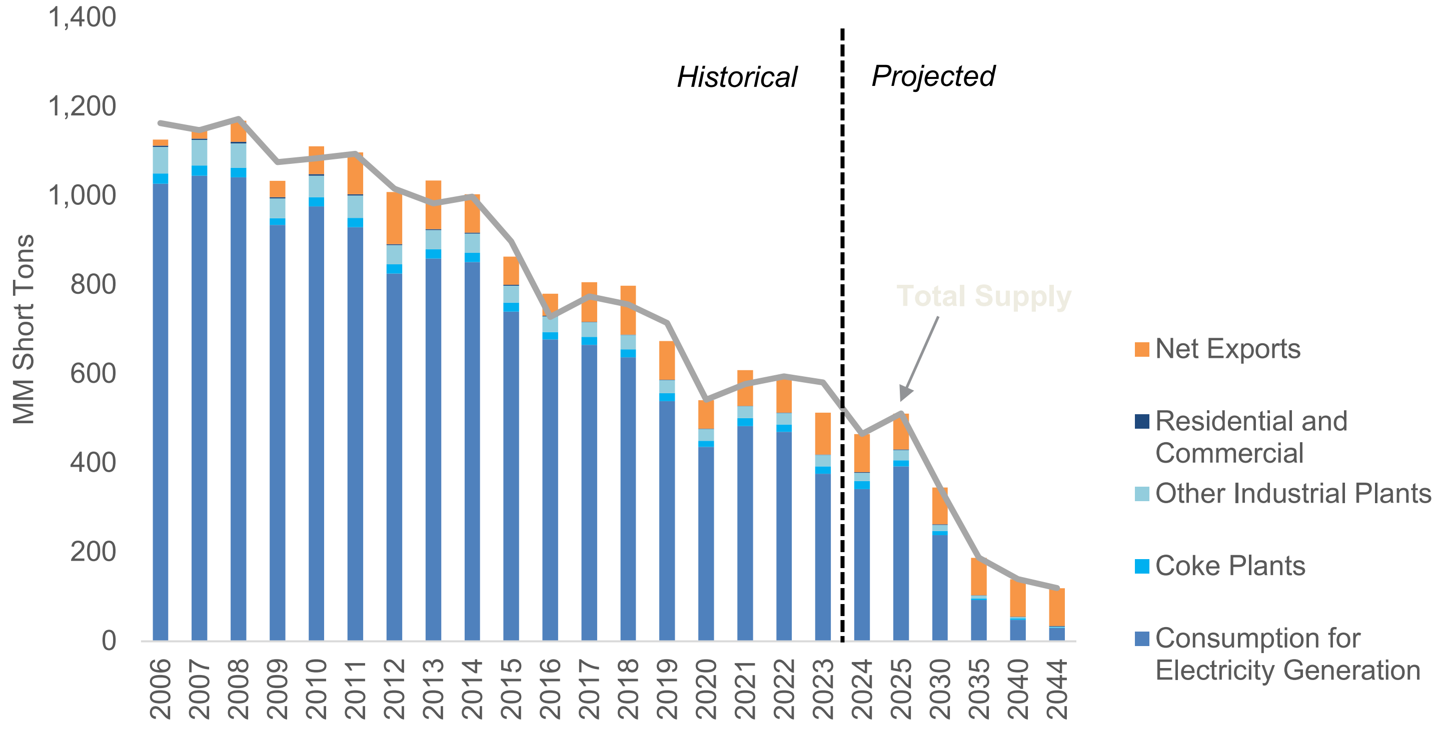
U.S. Gas Demand



# COAL SUPPLY-DEMAND PROJECTIONS

CRA's price forecast reflects declining domestic demand

**Historical and Forecasted Supply Demand Balance for Coal**




*Historical: EIA and MSHA*
*Forecast: CRA Analysis*

- A 3% uptick in coal production was experienced in 2022, following a higher 6% increase in 2021 due to elevated gas prices, strong exports, and a greater dependence on coal-fired generation in that period. 2023 production is, however, estimated to have fallen by about 2% to about 581 MM tons.
- Further declines in coal demand are expected in the next 5 years due to continued retirements and increasing penetration of natural gas and renewable resources.



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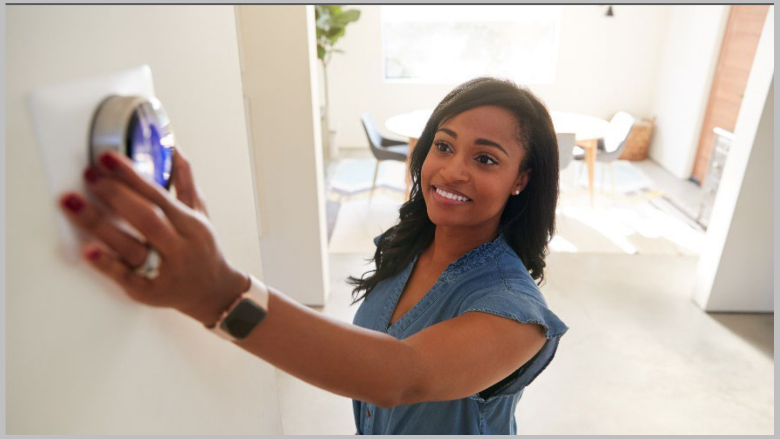
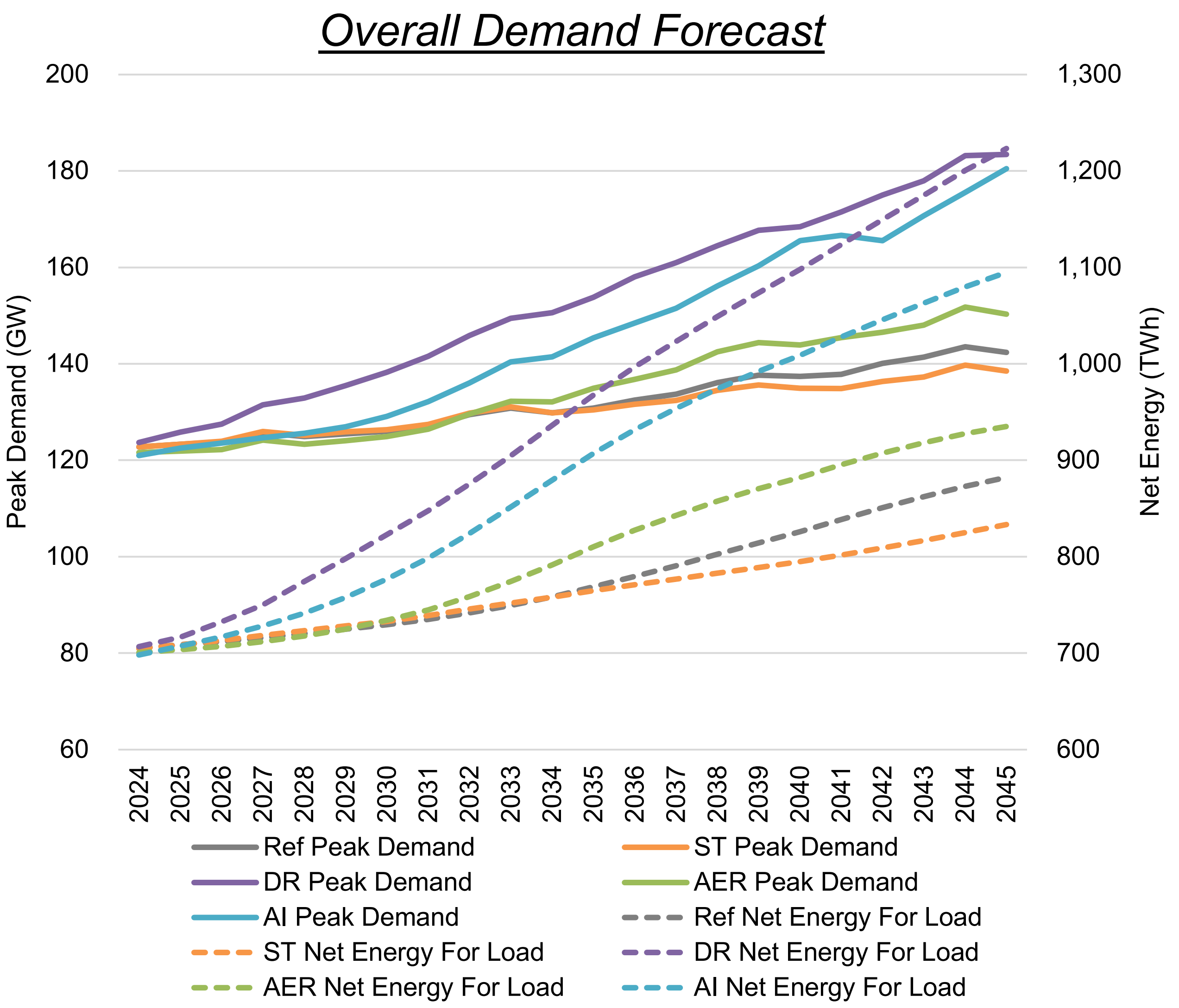
*We exist to deliver safe, reliable energy that drives value to our customers*

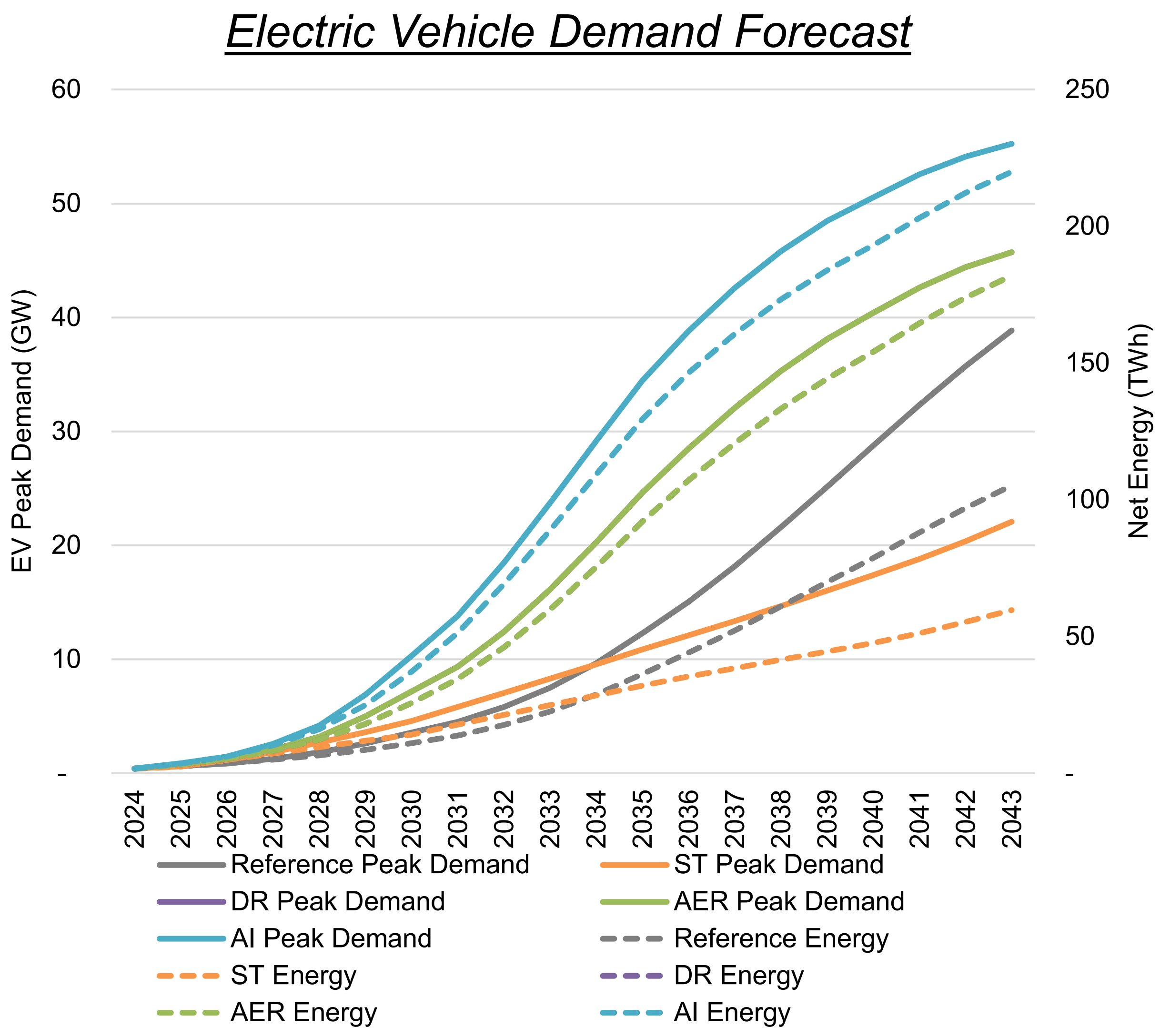
# APPENDIX: SCENARIO ANALYSIS MISO MARKET OUTPUTS



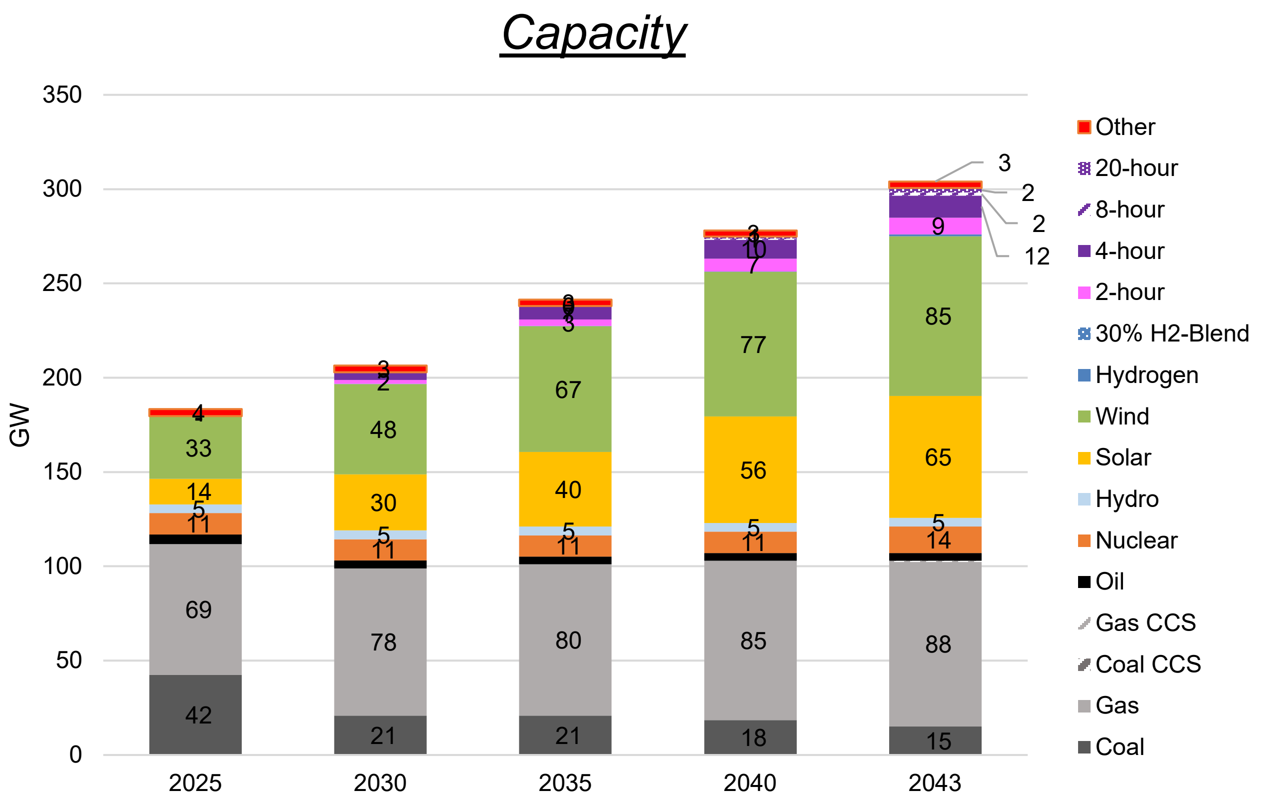


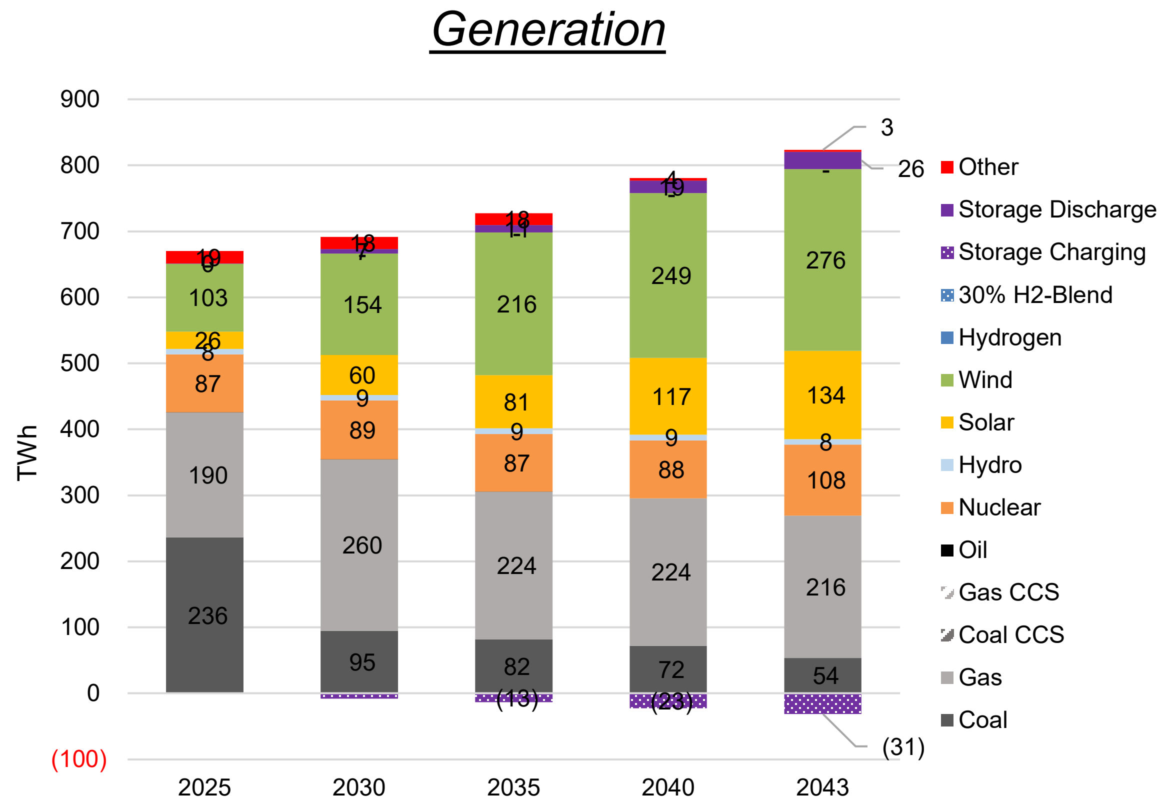
# MISO LOAD FORECAST RANGES



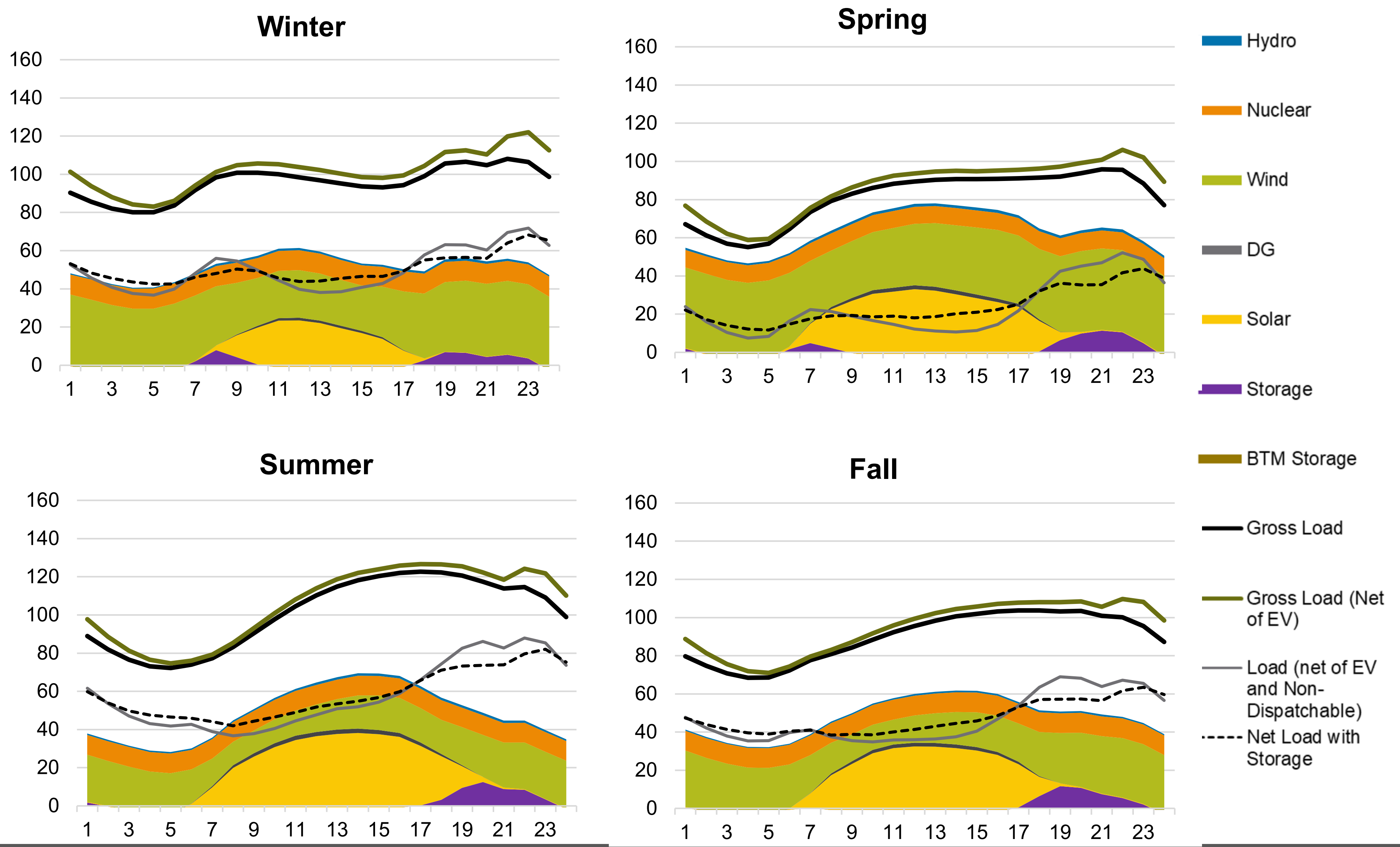



# MISO CAPACITY AND GENERATION MIX (SLOWER TRANSITION)

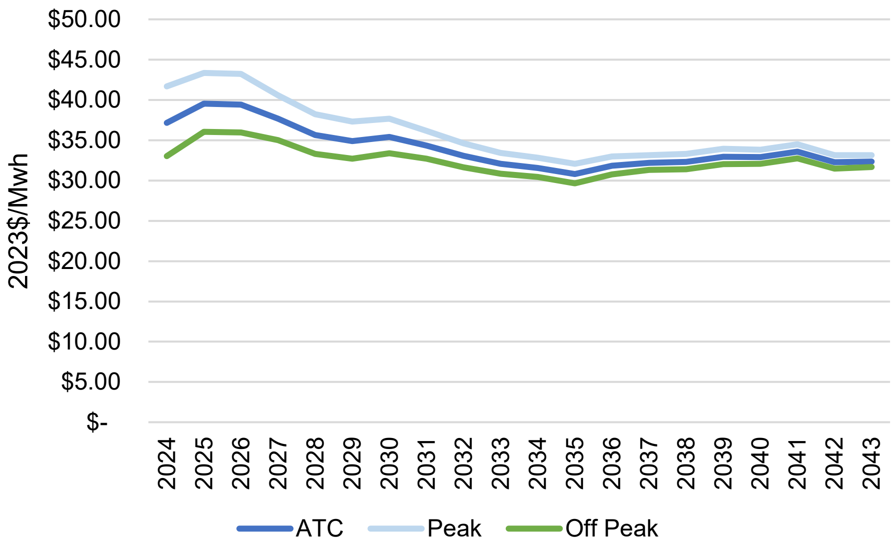


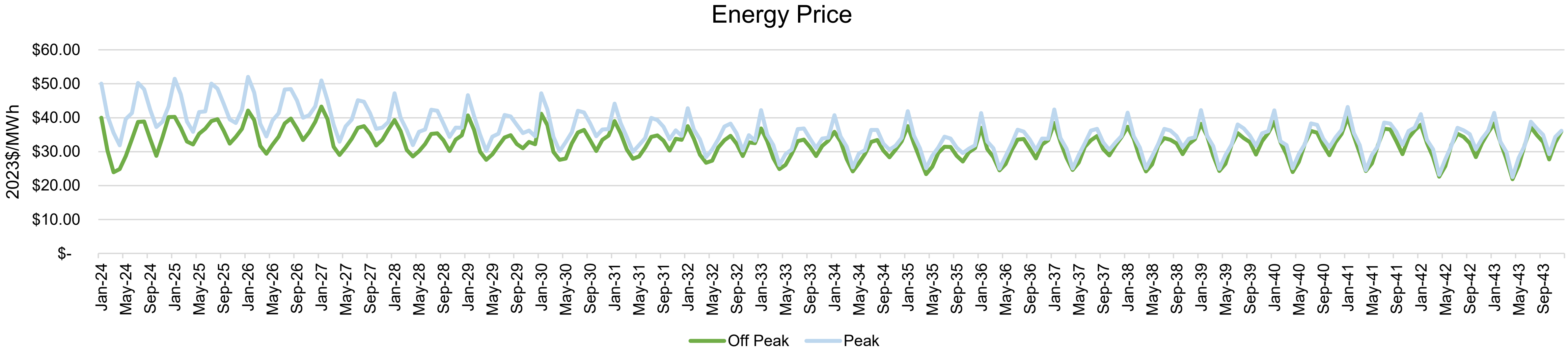



# MISO HOURLY ENERGY PROFILE (SLOWER TRANSITION) - 2040

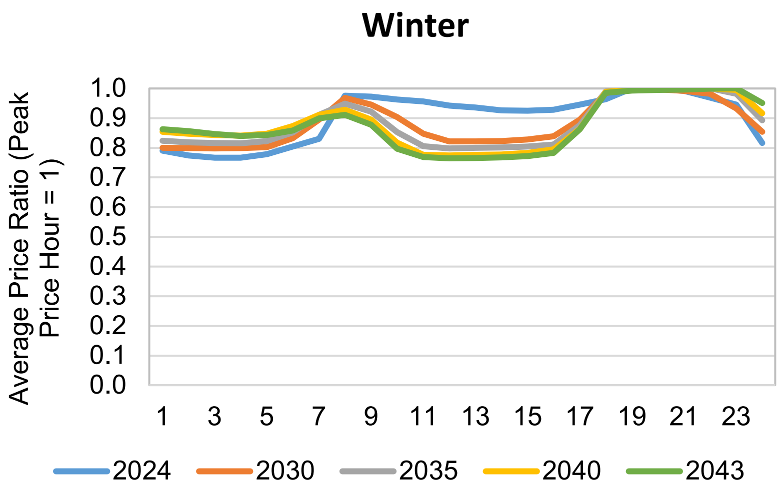


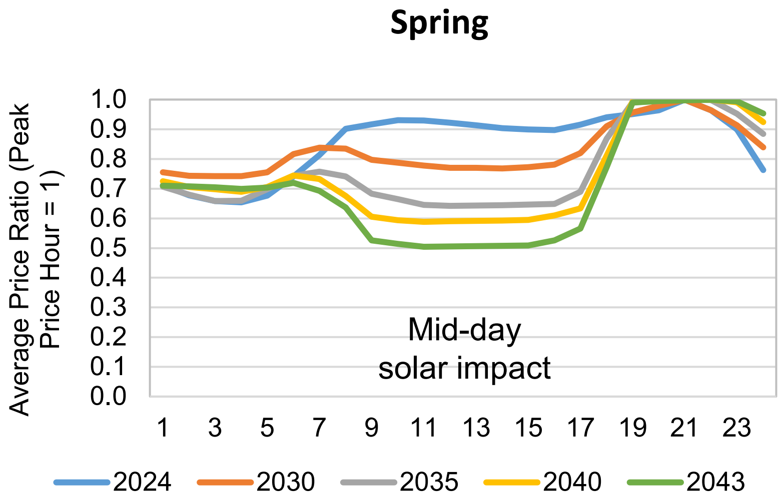
# MISO ZONE 6 POWER PRICE PROJECTIONS – SLOWER TRANSITION

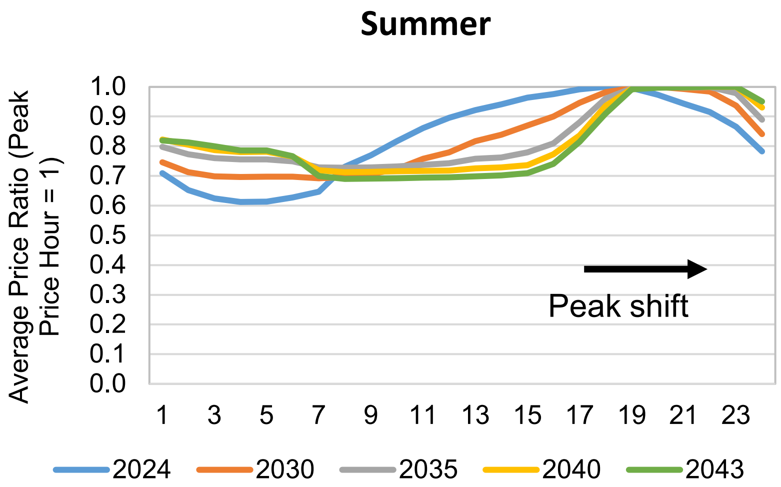


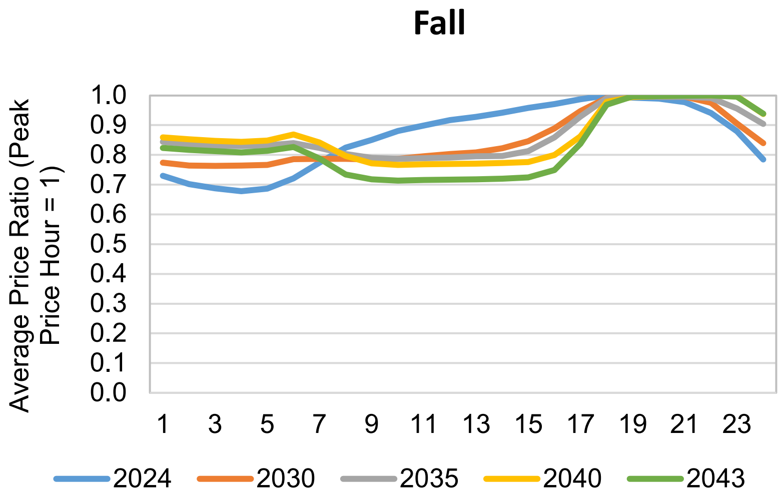



# HOURLY PRICE SHAPES – SLOWER TRANSITION

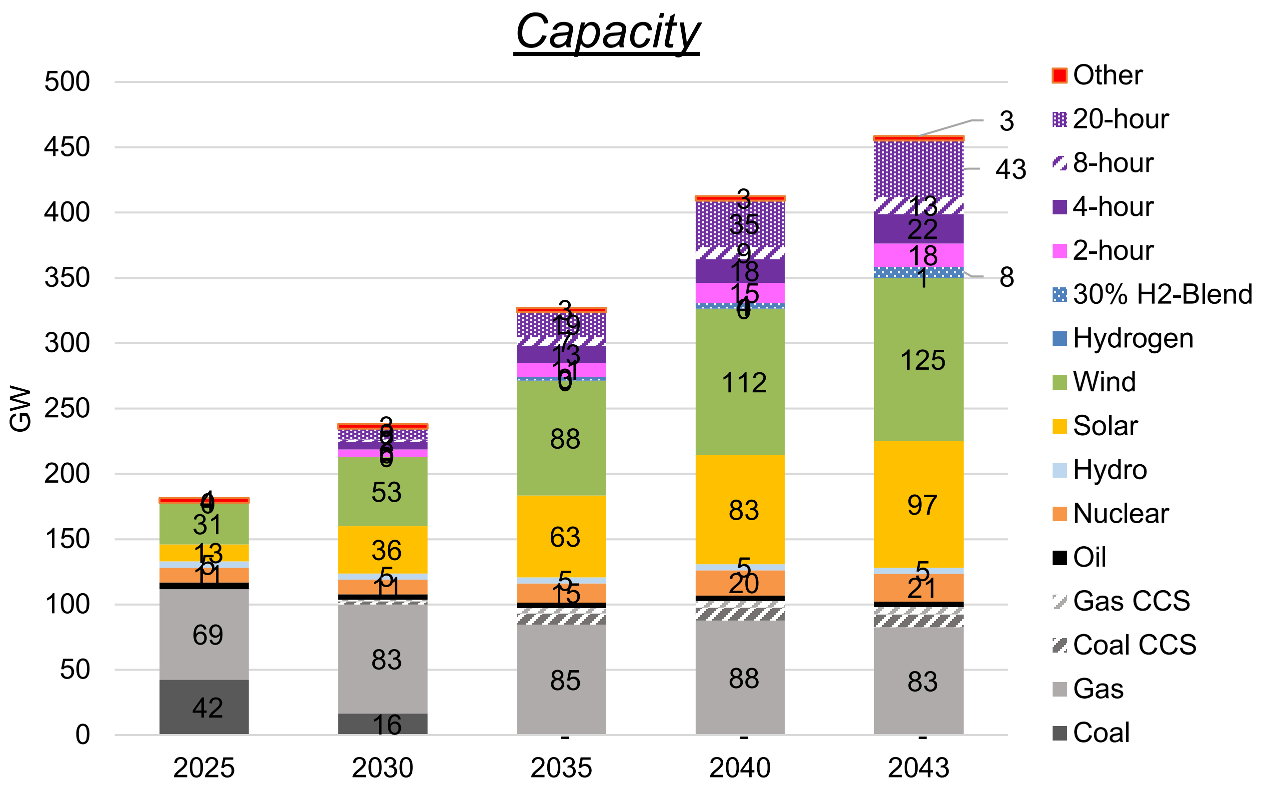


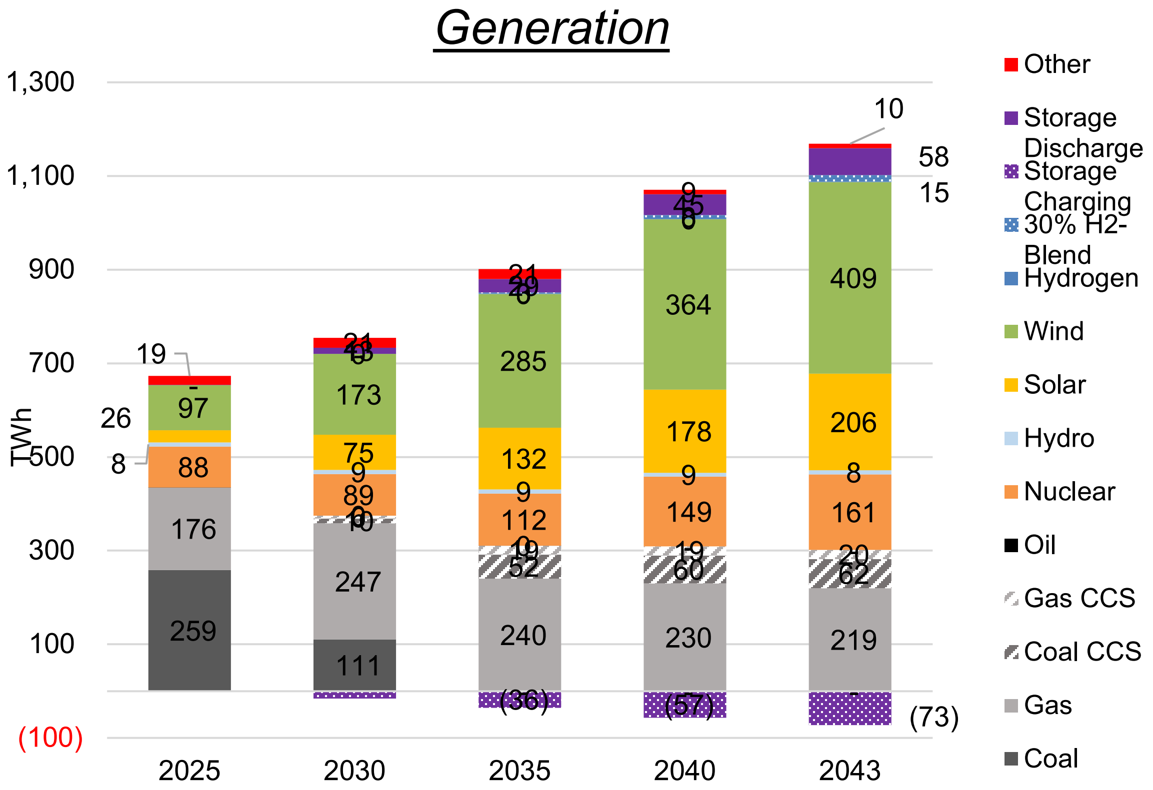



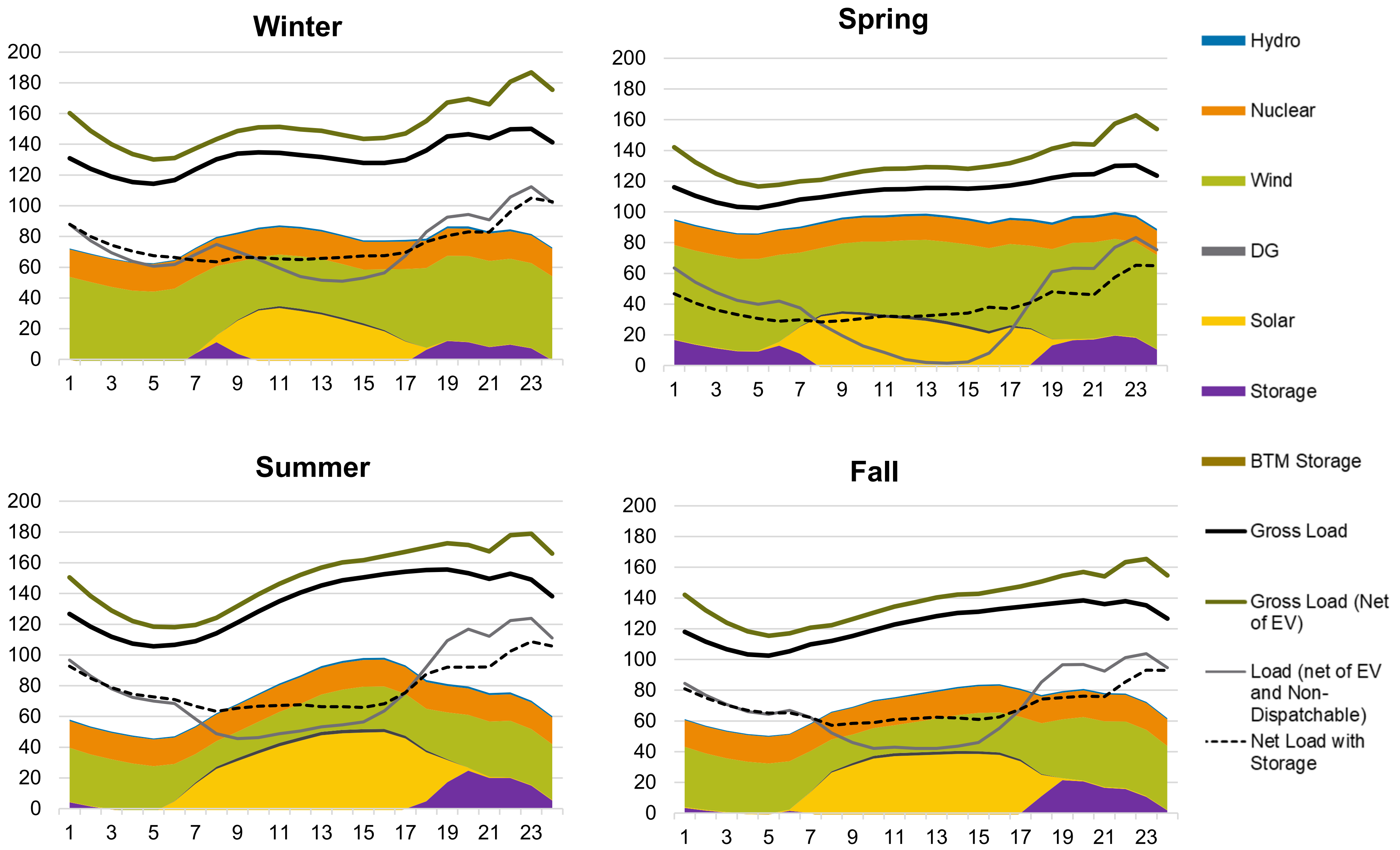



# MISO CAPACITY AND GENERATION MIX (DOMESTIC RESILIENCY)

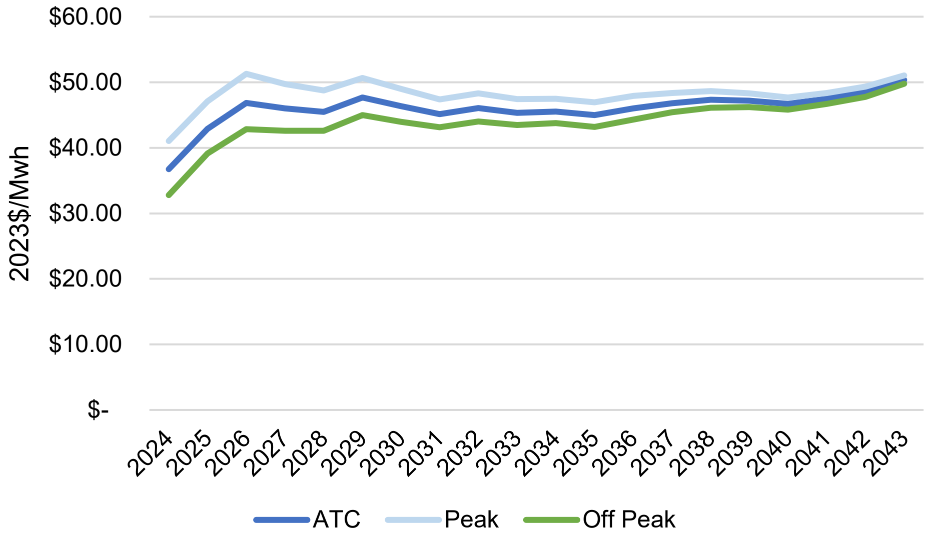


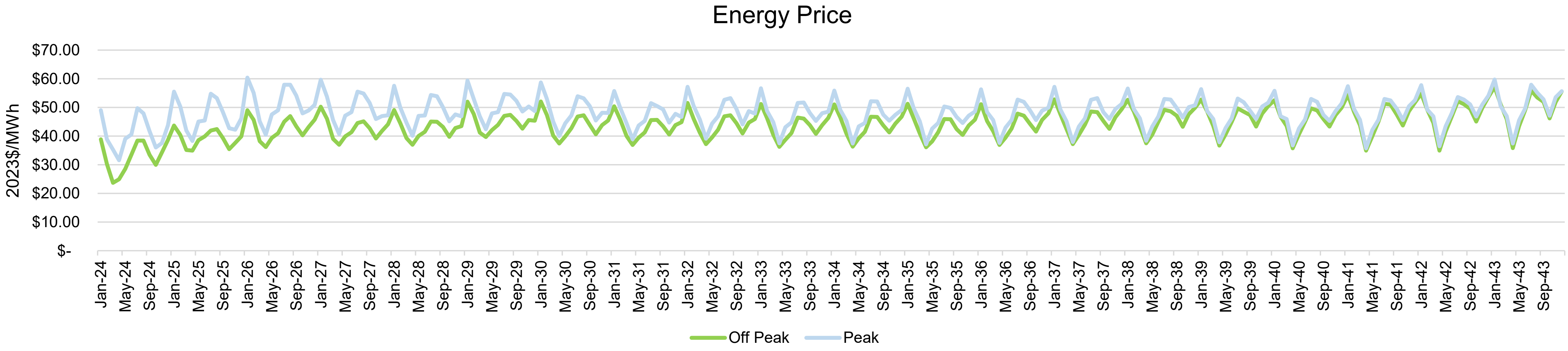



# MISO HOURLY ENERGY PROFILE (DOMESTIC RESILIENCY) - 2040

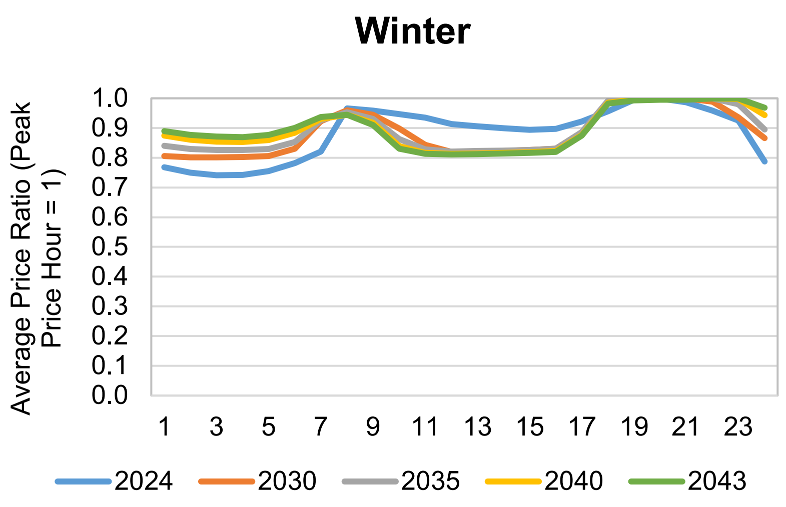


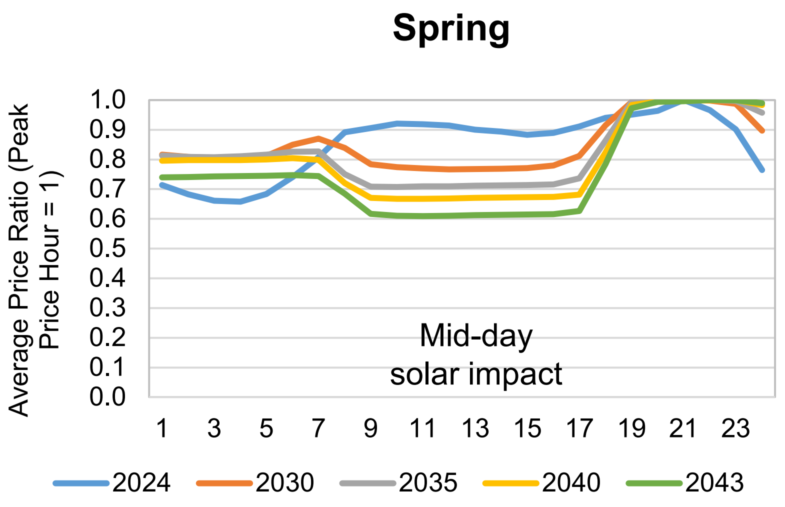
# MISO ZONE 6 POWER PRICE PROJECTIONS – DOMESTIC RESILIENCY

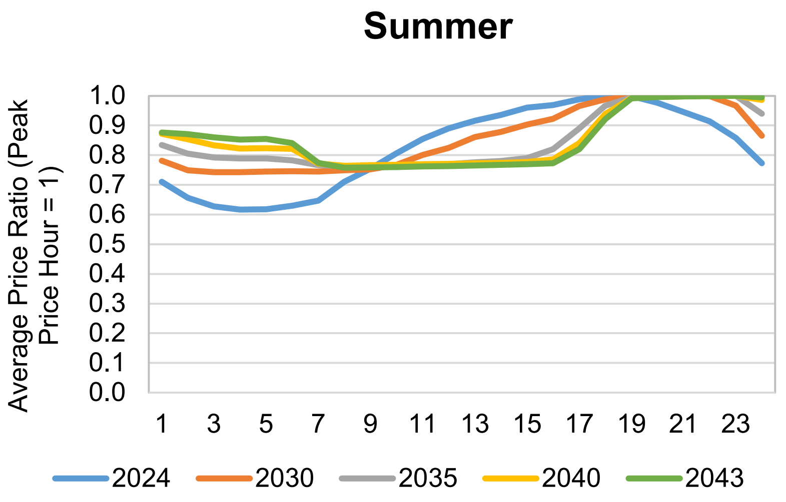


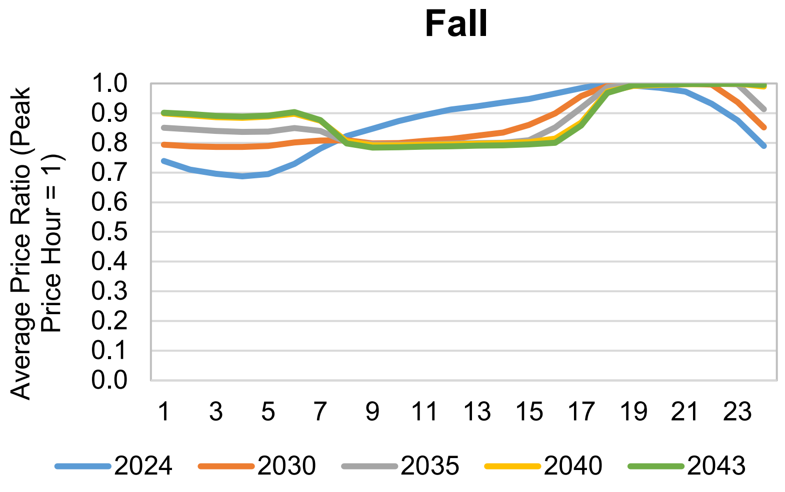



# HOURLY PRICE SHAPES – DOMESTIC RESILIENCY

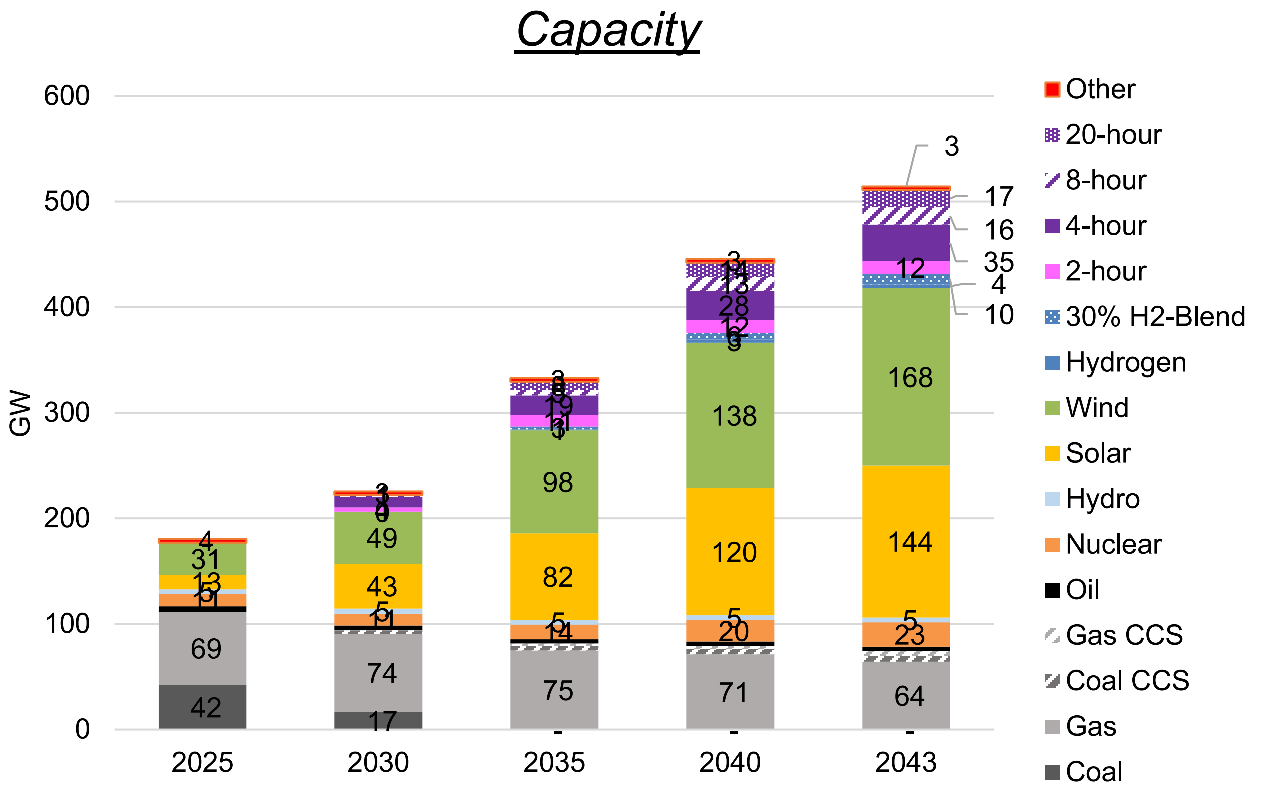


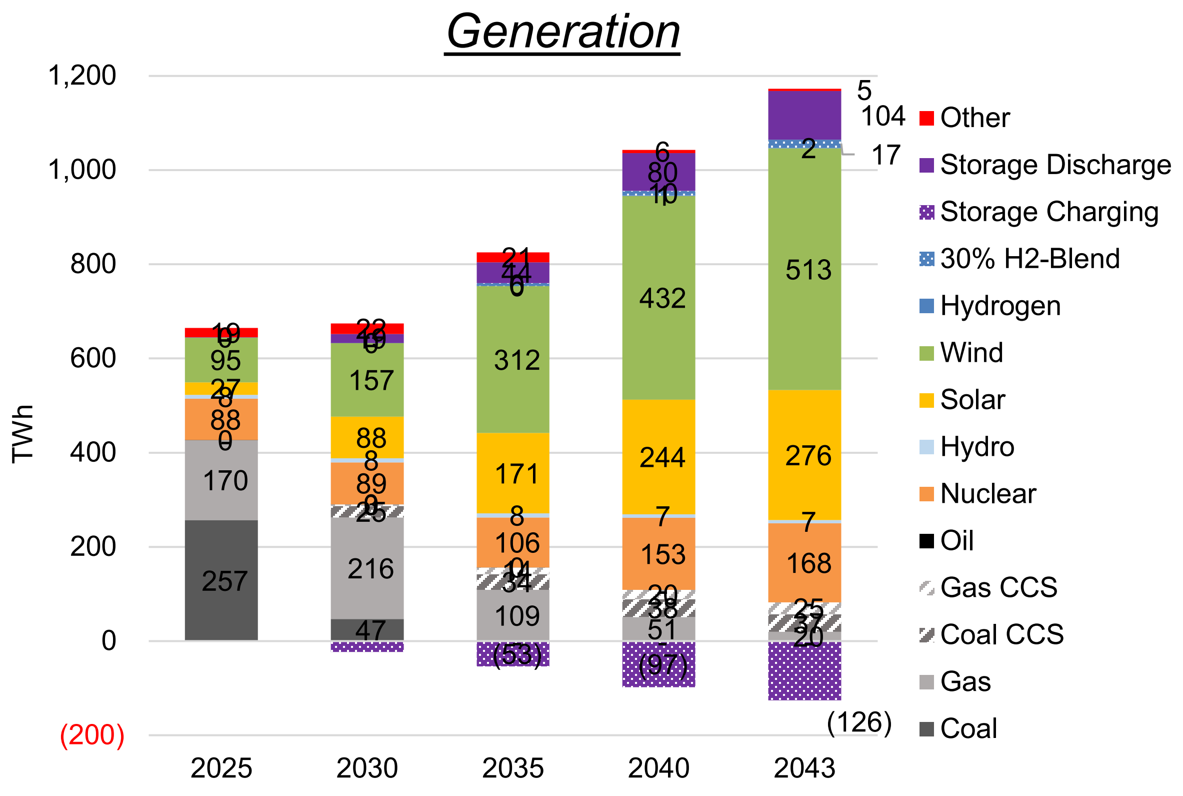



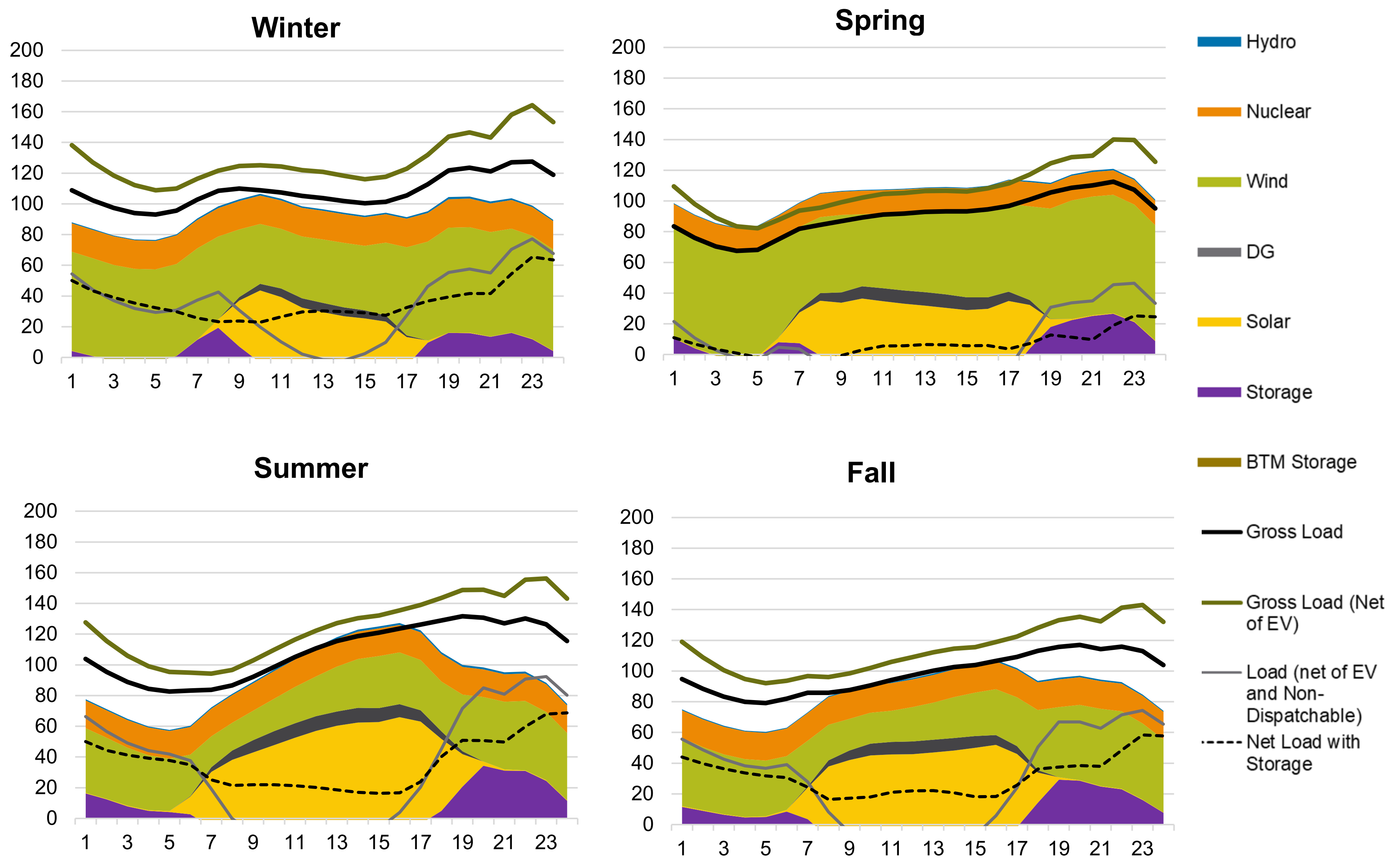



# MISO CAPACITY AND GENERATION MIX (AGGRESSIVE ENVIRONMENTAL REGULATION)

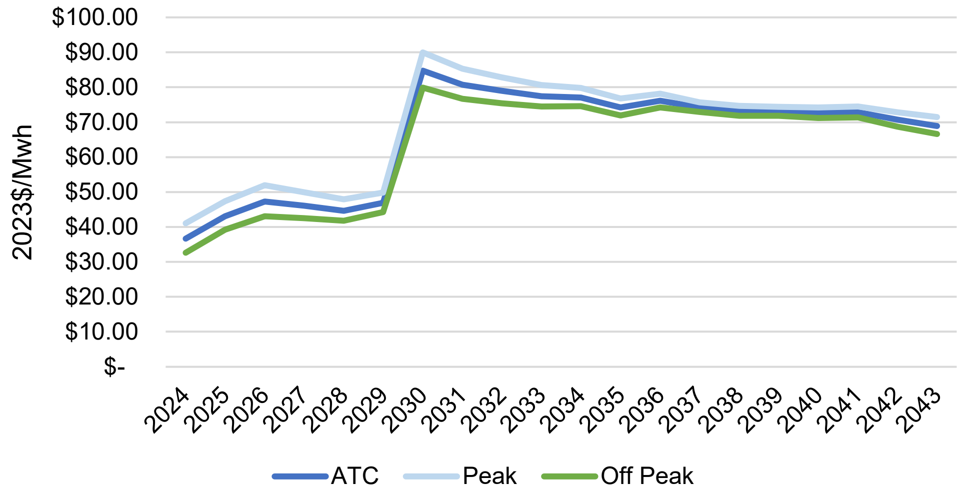


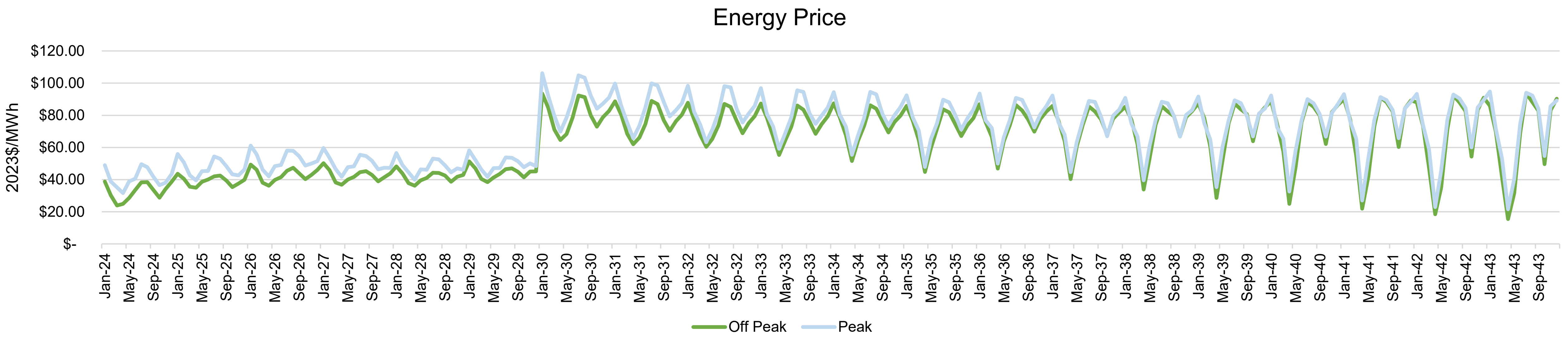



# MISO HOURLY ENERGY PROFILE (AGGRESSIVE ENVIRONMENTAL REGULATION) - 2040



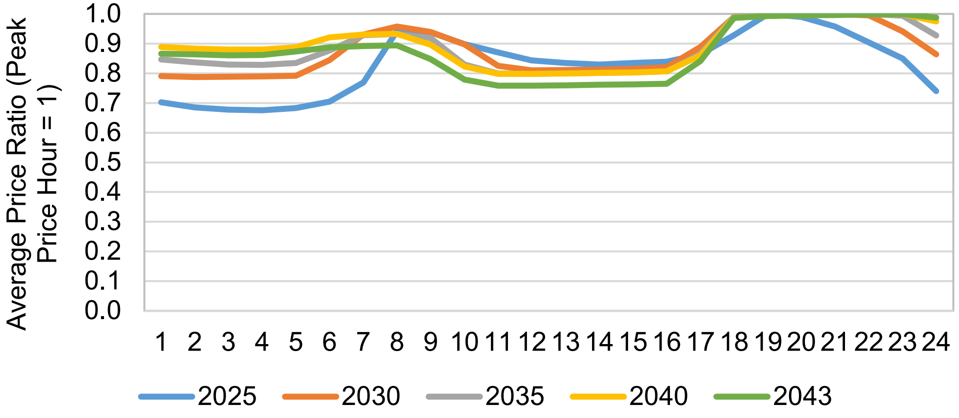
# MISO ZONE 6 POWER PRICE PROJECTIONS – AGGRESSIVE ENVIRONMENTAL REGULATION



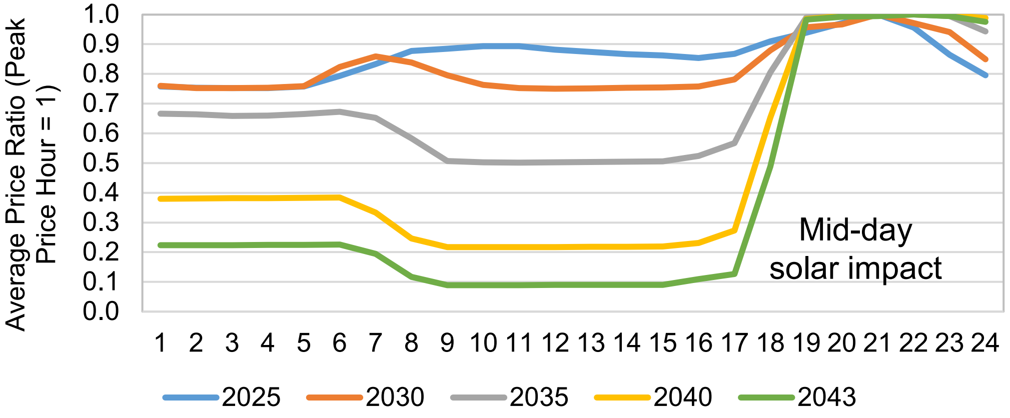



# HOURLY PRICE SHAPES – AGGRESSIVE ENVIRONMENTAL REGULATION

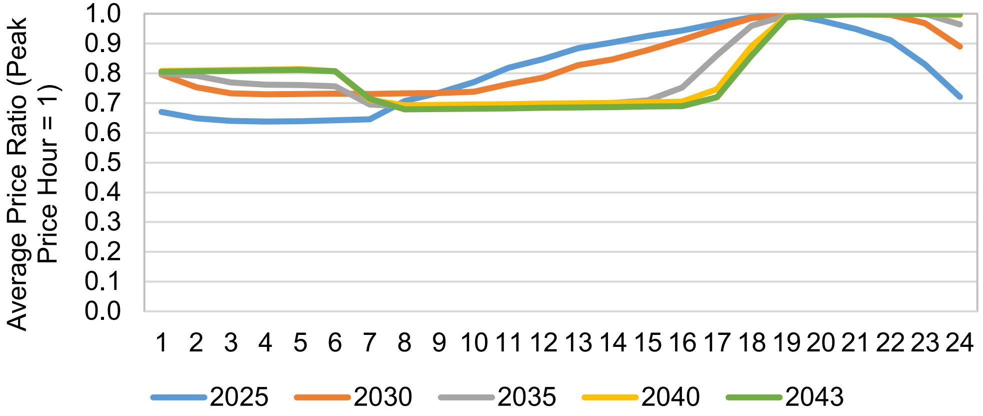
## Winter



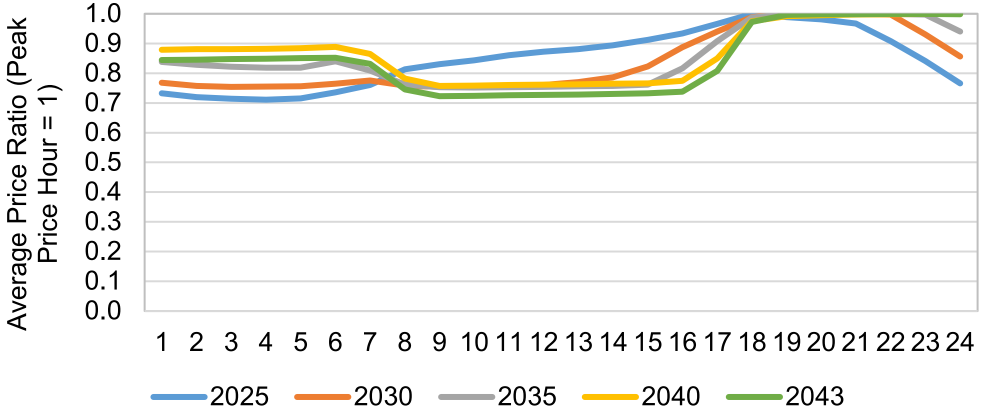

## Spring



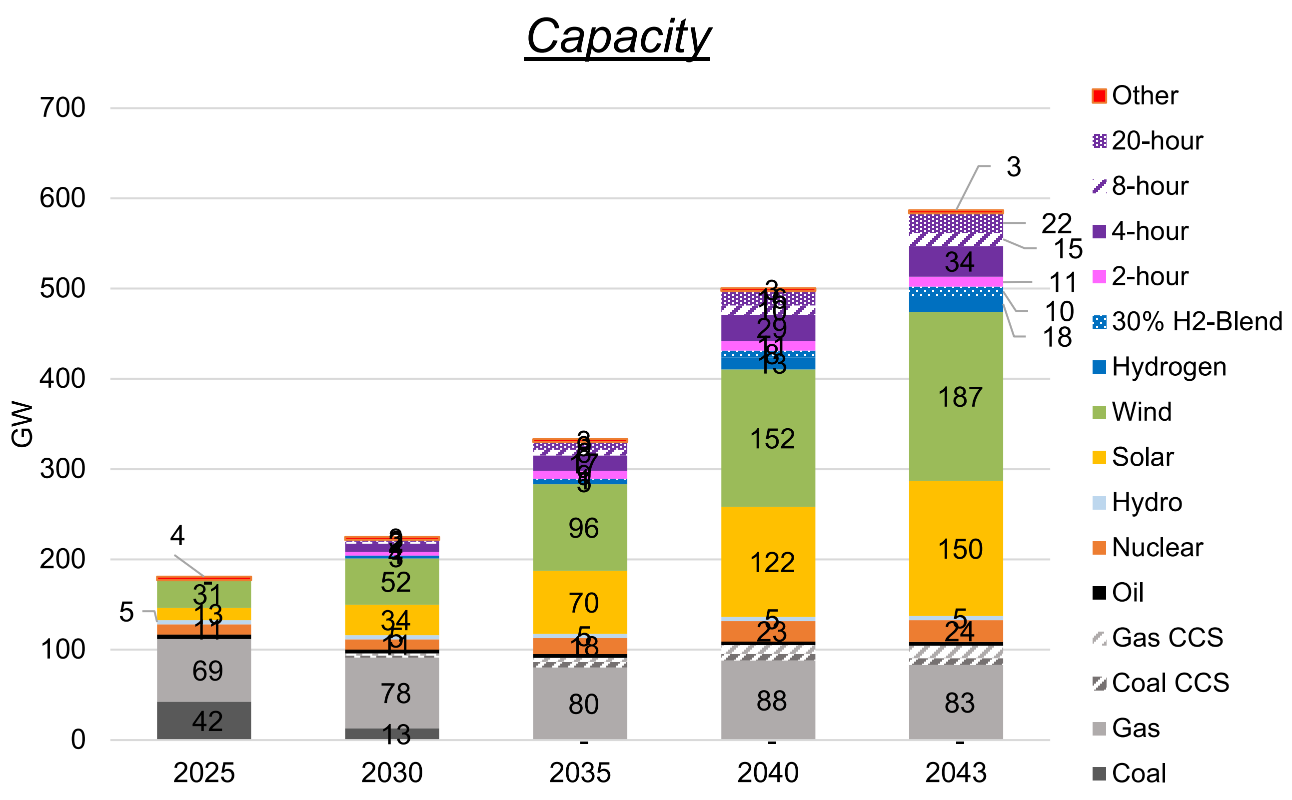

## Summer

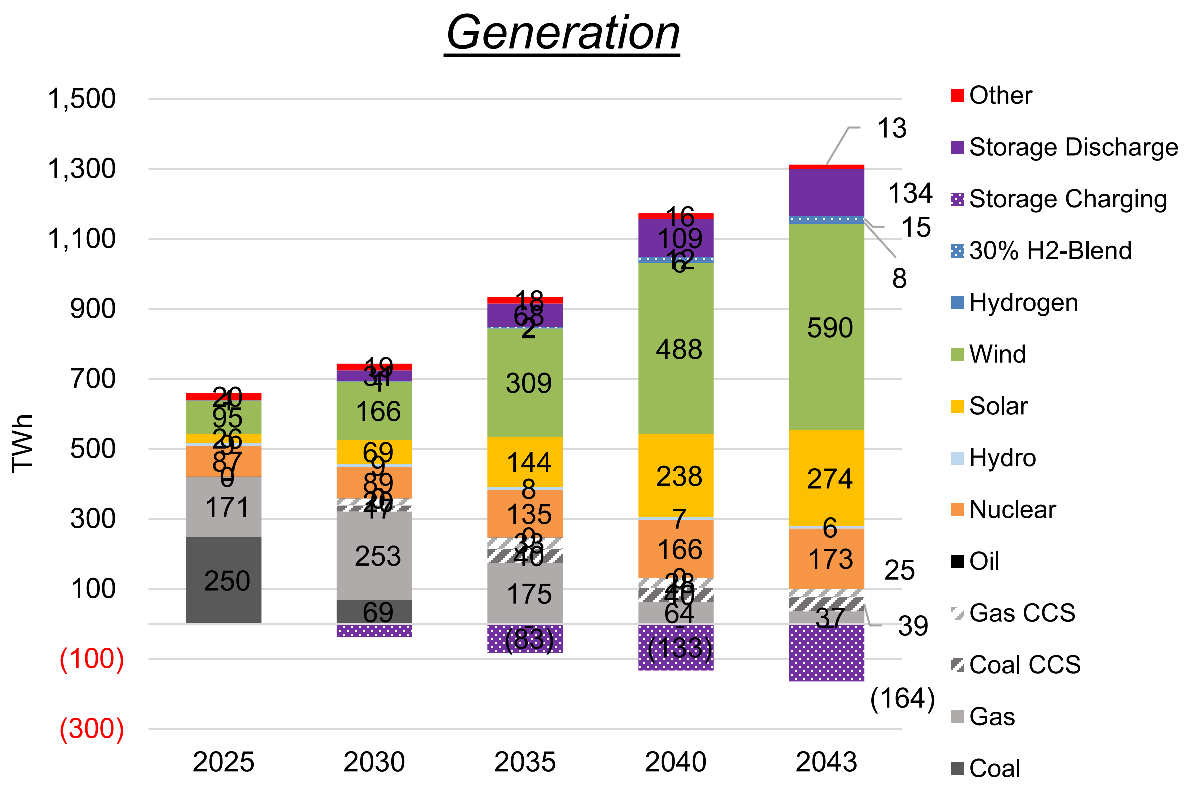



## Fall

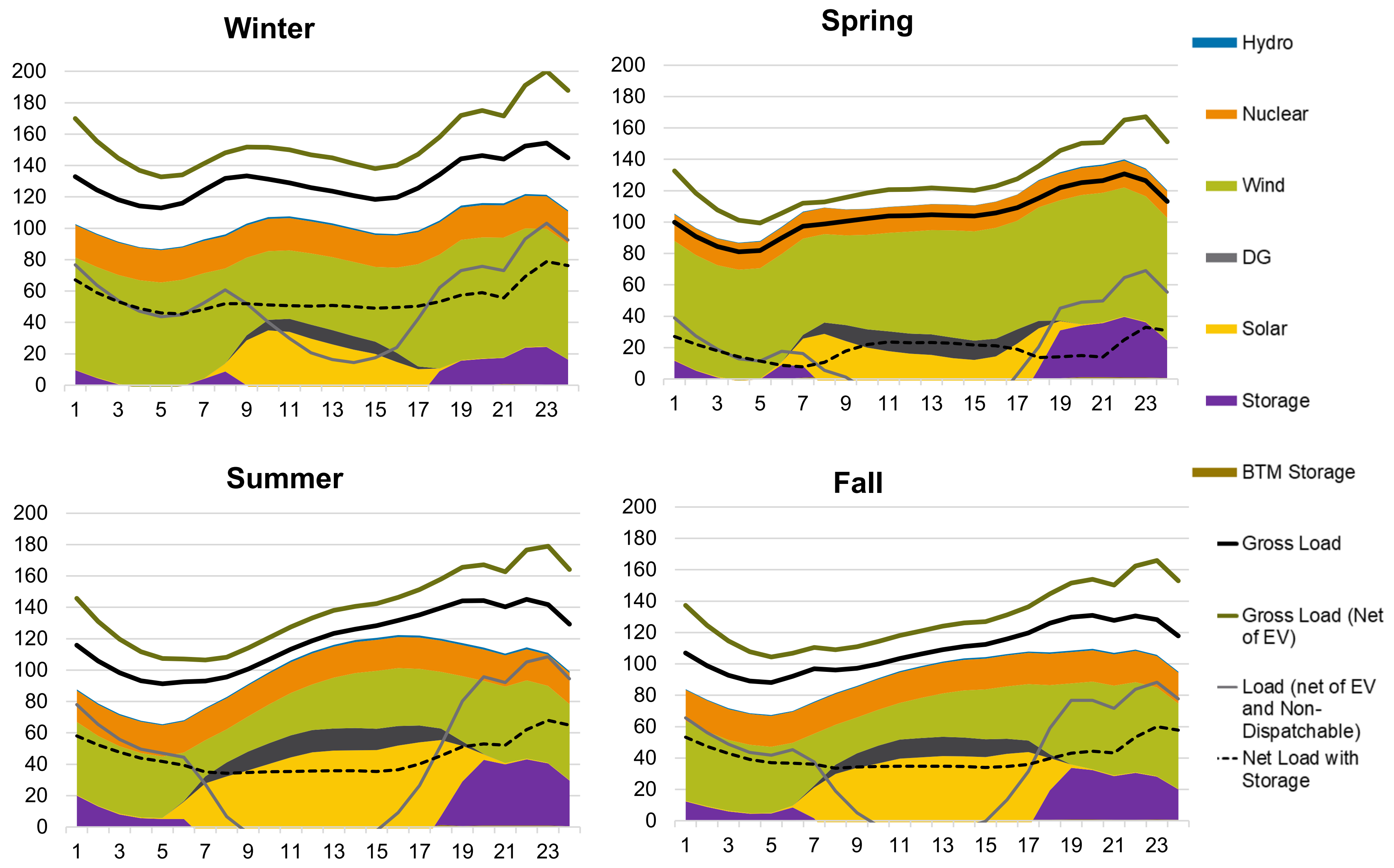


# MISO CAPACITY AND GENERATION MIX (ACCELERATED INNOVATION)

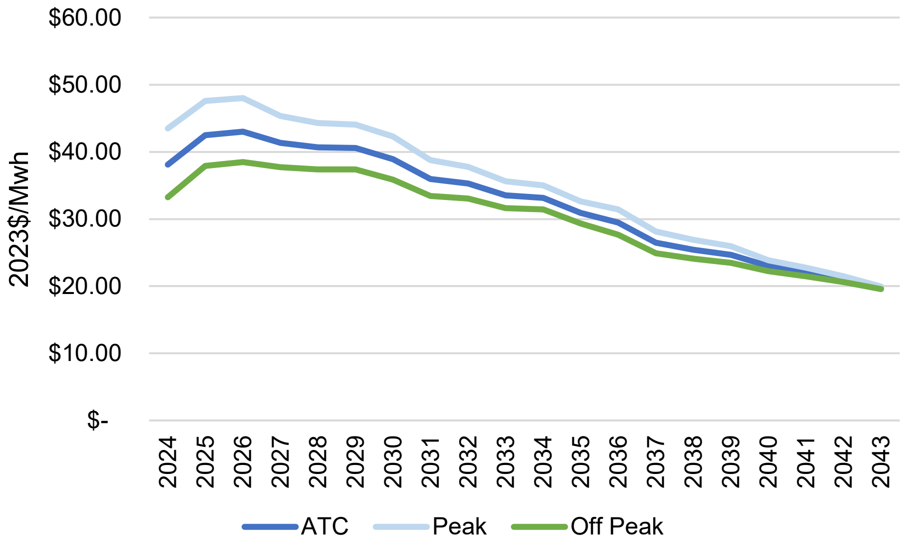


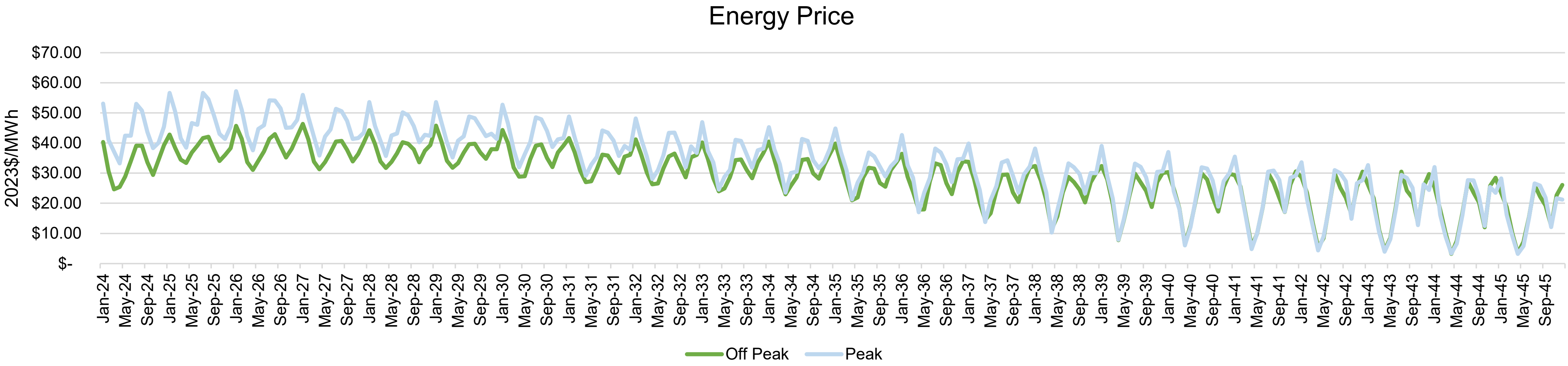



# MISO HOURLY ENERGY PROFILE (ACCELERATED INNOVATION) - 2040

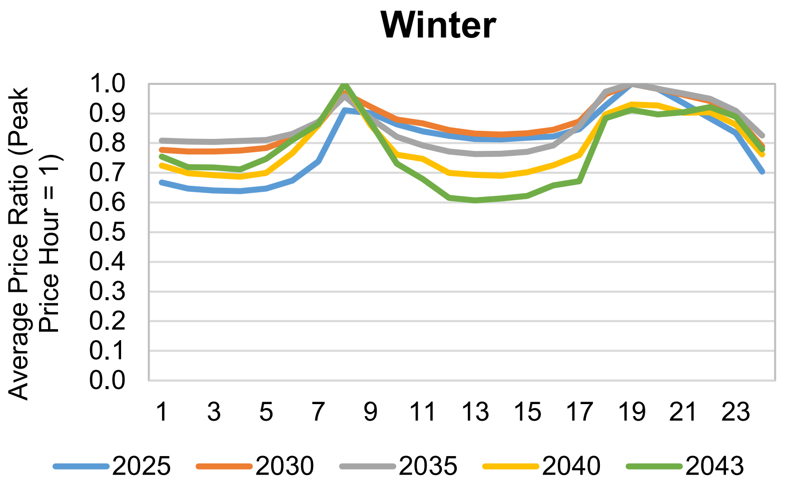


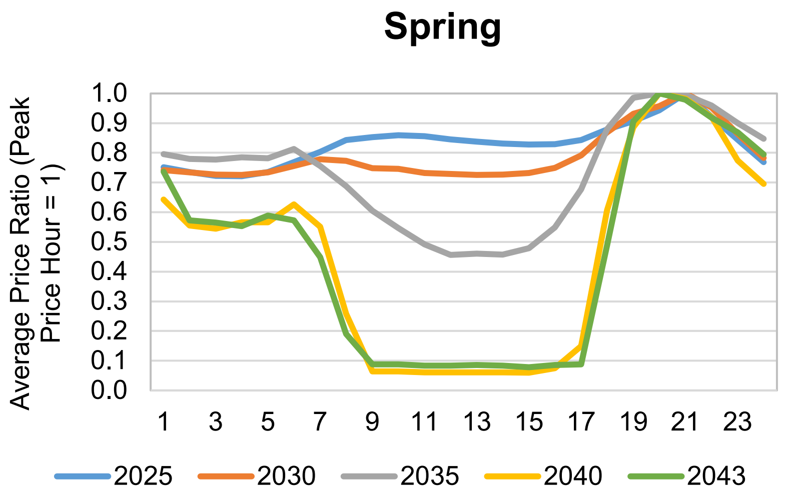
# MISO ZONE 6 POWER PRICE PROJECTIONS – ACCELERATED INNOVATION

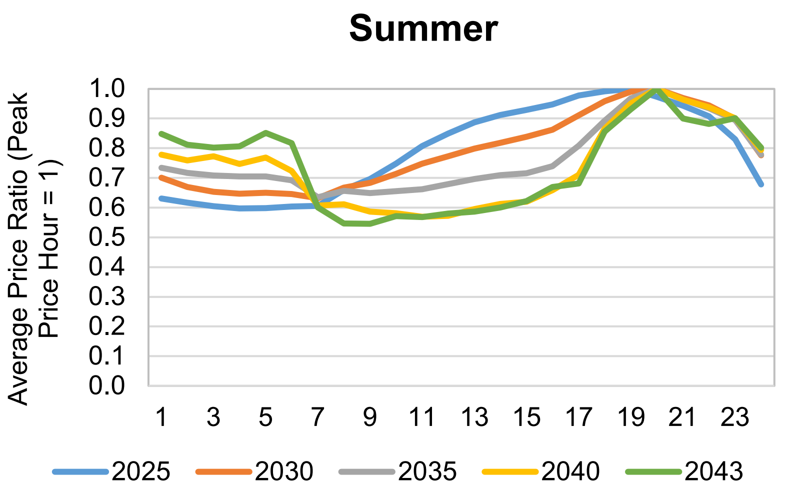


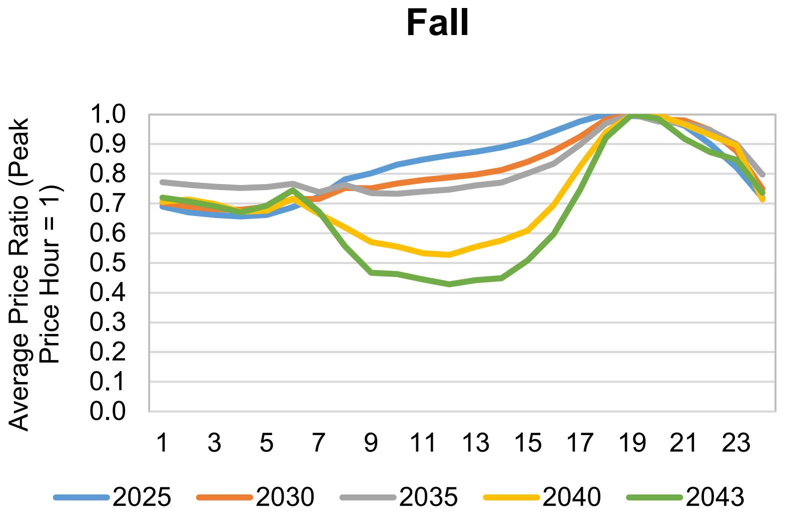



# HOURLY PRICE SHAPES – ACCELERATED INNOVATION



# 2024/2025 MISO SEASONAL CAPACITY MARKET RESULTS PARAMETERS

- MISO's 2024/25 capacity auction prices continued the trend observed in the 2023/24 auction, except Z5 experienced significant price spikes in the Fall and Spring seasons. However, total surplus in summer decreased by approximately 30% due to retirements, increased PRMR, and reduced external offers.
- Market participants in the broader MISO footprint demonstrated surplus across all seasons, with summer remaining the tightest, while participants in MISO North see relative tightness in both summer, fall and spring. The region also utilized cheaper imports from MISO South and external regions to maintain lower prices. MISO South remains more abundant in, but future retirements and load growth could threaten the surplus.
- The auction results remain consistent with CRA's general expectations, where demand growth and continued retirements could create greater upward pressure in prices into the end of the decade.

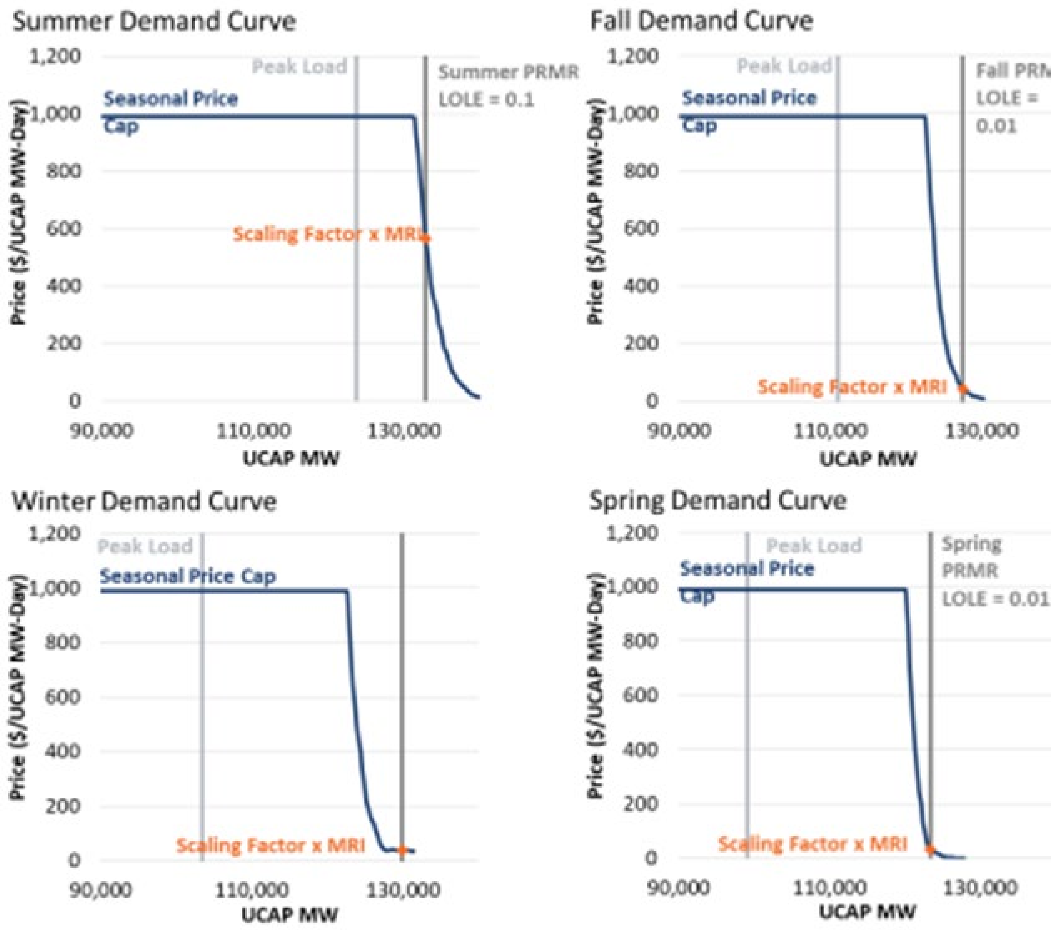
*Source: 2024/25 PRA Detailed Report published by MISO, May 20, 2024*

| | MISO PRA DATA PY24-25 | | | |
|---|---|---|---|---|
| **MISO Planning Reserve Margin (PRM)** | **Summer** | **Winter** | **Fall** | **Spring** |
| MISO Peak Demand (MW) | 124,474 | 102,807 | 109,686 | 100,767 |
| MISO UCAP PRM Requirement (MW) | 135,691 | 130,985 | 125,270 | 127,696 |
| MISO North Peak Demand (MW) | 92,476 | 74,738 | 81,116 | 73,168 |
| MISO North UCAP PRM Requirement (MW) | 100,810 | 95,227 | 92,643 | 92,722 |
| MISO South Peak Demand (MW) | 31,998 | 28,069 | 28,570 | 27,599 |
| MISO South UCAP PRM Requirement (MW) | 34,881 | 35,759 | 32,627 | 34,974 |
| MISO Planning Reserve Margin (%) | 9.00% | 27.40% | 14.20% | 26.70% |
| Total MISO SAC (exclude imports) | 141,941 | 153,277 | 138,764 | 142,681 |
| Total MISO Offer+FRAP (exclude imports) | 138,631 | 145,864 | 132,486 | 134,136 |
| Total MISO North SAC (exclude imports) | 102,454 | 111,845 | 99,566 | 101,583 |
| Total MISO North Offer+FRAP (exclude imports) | 100,682 | 106,527 | 95,613 | 95,936 |
| Total MISO South SAC (exclude imports) | 39,487 | 41,432 | 39,198 | 41,099 |
| Total MISO South Offer+FRAP (exclude imports) | 37,950 | 39,336 | 36,874 | 38,199 |
| MISO % Capacity Surplus (exclude Imports) | 11.4% | 41.9% | 20.8% | 33.1% |
| MISO North % Capacity Surplus (exclude imports) | 8.9% | 42.5% | 17.9% | 31.1% |
| MISO South % Capacity Surplus (exclude imports) | 18.6% | 40.1% | 29.1% | 38.4% |
| Z1-4, 6-7 Clearing Prices ($/MW-Day) | 30.00 | 0.75 | 15.00 | 34.10 |

# MISO CAPACITY MARKET CONSIDERATIONS

- In MISO's current PRA construct, capacity prices are set by the intersection of supply and demand. In these auctions, the demand for capacity is represented as a vertical line at the PRMR, reflecting the need for market participants to satisfy MISO's minimum reserve requirement.
- However, by using a vertical demand curve, any additional unit of capacity provided above the minimum requirement is not valued in the PRA.
- To improve this design, MISO has proposed to implement a sloped, or "reliability-based" demand curve ("RBDC"). By assuming sloped demand, MISO's auctions would value each additional MW of capacity in excess of the minimum requirement at a decreasing rate. A downward sloping demand curve could more accurately reflect the diminishing marginal value an incremental unit of capacity provides to system reliability.
- As a result, market participants should have greater incentive to sell extra capacity and provide reliability benefits above the PRMR.
- However, due to the preliminary status and uncertainty in final design, CRA's Reference Case does not reflect the proposed changes related to RBDC.

***Indicative Seasonal RBDC***




Source: MISO



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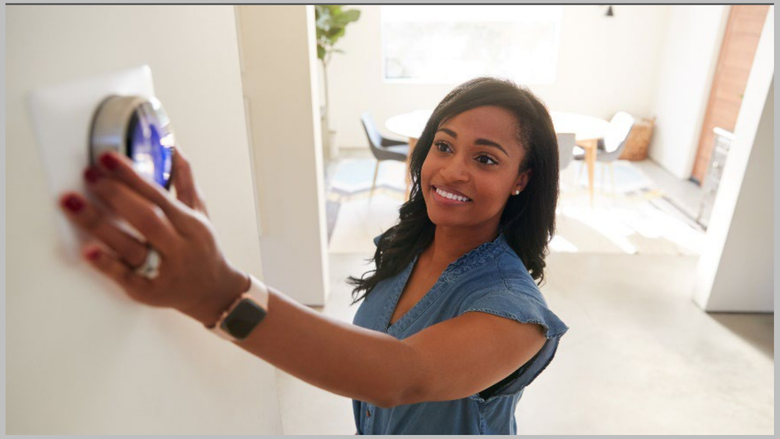
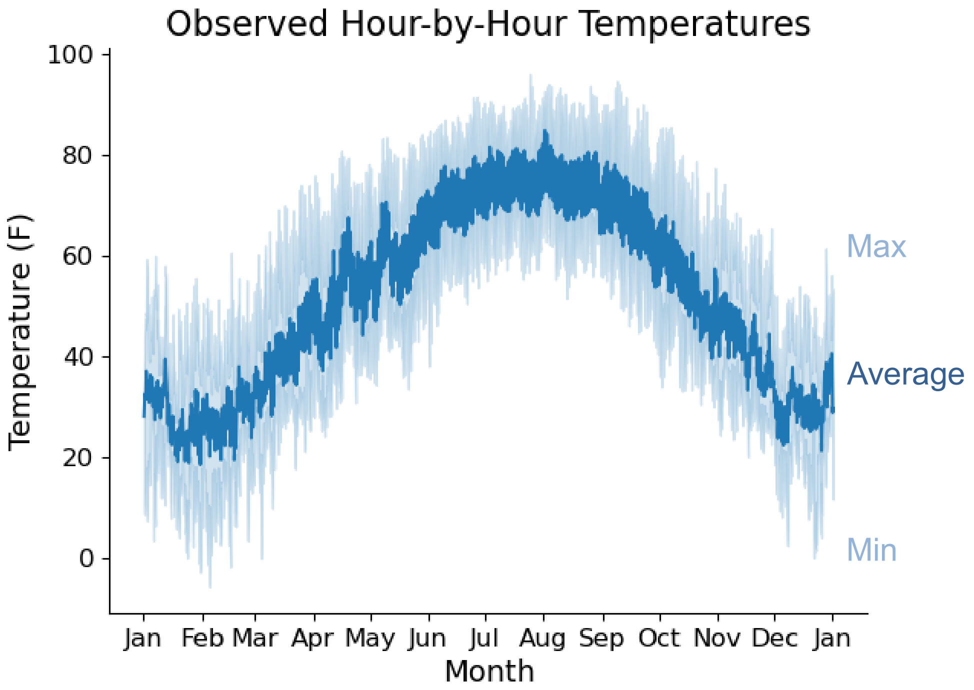
*We exist to deliver safe, reliable energy that drives value to our customers*

# APPENDIX: STOCHASTIC ANALYSIS INPUTS

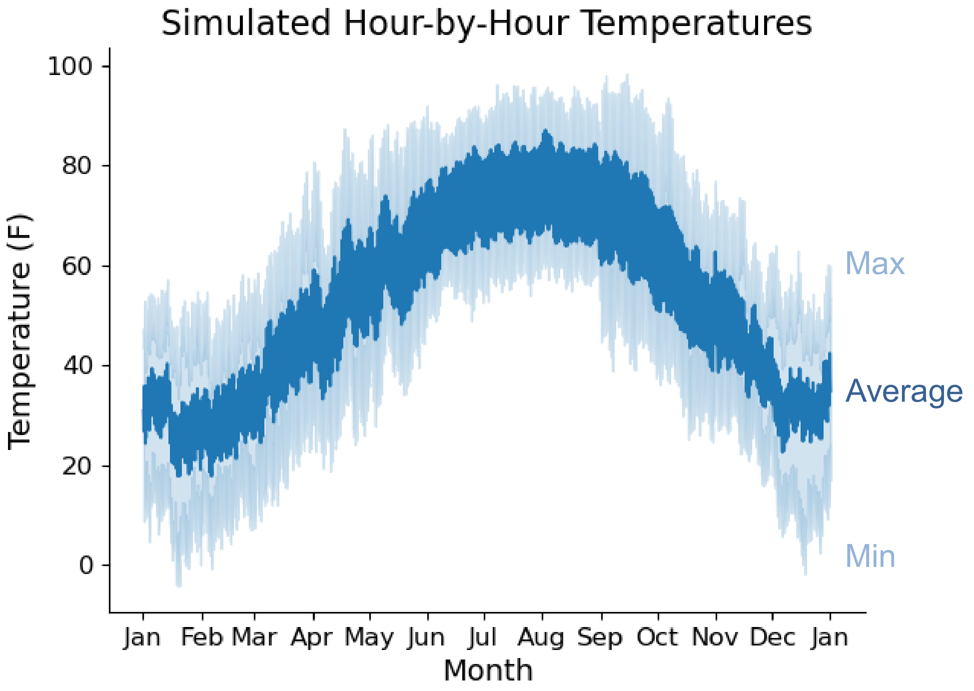



# SYNTHETIC TEMPERATURE GENERATION

- A mean reverting random walk on trend + residual is used to simulated hourly temperatures
- Synthetic data captures high and low temperature extremes, characteristic seasonal behaviour, and multi-day temperature cycles



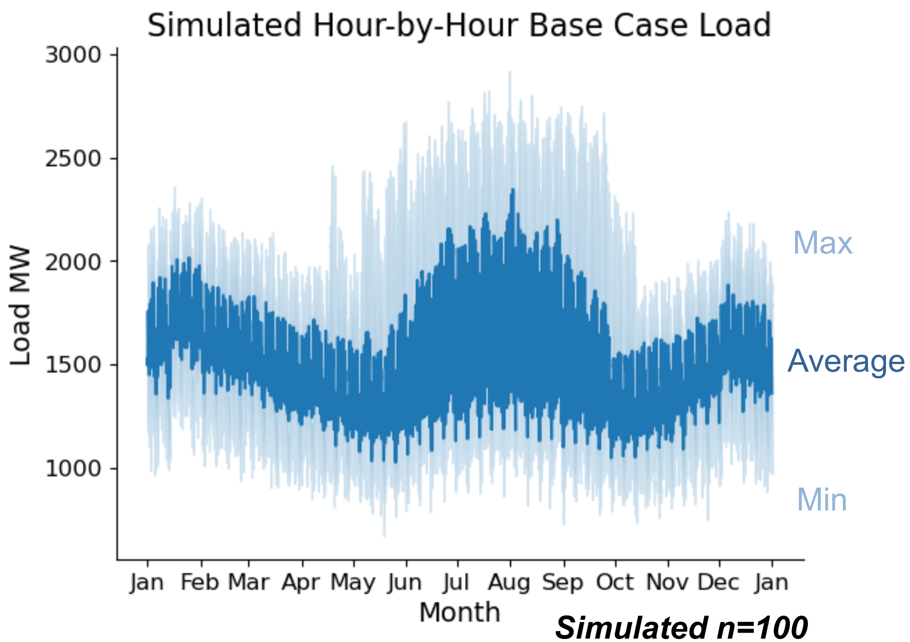

*Years n=19*




*Simulated n=100*

*Source: NREL*

# LOAD TIMES SERIES MODEL ANALYSIS




***Simulated n=100***

**Data Pre-Processing**

- Historical data on hourly loads and temperature data from NREL's NSRDB database
- De-trend load data
- Visual/qualitative analysis

**Temperature Model**

- Stochastic processes on temperature
- Model testing and calibration

**Regression models**

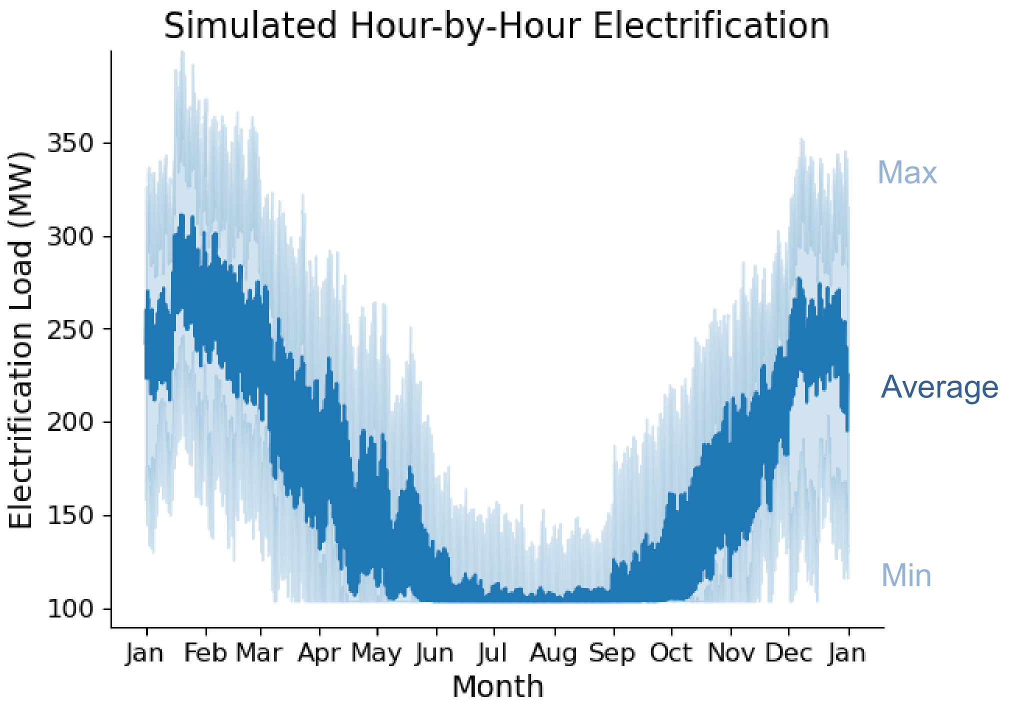
- Learn regression models to temperature shock load
- Build regressions on HDD and CDD versus econometric load, EV (scenario specific level), and electrification (scenario specific level)

**Outputs**

- Shift load up to match long-term econometric forecast as needed
- Produce 1000 synthetic load shapes

# ELECTRIFICATION LOAD UNCERTAINTY

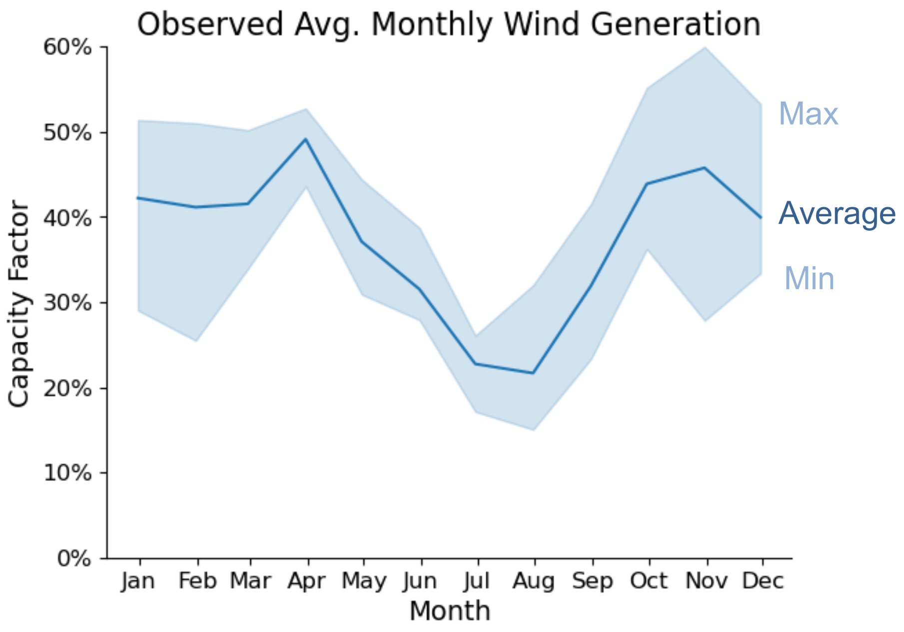
- Temperature has a meaningful impact on potential future electrification loads, since much of it could come from heating demands
- Linear regression model on heating degree days (HDD) is used (Typical Meteorological Year with monthly average HDD)

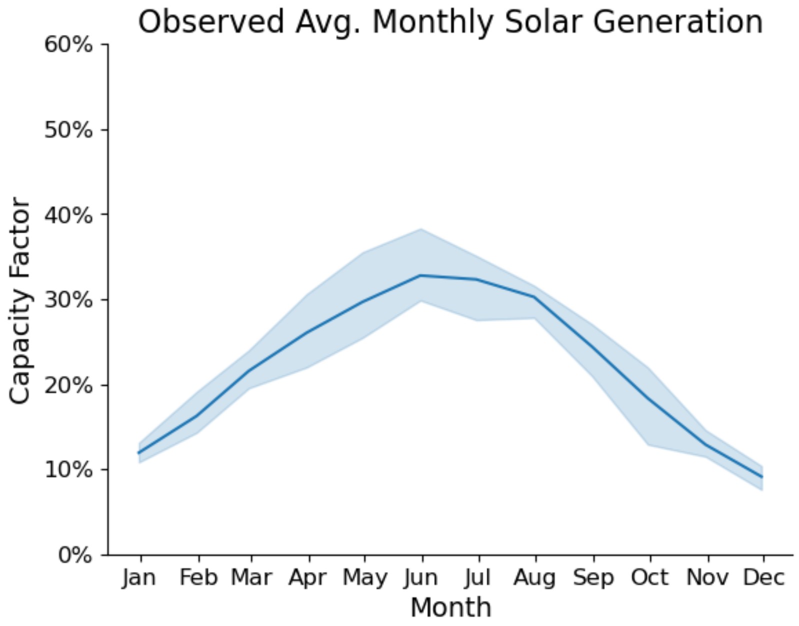



***Simulated n=100***

# NIPSCO RENEWABLE CAPACITY FACTOR UNCERTAINTY

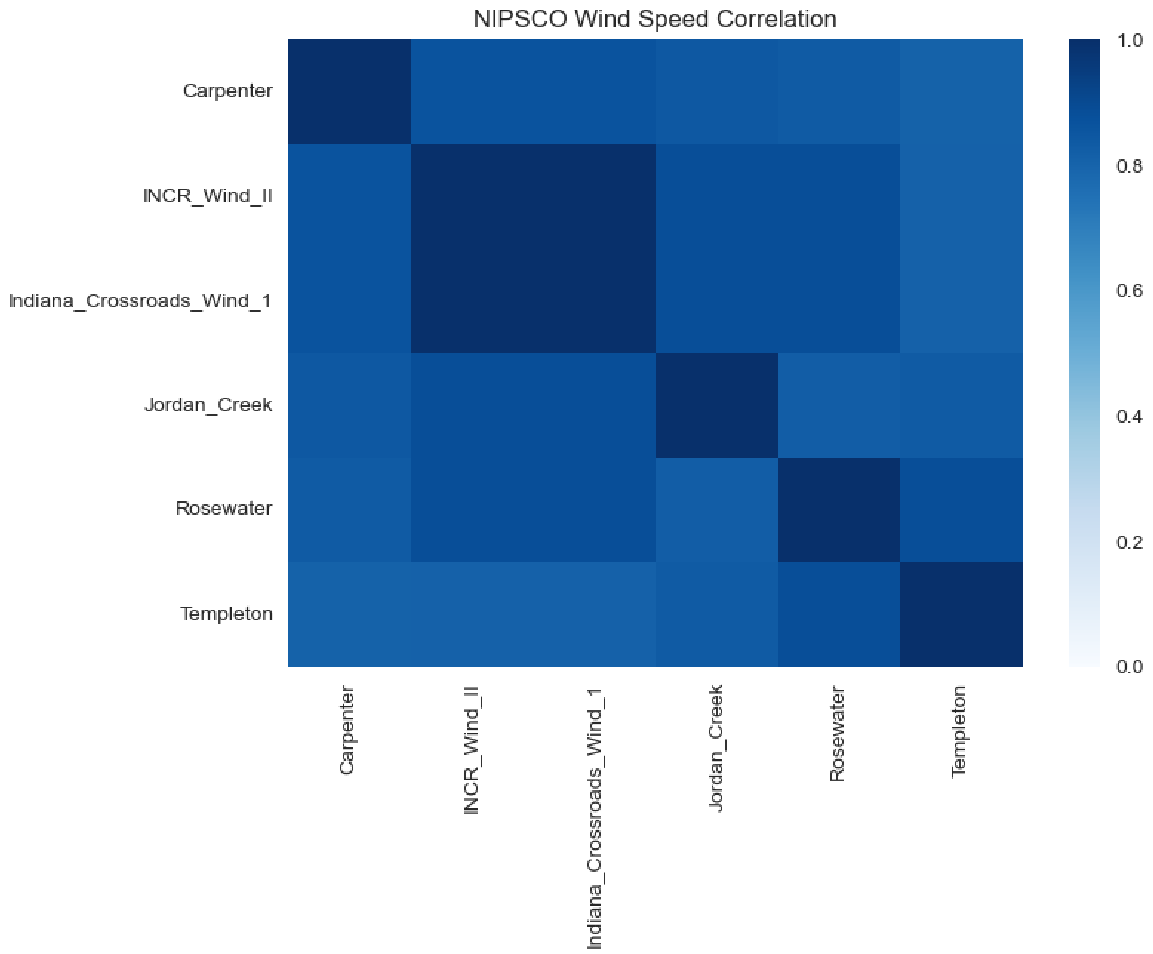
- Based on historical weather data from 2007 through 2014, NIPSCO's renewable portfolio is expected to have an aggregate average wind capacity factor of 37.4% and an average solar capacity factor of 25.3%

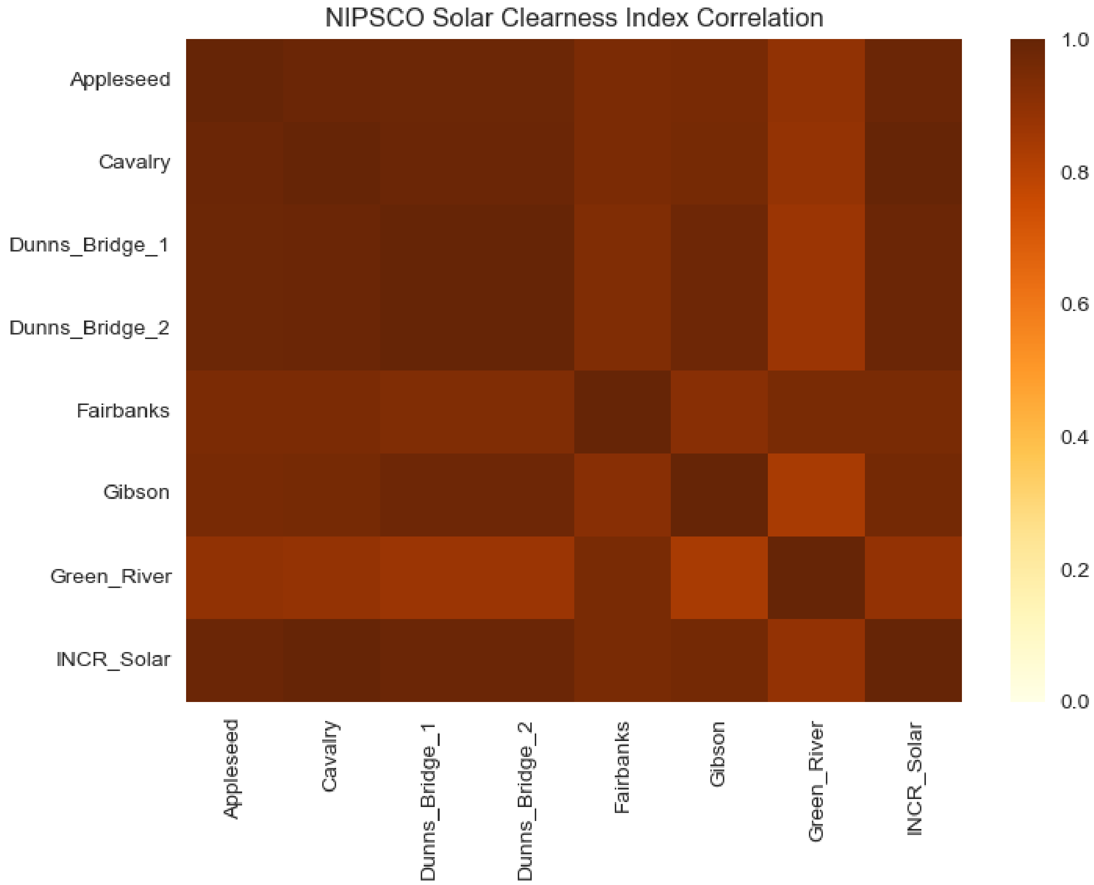



*Source: NREL*

# EXPECTED GENERATION FROM NIPSCO'S WIND AND SOLAR SITES IS HIGHLY CORRELATED



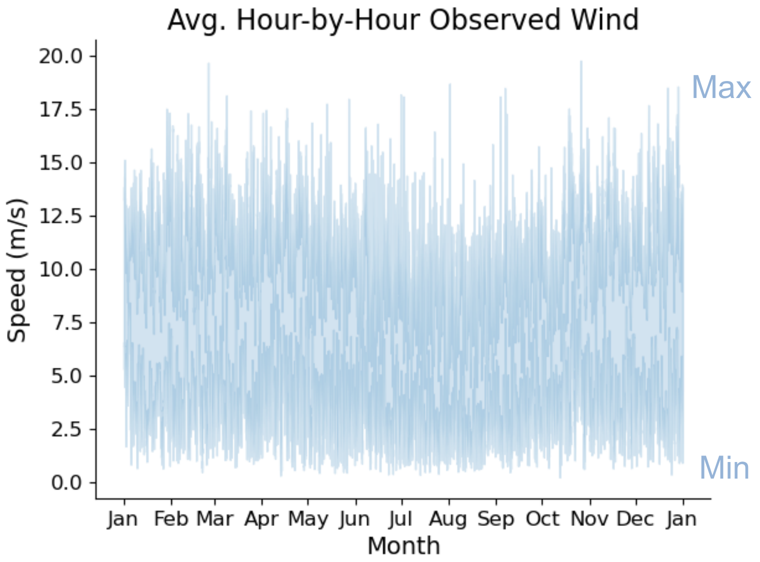



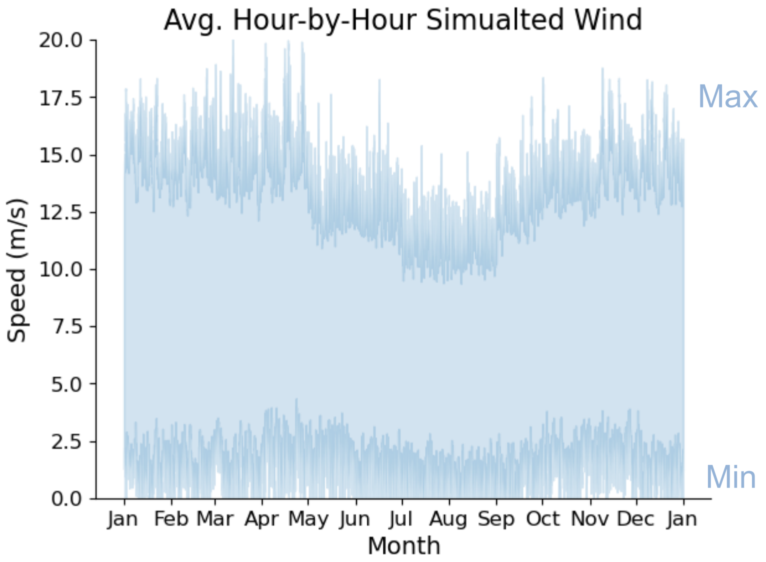

*Source: NREL*

# SYNTHETIC WIND SPEED AND POWER PRODUCTION SIMULATIONS

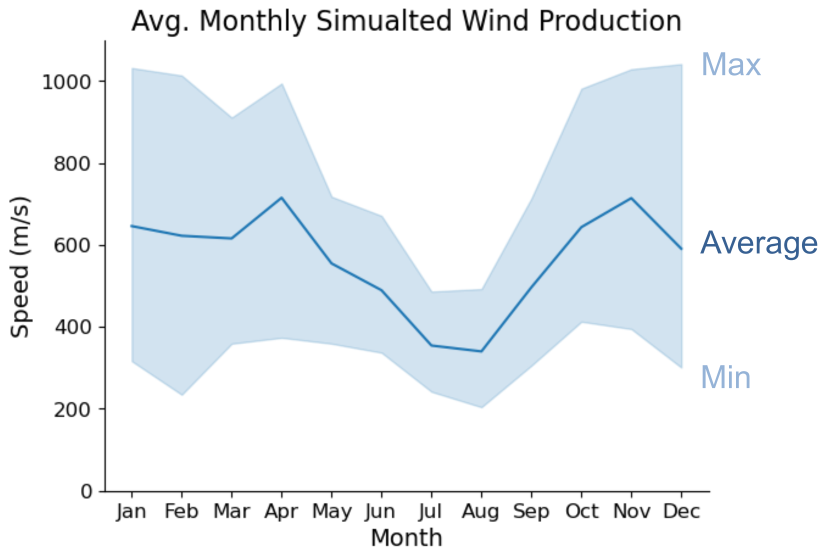
- A mean reverting random walk on trend + residual is used to simulated hourly wind
- Synthetic wind data captures high and low event extremes and characteristic seasonal behaviour
- Power curve models are used to translate speed to MWh for NIPSCO’s portfolio

**Get Historical Data** → **Learn Distribution** → **Simulate Generation**



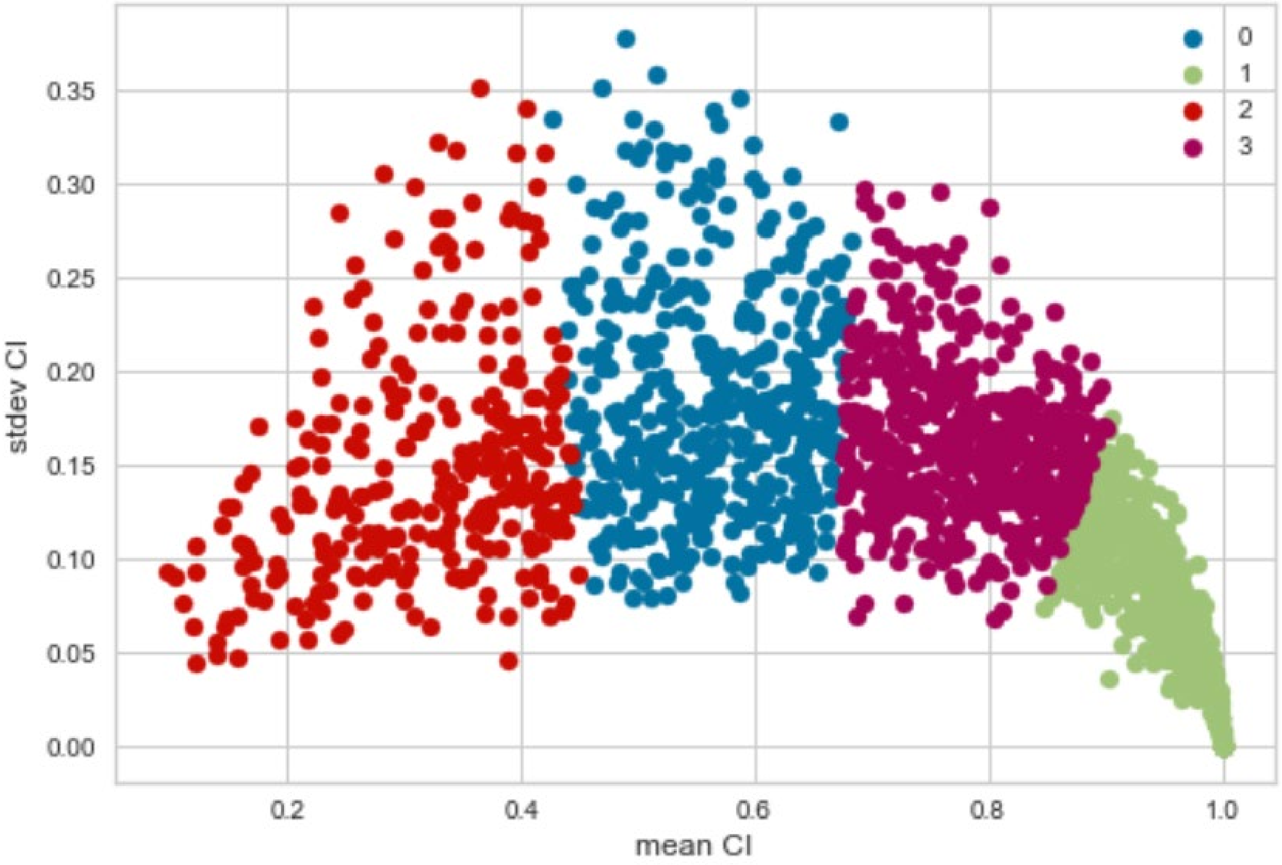

***Simulated n=100***




***Simulated n=100***

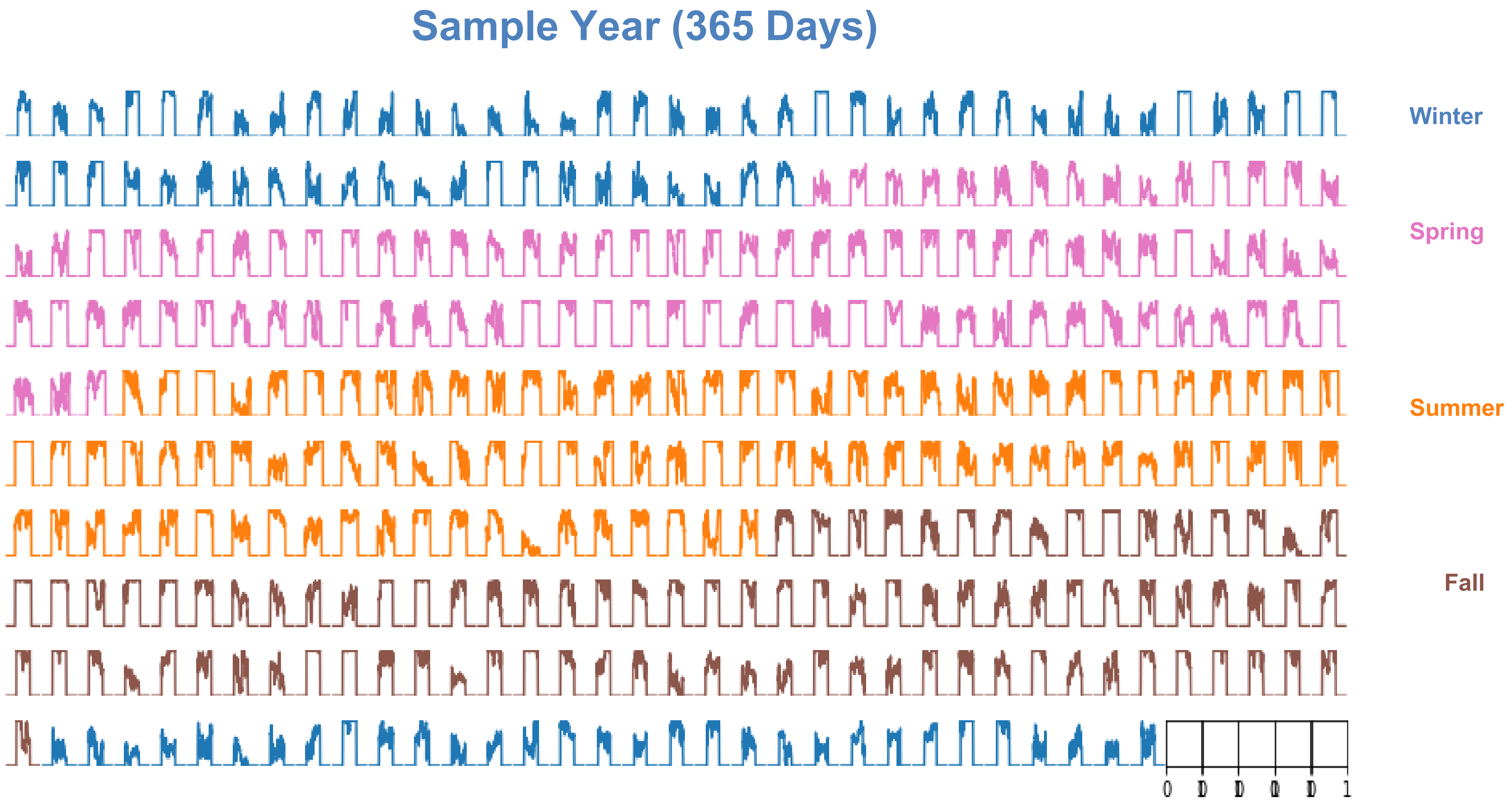
# SOLAR GENERATION DATA ANALYSIS

- Solar output is simulated using a custom, clustering-based seasonal model
- Historical days are classified into "clusters" (i.e., sunny, intermittent cloudy, total cloudy, etc.) based on Clearness Index: (Irradiance / theoretical maximum)
- Randomly generate series of days, based on Markov transition matrix. Randomly sample from existing days.
- Convert weather to power generation
  – Bifacial, single axis tracking



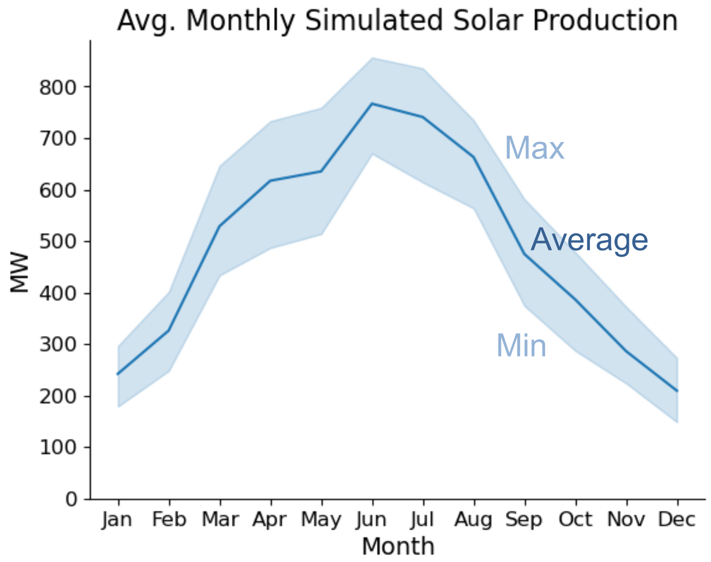
# SOLAR GENERATION INPUT DEVELOPMENT

- Simulate solar days across the year based on clearness index clustering and simulated solar irradiance

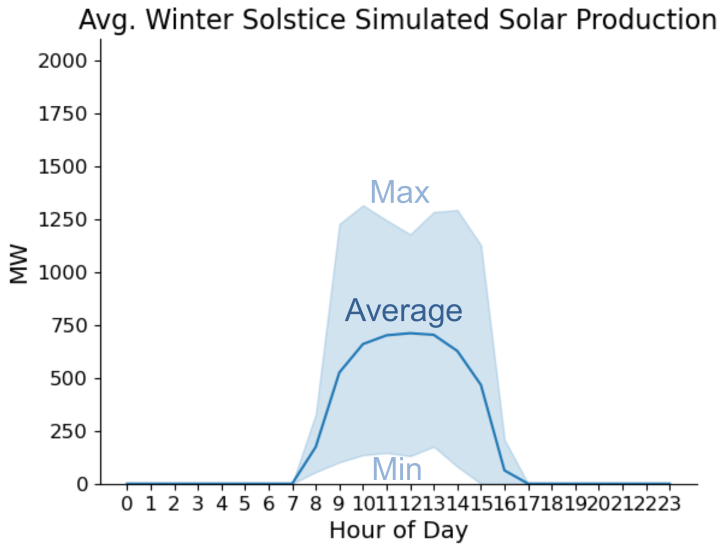


# SYNTEHTIC SOLAR GENERATION

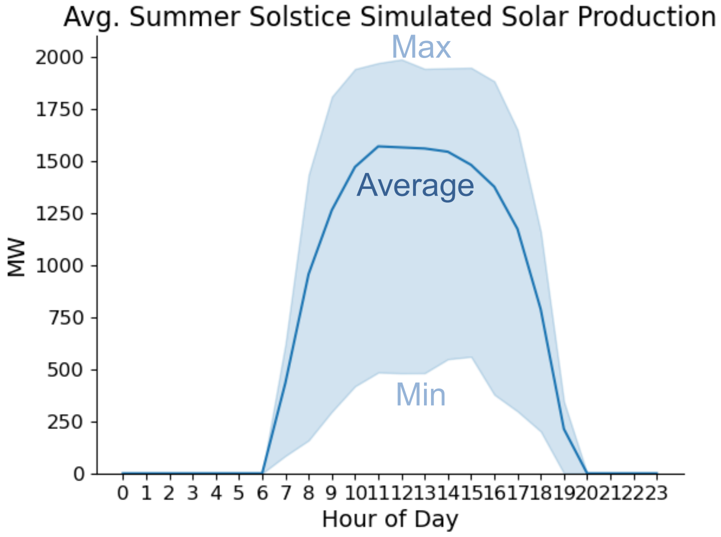
- Pass synthetic irradiance through a power curve
- Synthetic solar data has significant volatility at the hourly level (prior slide), with a range of seasonal and daily/hourly shape outcomes




***Simulated n=100***



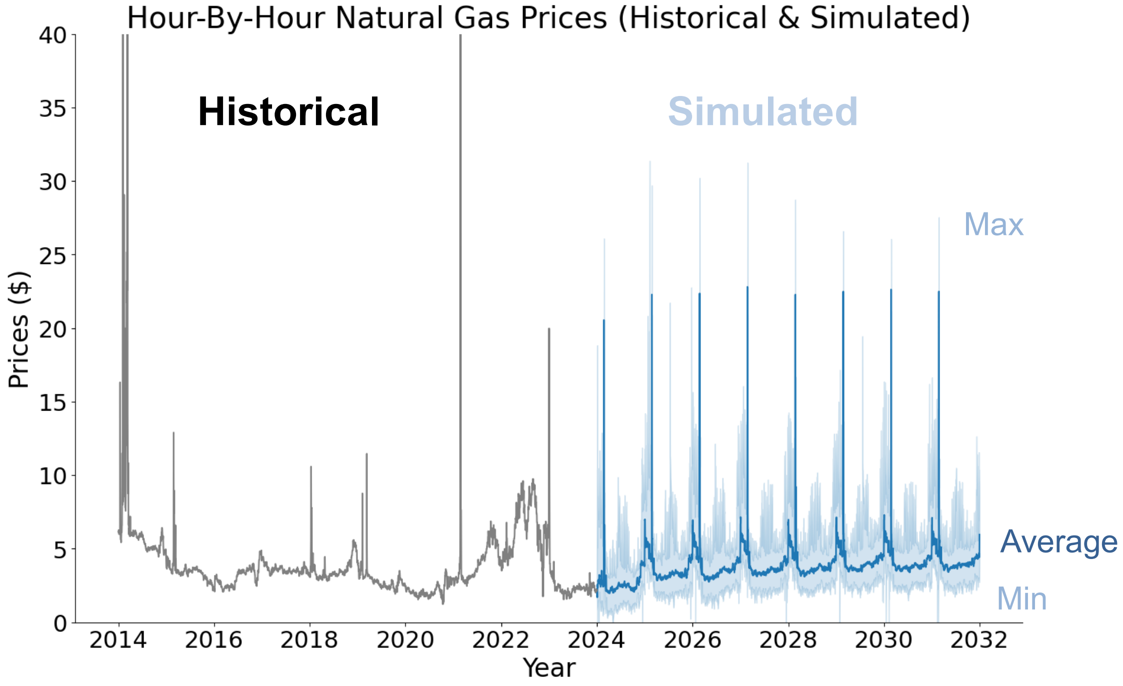

***Simulated n=100***

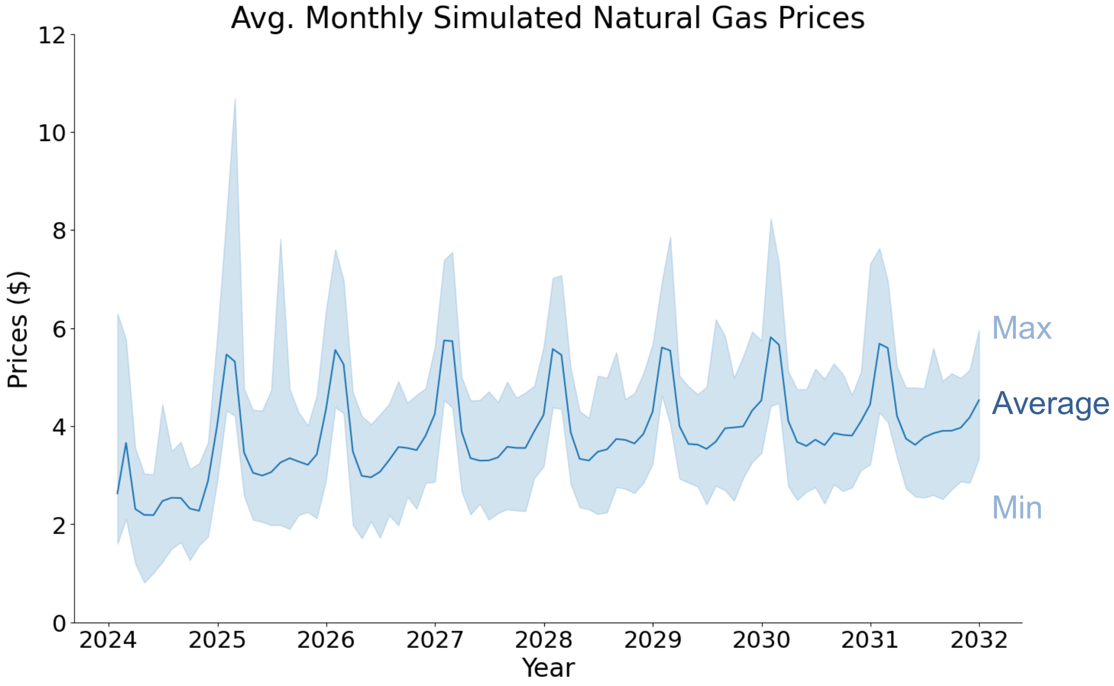



***Simulated n=100***

# NATURAL GAS PRICE DISTRIBUTIONS

- **Simulated data behaves similarly to historical data, and includes large range of prices across iterations**
  - Daily fluctuations in historical data are well captured within 5th and 95th percentile ranges
  - Monthly fluctuations reflect spiking behavior in the winter, as expected
- **On average, simulated spike values adequately match historical spike events**



# MISO POWER PRICE DISTRIBUTIONS

- **Simulated data behaves similarly to historical data**
  - Daily fluctuations in historical data are well captured within 5th and 95th percentile ranges
  - Model sees increased volatility in winter, as expected, but prices fluctuate more in the downward direction as a result of potential renewable energy impacts
- **On average, simulated spike values match historical spike values very well**