# Triennial Integrated Resource Plan Stakeholder Meeting

*December 8, 2023*

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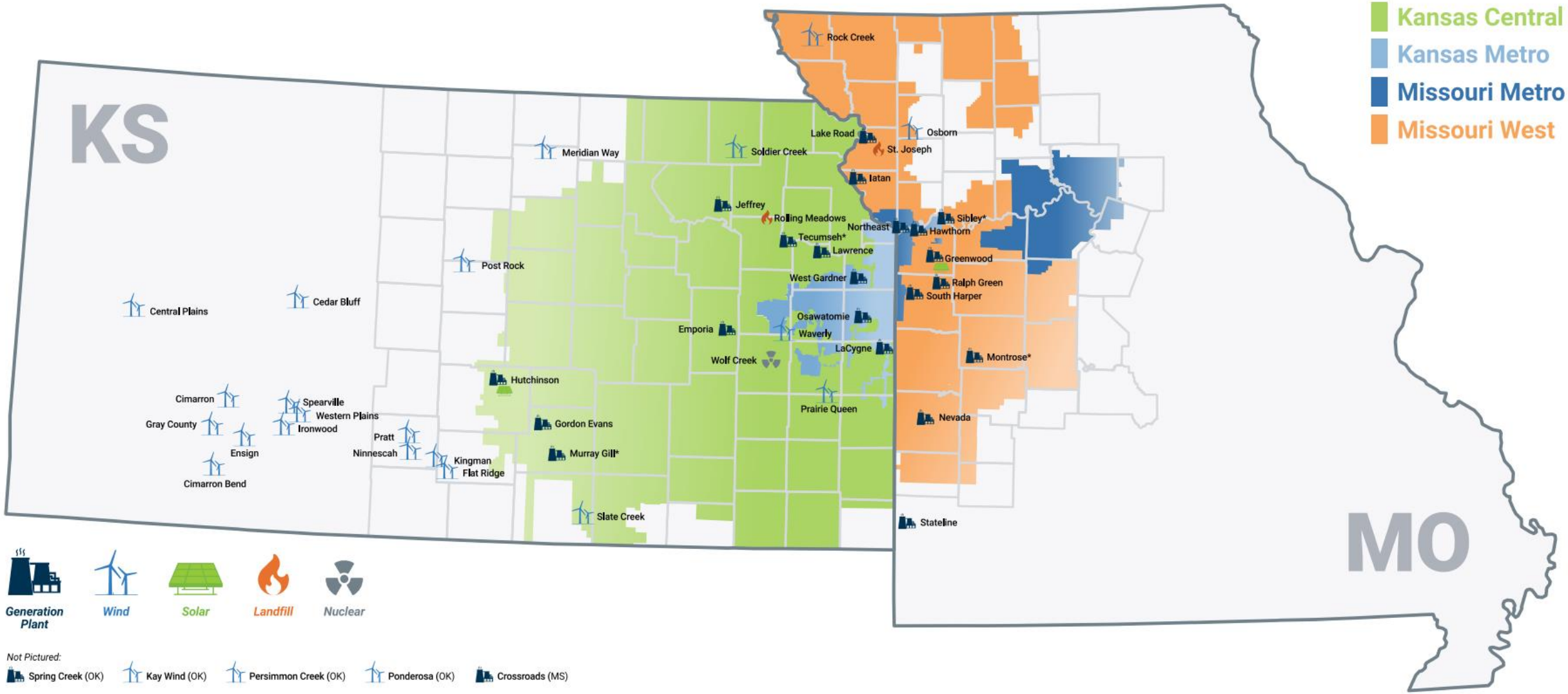
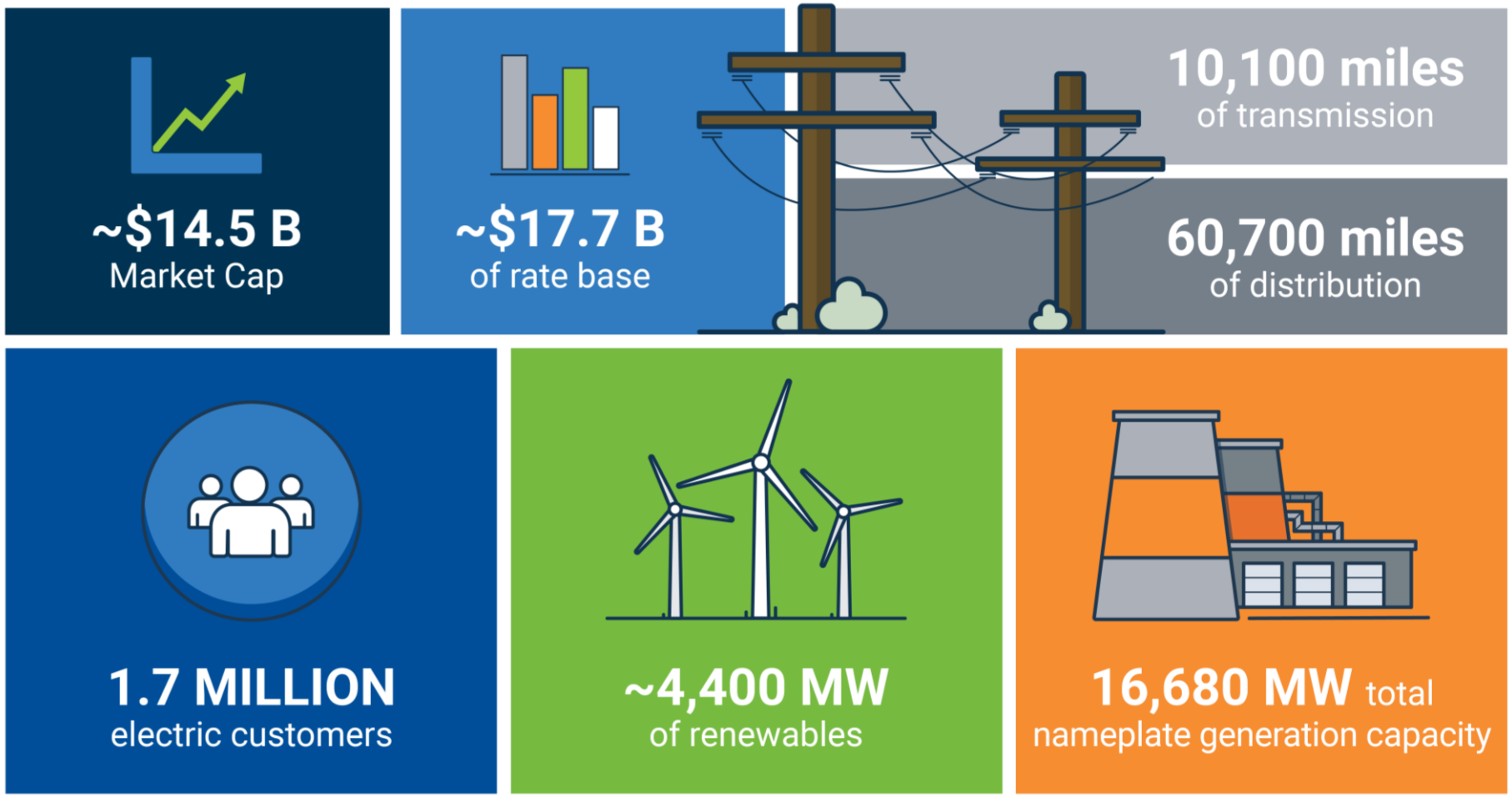
# Agenda

- Evergy Overview
- Goals & Timeline for Stakeholder Meetings
- Changes from the 2023 Update
- Load Analysis & Load Forecasting
- Demand-Side Resources
- Supply-Side Resources
- Integrated Planning & Risk Analysis
- Wrap-Up

# Evergy Overview

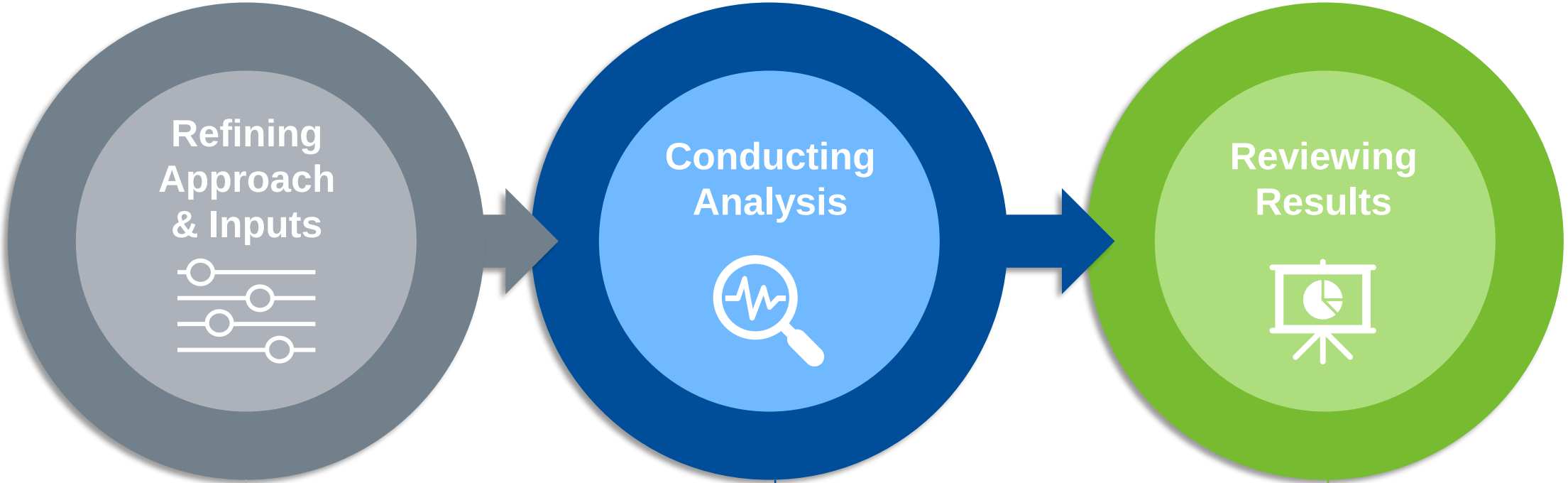


# Evergy By the Numbers[1]




1. All as of YE 2022

# Triennial IRP Development Timeline




**December 2023:**
Introduce process and discuss inputs

**February 2024**:
Discuss preliminary results

**March 2024:**
Review updated results including detailed review of inputs outlined in IRP rules

# Goals for Stakeholder Engagement

| | |
|---|---|
| **Encourage Transparency** | Share the IRP methodology, analysis and planning process with stakeholders to build understanding and gain insight |
| **Expand and Enrich Analysis** | Engage a variety of viewpoints to expand and enrich the scenarios evaluated through the IRP process |
| **Discuss and Balance Trade-Offs** | Understand and balance trade-offs between the different IRP tenets (reliability, value/affordability, safety, flexibility, environmental stewardship) |



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# Changes from the 2023 Update

## Big Themes Last Year

*Reduction in capacity-long position*

- **New loads and economic development**
  - Multiple economic development projects on the horizon, increasing load and capacity need
- **Resource adequacy changes**
  - Higher reserve margin, heading to performance-based accreditation
- **Demand-side management:**
  - Lower volume of DSM capacity primarily due to EISA lighting standard, ongoing KEEIA proceeding

*Changes to resource economics*

- **Inflation Reduction Act**
  - Improvement in incentives for new resources (solar, wind and batteries) combined with cost increases
- **Changes to environmental policy outlook**
  - Removed carbon tax modeling and aligned with SPP's future plans, which include differing levels of carbon constraints
- **Economic drivers:** higher natural gas prices, inflation and supply chain issues could increase costs

## Big Themes This Year

- **Resource adequacy**
  - Estimating winter needs, likely increasing requirements over time, reduced resource accreditation due to performance-based and ELCC methods, and ongoing assessments of new loads and economic development
- **Update modeling assumptions for generation resources**
  - Increase in thermal build costs due to inflation. Analyze risk and sensitivities to near-term resource additions, particularly given further increases in capacity requirements
- **Understand the implications of the federal EPA's proposed GHG rule**
  - Scenario analysis to understand the implications from $CO_2$ constraints included in proposed GHG rule
  - Include costs associated with carbon capture and other non-emitting technologies needed late in planning horizon

# Overview of Inputs for Discussion

| | |
|---|---|
| **Load Analysis & Load Forecasting** | • Overview of Load Forecasting methodology<br>• Evaluating varying levels of electrification impacts |
| **Demand-Side Resources** | • Use of Missouri potential study, updated for extension<br>• Incorporation of new Kansas programs |
| **Supply-Side Resource Analysis** | • Refreshing supply-side resource costs<br>• Including new clean technology options<br>• Incorporating latest SPP resource adequacy requirements |
| **Integrated Resource Plan & Risk Analysis** | • Overall analytical approach<br>• Uncertain Factor analysis<br>• Discrete Scenario testing |

# Load Analysis & Forecasting

*Al Bass*

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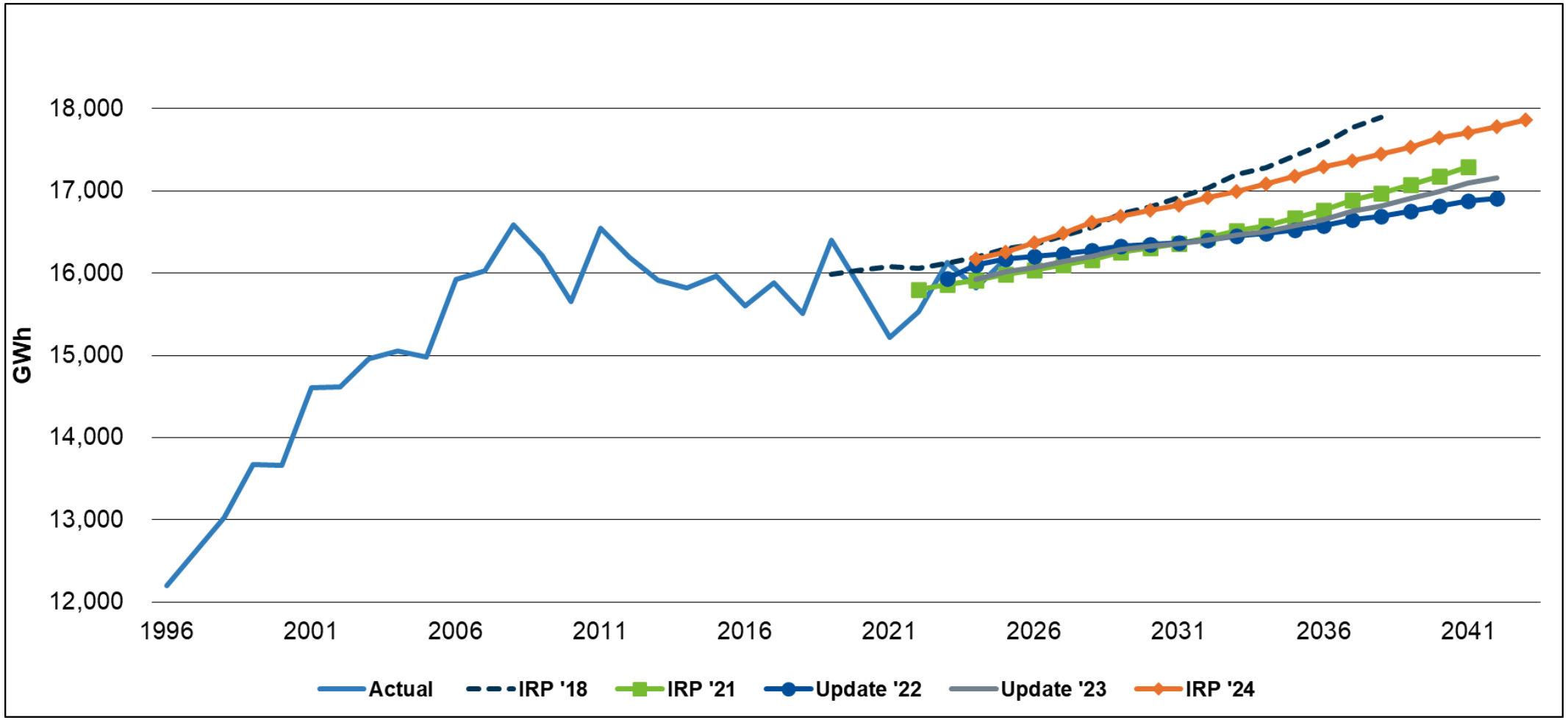
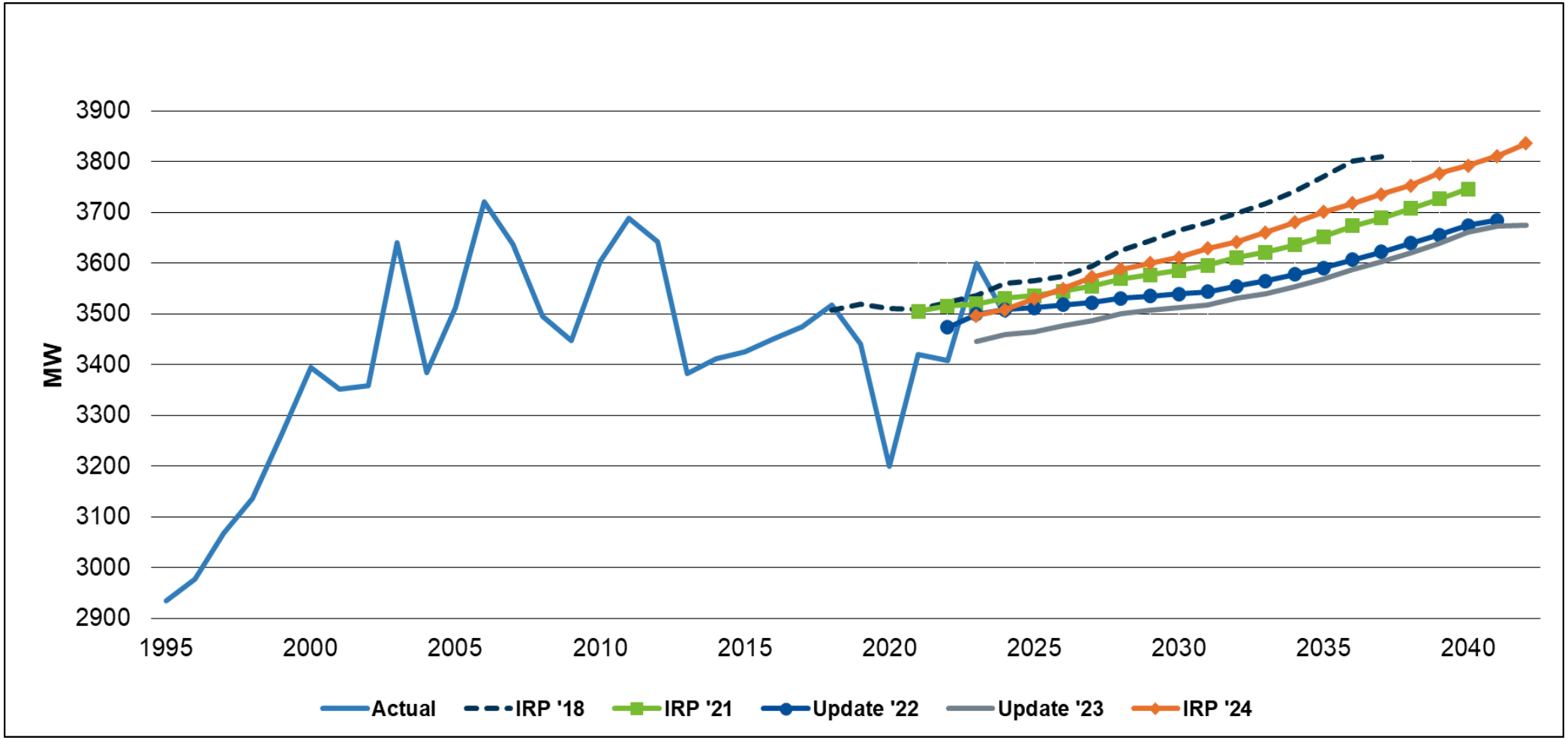
# Load Forecasting Models

- Model methodology – Statistical Adjusted End-Use (SAE)
- Historical data for customers, kWh and $/kWh: ending June 2023
- DOE forecasts of appliance and equipment saturations and kWh/unit: Annual Energy Outlook (“AEO”) 2023
- Updated economic forecasts from Moody’s Analytics. Historical data ending June 2023
- The Company also re-evaluated the output elasticity used in the commercial and industrial models and the elasticity used in the residential model. Adjustments made were to improve the model fit
- Company utilized EPRI electric vehicle study within its modeling for the 2023 IRP Forecast
- The load forecast includes a low scenario, high scenario, significant loss, extreme weather and a High Electrification scenario in addition to the base case forecast
- The low and high scenarios are the product of low and high growth economic forecast assumptions
- The high electrification scenario includes: high growth economic assumptions, EPRI electric vehicle high case adoption, 1898 Electrification Study long-haul trucking electrification forecast and assumptions for increased adoption of electric space heat and electric water heat in residential and commercial buildings
- The Company utilized Google Mobility Reports data to account for load changes resulting from geolocation behaviors induced by the COVID19 pandemic
- EIA data includes EE impact from IRA that relate to tax credits. Currently the impact is very small
- The load forecast does not assume behavioral changes in response to the implementation of new time-of-use rates. This will be evaluated and addressed in the 2025 IRP Update

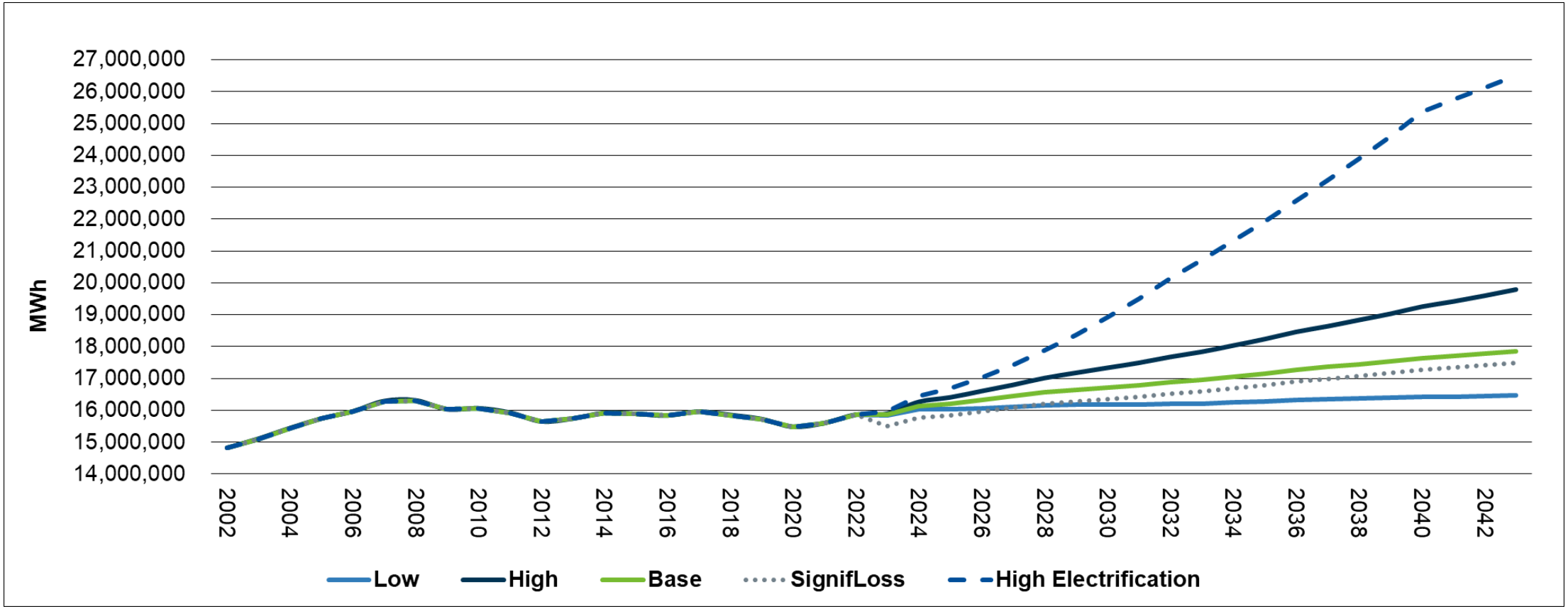
# Energy Forecasts – Triennial IRP Scenarios
## Evergy Metro



# Peak Forecasts – Triennial IRP Scenarios
## Evergy Metro



# Evergy Metro Historical and Comparison of Mid-Case Forecasts of Net System Input, Excluding future DSM Impacts



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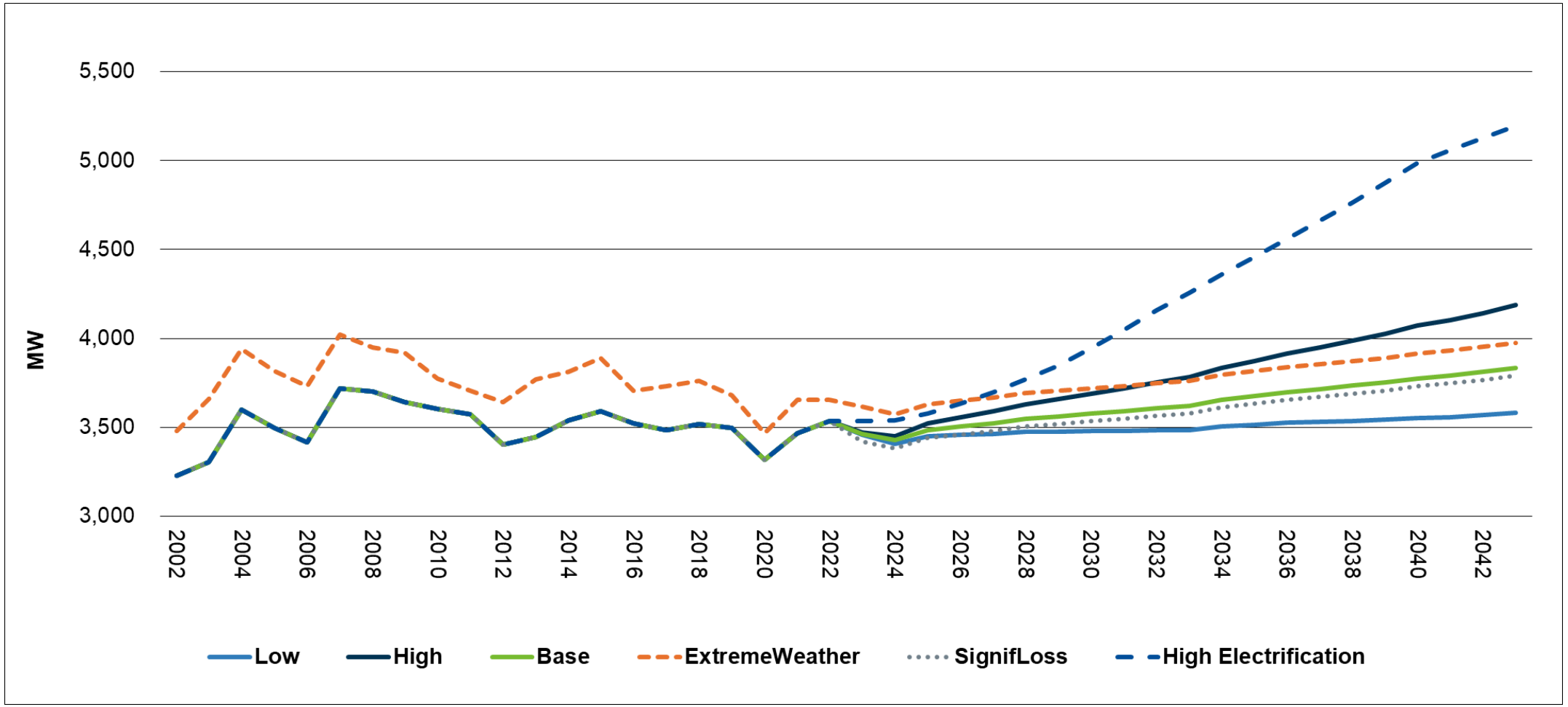
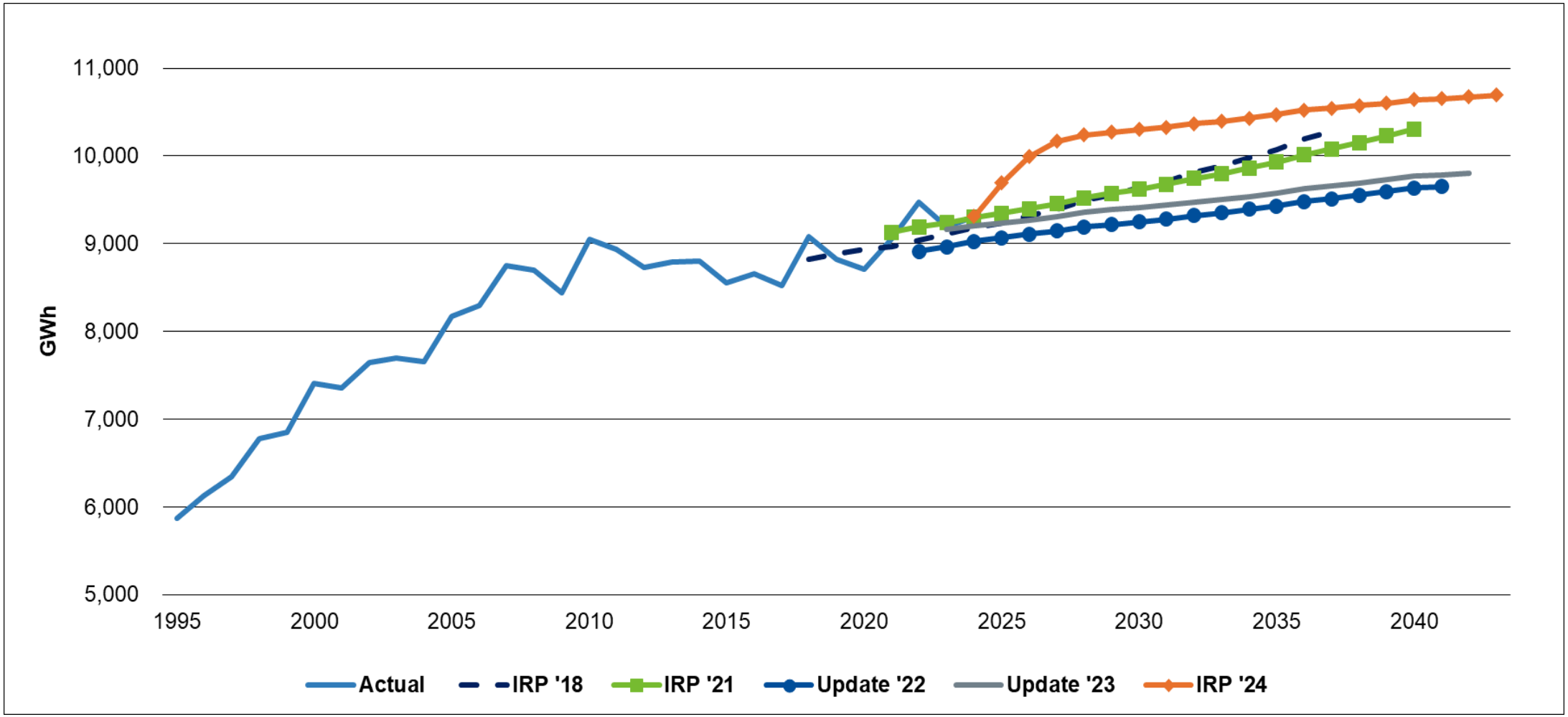
# Evergy Metro Historical and Comparison of Mid-Case Forecasts of Demand, Excluding future DSM Impacts



# Energy Forecasts – Triennial IRP Scenarios
## Evergy Missouri West



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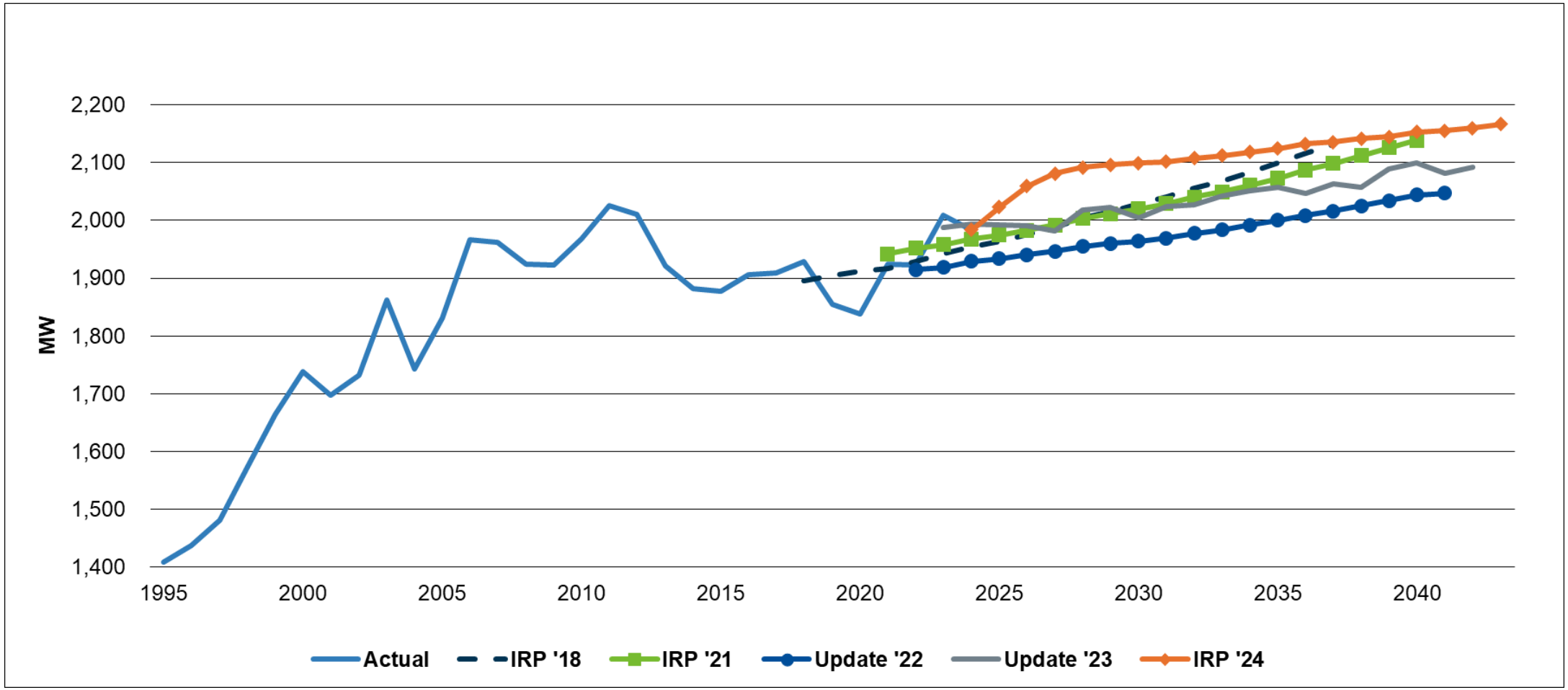

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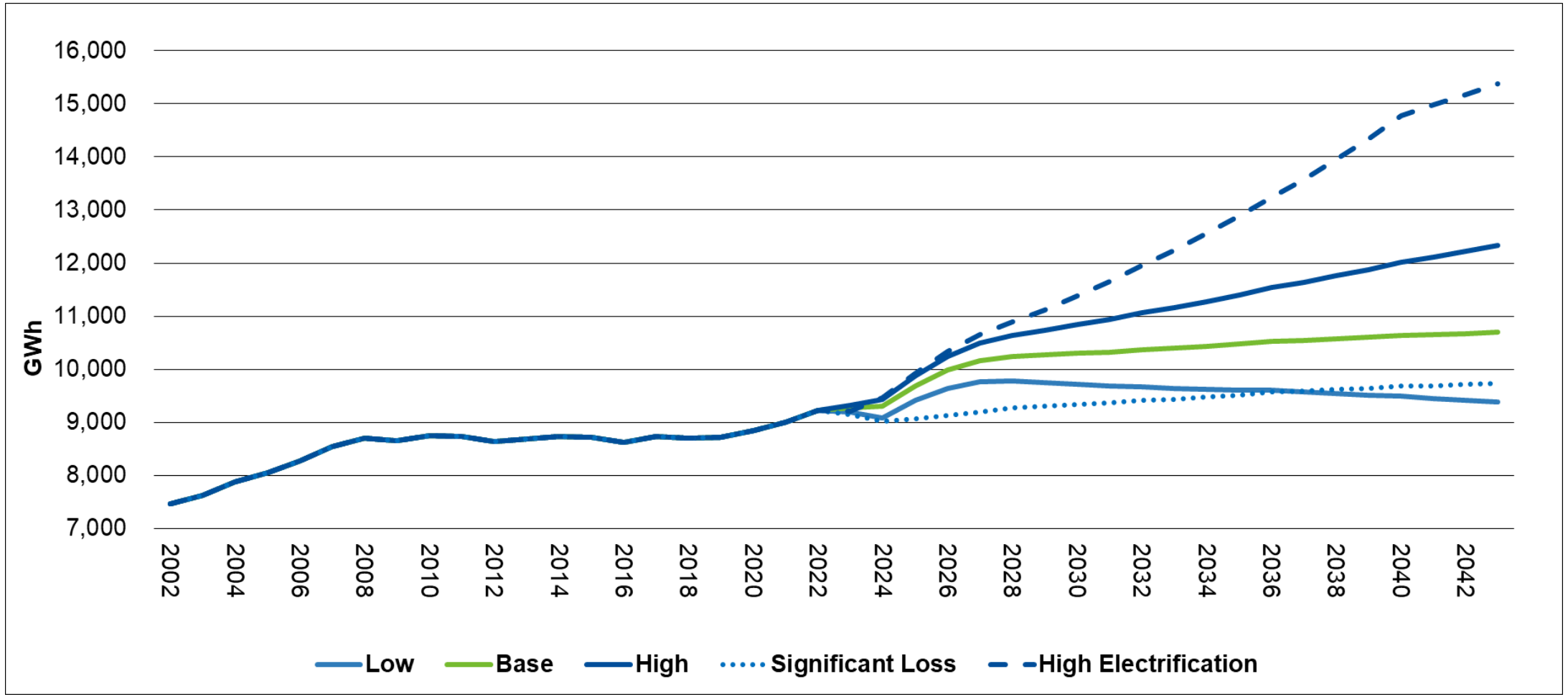

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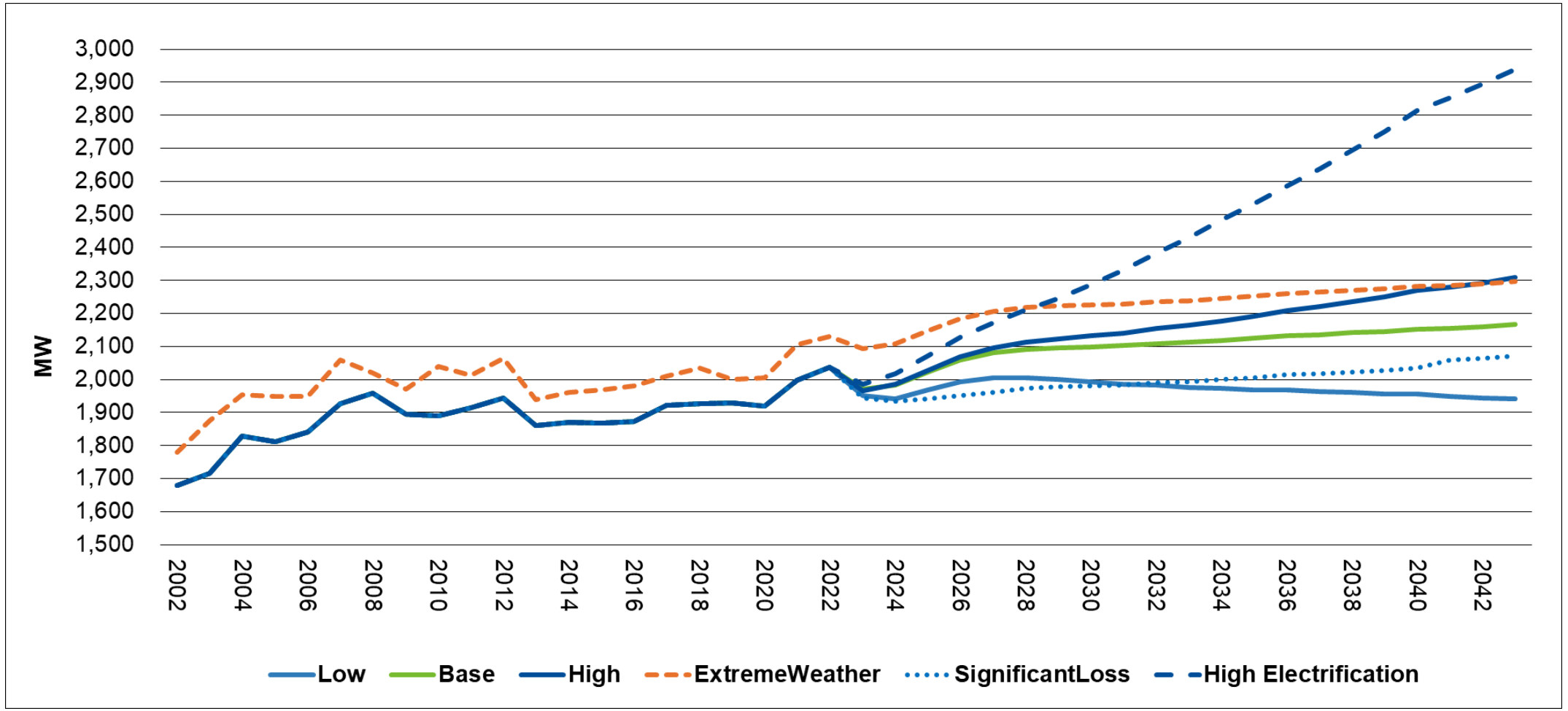

# Demand-Side Resources

*Tim Nelson*

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# DSM Analysis – KS Metro

- KCC conditionally approved DSM programs for 2024 – 2027
- DSM potential was developed based on KCC approved plan for first four years of the planning horizon
- 2022 DSM Potential Study results were used as the reference for continuation of KEEIA in future years (2028 - 2044)

# DSM Analysis – Missouri

- 2022 DSM Market Potential Study Results were incorporated in IRP 2023 annual updates
- 2022 DSM Market Potential Study assumed new program year starts in 2024
- MEEIA 3 extension approved for 2024
- 2022 DSM Market Potential Study results will be incorporated again in the 2024 Triennial with impacts shifted to begin in 2025
- Includes assumed peak reduction from default Time-of-Use residential rates

# Supply-Side Resource Analysis

*Kelli Merwald*

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# Technologies Considered

- Wind
- Solar
- Battery Storage – 4-hour duration
- Natural Gas
  - Combined cycle advanced class 1x1, hydrogen capable
  - Combustion turbine, simple cycle F class, hydrogen capable
  - Combined-cycle with 90% carbon capture and sequestration (CCS), or addition of 90% CCS in future year
- Coal
  - Addition of natural gas burn capability to existing resources
  - Addition of 90% CCS to existing resources – high carbon restriction scenarios
- Uranium
  - Small modular reactor – late in time horizon, high carbon restriction scenarios

# Review of Cost Assumption Sources – New Resources

- **Wind:** 2023 All Source Request for Proposal responses, confirmed with offer refresh; adjusted over time based on average cost curve from NREL and EIA
- **Solar:** 2023 All Source Request for Proposal responses, confirmed with offer refresh; adjusted over time based on average cost curve from NREL and EIA
- **Battery Storage:** Average price based on 2023 All Source Request for Proposal responses; adjusted over time based on average cost curve from NREL and EIA
- **Natural Gas:** Composite of publicly available cost estimates (EIA 2023 Annual Energy Outlook & announced projects) & 2023 technology study; carbon capture costs estimates from NREL
- **Coal:** Carbon capture cost estimates from NREL; internal estimates of natural gas conversion costs
- **Uranium:** Composite of vendor and engineering firm estimates, adjusted to reflect cost uncertainty for technology not yet deployed

# Availability of Resources for Capacity Expansion by Year

## Evergy Metro

| Resource | 2024 | 2025 | 2026 | 2027 | 2028+ |
|---|---|---|---|---|---|
| Wind | | | 150 | 150 | 150 |
| Solar | | | | 150 | 150 |
| Battery | | | 150 | 150 | 150 |
| Combined Cycle | | | | | 260 |
| Combustion Turbine | | | | | 238 |
| Dogwood CC | | | | | |
| Market Capacity | 300 | 300 | 100 | 30 | 30 |

## Evergy Missouri West

| Resource | 2024 | 2025 | 2026 | 2027 | 2028+ |
|---|---|---|---|---|---|
| Wind | | | 150 | 150 | 150 |
| Solar | | | 150 | 150 | 150 |
| Battery | | | 150 | 150 | 150 |
| Combined Cycle | | | | | 260 |
| Combustion Turbine | | | | | 238 |
| Dogwood CC | 143 | | | | |
| Market Capacity | 300 | 300 | 100 | 20 | 20 |

# Resource Adequacy Requirements Update

- Summer Reserve Margin:
  - Current: 15%
  - Future Indicators: Updated Loss of Load study performed by SPP indicated summer reserve margin could increase to ~17% in 2025/2026
- Winter Reserve Margin:
  - Beginning Winter ’24/25: 15%
  - Future Indicators: Studies performed by SPP thus far project that winter reserve margin is likely to significantly increase beyond 2025/2026; stakeholder discussions are ongoing
- Performance-Based Accreditation
  - Expect implementation summer 2026
  - Impact to Evergy will vary based on fleet performance versus SPP resources overall
- Effective Load Carrying Capability
  - Expect implementation summer 2026 – have received accreditation results from 2023 ELCC study for existing renewable resources
  - Accreditation of all ELCC resources will change over time as penetration within SPP changes
- 2024 Triennial Approach: Will incorporate assumed impacts of these policy changes on capacity requirements over time

# Integrated Resource Plan & Risk Analysis

*Kelli Merwald*

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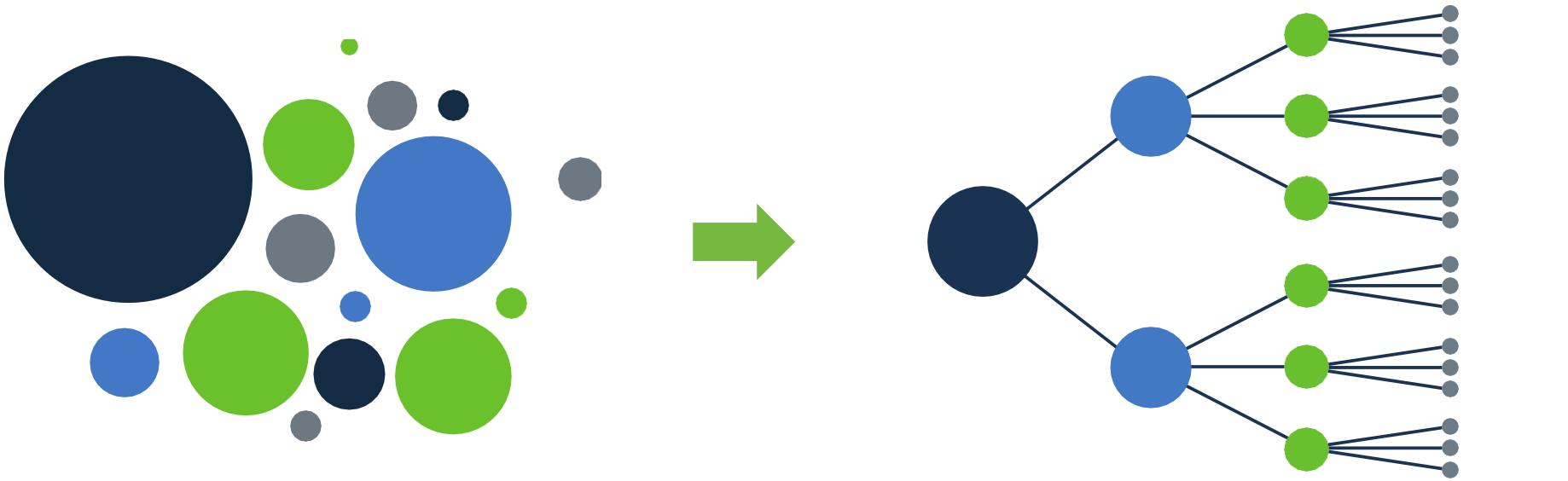
# Analytical Approach

| *Evergy Level* | *Utility Level* | | |
|---|---|---|---|
| **Critical Uncertain Factor Analysis** | **DSM Portfolio and Retirement Testing** | **Discrete Scenario Testing** | **Contingency Plans** |
| *What variables are "critical" to the performance (cost) of our resource plans?* | *How do differing levels of DSM implementation and any additional accelerated retirements impact plans?* | *What is the lowest-cost resource plan under "Proposed GHG Rule Compliance" (aggressive decarbonization) and "Delayed Retirements" (status quo environmental regulations) scenarios?* | *Which alternative resource plans should be modeled to inform execution options if conditions change?* |
| **Expectation:**<br>• Load<br>• Natural Gas Prices<br>• Env Policy ($CO_2$ restriction)<br>• Construction Costs | **Expectation:**<br>• Limited change versus 2023 Update other than impact of increased KS DSM; retirement changes TBD based on updated cost forecasts | **Expectation:**<br>• Produce resource plans built around internally consistent macro assumptions to supplement typical Critical Uncertain Factor-based evaluation | **Expectation:**<br>• Will provide additional analysis of discrete resource decisions for use in CCN and similar cases |
| ***Discussion focus for today*** | | ***Discussion focus for today*** | |

# Critical Uncertain Factor Approach



**Uncertain Factors**

Analyzed individually to determine criticality (i.e., impact on Alternative Resource Plan ranking)

**Scenarios**

Constructed based on combinations of Critical Uncertain Factors (gas price, $CO_2$ pricing, load forecast, etc.)

# Preliminary Uncertain Factors Evaluation

| Uncertain Factor | Evaluated? | Critical? | Comments |
|---|---|---|---|
| Load Growth | ✓ | ✓ | |
| Interest Rate | ✓ | ✗ | |
| Legal Mandates | ✓ | ✓ | $CO_2$ restriction |
| Fuel Prices | ✓ | ✓ | Only Nat. Gas prices critical |
| New Gen Construction / Permitting | ✓ | ✓ | |
| Purchased Power | N/A | ✗ | Purchased Power cost uncertainty assessed using other factors |
| Emission Allowance Pricing | ✓ | ✗ | $CO_2$ tax included in legal mandates factor |
| Gen O&M costs | ✓ | ✗ | |
| Forced Outage Rates | ✓ | ✗ | |
| DSM Load Impacts | ✓ | ✗ | |
| DSM Costs | ✓ | ✗ | |
| Other potential uncertain factors | TBD | TBD | |

✓ Currently considered "Critical"

✗ Not currently considered "Critical"



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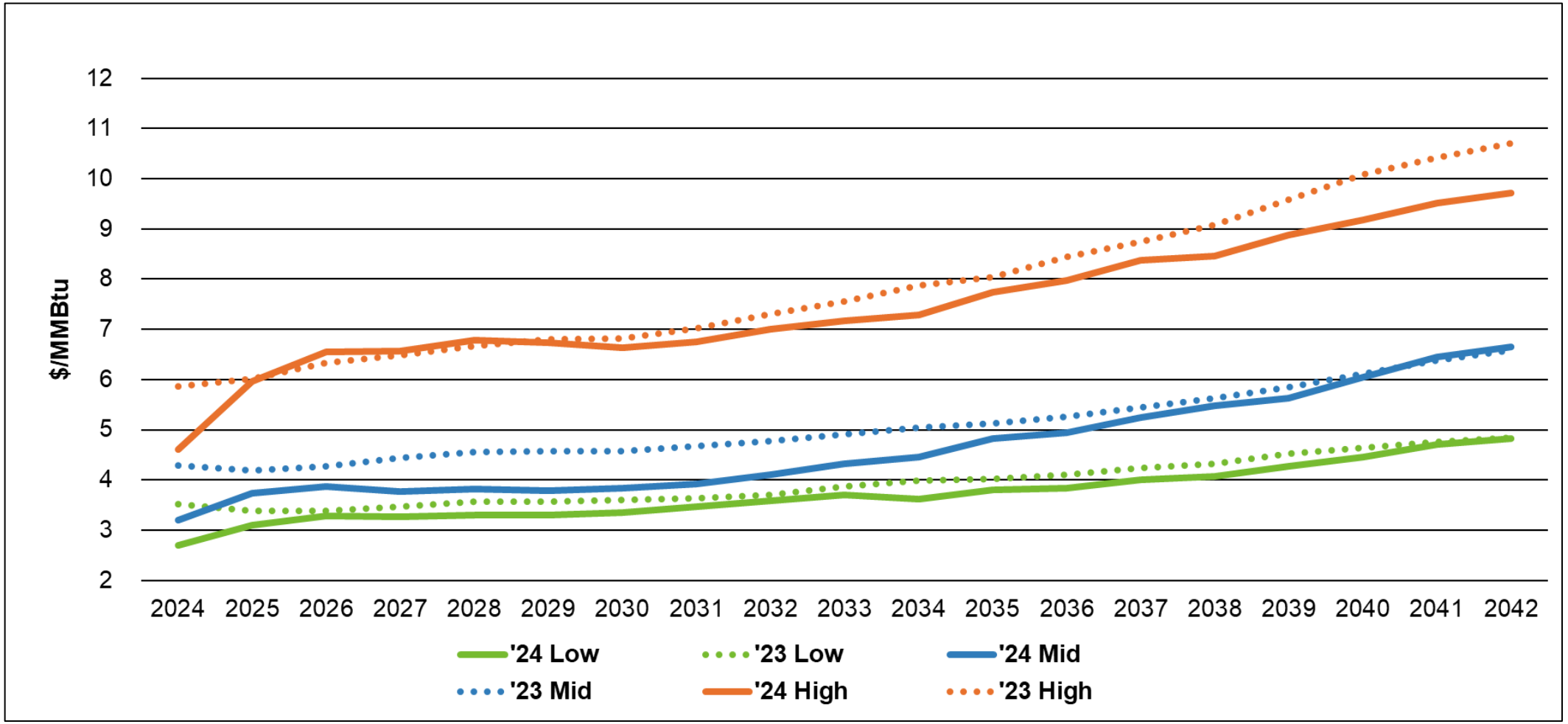
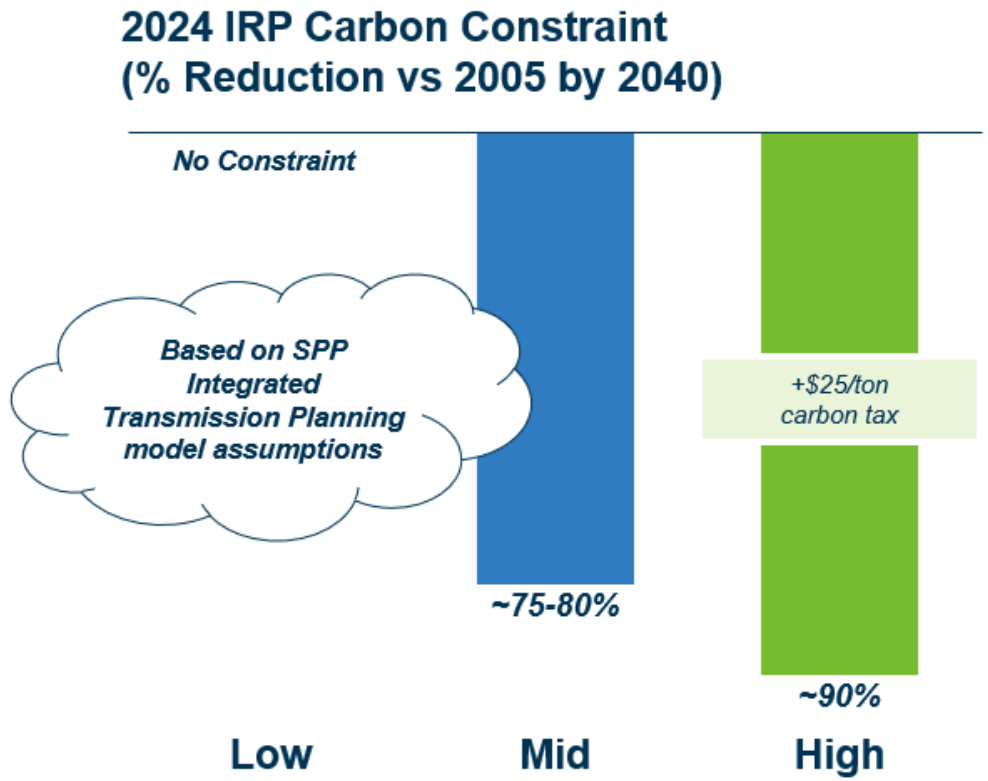
# Critical Uncertain Factors – Natural Gas Prices



# Critical Uncertain Factors – Legal Mandates / $CO_2$ Restriction

- Includes varying levels of carbon restriction, consistent with SPP assumptions, which impact market prices and dispatch
- High Carbon Restriction scenario includes additional carbon tax
- Will include incremental cost of carbon capture on new natural gas in order to enable non-emitting operations in High restriction scenario (different approach than 2023 Annual Update)

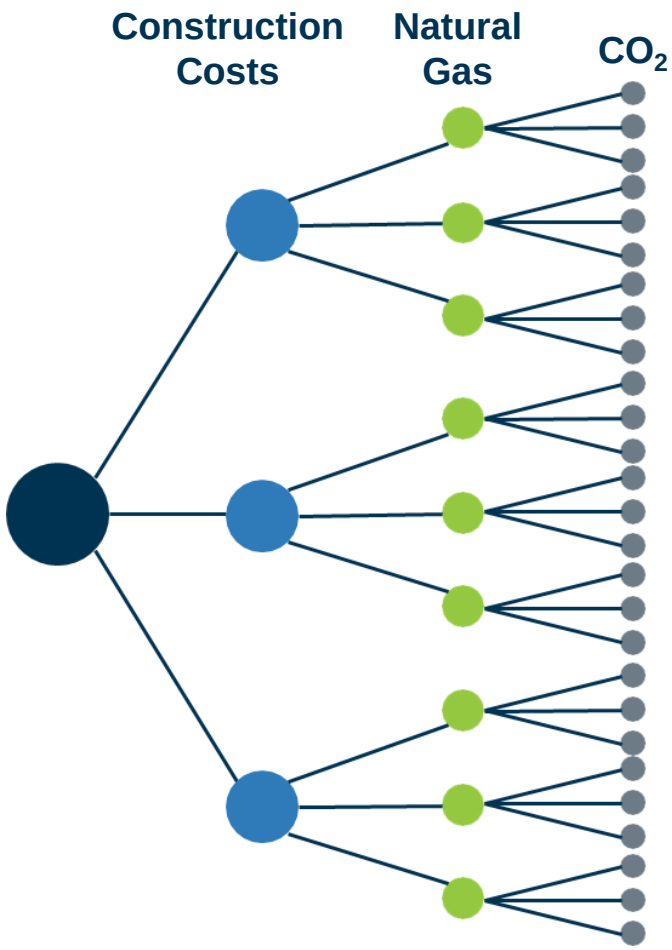


# Critical Uncertain Factors – Construction / Permitting / Interconnection Costs

- Construction and Interconnection Costs have been highly volatile past few years impacted by both macroeconomic and industry specific factors
  - Construction uncertainty tested +/- 25% consistent with observed year over year variations seen in past few years
  - Interconnection cost uncertainty based on 2019-2023 study data for SPP

- 2024 IRP build costs
  - Renewables build cost estimates consistent with IRP 2023 for mid scenario, based on price refresh from RFP offers
  - Thermal build cost estimates expected to increase for mid scenario due to inflation

# Reminder – Scenario Endpoint Example (2021 Triennial)




| Endpoint | Load Growth | Natural Gas | $CO_2$ | Endpoint Probability |
|---|---|---|---|---|
| 1 | High | High | High | 1.6% |
| 2 | High | High | Mid | 3.1% |
| 3 | High | High | Low | 1.6% |
| 4 | High | Mid | High | 3.1% |
| 5 | High | Mid | Mid | 6.3% |
| 6 | High | Mid | Low | 3.1% |
| 7 | High | Low | High | 1.6% |
| 8 | High | Low | Mid | 3.1% |
| 9 | High | Low | Low | 1.6% |
| 10 | Mid | High | High | 3.1% |
| 11 | Mid | High | Mid | 6.3% |
| 12 | Mid | High | Low | 3.1% |
| 13 | Mid | Mid | High | 6.3% |
| 14 | Mid | Mid | Mid | 12.5% |
| 15 | Mid | Mid | Low | 6.3% |
| 16 | Mid | Low | High | 3.1% |
| 17 | Mid | Low | Mid | 6.3% |
| 18 | Mid | Low | Low | 3.1% |
| 19 | Low | High | High | 1.6% |
| 20 | Low | High | Mid | 3.1% |
| 21 | Low | High | Low | 1.6% |
| 22 | Low | Mid | High | 3.1% |
| 23 | Low | Mid | Mid | 6.3% |
| 24 | Low | Mid | Low | 3.1% |
| 25 | Low | Low | High | 1.6% |
| 26 | Low | Low | Mid | 3.1% |
| 27 | Low | Low | Low | 1.6% |

**For each factor:**
High – 25%
Mid – 50%
Low – 25%



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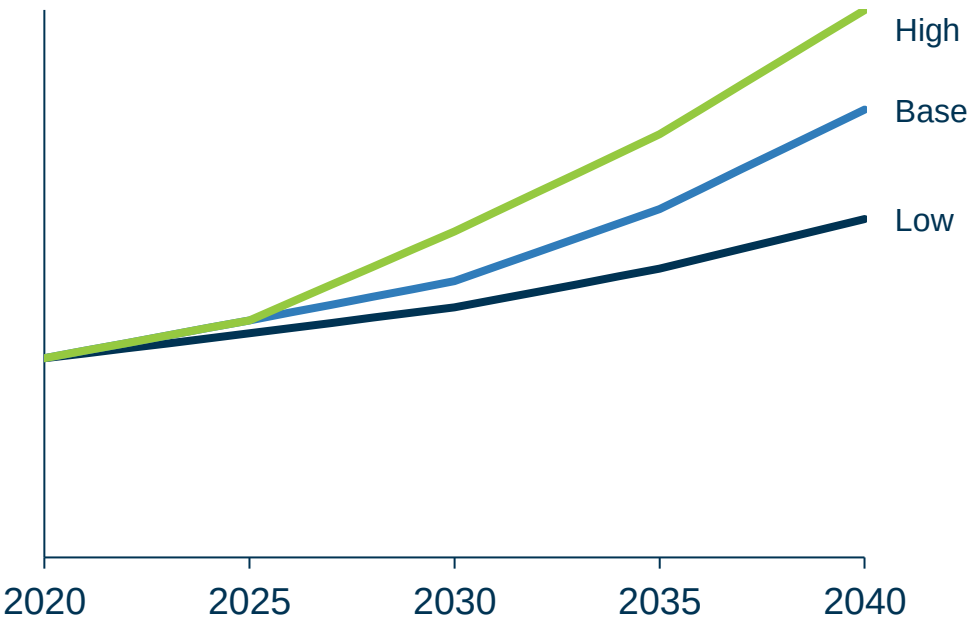
# Critical Uncertain Factors – Load

- Load is critical in that it determines *how much* capacity is required – which drives the creation of resource plans
- Historically, load has been incorporated as an endpoint in evaluating Revenue Requirements, but evaluated resource plans were not adjusted to reflect more/less capacity required
- In 2024 Triennial, propose evaluating load as a "contingency plan" to reflect that different resource decisions could be made if load was higher/lower than expected
- Will not be factored into "endpoint" analysis of Revenue Requirements

**Load Scenarios That Drive Need for More Capacity**

*Illustrative Example*




Contingency Plans:

- What resource plans solve best for high electrification scenario?
- What resources help meet customer demand if load growth slows down?



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# Discrete Scenario Analysis – For Discussion

## "Delayed Retirements" Scenario

- Only retire Lawrence Energy Center – delay all other retirements beyond 20-year period
- Assumes no large environmental retrofits (i.e., SCRs) required
- Capacity Expansion model optimizes for Low gas; Low (No) carbon restriction; Mid construction costs

## Proposed GHG Rules / Deep Decarbonization Scenarios

**"Prescriptive" (based on compliance options included in proposed GHG rule – details by plant next slide)**

- Capacity factor limits
- Co-firing with natural gas
- Carbon capture
- Hydrogen blending (if cost estimate can be developed)
- Capacity expansion modeling under High gas; High carbon restriction; Mid construction costs

**Optimized**

- No prescriptive requirements for compliance paths – dispatch and resource additions optimized based on capacity expansion; include accelerated retirements versus current Preferred Plan
- Capacity expansion modeling under High gas; High carbon restriction; Mid construction costs

# Prescriptive GHG Rule Scenario

## 2023 IRP Update Preferred Plan Coal Retirement Schedule (MW)

***** The proposed GHG rule includes emission limitations and operating constraints beginning on January 1, 2030. *****

**Retired by 12/31/31**

-485 LEC4-5

-1,337 JEC2-3

*Routine operations / no baseline emission increases[1]*

**Retired 2032-2034**

-758 LAC1

*20% annual capacity factor restriction from 1/1/30 – 12/31/34[1]*

**Retired 2035-2039**

-1,957 JEC1, LAC2, IAT1

*40% natural gas co-firing, equating to a 16% reduction in $CO_2$ emissions, starting in 2030[1]*

**Retired 2040+**

-1,205 IAT2, HAW5

*90% Carbon Capture & Sequestration starting in 2030[1]*

**2025 — 2030 — 2035 — 2040**

## Two options for new combined cycles:

| | | | |
|---|---|---|---|
| Hydrogen -vs- | ***2030 – 2032:*** 770 - 900 lbs. $CO_2$/MWh restriction | *2032 – 2037:* 30% Hydrogen blending by volume | *2038 and beyond:* 96% blending by volume |
| Carbon Capture | ***2030 – 2034:*** 770 - 900 lbs. $CO_2$/MWh restriction | ***2035 and beyond:*** CCS at 90% capture rate | |

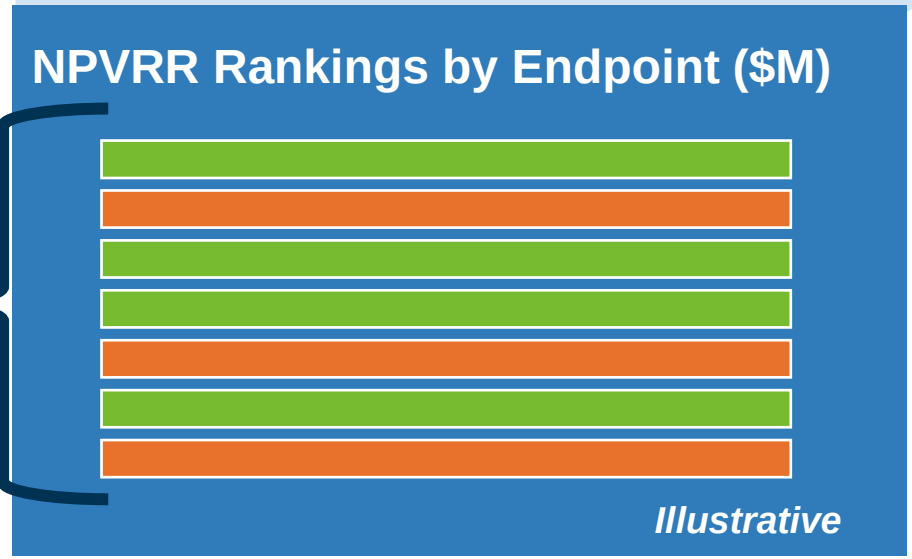
Cost estimates for compliance may be challenging

- Hydrogen pricing – need source (preliminary research reveals wide-range)
- Carbon capture – NREL estimates for capture facilities, need source for storage/transport
- Co-firing – internal estimates for natural gas transport costs, facility upgrade needs



1. *Actual capacity factor restriction will be a unit specific inquiry, based on design efficiency. States will set resulting performance standards using a unit-specific baseline emissions rate.*

# Analytical Approach, continued


***Costs will be compared across Alternative Resource Plans and endpoints to result in selection of Preferred Plan***

- Evaluation of next-lowest-cost plan if near-term resources (e.g., Dogwood) are removed from plan – similar to comparison plans evaluated in 2023
- Capacity expansion results under High and Low load forecasts
- Comparison of costs for changes in specific plant retirements (e.g., Jeffrey 2)
- Others TBD

"Discrete Scenario" Resource Plan  Other Alternative Resource Plans

**Additional **reliability analysis** will be conducted (as agreed following 2021 Triennial) to evaluate plan performance under different extreme scenarios*



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# Wrap-Up

# Next Steps

- Follow up via email ***before January 12th*** with any specific comments to:

regulatory.affairs@evergy.com

- Next stakeholder meeting to be scheduled for February

- Dockets now open for 2024 Triennial:
  - Evergy Missouri Metro / EO-2024-0153
  - Evergy Missouri West / EO-2024-0154