IRP Stakeholder Meeting

January 21, 2021

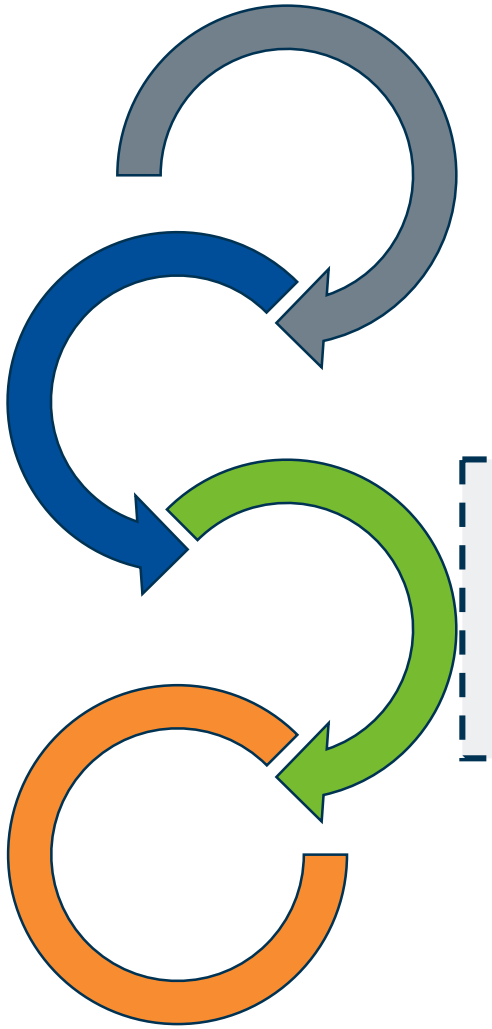
Triennial IRP Development Timeline

Gathering Input

July: Stakeholder meeting to discuss modeling assumptions / inputs

Reviewing Results

Q1 2021: Review updated results including detailed review of inputs outlined in IRP rules



Refining Assumptions and Inputs

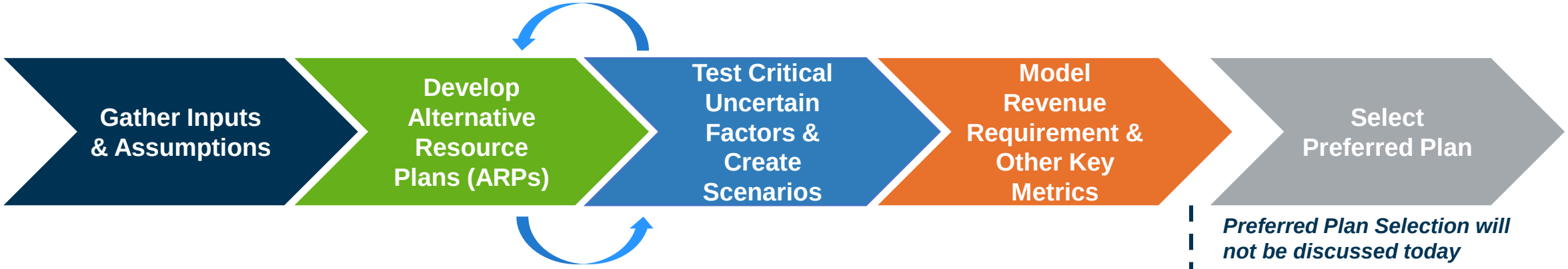
Early April: 2020 Annual Update Stakeholder Meeting to introduce process

Conducting Analysis

Late Q3 – Early Q1: Stakeholder meeting(s) to discuss preliminary results

- ***October 19th:*** *Initial review of preliminary results*
- **Early-December:** Additional stakeholder meeting to review next round of results
- **January**: Demand-Side (Electrification, DSM, Behind-the-Meter solar & storage) Focused Discussion
- ***As Needed:*** Topical meetings with specific stakeholders on comments received

Overall Analytical Process



Preferred Plan Selection will not be discussed today

Load Forecasts
Low, Mid, High, Electrification

Fuel Forecasts
Nat Gas, Coal, Fuel Oil

DSM Forecasts
Maximum and Realistic Potential

New Generation
Capital, O&M, Operational info

Existing Generation
Capital, O&M, Operational info

ARPs include combinations of unit retirements, unit additions, DSM levels

Specific ARPs will not be discussed today

Combinations of Critical Uncertain Factors analyzed – currently 27 total combinations:

Load
Low, Mid, High

Nat Gas
Low, Mid, High

CO_2
Low, Mid, High

20-Year Net Present Revenue Requirement (NPVRR) calculation of ARPs for each of the 27 scenarios

ARP providing lowest NPVRR across scenarios is generally selected as the Preferred Plan.

Higher NPVRR ARP can be selected but decision must be supported

evergy

Agenda

Behind-the-Meter Solar & Storage Potential Study

DSM Potential Study

Electrification Market Assessment

Behind-the-Meter (BTM) Solar and Storage Potential Study

Tim Nelson

evergy™

Behind-the-Meter Solar & Storage

Gain insights on adoption of Behind-the-Meter (BTM) solar and storage within Evergy's service territories.

Understand when adoptions might occur.

Define the potential for deployment of specific technologies, products and programs.

Learn motivating factors behind adoption and barriers to entry.

Technology Overview

Behind-the-Meter

Solar

- Customers can install solar PV on-site to be collocated with their load. Generation is consumed on-site by the customer before exporting to the grid.

Storage

- Customers can store energy from the grid for later use on their site.

Solar + Storage

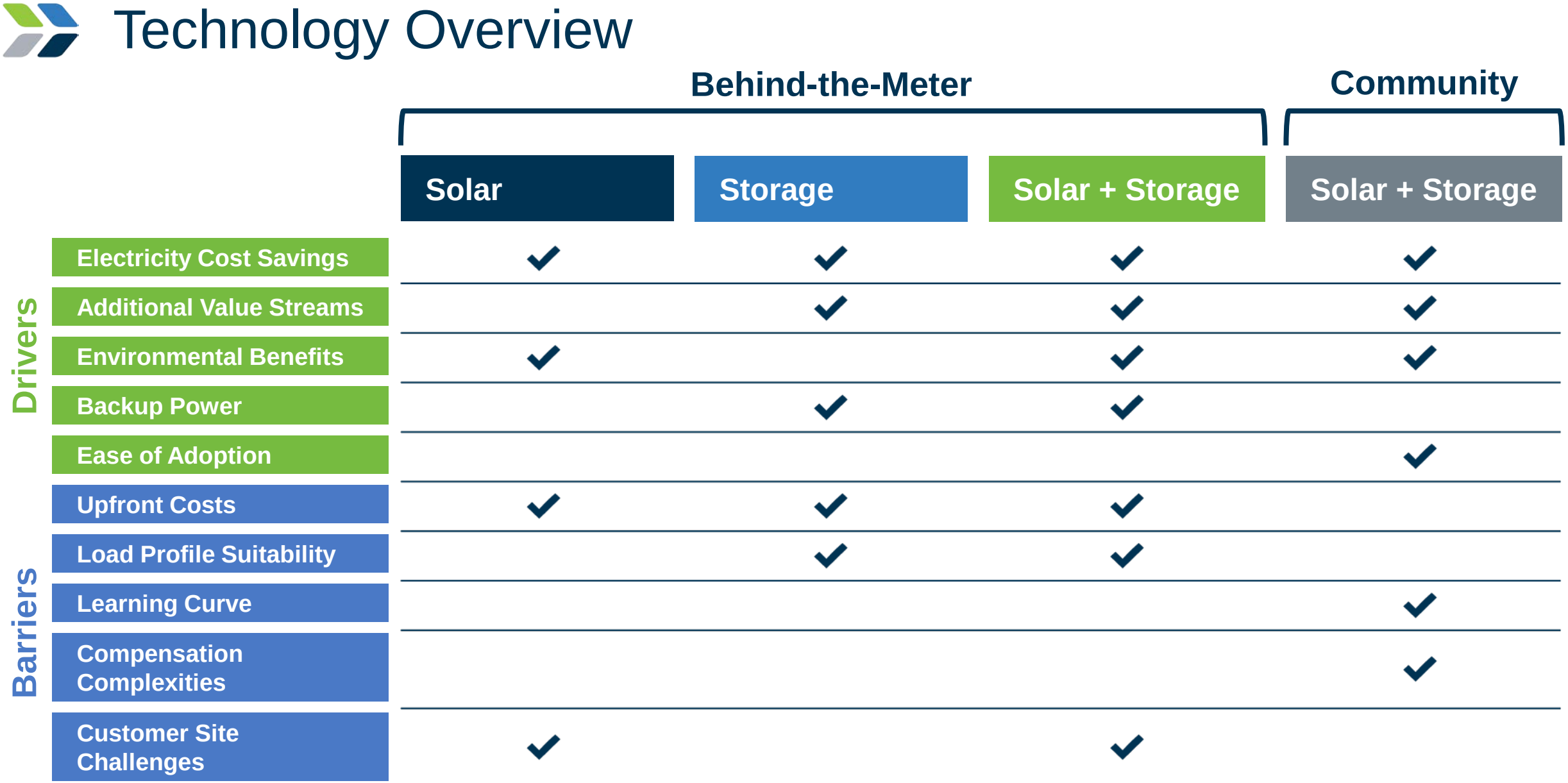
- Customers can store power produced by on-site solar PV in a battery for later use.

Community

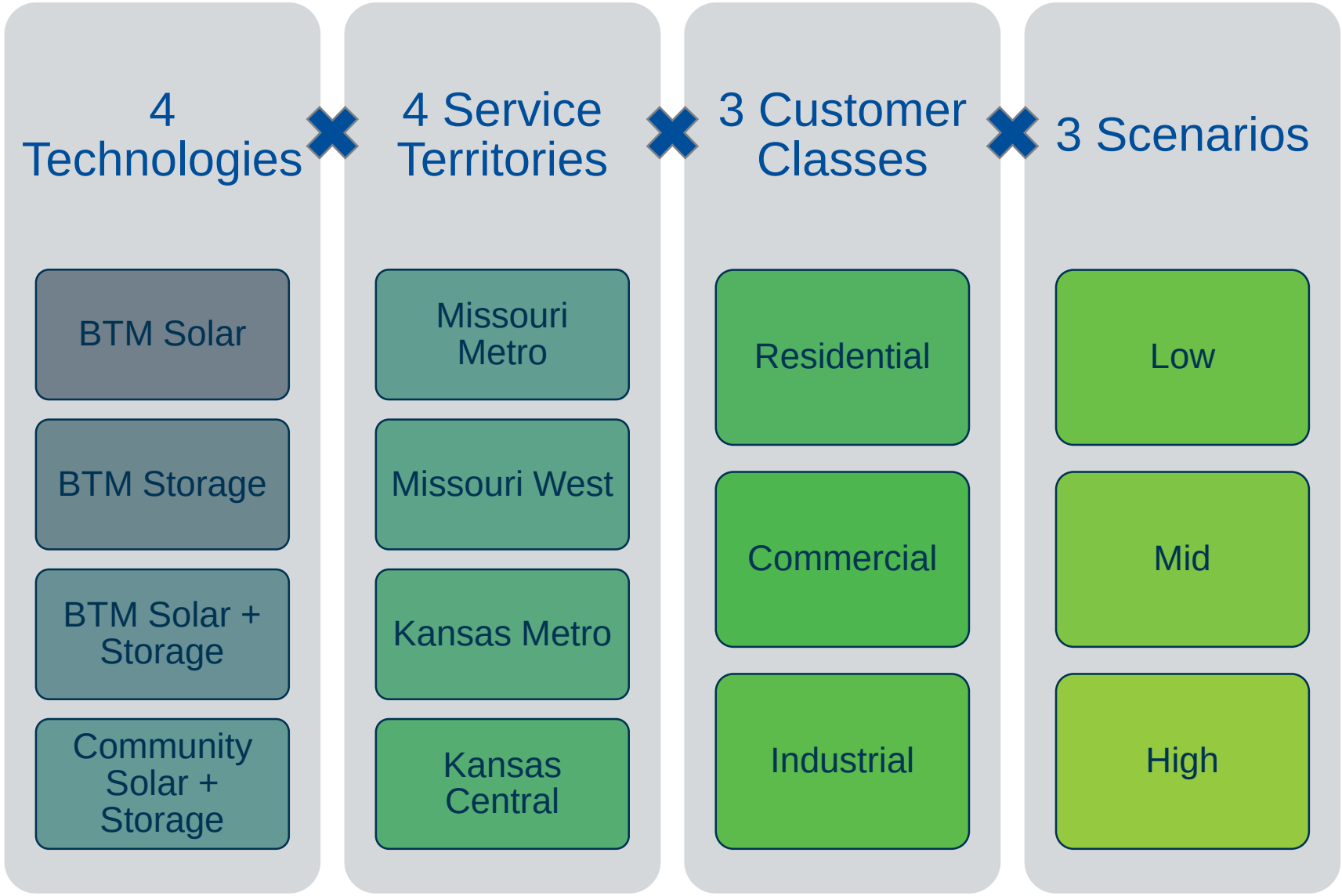
Solar + Storage

- Customers can subscribe to a portion of a large, off-site solar array. Subscribers receive a monthly credit based on their portion of the system or output.

Technology Overview



Approach and Parameters



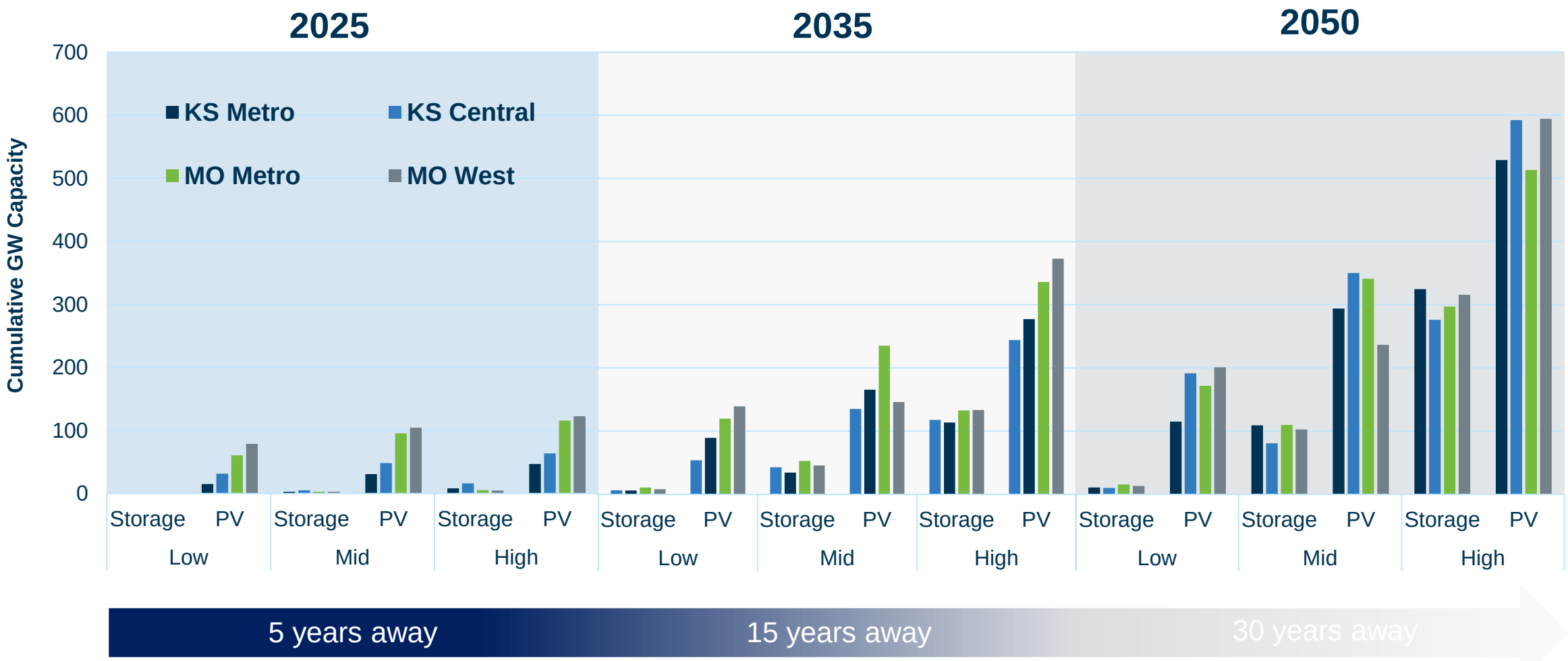
144 combinations x 30 years

Scenarios Analyzed

	Low	Mid	High
Adoption Curve	*Slow* adoption curve	*Moderate* adoption curve based on similar trends nationwide	*Aggressive* adoption curve, but capped below leading markets
Technology Cost	NREL ATB 2020 *Conservative* forecast	NREL ATB 2020 *Moderate* forecast	NREL ATB 2020 *Advanced* forecast
Tariffs / Rates	EAAGS* Scenario 6 (*High Load, Low Gas, No CO2 Restrictions*)	EAAGS* "Expected Value"	EAAGS* Scenario 15 (*Low Load, Mid Gas, with CO2 Restrictions*)
Incentives	*No* new or extended incentives included	*No* new or extended incentives included	*No* new or extended incentives included

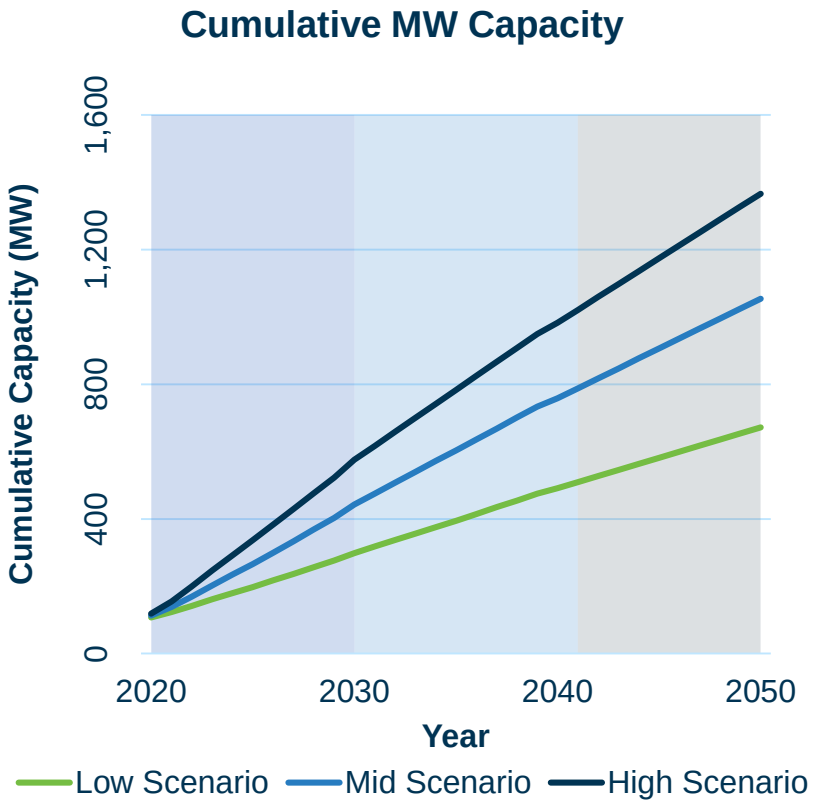
*EEAGS represents the total company Evergy preferred plan for the 2020 IRP. It was used to estimate revenue/rate growth over the study period.

Forecast Summary

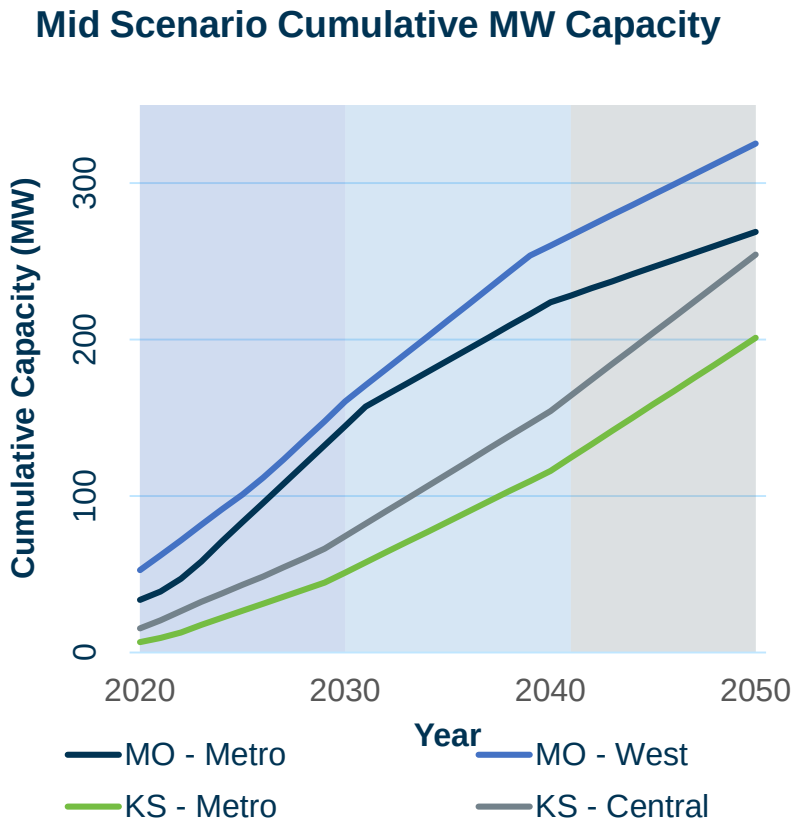


BTM Solar PV Results

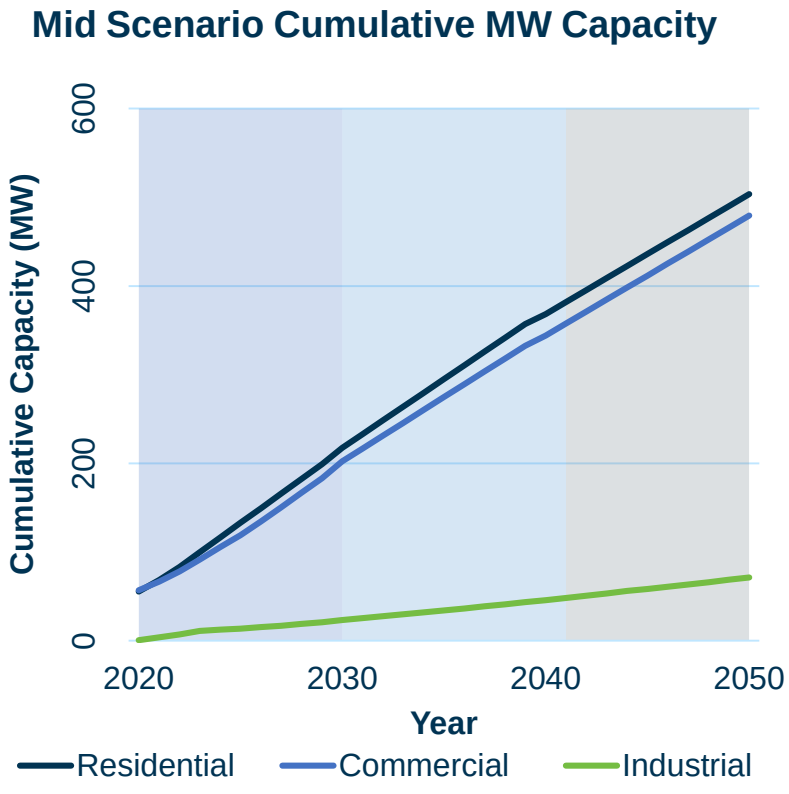
Scenario



Service Territory



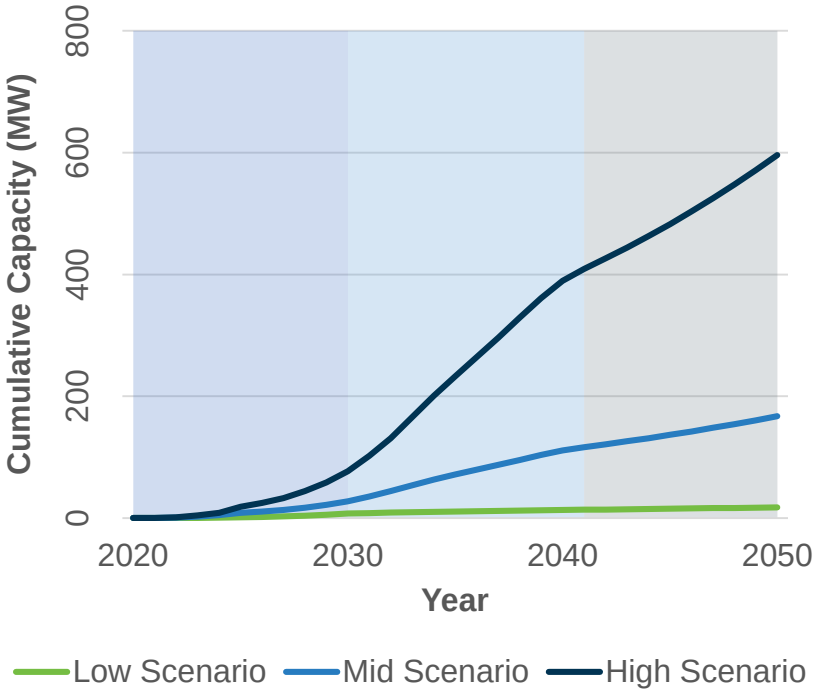
Customer Class



BTM Battery Storage Results

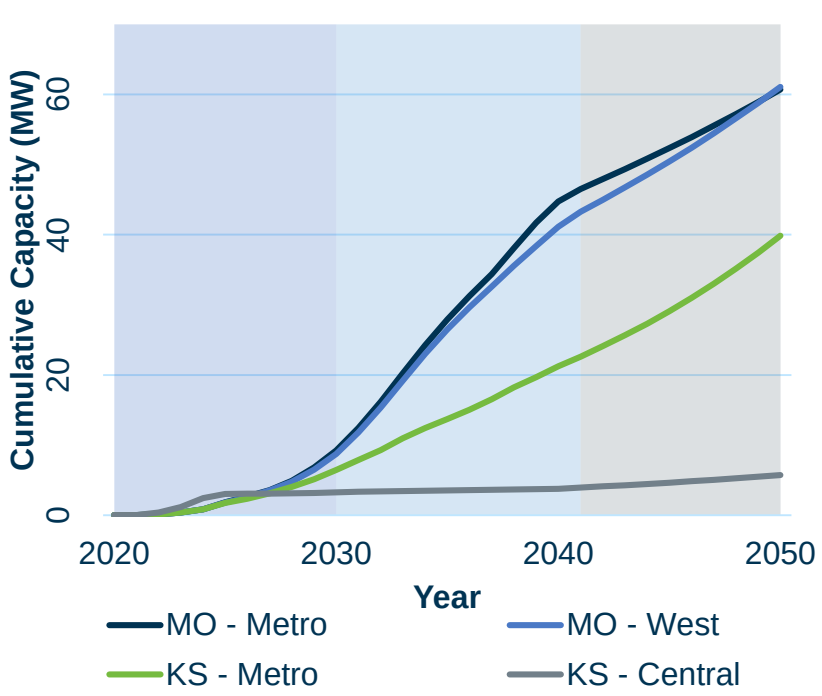
Scenario

Cumulative MW Capacity



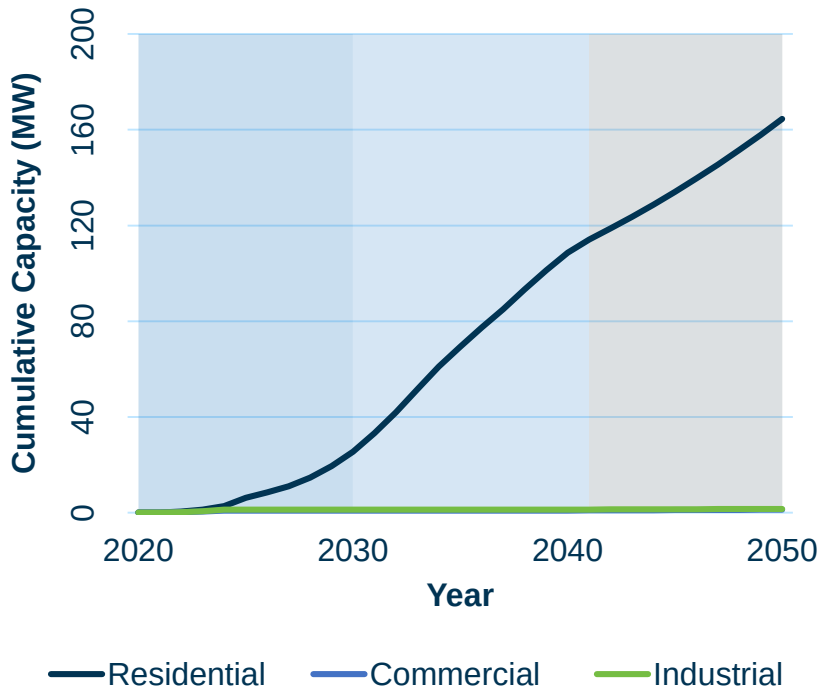
Service Territory

Mid Scenario Cumulative MW Capacity



Customer Class

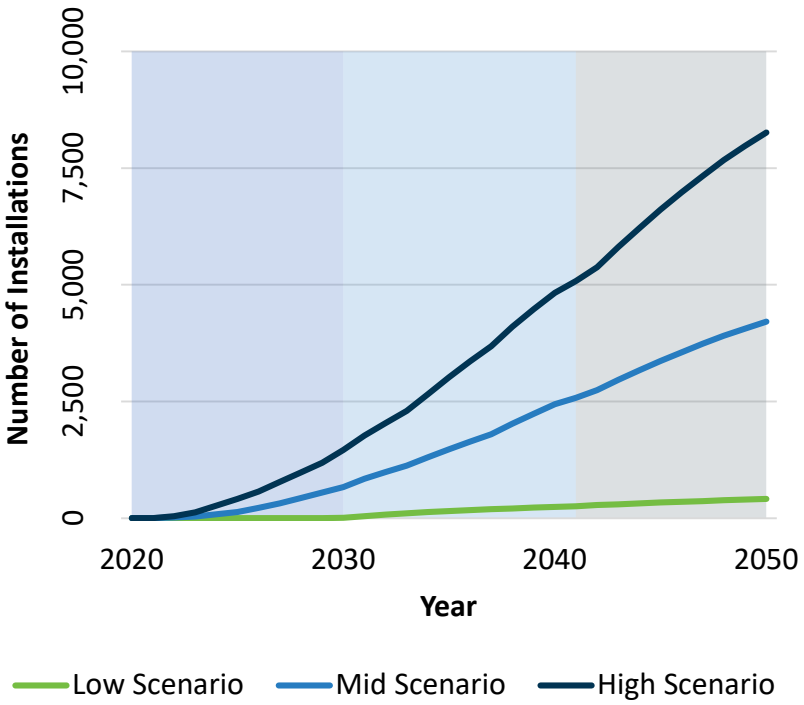
Mid Scenario Cumulative Installations



BTM Solar + Storage Results

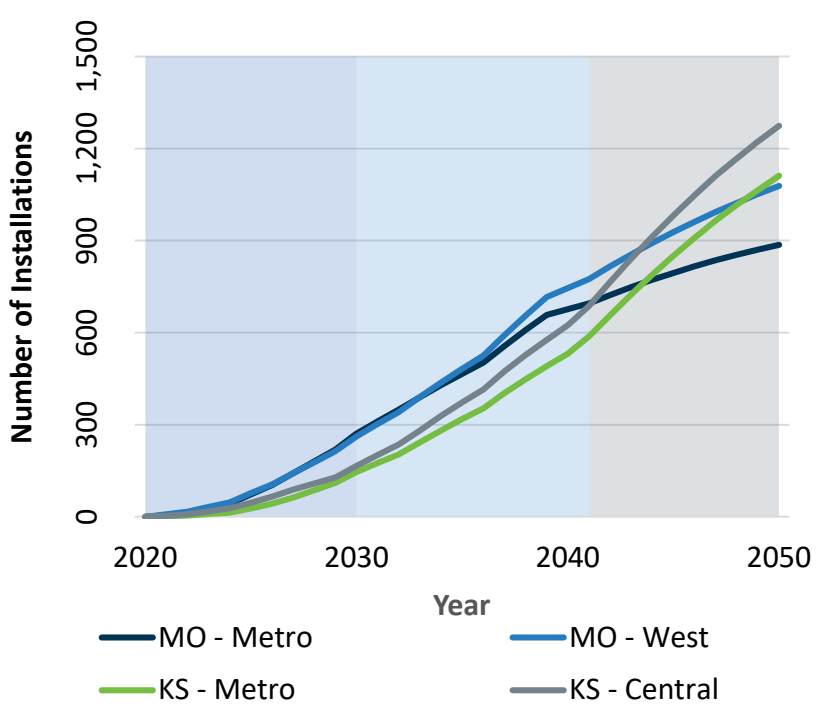
Scenario

Cumulative Annual Installations



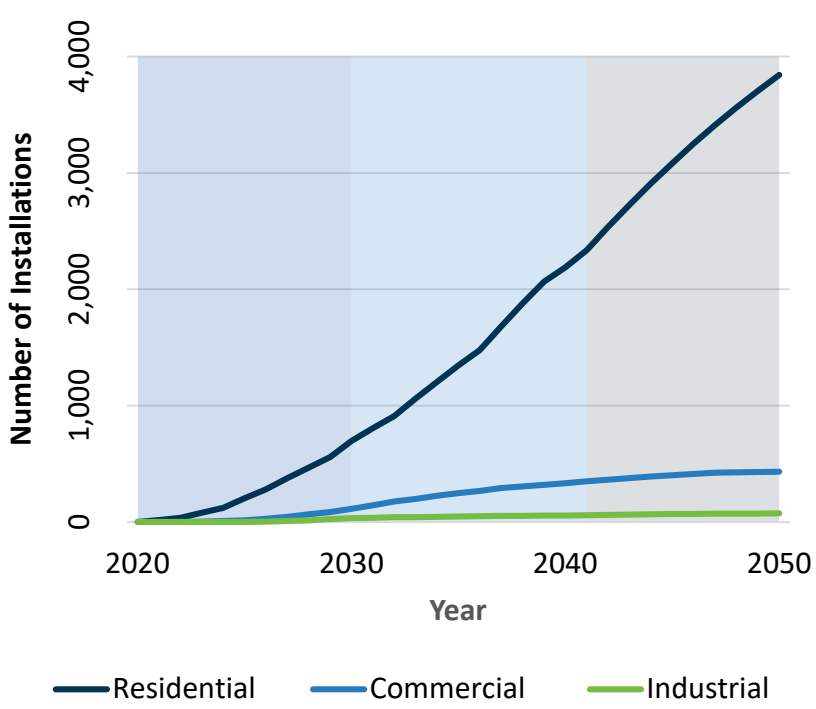
Service Territory

Mid Scenario Cumulative Installations



Customer Class

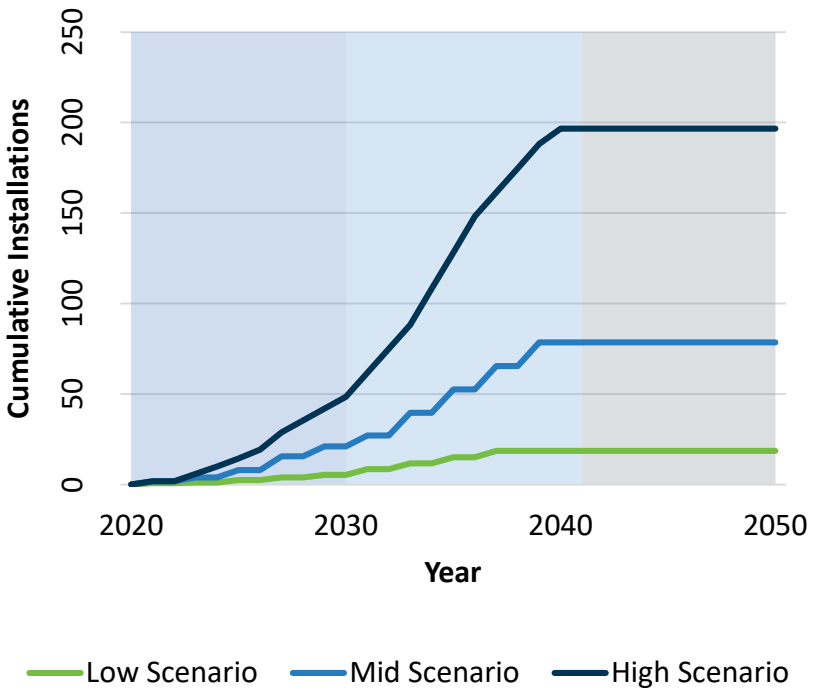
Mid Scenario Cumulative Installations



Community Solar + Storage Results

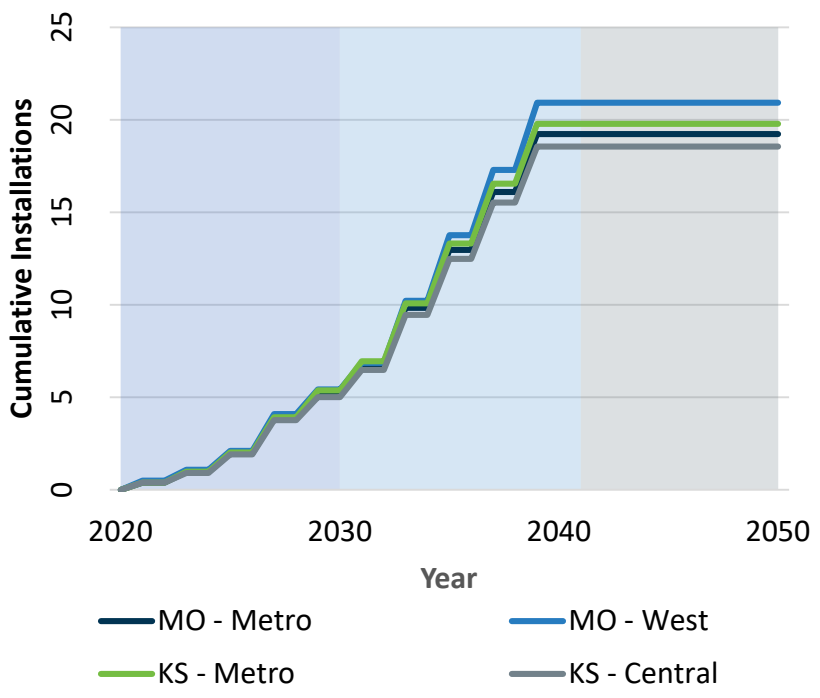
Scenario

Cumulative Annual Installations



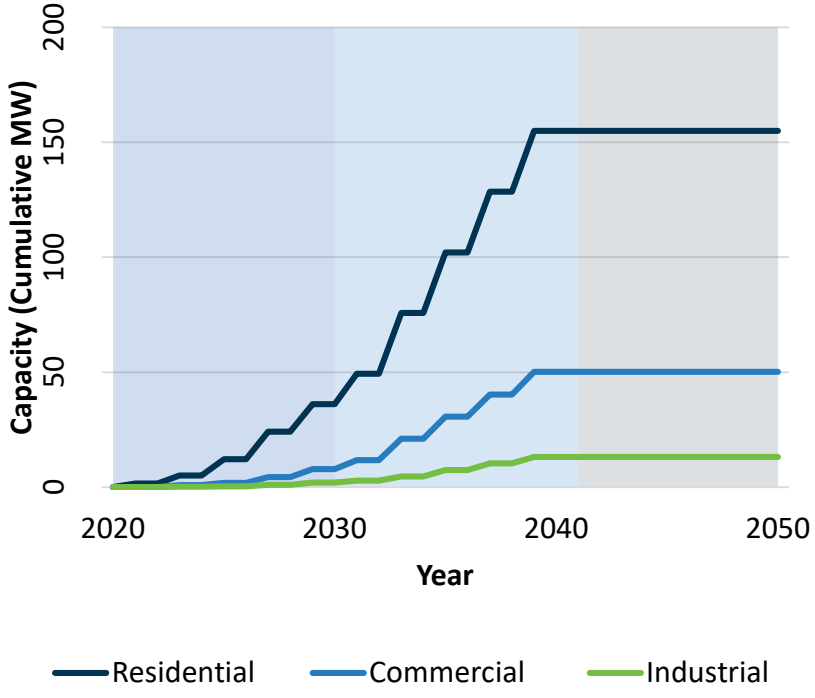
Service Territory

Mid Scenario Cumulative Installations



Customer Class

Mid Scenario Cumulative MW Capacity



Modeling BTM Solar & Storage in IRP

- Evaluate the impact of the BTM High Solar and High Energy Storage adoption scenario on the preferred resource plan selection
- Approach:

Re-run the Net Present Value of Revenue Requirements (NPVRR) analysis for each Alternative Resource Plan (ARP) with the combined load impact of BTM solar and storage

Done for each combination of CO_2 cost and natural gas price assumption (nine total scenarios)

Done for each stand-alone utility ARP and Evergy level ARP

Rank ARPs by NPVRR results for each scenario

Compare any changes in ARP ranking across each CO_2/natural gas price scenario

Demand-Side Resource Analysis

Tim Nelson

evergy™

DSM Potential Study Overview

APPLIANCE SATURATION STUDY

POTENTIAL MODELING & PROGRAM DEVELOPMENT

- Market Characterization and Historical Load Analysis
- Identification of a Set of Potential Resources
- EE, CHP, DR, DSR, and Emerging Technologies
- Estimation of Technical and Economic Potential
- Development of Programs and Estimation of Achievable Potential
- Optimization, Sensitivity and Uncertainty Analysis

STUDY OUTCOMES

- Appliance Saturation Results
- Baseline Energy and Demand Forecast
- Potential Estimates: Technical, Economic, and Achievable
- Program Details: Savings, Cost, and Effectiveness

- Study Time Horizon - 20 years (2023 – 2042)
- Potential Estimation includes MO Metro and MO West service territories

Potential Study Evaluated Programs

Energy Efficiency

Residential
- Home Energy Reports
- Home Lighting
- Income Eligible
- Whole House Efficiency (WHE)
- Multi-family Direct Install
- Midstream HVAC and HPWH

Commercial and Industrial
- Standard
- Custom
- Small Business*
- Block Bidding*
- Strategic Energy Management (SEM)
- New Construction*

*Commercial only

Demand Response

Residential
- Smart Thermostat
- Direct Load Control
  - Water Heating
  - Pool Pumps
  - Hot Tubs
- Direct Load Control
  - Battery Storage
  - EV Smart Charger
- Behavioral DR
- Peak Time Rebate
- Critical Peak Pricing

Commercial
- Smart Thermostat
- Direct Load Control
  - Water Heating
  - Pool Pumps
- Thermal Storage
- Business DR
- Critical Peak Pricing

Industrial
- Business DR

Demand Side Rates

Residential
- Time of Use
- Demand Side Rate

Commercial and Industrial
- Time of Use
- Real Time Pricing

The following programs are projected to start in 2026:
- Residential
  - DLC Battery Storage
  - Peak Time Rebate
  - Behavioral DR
  - Critical Peaking Pricing
- Commercial
  - Critical Peak Pricing
  - Real Time Pricing
- Industrial
  - Real Time Pricing

Legend
- RAP and MAP
- MAP Only

DSM Scenarios for Evaluation in IRP

MAP	RAP	RAP-	RAP+	MEEIA Goals	Stand Alone DR	Stand Alone DSR
• Maximum Achievable Potential without restrictions to program budget	• Realistic Achievable Potential • Base Case Study • Optimization • Uncertainty and Sensitivity Analysis • COVID-19 Impact will be evaluated in Uncertainty and Sensitivity Analysis	• Level of savings below RAP by benchmarking programs performance with other utilities • EISA standard applied	• Level of savings between RAP Scenario and MAP Scenario	• Level of savings by meeting MEEIA goal outlined in 4 CSR 240-20.094(2)	• MAP at Demand Response Programs Only	• MAP at Demand Side Rates Only

Optimization

- RAP Scenario
- ICF DSRPM model (Demand Side Resource Potential Model)
- Linear approach that allows single or multiple objectives and large number of constraints
- Optimizing for MEEIA goal of “achieving all cost-effective demand side savings” and IRP’s criteria of “minimizing long-run utility costs”

Electrification Market Assessment (EMA)

Tim Nelson

Electrification Market Assessment

- Study Approach
- Summary Results
- Evergy Load Forecast Integration

Electrification Study Approach

Evergy's IRP load forecast was informed by the assessment's initial two phases

Understanding the technical potential for electrification in Evergy's territory. Forty (40) technologies were assessed.

Producing 20-yr adoption forecasts by rating electrification potential against various barriers to conversion.

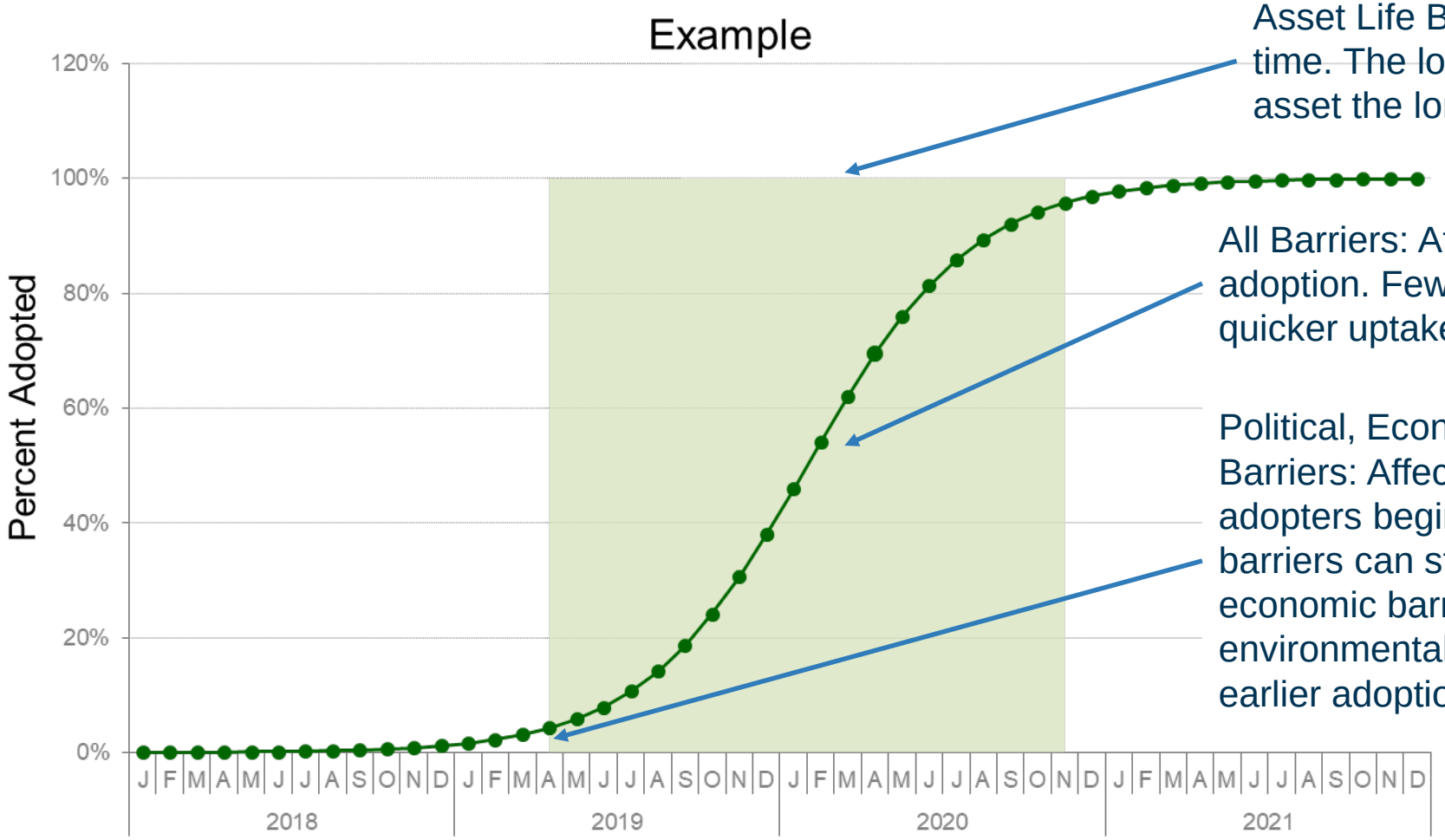
Electrification Study Approach

1898's algorithm produced 20-yr adoption curves based on four primary barriers

Asset Life	Policy & Incentives	Economic Barriers	Environmental Barriers
25 + Years	Illegal or Negative Policy	2x conversion cost or no lifetime savings	Worse environmental impacts
10-25 Years	No Incentive	Higher conversion cost with lifetime savings	Similar environmental impact
5-10 Years	Positive Policy	Similar conversion cost with lifetime savings	Fewer environmental impacts
0-5 Years or New Load	Mandated or no other option	Cheaper conversion cost or no other option	Mitigate direct environmental impacts

Electrification Study Approach

1898's adoption forecasts are represented by individual technology S-curves



Asset Life Barrier: Affects the takeover time. The longer the life cycle of the asset the longer the takeover time.

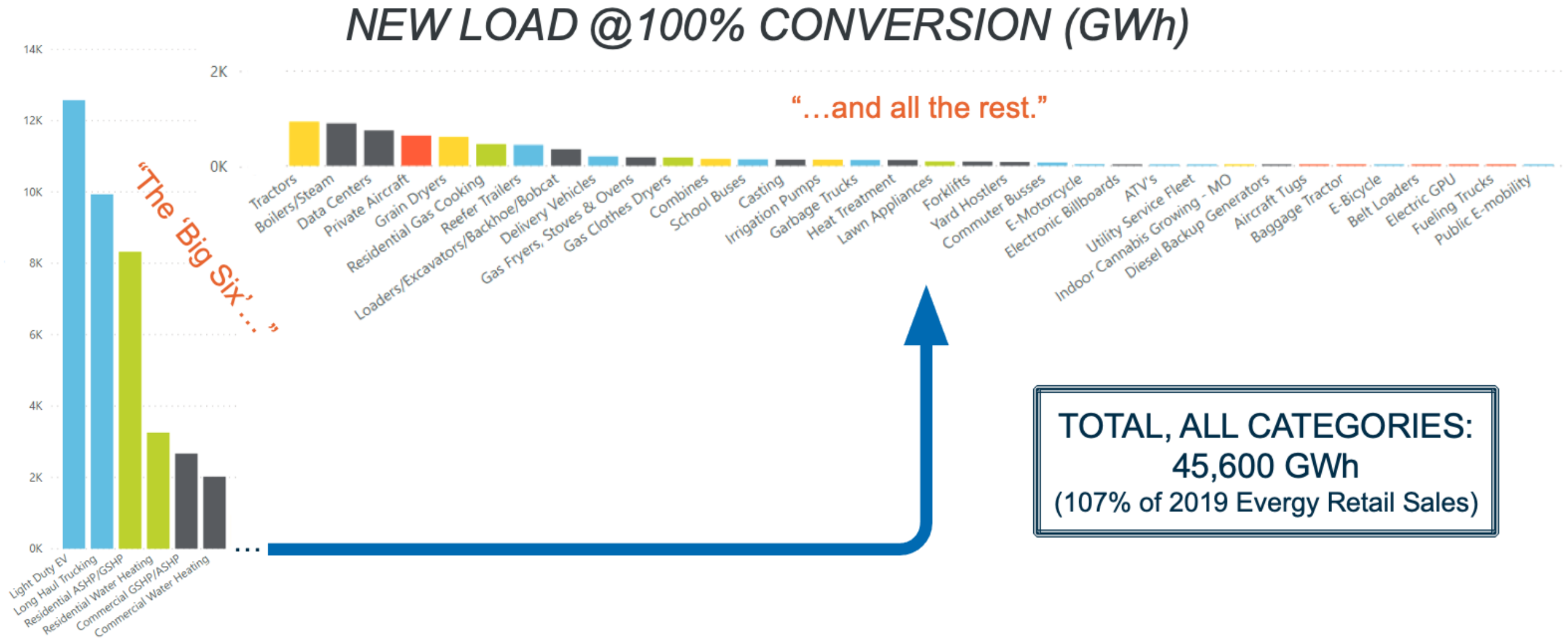
All Barriers: Affects the acceleration of adoption. Fewer barriers result in quicker uptake of adoption.

Political, Economic & Environmental Barriers: Affects how soon the early adopters begin adopting. Political barriers can stop indefinitely. Low economic barriers and or high environmental & tech value can drive earlier adoption.

Note: Start value of 0% (i.e. studying the remaining market)

Results - Quantifying the Market - Technical Potential

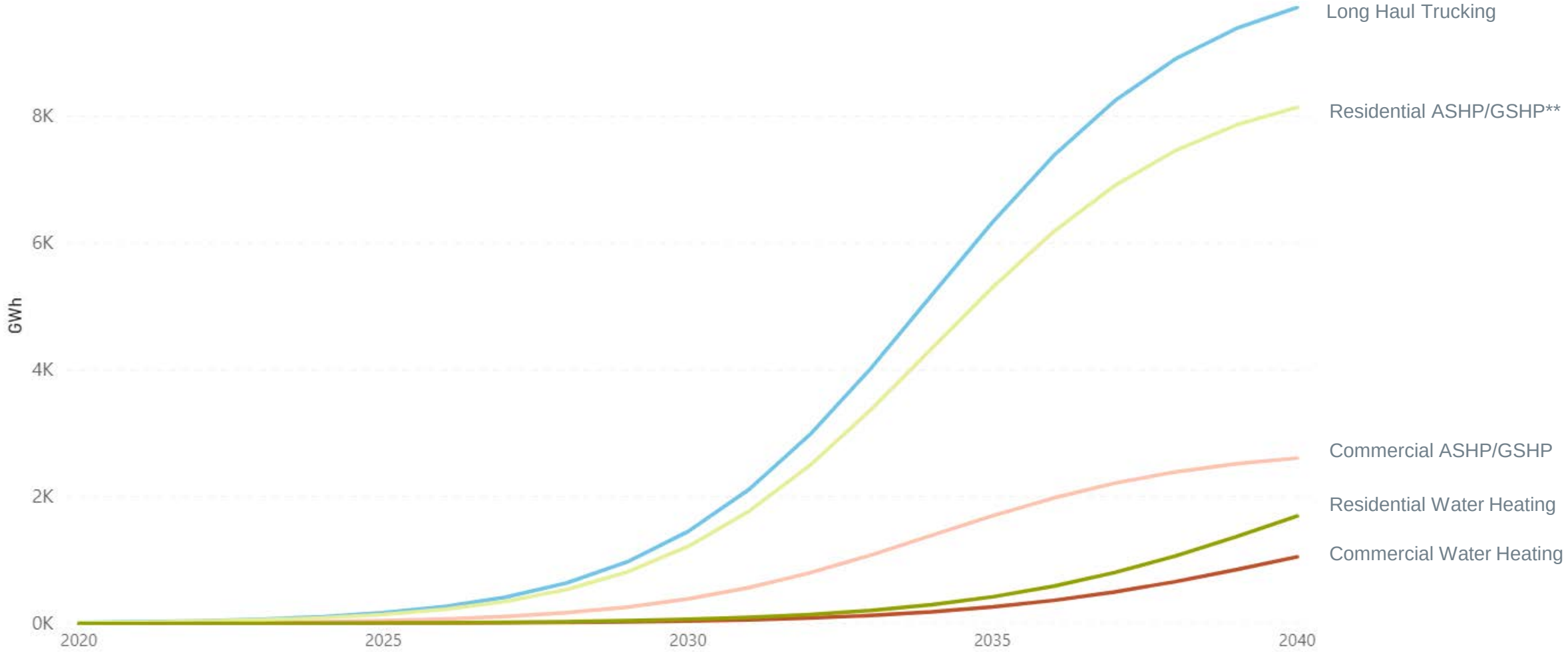
Approximate potential in Evergy's service territory is 45,600 GWh



TOTAL, ALL CATEGORIES:
45,600 GWh
(107% of 2019 Evergy Retail Sales)

Results
Forecasting Adoption - Primary Technology S-Curves

*Study results informed Evergy's load forecast for five of the six highest potential technologies**



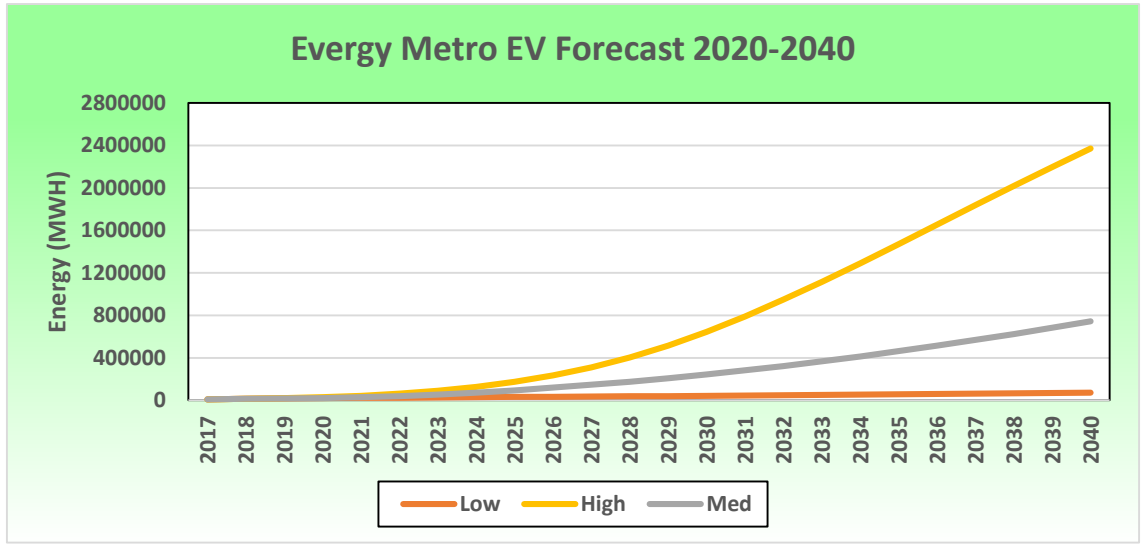
*Light duty vehicle forecast provided by EPRI

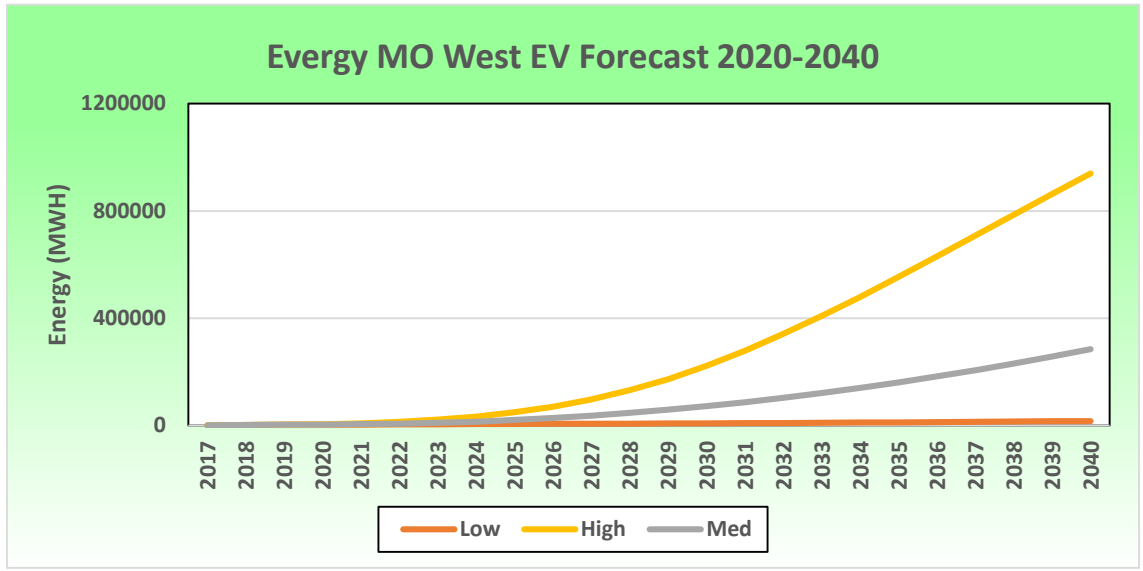
**Air-Source Heat Pump / Ground-Source Heat Pump

Light Duty EV Forecast

- Forecast of light-duty EV adoption provided by EPRI
- EPRI provided three scenarios
  - Low adoption
  - Med adoption
  - High adoption

- EPRI Med (base) forecast used in Evergy Low, Med, and High load forecast cases
- Additional load forecast scenarios of Low EV & High EV were also created using EPRI Low & High
- Electrification scenario also uses the EPRI High





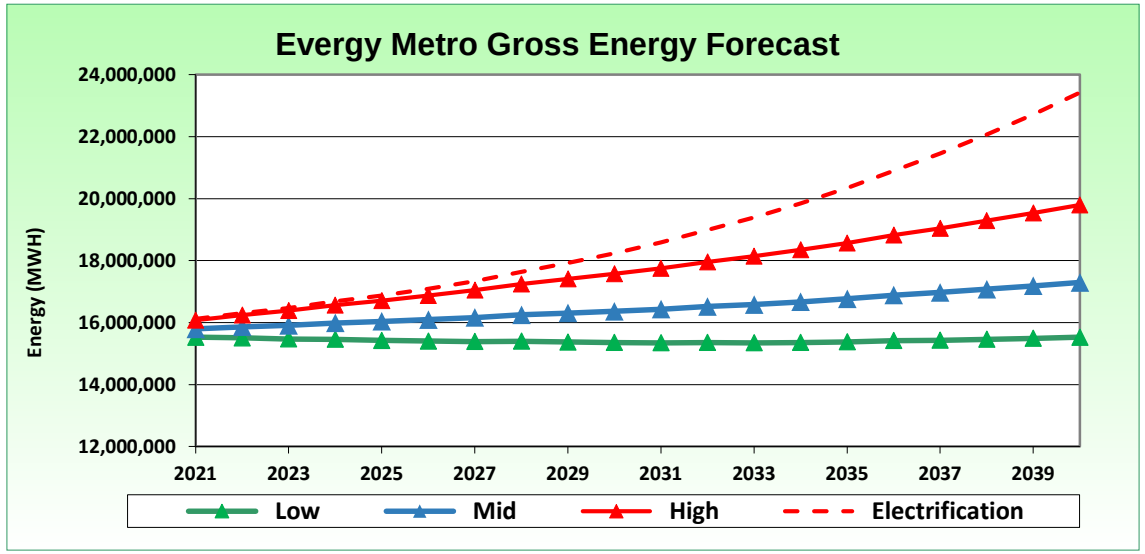
Incorporating Study Results into Evergy's Load Forecast

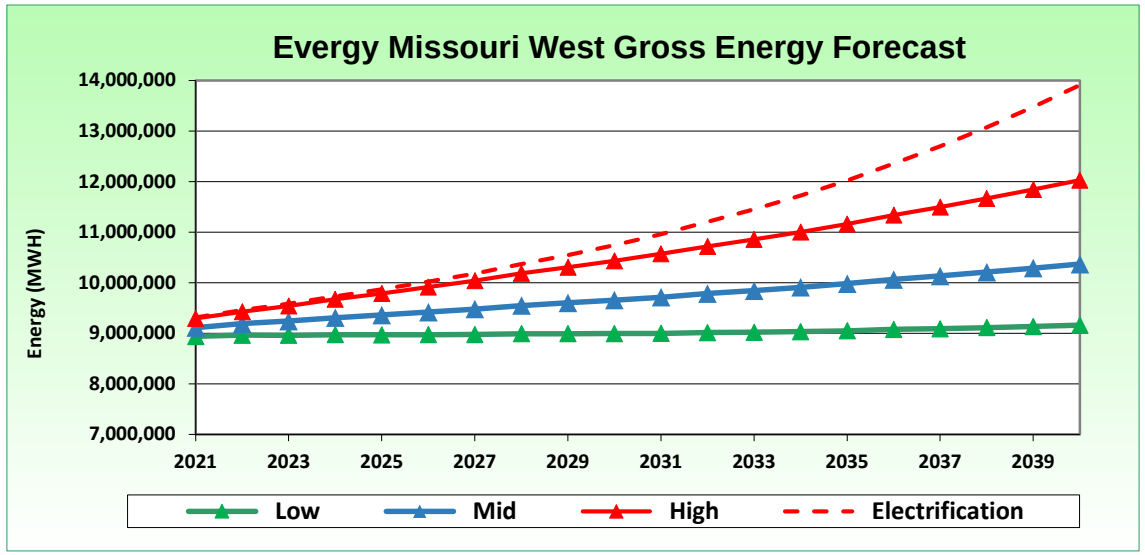
The electrification adoption scenarios for the 'Big Six' were added to the high case load forecast to create a High Electrification Load scenario

Electric Space Heat and Electric Water Heat adoption for Residential and Commercial from the 1898 Electrification study were added to existing end-use adoption forecasts based on EIA Annual Energy Outlook and Company saturation surveys

Electric vehicle adoption was added from two different studies

- Long-haul trucking adoption from the electrification market potential study
- Light-duty vehicles were included using the high case adoption scenario produced for Evergy by EPRI





NOTE: Gross Energy Forecast does not include impact of future DSM programs

Next Steps

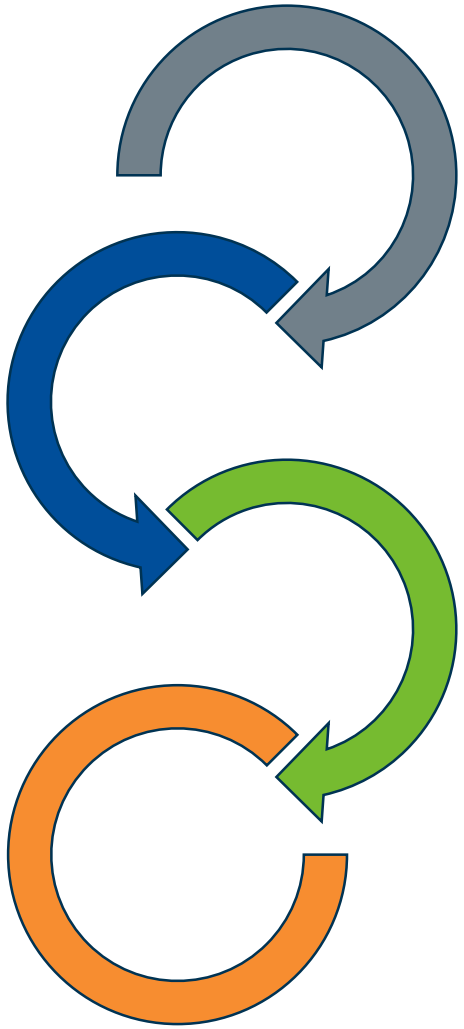
Triennial IRP Development Timeline

Refining Assumptions and Inputs

Early April: 2020 Annual Update Stakeholder Meeting to introduce process

Gathering Input

July: Stakeholder meeting to discuss modeling assumptions / inputs



Conducting Analysis

Late Q3 – Early Q1: Stakeholder meeting(s) to discuss preliminary results

- **October 19th:** Initial review of preliminary results
- **Early-December:** Additional stakeholder meeting to review next round of results
- **January**: Demand-Side (Electrification, DSM, Behind-the-Meter solar & storage) Focused Discussion
- ***As Needed:*** Topical meetings with specific stakeholders on comments received

Reviewing Results

Q1 2021: Review updated results including detailed review of inputs outlined in IRP rules

Next Steps

Follow up via email with any specific comments to

Sarah.Gott@evergy.com

before February 5th