2021 Triennial Integrated Resource Plan (IRP)

Missouri Stakeholder Meeting

July 23, 2020

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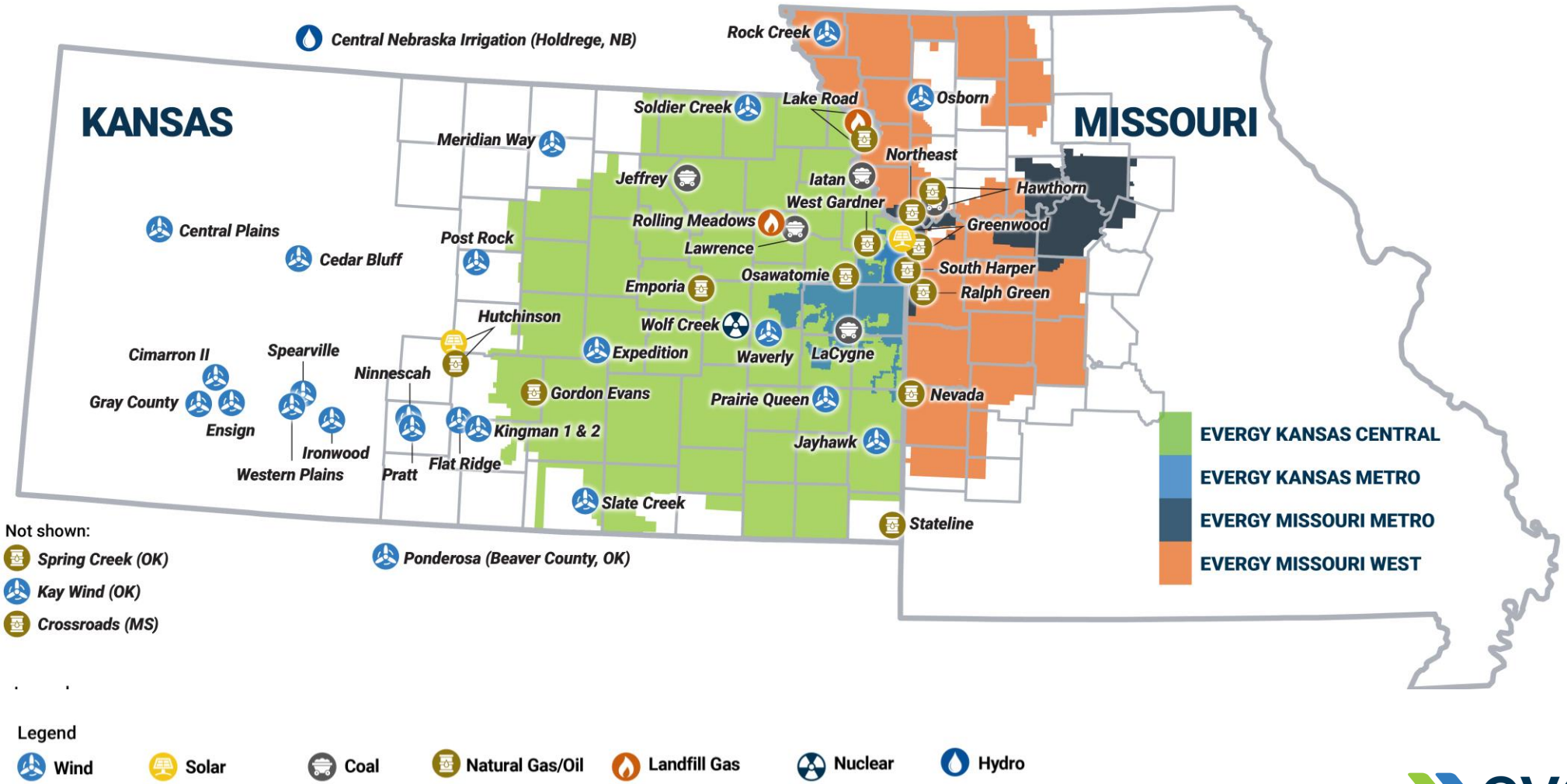
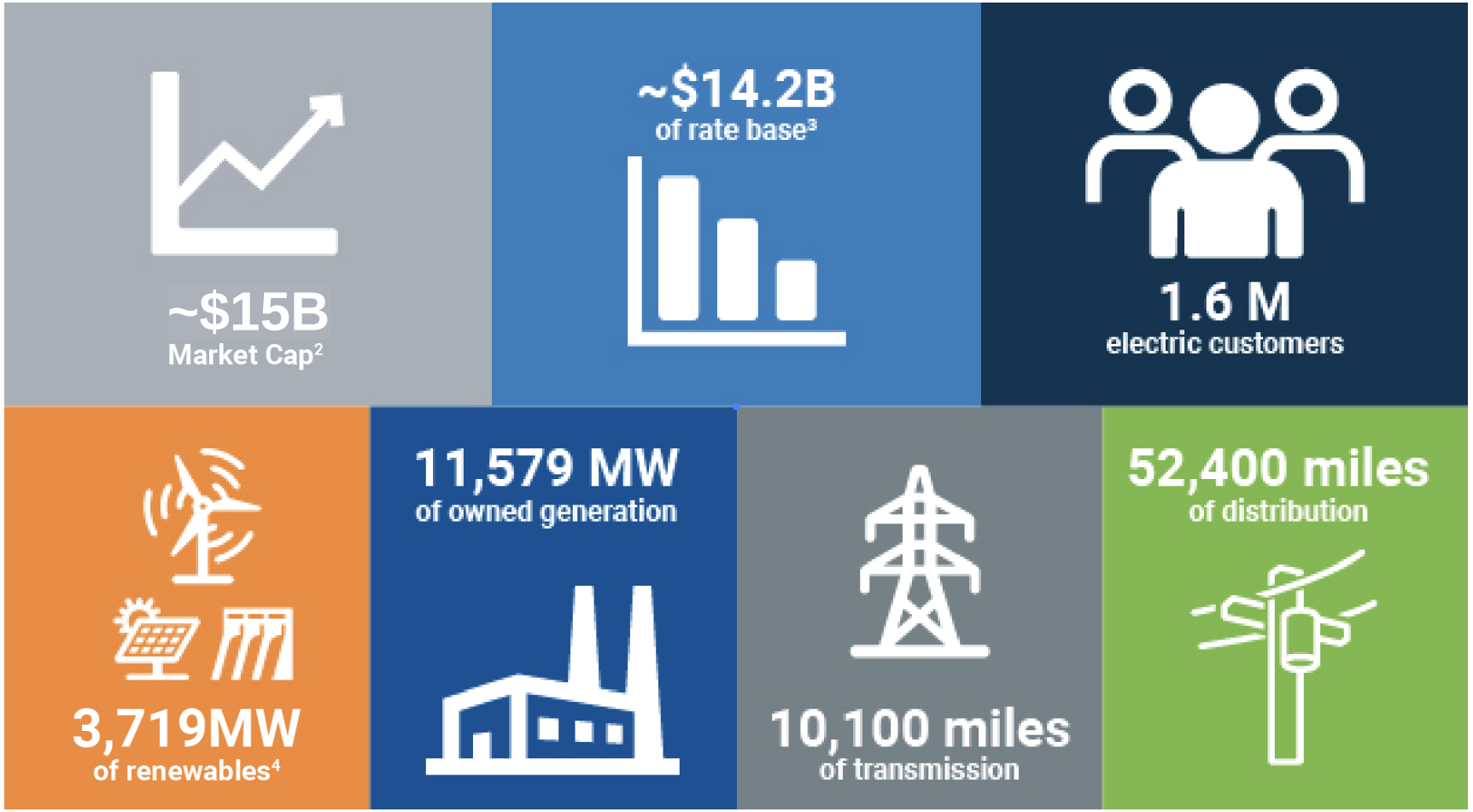
Agenda

- Evergy Overview & Objectives
- Stakeholder Engagement Approach
- Discussion of Key IRP Inputs
- Next Steps

Evergy Combined Service Area



Evergy By the Numbers[1]



1. Statistics as of 12/31/19.
2. Market cap as of 12/31/19.
3. Estimated rate base based on ordered and settled rate cases.
4. Renewables include both owned and purchase power agreements as of 12/31/19.

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Core Tenets of the IRP Process

Balancing priorities and managing costs to provide the power customers need at a competitive price

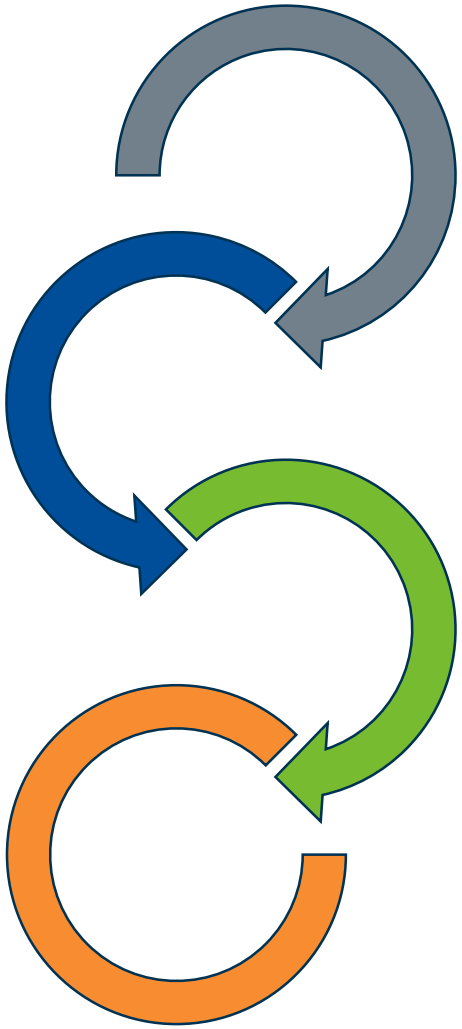
Keeping the safety of our employees, customers and communities at the core of our plans

Adapting our plans as conditions evolve to best serve our stakeholders

Managing our resources for the benefit of current and future generations

Ensuring our customers have the power they need when they need it

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: Stakeholder meeting to discuss preliminary results

Reviewing Results

Q1 2021: 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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Overview of Inputs for Discussion

Load Analysis & Load Forecasting	• Overview of Load Forecasting methodology • Proposed approach for incorporating COVID-19 impacts
Demand-Side Resource Analysis	• DSM Potential Study Update • Proposed approach for incorporation into IRP modeling
Resource Acquisition Strategy Selection	• Assessment of Load Building / Beneficial Electrification in IRP
Transmission & Distribution Analysis	• Economic & Reliability Assessment of Transmission Impacts
Supply-Side Resource Analysis	• Behind-the-Meter Solar & Storage Potential Study • Technology Assessment Approach • All-Source RFP Responses
Integrated Resource Plan & Risk Analysis	• Uncertain Factor Analysis • Construction of Alternative Resource Plans

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Load Forecasting & Analysis

Al Bass

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Load Forecasting Methodology

Statistically Adjusted End-Use (SAE) Models

End-use modeling approach

- Better ability to identify the end-use factors that drive energy usage
- Incorporates end-use structure into an econometric model
- Exploits the strengths of both end-use and econometric modeling
- End-use components are estimated for Heat, Cool, and Other
  - Heat, Cool, and Other explanatory variable are used to construct variables that are used in the monthly regression model to estimate multipliers and trend adjustments that provide the best historical fit

Strengths of SAE approach

- Equipment efficiency trends and saturation changes are embodied in the end-use forecasts
- Provides a strong bridge between a short-term and long-term forecast
- By bundling price, economic, demographic and equipment drivers, a rich set of elasticities can be built into the model
- Provides estimates of weather sensitivity that vary over time, thus reflecting changes in equipment shares and efficiency levels

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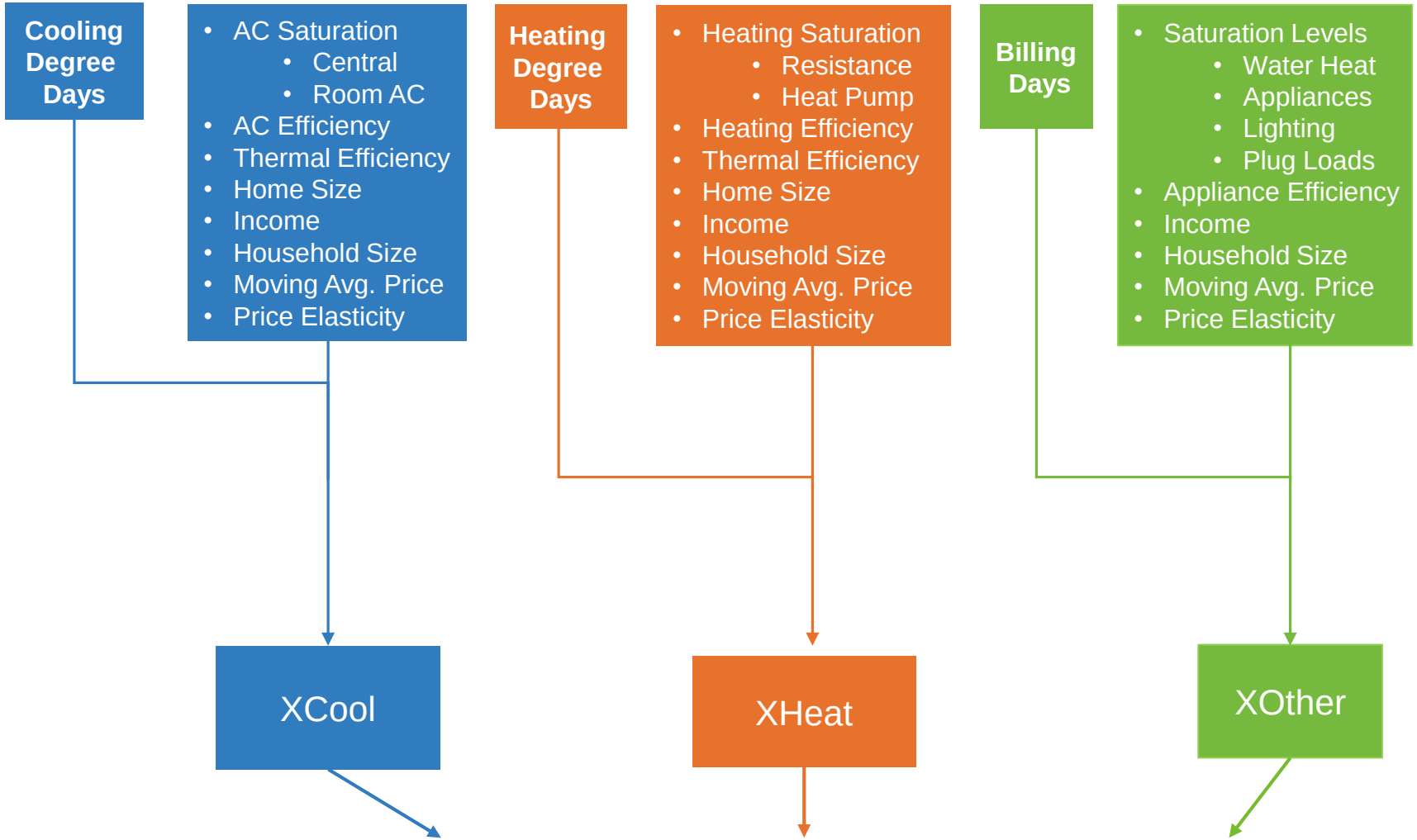
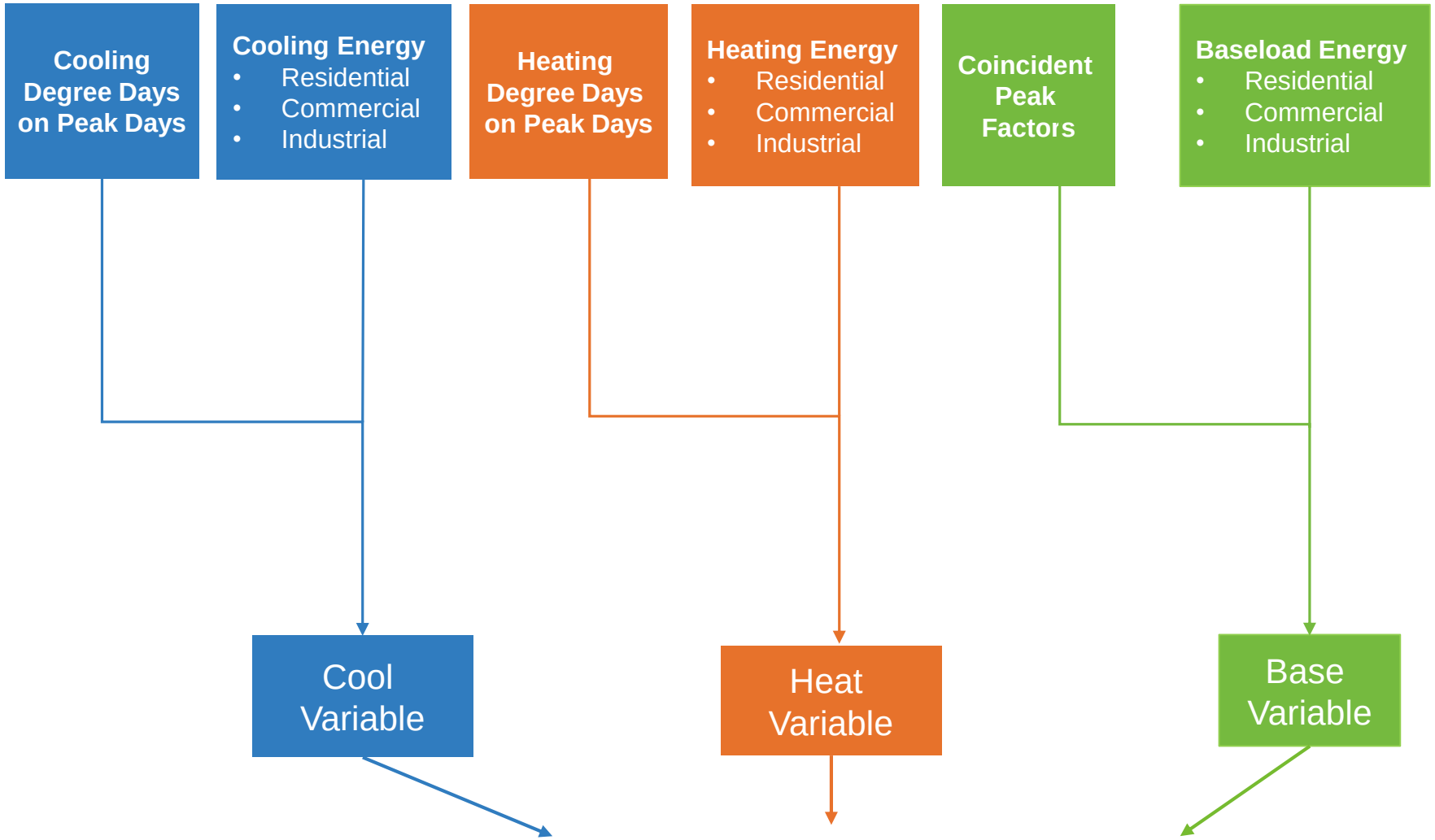
Class Energy Model (SAE Approach)



$$AvgUse_m = a + b_c \times XCool_m + b_h \times XHeat_m + b_o \times XOther_m + e_m$$

Estimate monthly model with historical billed sales data

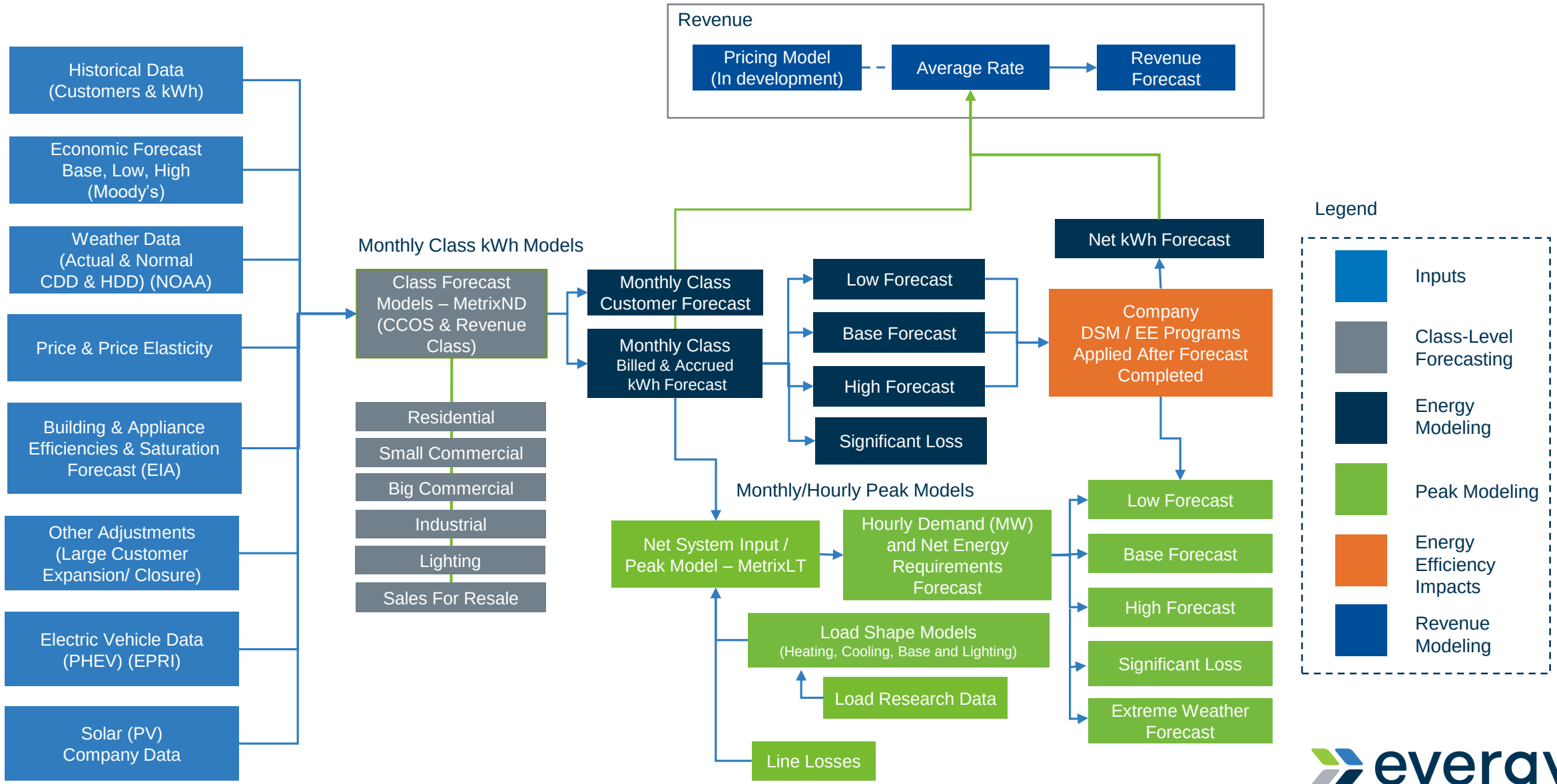
Peak Model (SAE Approach)



$$Peak_m = a + b_c CoolVar_m + b_h HeatVar_m + b_o BaseVar_m$$

Estimate monthly model with system peak data

Energy and Peak Demand Forecasting Methodology



Incorporation of COVID-19 Impacts into Load Forecasting

Incorporation of COVID-19 into Base Case

- Based on Moody's Analytics economic forecast
- Current Expectation is short-term impact of COVID-19; Will continue to update
- Based on GMP (Non-Manufacturing and Manufacturing) and Households

Additional COVID-19 Scenarios Under Consideration

- Proposed COVID-19 scenarios based on GDP and Unemployment assumptions
- Scenarios will be based on a variety of assumptions around virus resurgence and effectiveness of intervention

Demand-Side Resource Analysis

Tim Nelson

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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

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Potential Study Evaluated Programs

Energy Efficiency

Residential
- Home Energy Reports
- Home Lighting
- Income Eligible
- Whole House Efficiency (WHE)

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

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)	• RAP at Demand Response Programs Only	• RAP at Demand Side Rates Only

Optimization

- RAP Scenario
- R-based tool integrated into DSRPM (Demand Side Resource Potential Model) through Excel
- Linear approach that allows single or multiple objectives and large number of constraints
- Leverage MEEIA goal of “achieving all cost-effective demand side savings” and IRP’s criteria of “minimizing long-run utility costs”

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Load-Building and Beneficial Electrification

Kim Winslow

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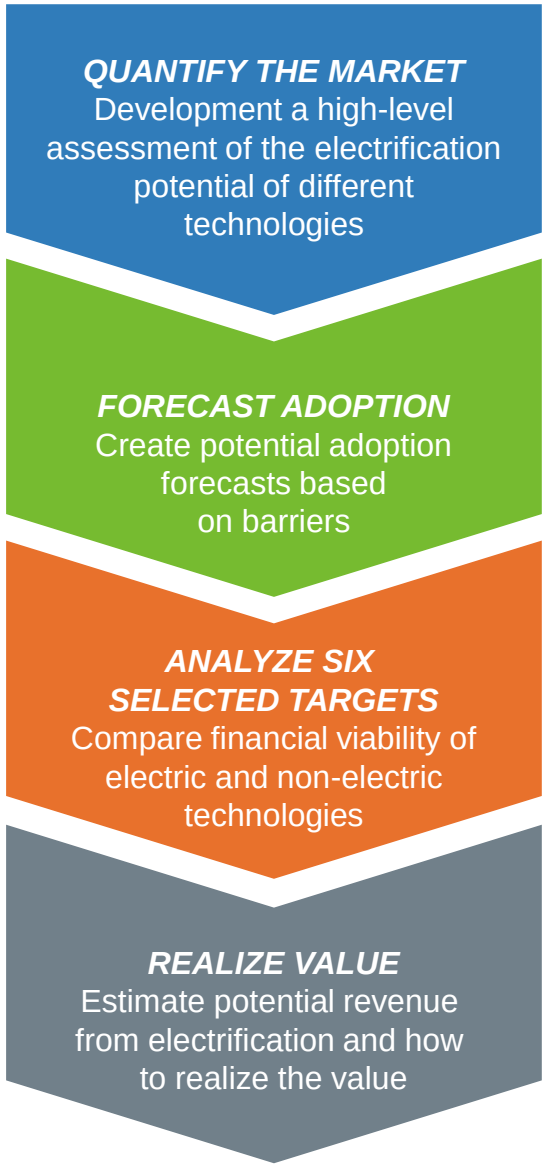
Electrification Market Assessment Process



Understanding the electrification potential in Evergy's territory sets the landscape for identifying target technologies.

Rating electrification potential against barriers to conversion gives insight into feasible target technologies.

Analyze if the selected target technology is financially viable from the customer's perspective.

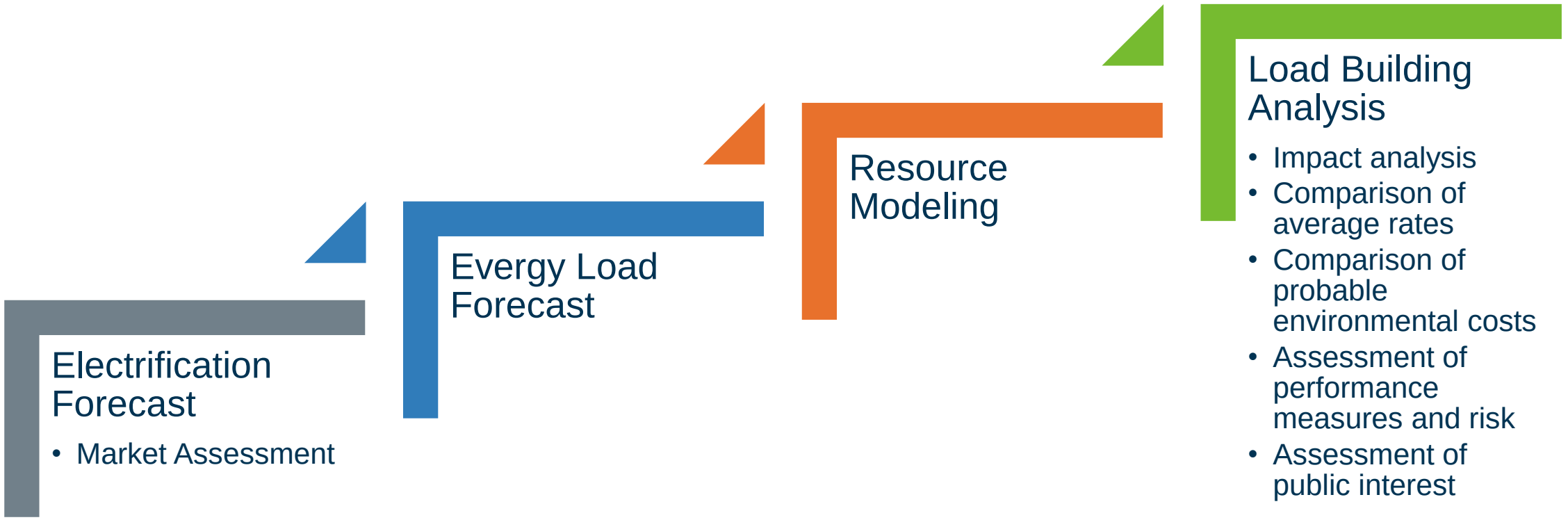
To realize revenue, customers will need support to successfully convert to electrified technology.

Source: 1898 & Co.

Other Electrification Activities

- Evergy owns and operates the Clean Charge Network, consisting of over 1,000 electric vehicle charging stations
- Evergy is evaluating other opportunities to promote beneficial electrification
  - These opportunities will be discussed with stakeholders later in 2020
  - A dedicated regulatory filing is anticipated in the first quarter of 2021

Current Plan for Incorporation into IRP Analysis



Supply-Side Analysis – Behind-the-Meter (BtM) Resources

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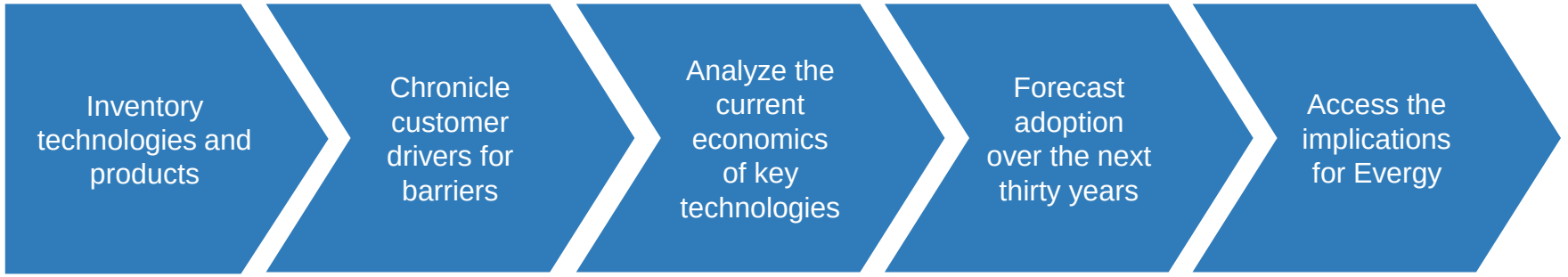
BtM Solar/Storage Potential Study Approach

Assess the potential for adoption, the timing, and the impact of Evergy's program efforts on the market.



TECHNOLOGIES

- PV Solar
- Battery Storage
- PV Solar + Battery Storage
- Community Solar + Storage

Current Plan for Incorporation into IRP Analysis

Three forecast scenarios covering 30-year horizon

MID	*HIGH*	*LOW*
• Naturally-occurring forecast (of new capacity only) • Without intervention on the part of Evergy • Considers interactive effects between solar and storage adoption	• Upward adjustment to the Mid Scenario • Estimate of upper bound on adoption • Considers new regulatory drivers, changes in technology/project economics	• Downward adjustment to Mid Scenario • Estimate of floor on adoption • Uses same drivers as high scenario but considers the potential for dampening effect

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T&D Analysis – Transmission Assessment

Katy Onnen

Transmission Assessment Approach

- Steady-state and stability transmission reliability analysis completed with 2020 IRP update
- 1898 & Co (Burns & McDonnell) to perform economic transmission analysis on near-term generation retirements
  - Using Southwest Power Pool's Integrated Transmission Planning models as base case, evaluate economic impact of retirements
  - Assess impact of implementing upgrades identified during reliability analysis
  - Develop solutions to address needs identified in economic analysis
    - Centered around adjusted production cost (APC) benefits

Supply-Side Analysis – Technology Assessment and All-Source RFP

Laura Becker

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Supply-Side Technology Assessment

GOAL

Per Missouri IRP rules, goal is to ensure "a wide variety of supply-side resource options with diverse fuel and generation technologies, including a wide range of renewable technologies and technologies suitable for distributed generation" are considered.

IDENTIFICATION

Identify potential supply-side resource options

SCREENING

Screening to determine viability and technology maturity of potential supply-side resource options

OPTIONS

Supply-side resource options (including existing resources) advance to the integration analysis by being incorporated into at least one Alternative Resource Plan

Technologies to be Screened

Coal

- Ultra-Supercritical coal (USC) with 90% carbon capture and sequestration (CCS)

Natural Gas

- Combined-cycle-single shaft
- Combined-cycle-multiple shaft
- Combined-cycle with 90% CCS
- Combustion turbine-aeroderivative
- Combustion turbine-industrial frame
- Fuels cells
- Internal combustion engine

Uranium

- Advance nuclear
- Small modular reactor

Wind

- SPP Region

Solar

- Solar thermal
- Solar photovoltaic-tracking
- Solar photovoltaic-tracking + battery storage

Biomass

- Biomass

Municipal Solid Waste

- Municipal Solid Waste - Landfill Gas

Battery Storage

- Various sizes and durations

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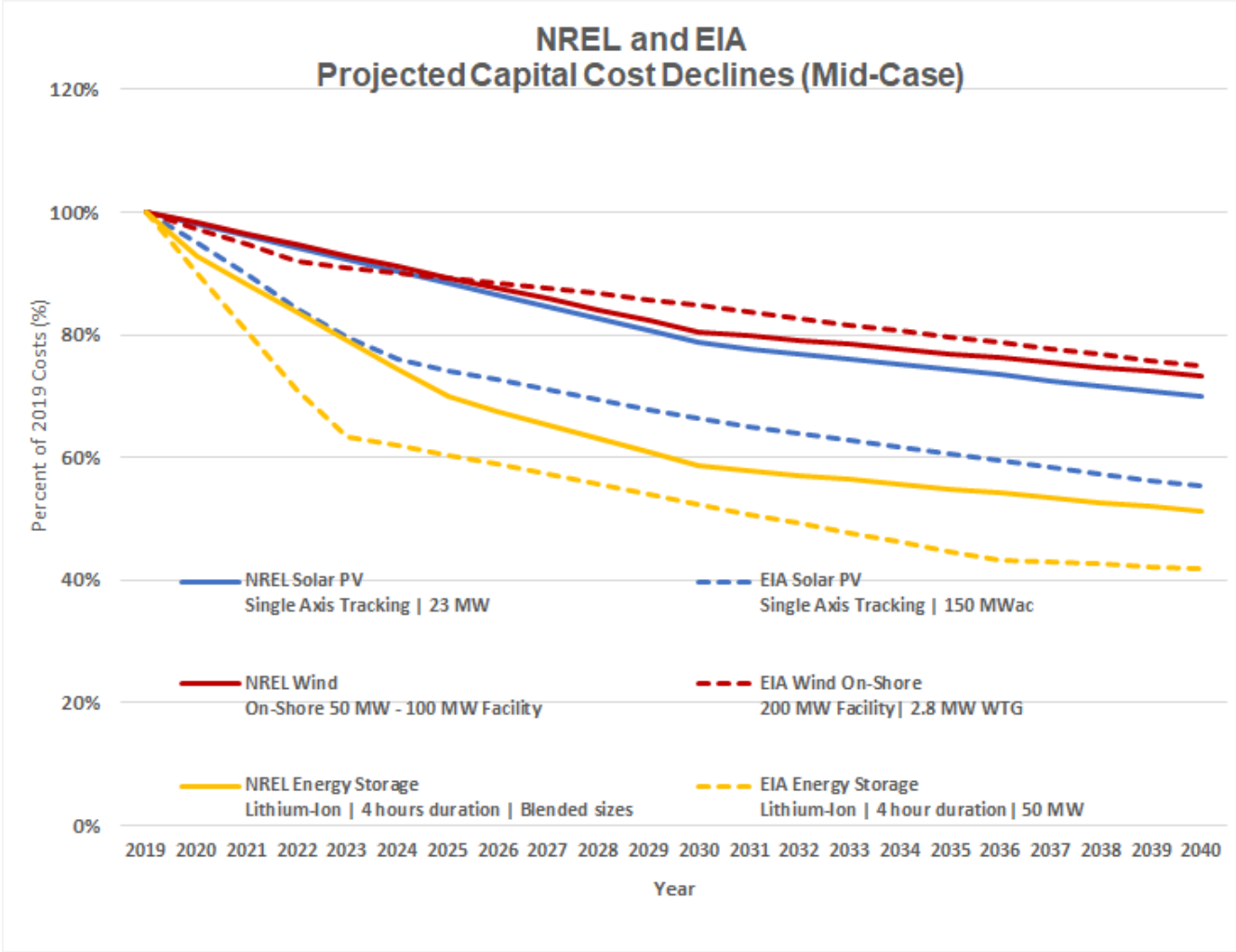
Summary of All-Source RFP Responses Received

SOLAR		Distributed (Rooftop/Covered Parking, etc.) from 100 kW to 15 MW and Utility-Scale up to 500 MW Ownership and PPA Options
SOLAR + ENERGY STORAGE		Utility-Scale - Up to 500 MW Solar / 100 MW Battery Ownership and PPA Options
ENERGY STORAGE		New Asset - 50 MW - 100 MW PPA Option Only
WIND		New and Existing Assets - ~75 – 400 MW Ownership and PPA Options
HYDRO		Existing Asset - 62 MW PPA Option Only
COMBINED CYCLE		New and Existing Assets - ~150 - 795 MW Ownership and PPA Options
COAL		Existing Asset - 50 MW PPA Option Only

Renewable Technologies

- Further declines in renewable technology costs are projected, with the rate of decline slowing as technologies mature
- Evergy will review various sources of industry data (in conjunction with RFP results) and incorporate projections for declining costs for solar, wind and battery storage technologies in the analysis



Integrated Analysis – Uncertain Factors

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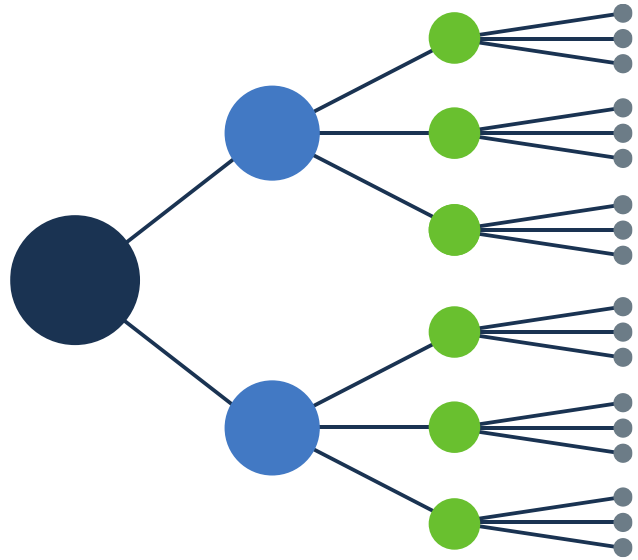
Critical Uncertain Factor Approach



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.)

List of Uncertain Factors Evaluated

Uncertain Factors: Commodities, events, costs, that can materially affect resource planning decisions

- Future load growth range – low and high forecast cases
- Future interest rate and other credit market condition effects on cost and access to capital
- Future changes to legal mandates
- Relative real fuel prices
- New generation construction/permitting costs and schedule timing of new generations and/or transmission facilities
- Purchased power cost, terms, availability, optionality, other benefits
- Emission allowance pricing including sulfur dioxide, carbon dioxide, and nitrogen oxides
- New and existing generation fixed and variable operations and maintenance costs
- New and existing generation full and partial forced outage rates
- Demand-Side Management and Demand-Side Rates impacts on load
- Demand-Side Management and Demand-Side Rates marketing and delivery costs
- Renewable penetration potential
- SPP coal plant retirements
- Behind the meter solar and storage adoption
- Any other uncertain factors that may be critical to the performance of the alternative resource plans

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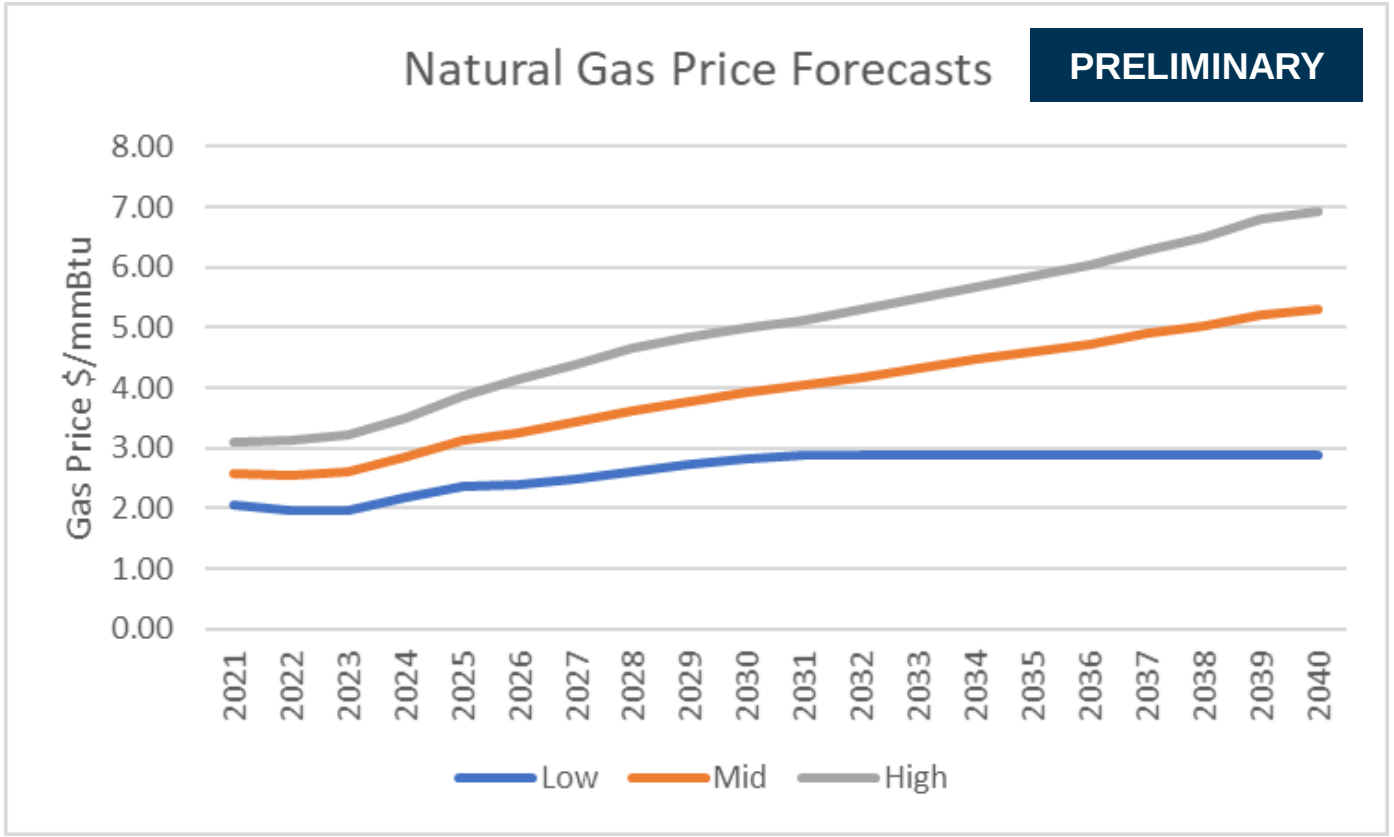
Natural Gas Price Assumptions

- Similar to prior IRPs, testing three different gas price levels
- High and Mid forecasts based on a composite of external gas price forecasts
- Low forecast capped at 5-year historical average



CO_2 Assumptions

- Prior IRP Update included two levels of CO_2 emission allowance pricing
  - Low: $0 per ton
  - High: Confidential
- Proposing three levels for the 2021 IRP
  - Low: $0 per ton
  - Mid: Similar to High Scenario from 2020 IRP Update
  - High: Multiple of the 2020 IRP Update High Scenario

Note CO_2 pricing assumptions are confidential as they are purchased from external sources.

New Uncertain Factor – Renewable Penetration

SPP Market Renewable Penetration

- Low: 50% of energy provided by renewables by 2040
  - Battery Storage: 2 GW by 2040
  - Utility Scale Solar: 10 GW by 2040
  - Wind: 29 GW by 2040
- High: 80% of energy provided by renewables by 2040
  - Battery Storage: 15 GW by 2040
  - Utility Scale Solar: 30 GW by 2040
  - Wind: 38 GW by 2040

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New Uncertain Factor – Regional Coal Plant Retirements

- Plan to test two regional (SPP) coal plant retirement scenarios
  - Retire SPP coal units at 50 years of age
  - Retire SPP coal units at 60 years of age

Integrated Analysis – Alternative Resource Plans (ARPs)

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Integrated Resource Plan & Risk Analysis

Combinations of Resource Retirements / New Generation / DSM over 20 years

Made up of Critical Uncertain Factors (e.g., may consist of different wholesale market prices)

Net Present Value of Revenue Requirement (NPVRR) results for **Individual Scenarios**

Expected Value of NPVRR across all Scenarios

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Preliminary List of Alternative Resource Plans

EVERGY METRO OPTIONS

Plant Retirement Options

(individual and combinations)

- Hawthorn 5
- LaCygne 1
- LaCygne 2
- Iatan 1

Variables

- Various years
- Various DSM levels
- Variety of generation additions

EVERGY MO WEST OPTIONS

Plant Retirement Options

(individual and combinations)

- Lake Road 4/6
- Jeffrey 1
- Jeffrey 2
- Jeffrey 3

Variables

- Various years
- Various DSM levels
- Variety of generation additions

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Next Steps

Next Steps

Follow up via email with any specific comments to

Sarah.Gott@evergy.com

before July 31st

Will schedule next stakeholder meeting for late-Summer / early-Fall