



July 23, 2019

2019 Resource Planning Study



Agenda

- ▶ About Burns & McDonnell
- ▶ Resource Plan Update
- ▶ Industry Overview and Trends
- ▶ Utility Planning Requirements
- ▶ Planning Assumptions
- ▶ Analysis Results
- ▶ Conclusions & Recommendations
- ▶ Next Steps

About Burns & McDonnell

EXCELLENCE

TOP 5%

TOP 500
DESIGN
FIRMS

DEPTH

50+

OFFICES
WORLDWIDE

COMMITMENT

100%

EMPLOYEE-
OWNED

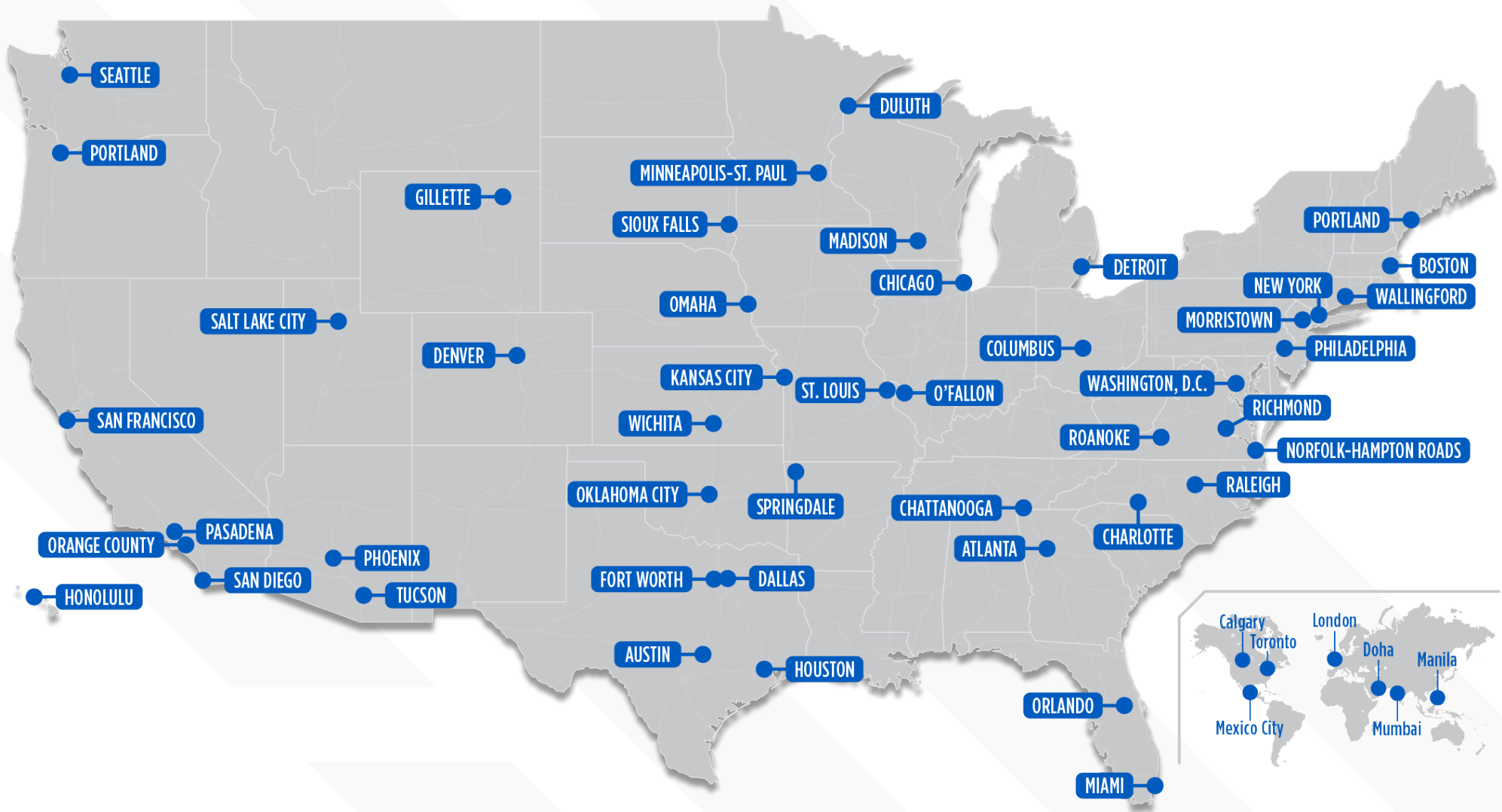
STRENGTH

MORE THAN
7,000

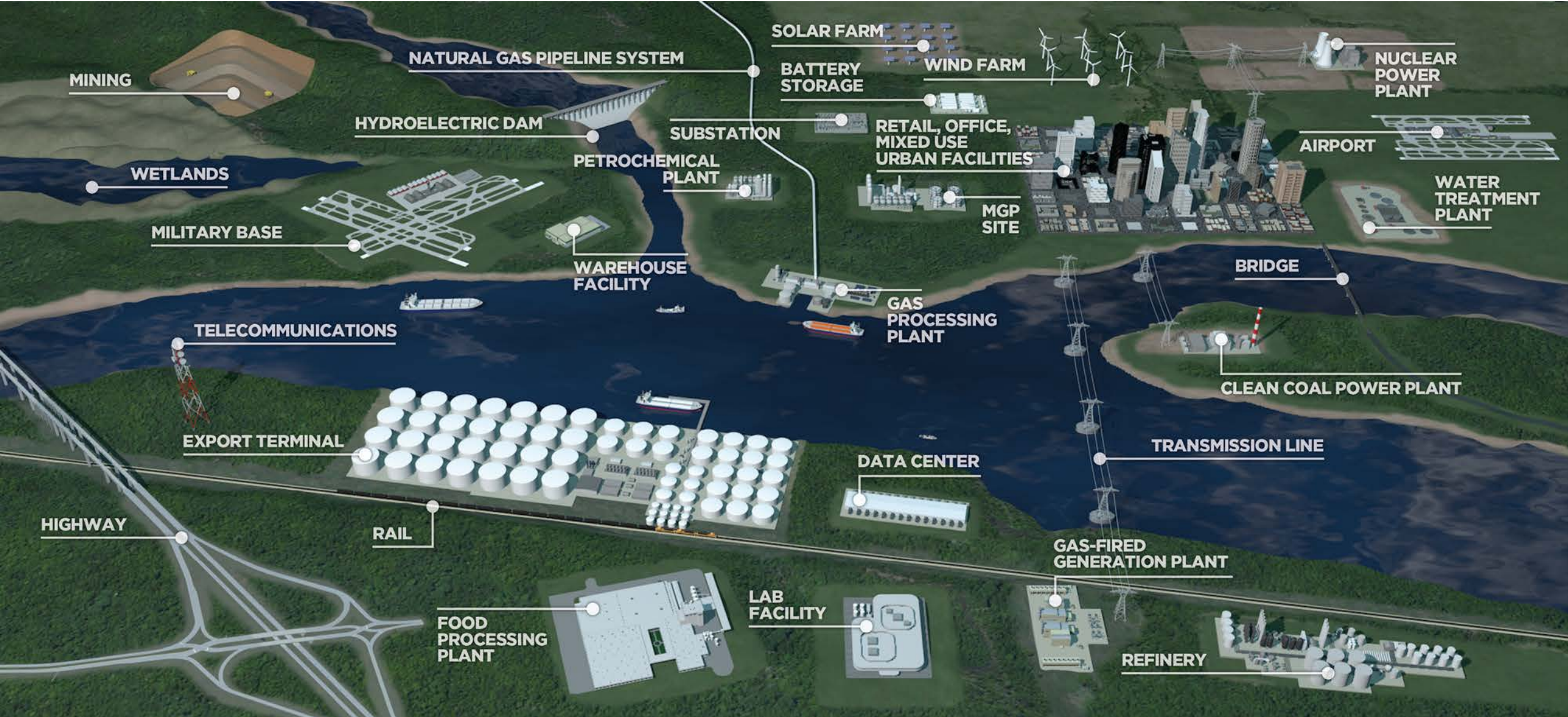
PROFESSIONALS

Who We Are

Where We Are



Key Industries and Markets We Serve



INDUSTRY SPECIFIC RANKINGS

Engineering News-Record

1

Power

1

Transmission and
Distribution

2

Cogeneration

2

Wind

3

Aerospace

Airports

4

Government Offices

5

Transmission Cables

5

Solar

7

Nuclear

9

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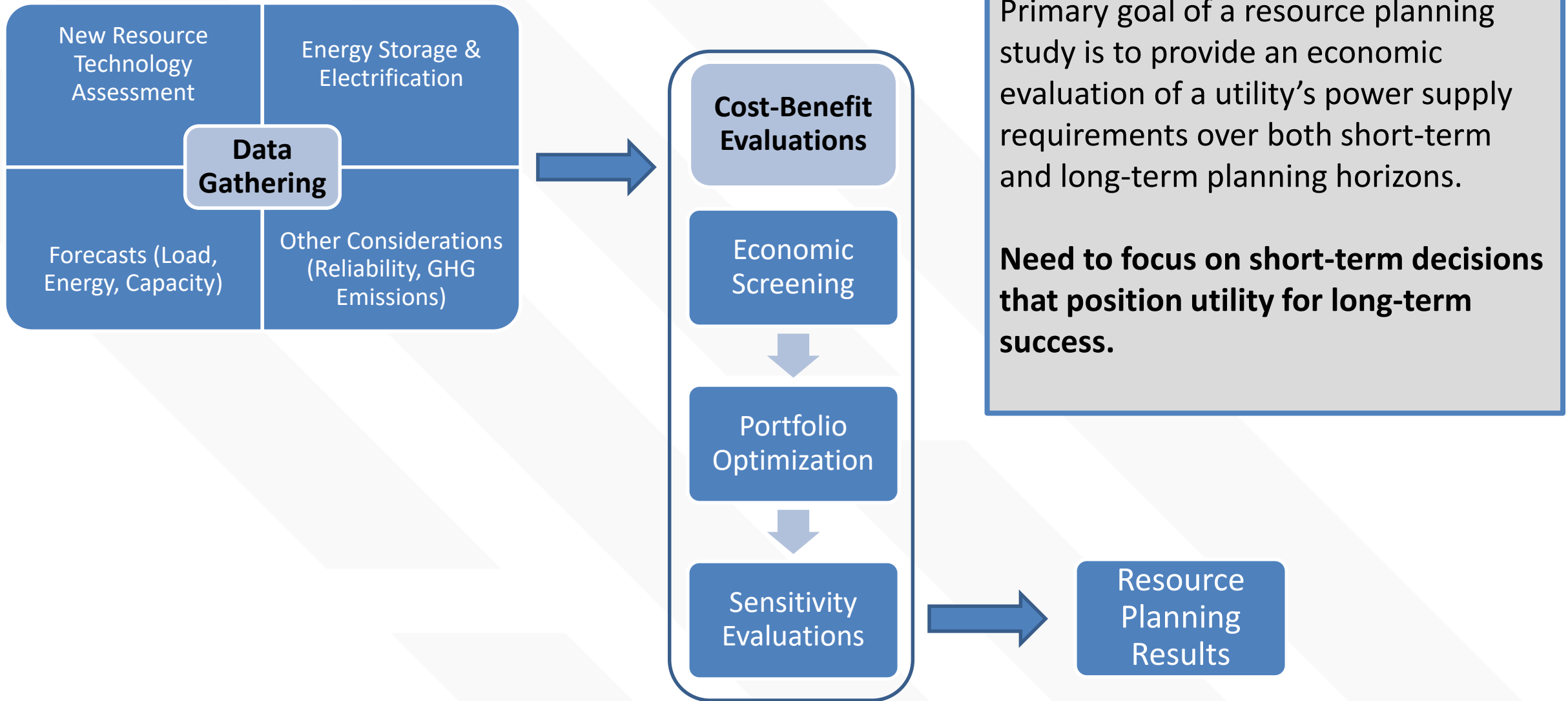
7

Nuclear

9

Resource Planning Update

What is a Resource Planning Study?



Resource Planning Highlights

- ▶ The Southern Minnesota Municipal Power Agency (SMMPA) contract (CROD) will expire in March of 2030. RPU will need to establish a replacement for both energy and capacity.
- ▶ Reduced fossil-based energy supply: Provides a pathway to drastically reduce RPU's current use of fossil-fueled energy by shifting a majority of energy production to renewable resources.
- ▶ Positions RPU to exceed City's goals regarding environmental attributes and compliance.
- ▶ Provides RPU the flexibility to position the utility to implement emerging technologies as they become more cost effective and mature.

Industry Overview & Trends

Recent Trends in the Power Industry

- ▶ Coal-fired power plant retirements are coming to fruition
- ▶ Natural gas prices remain low
- ▶ Electrical energy prices remain low
- ▶ Relatively low overall load growth across the U.S.
- ▶ Increased interest in “peaking” capacity to integrate increasing amounts of renewable power
- ▶ Shifting away from baseload plants to quick-start, flexible resources to accommodate renewables
- ▶ Renewable power costs continue to drop as technology improves
- ▶ Federal tax credits for renewables are set to expire soon
- ▶ Continued electrification of the economy and higher rates of electric vehicle (EV) penetration

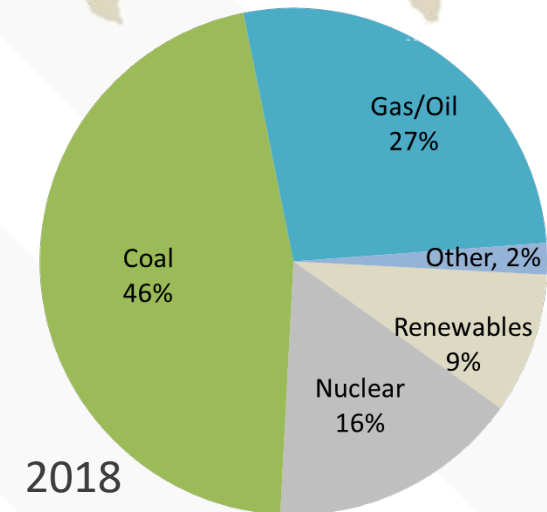
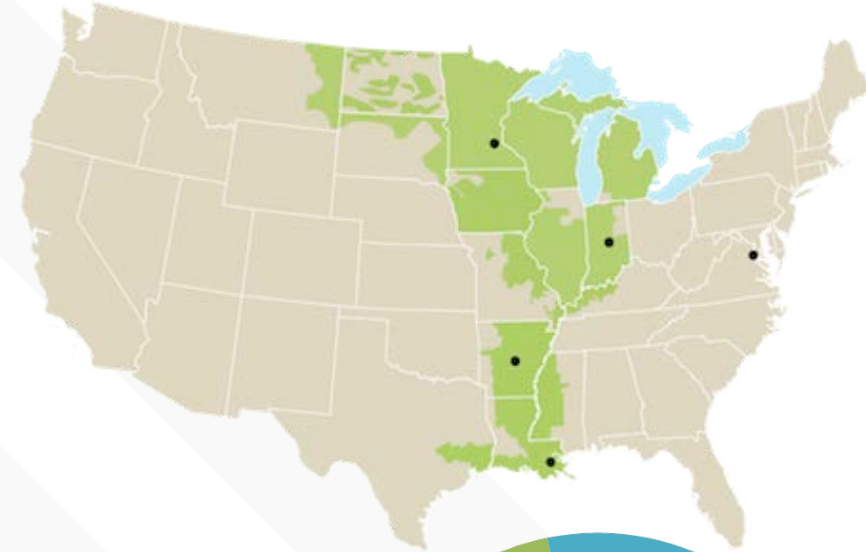
MISO Load Resource Zone

▶ Recent statistics on MISO (2018):

- Peak summer load: ~121,000 MW
- Peak winter load: ~105,000 MW
- Resources (UCAP): ~128,000 MW
- Wind capacity: ~18,000 MW
- Solar capacity: 313 MW

▶ RPU is a market participant

- MISO provides energy above the SMMPA PSC
- Opportunity for energy sales from generation



Fuel Mix by Energy Production

Utility Planning Requirements

Minnesota Requirements

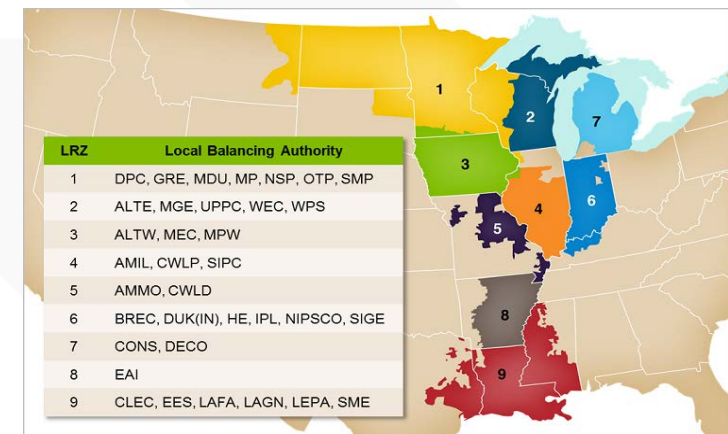
- ▶ Goals for reduced CO₂ emissions
- ▶ Renewable energy of 25% by 2025
- ▶ Solar energy of 1.5% by 2020
- ▶ Statewide Goal: 10% solar energy by 2030
- ▶ Conservation currently 1.5% of retail sales

City of Rochester's Goals

- ▶ Adopted per the Energy Action Plan (2014)
- ▶ Conservation of 1.5% annual retail energy savings
- ▶ 25% renewable energy by 2025 (25X'25 Renewable Energy Standard)
- ▶ Adopted State-wide GHG emissions reductions of:
 - 15% by 2015
 - 30% by 2025
 - 80% by 2050

RPU's Obligations

- ▶ Continue to provide reliable power supply to its customers
- ▶ Provide sufficient capacity (MW) to meet demand
 - MISO sets capacity requirement based on RPU's forecast
 - Capacity comes from units that RPU builds, contracts through a bi-lateral agreement, or demand side management
- ▶ Provide sufficient energy (MWh) to meet customers' needs
 - Electrical energy comes from units that RPU builds, contracts, net metering, conservation, and MISO market
- ▶ Energy must be compliant with regulations
 - Renewable and solar goals
 - Environmental regulations



Load and Energy Forecasting

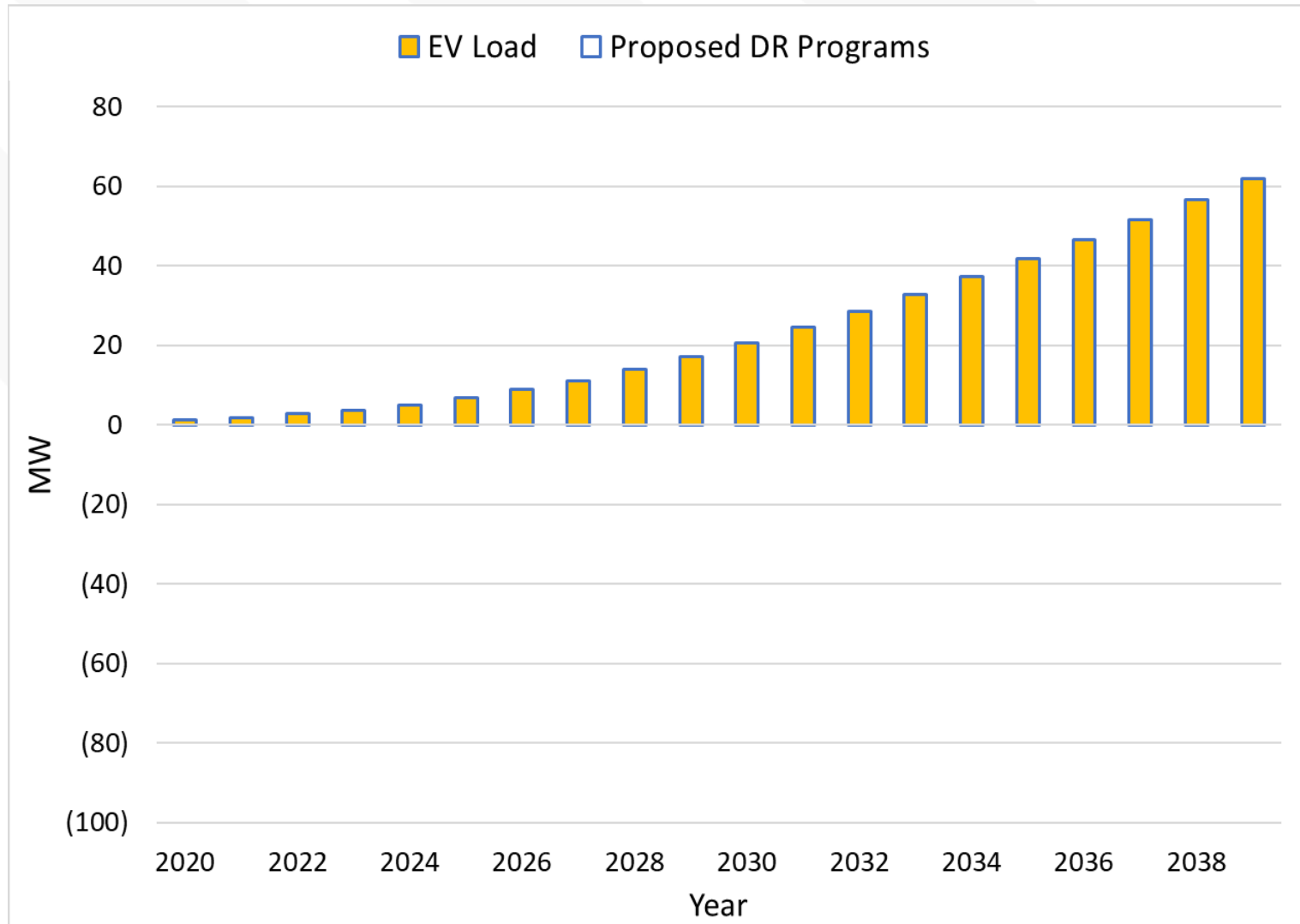
- ▶ MISO requires an annual forecast from utilities
- ▶ Econometric forecasting
 - Statistically links electricity consumption to key variables like electricity and fuel prices, customer income, commercial and industrial activity, weather, etc.
- ▶ RPU forecast and planning variables include:
 - Anticipated large projects within Rochester
 - Potential for customer-owned renewable generation
 - Electric vehicle projections and electrification of the economy
 - Demand Response (DR) projections
 - Conservation and load control programs
 - Weather normalization

Planning Assumptions

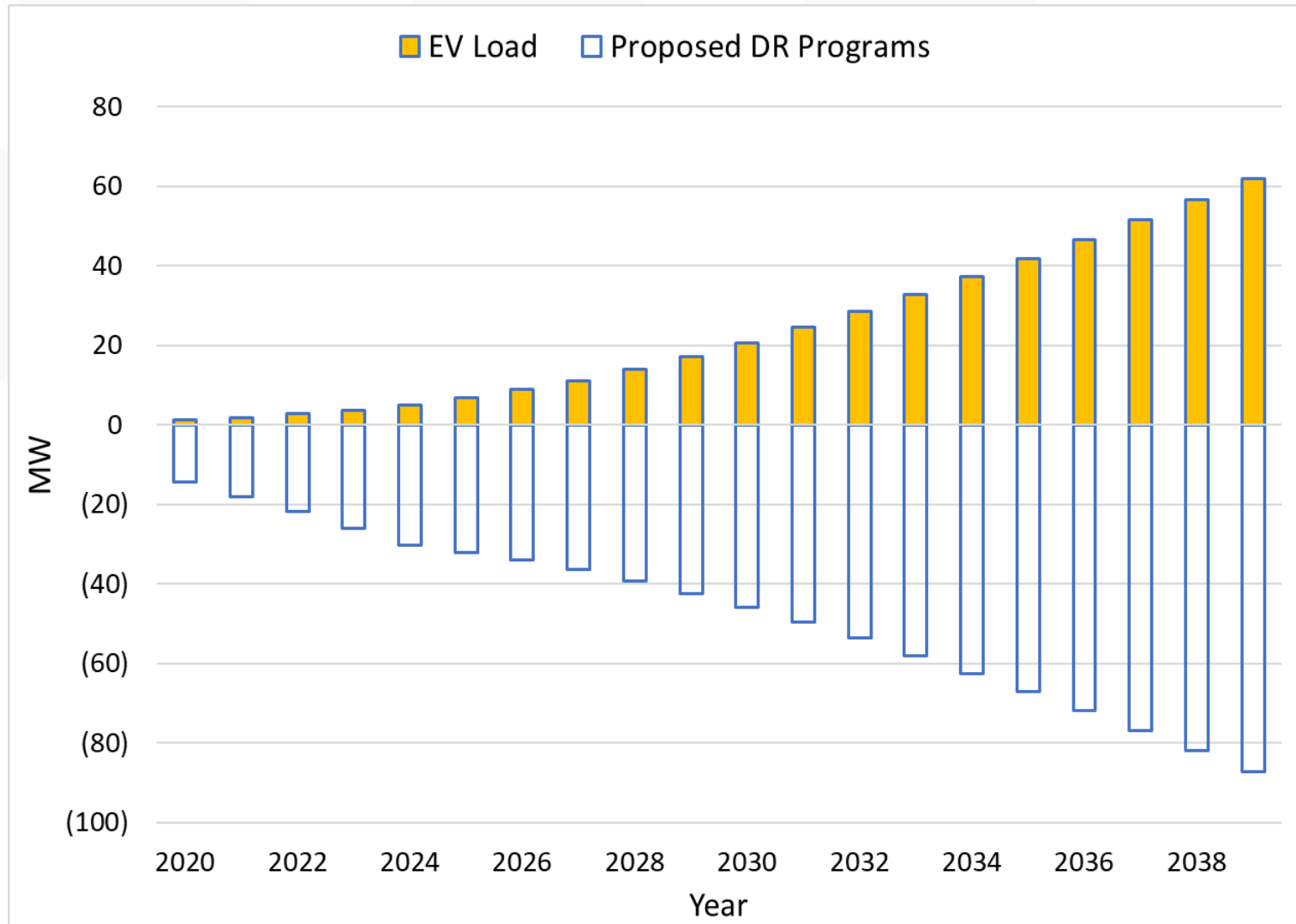
Resource Plan Assumptions

- ▶ Previous RPU Studies Have Been Incorporated
 - Incorporated May 2019 Demand Side Management Study
 - Applied Electric Vehicle adoption estimates
 - Battery storage technology

Peak Load (Electric Vehicles & Demand Response)

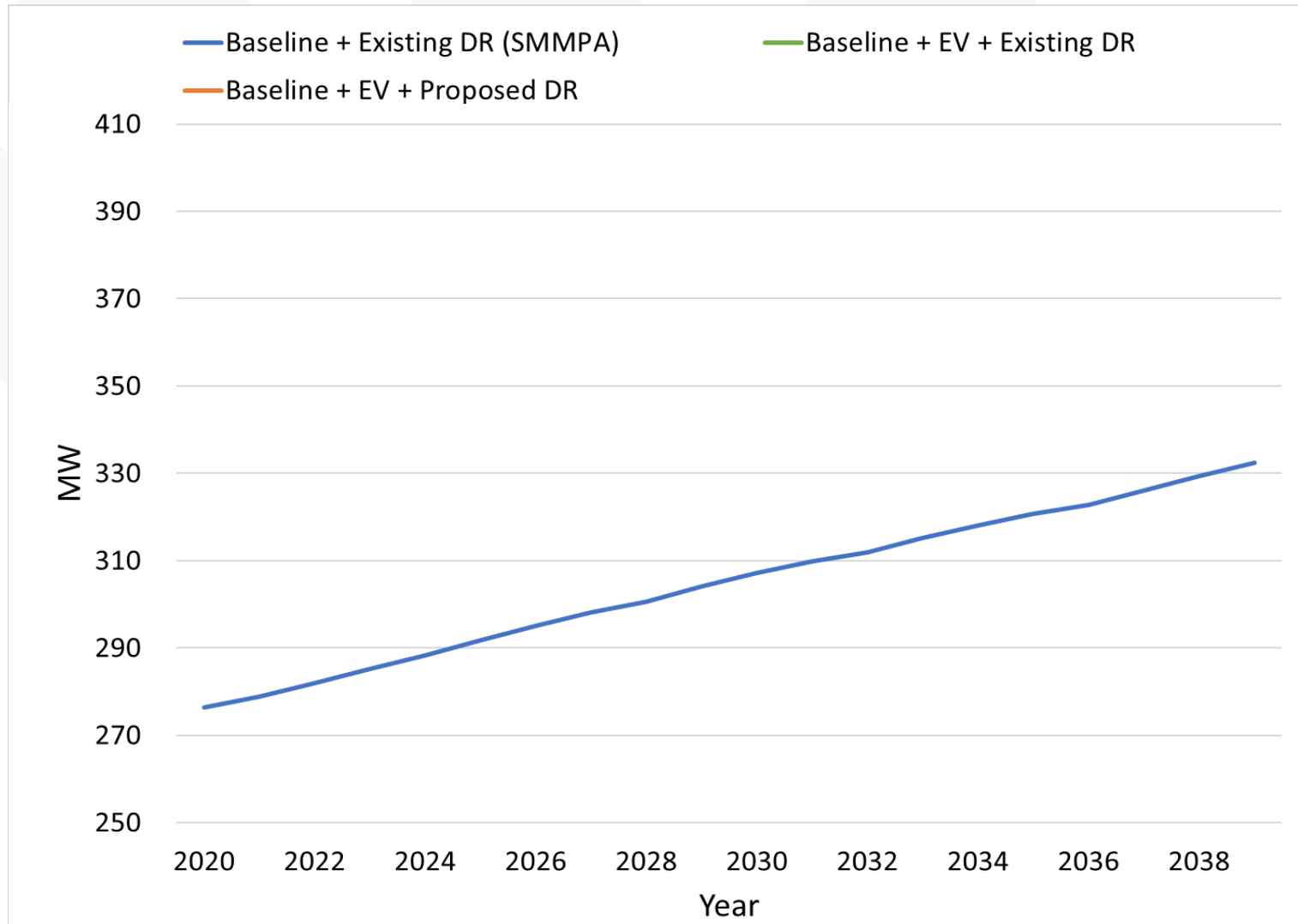


Peak Load (Electric Vehicles & Demand Response)

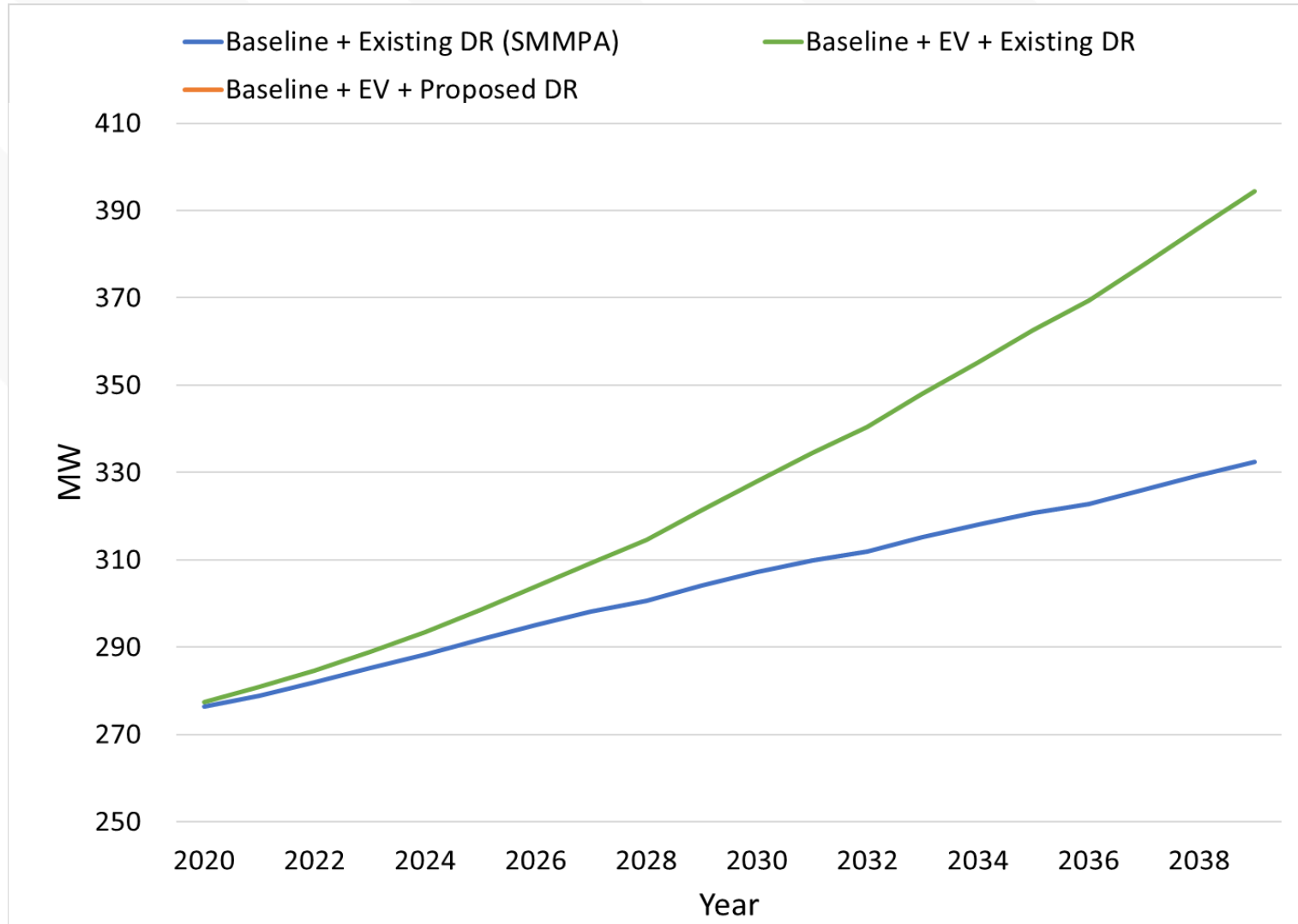


▶ Demand Response programs offset peak contribution of electric vehicles, AC usage, and water heating.

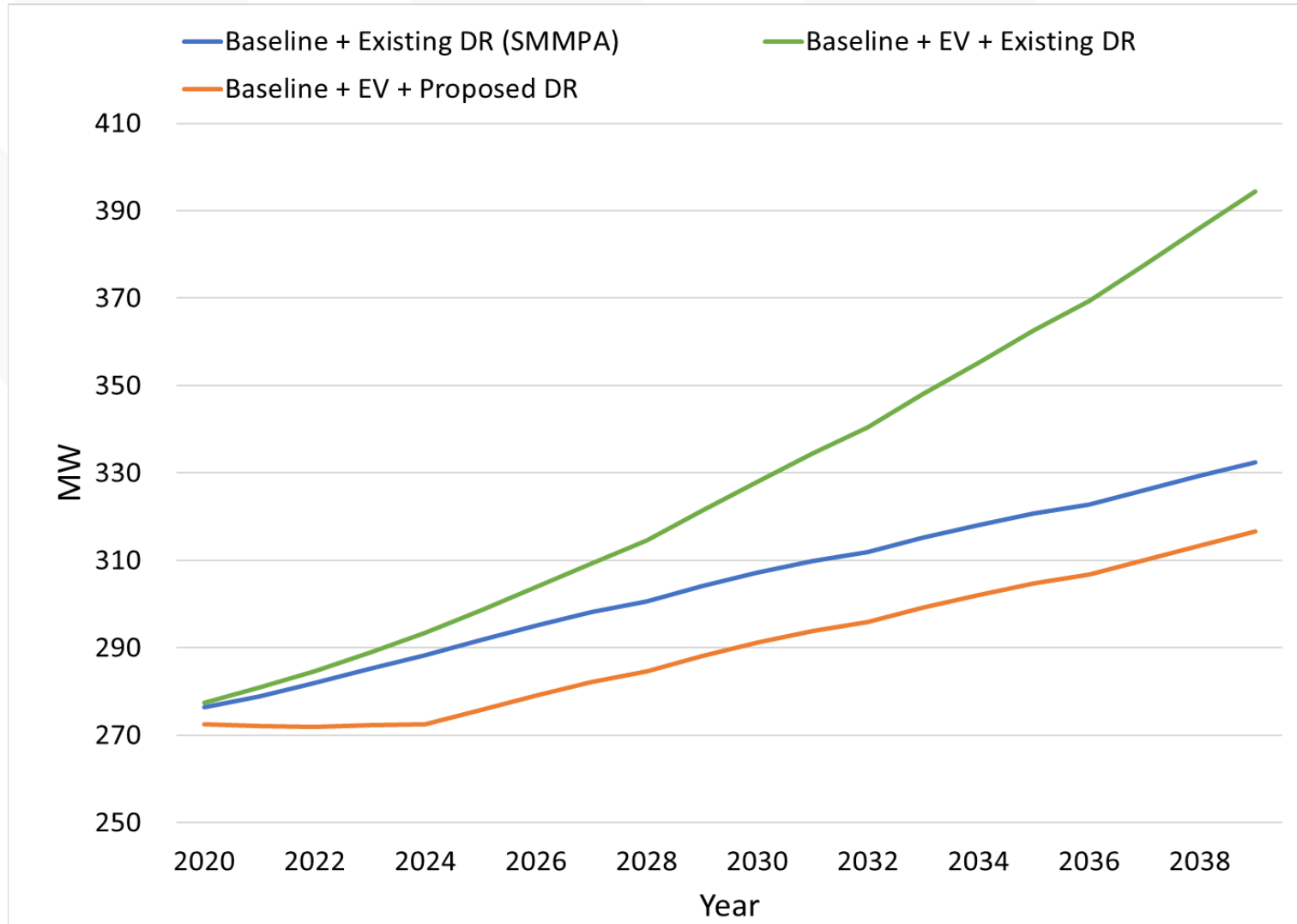
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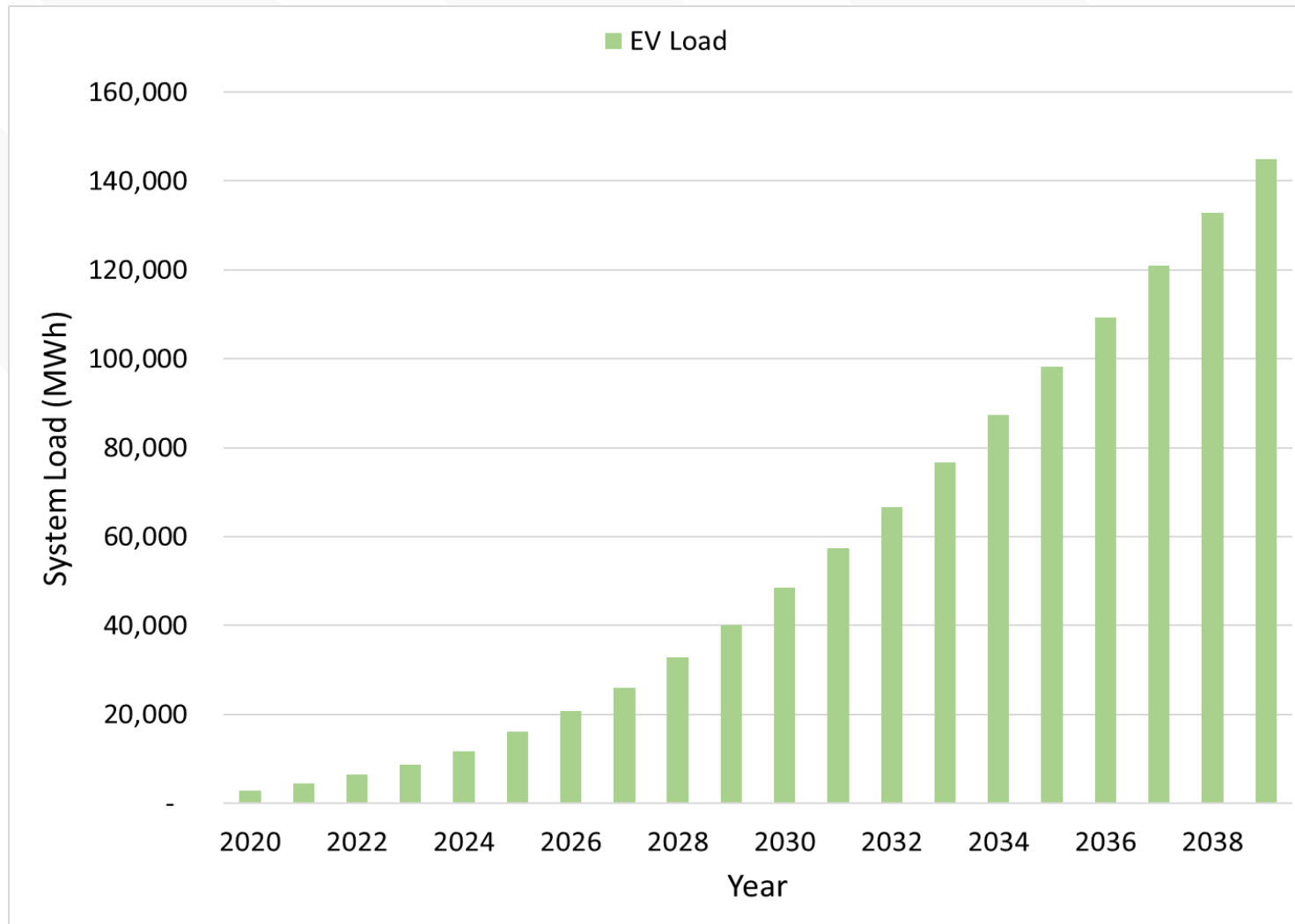


Peak Load (Electric Vehicles & Demand Response)



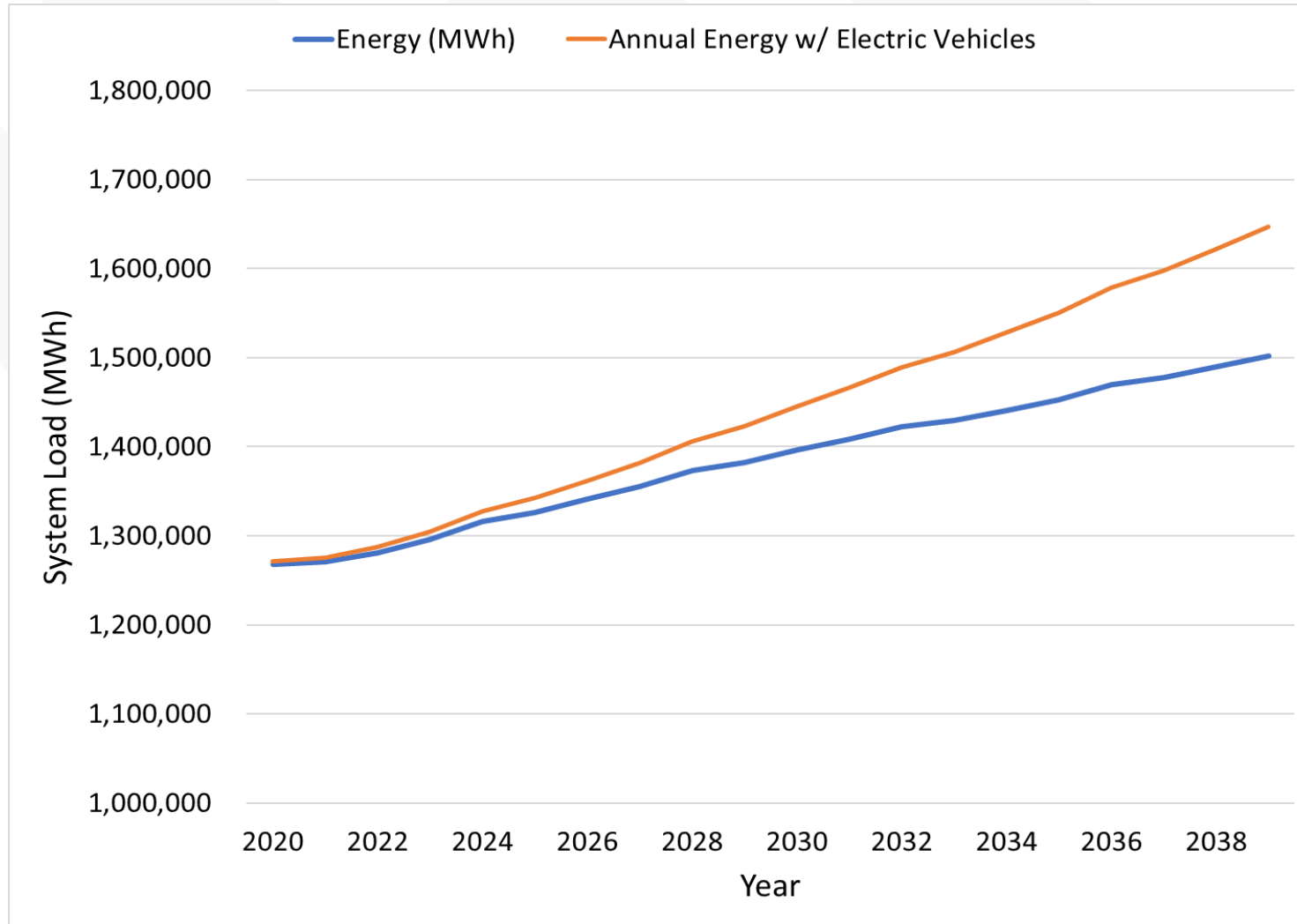
- ▶ Demand Response programs are essential to negate EV effect on peak demand
- ▶ 80 MW offset by 2039

Energy Forecast (Electric Vehicle Base)



- ▶ Two EVs is equivalent to adding a home when comparing energy consumption
- ▶ Projected EV growth is equivalent to adding 21,000 homes to the system by 2039

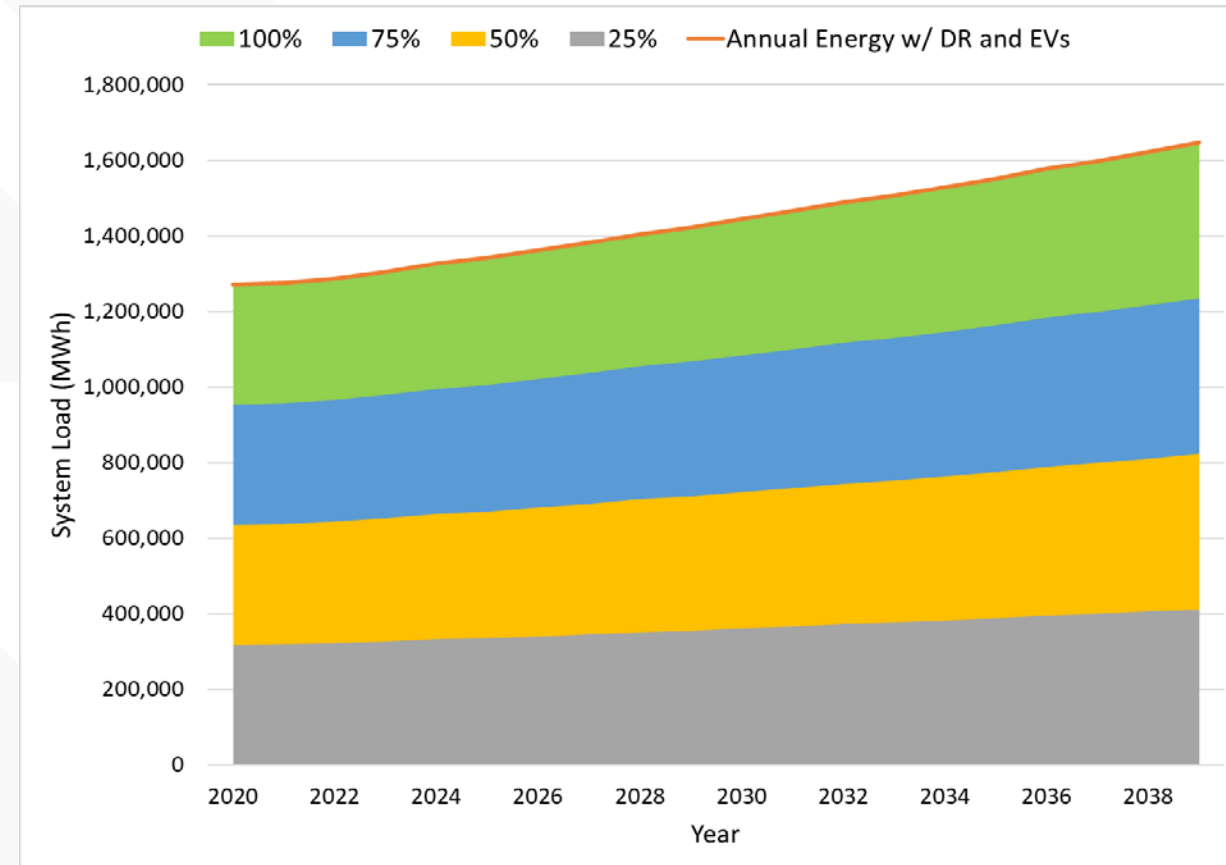
Energy Forecast (EV Base)



- ▶ Charging electric vehicles will increase electricity consumption
- ▶ Electric vehicle impact on energy consumption was added to the SMMPA energy forecast

Resource Plan Assumptions

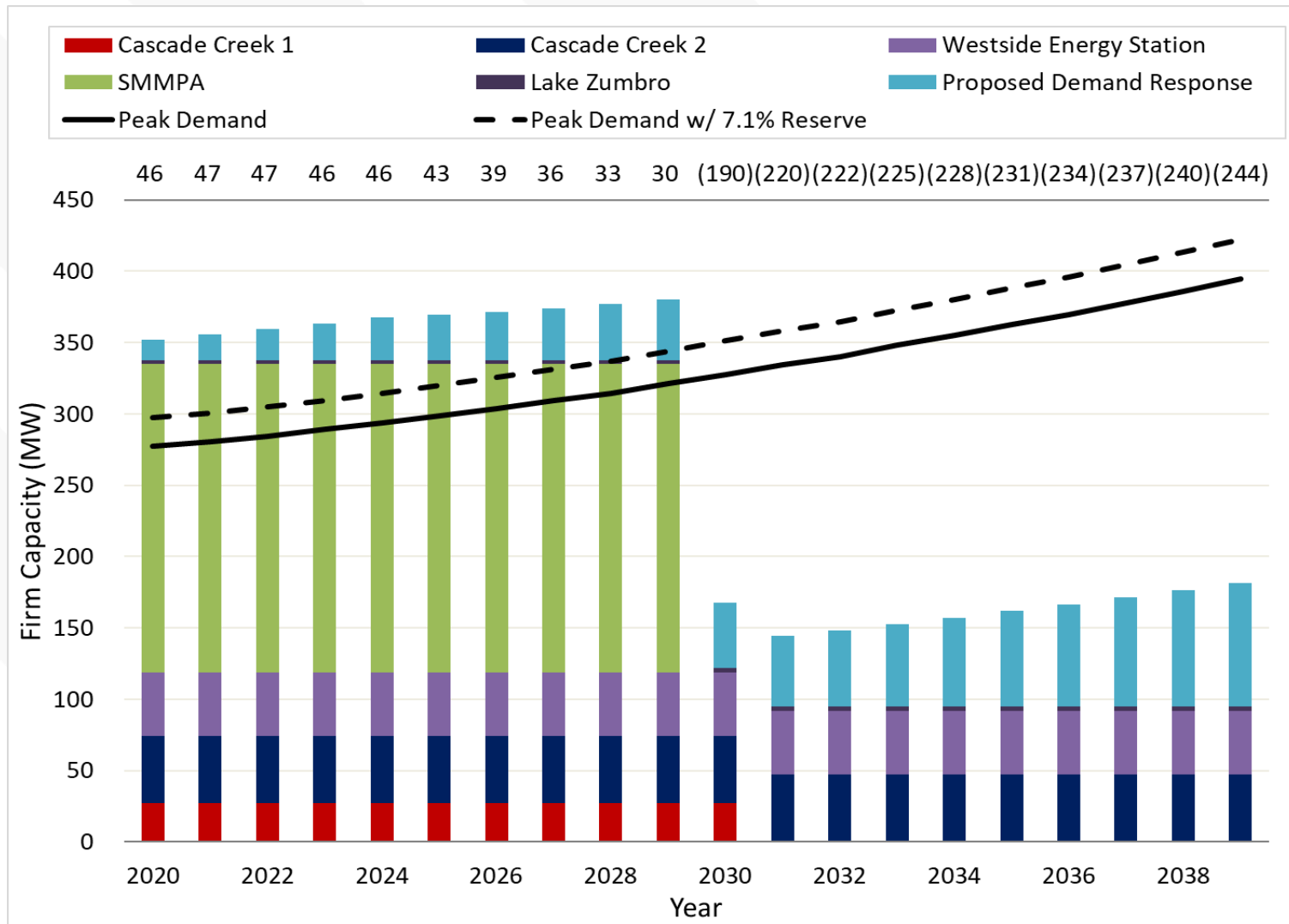
- ▶ Evaluated five different renewable power supply paths
 - 25% renewable energy
 - 50% renewable energy
 - 75% renewable energy
 - 100% renewable energy
 - 100% renewable energy and capacity



Example of 100% Renewable Energy

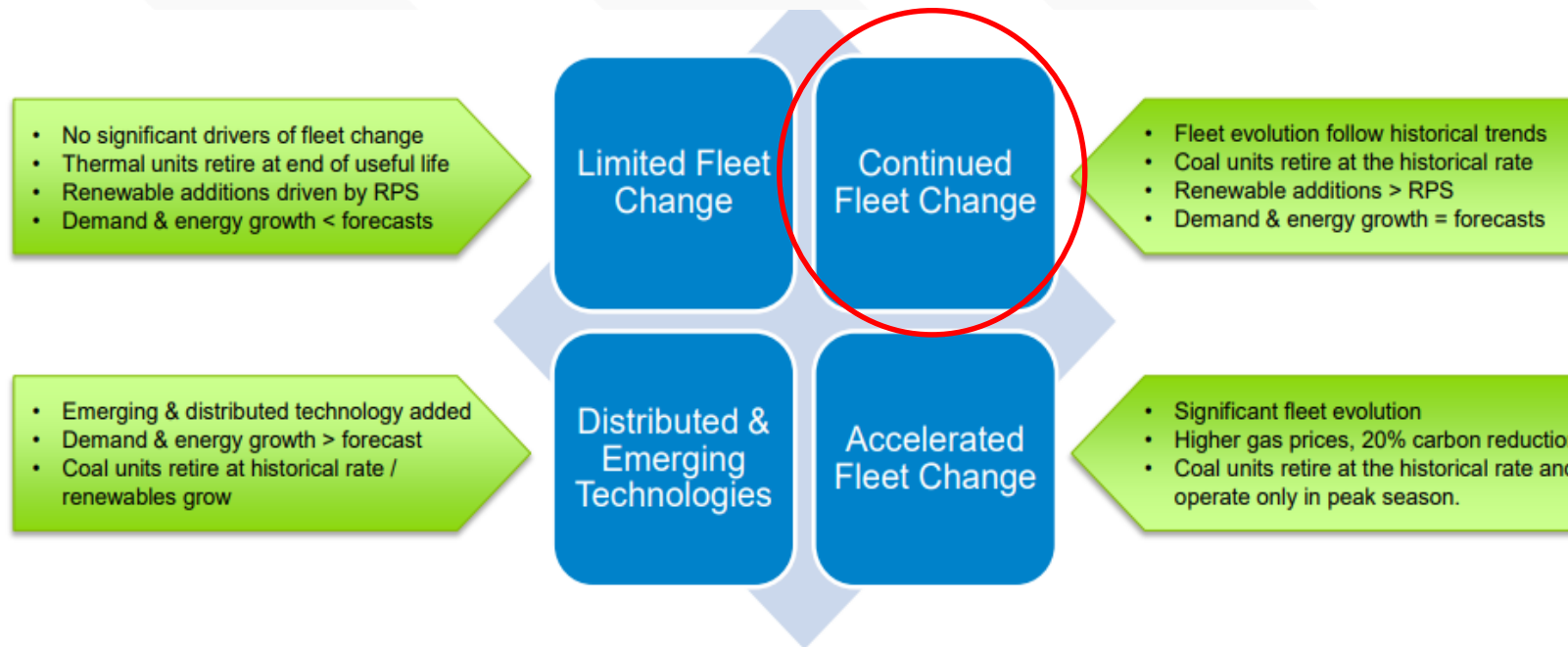
- ▶ RPU has a forecasted load of 1,646,500 MWh (2039).
- ▶ The software model was forced to select enough renewable resources to supply RPU with its entire energy (MWh) load forecast with renewable energy.
 - In other words, RPU will buy enough renewable energy to meet its entire energy load requirements

Current Balance of Loads & Resources

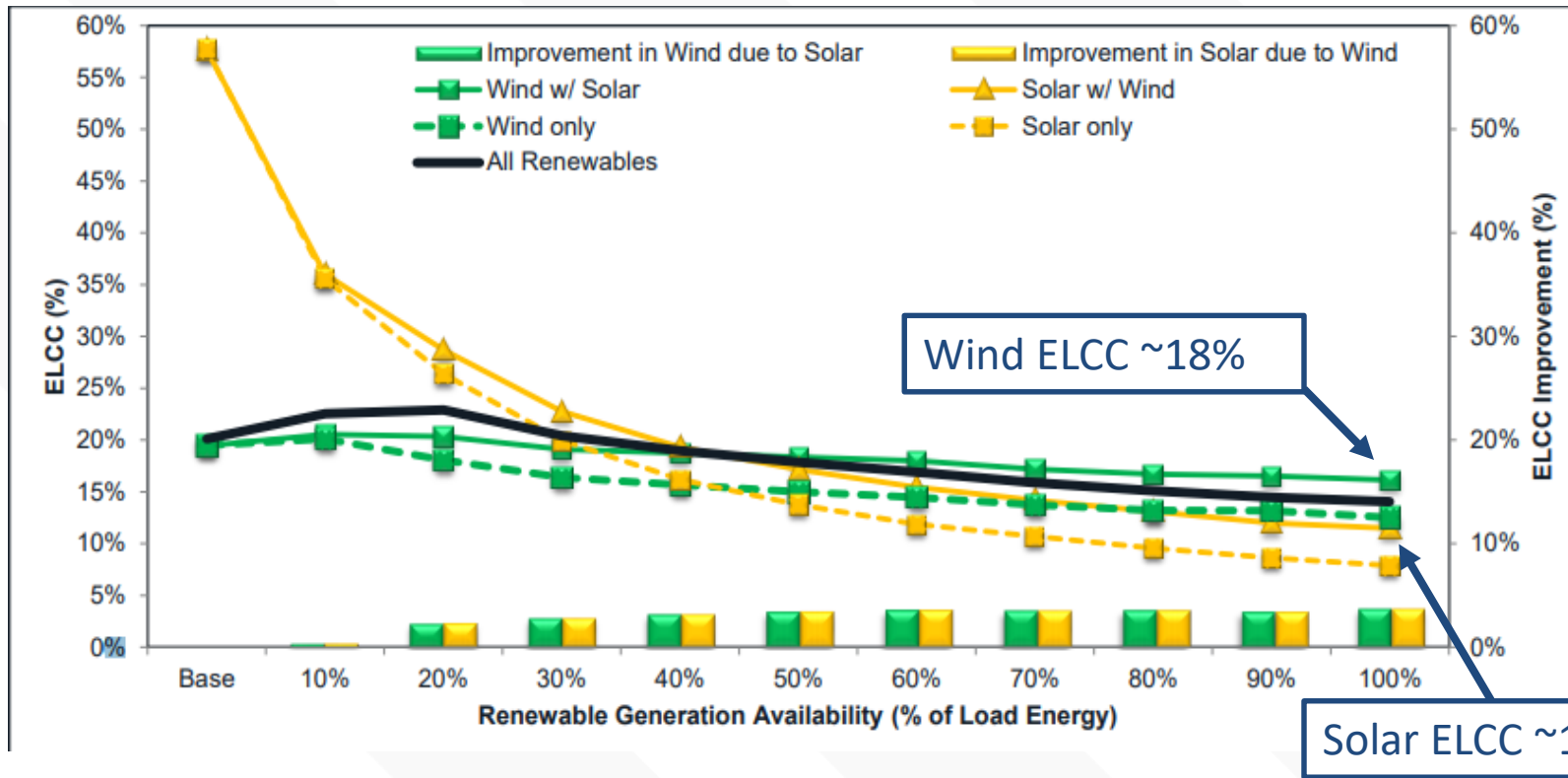


Leveraged MISO for Market Forecasts

- ▶ Used historical LMPs to get historical Market Prices for RPU service territory
- ▶ Used 2019 MISO Transmission Expansion Plan model to get forecasted market prices in RPU for the 2023, 2028, and 2033 study years.
- ▶ Interpolated and extrapolated for years in between to complete market forecast



MISO Studies Indicated Wind and Solar Receive Partial Capacity Credit



▶ ELCC – Effective Load Carrying Capability

- ▶ Increased renewable penetration and large amounts of renewable generation proposed in Minnesota
- ▶ Xcel Energy proposing 3,000 MW of Solar and 1,200 MW of wind by 2030, 100% Renewable by 2050

New Resource Considerations

- ▶ Developed capital costs, O&M costs, and performance estimates for new resources.
- ▶ Utilized projected power purchase agreement pricing for renewables.
- ▶ Resources considered
 - Wind
 - Solar
 - Energy storage with Li-ion batteries
 - Thermal units (simple/combined cycle, reciprocating engines)

Analysis Methodology

Optimizing for Capacity, Energy & Environmental Constraints

- ▶ Capacity expansion – Strategist allows for dynamic optimization of integrated resources in a side-by-side long range planning study
- ▶ Strategist uses reserve margin logic to evaluate expansion plans over a defined period of time and returns plans in a ranked order based on minimized utility cost.
- ▶ Met each path requirement for renewables and completed the expansion plan through lowest capital cost optimization.
- ▶ Five scenarios were selected for further analysis and were modeled in PROMOD for detailed hourly production cost modeling.

Resource Strategy for RPU

- ▶ Satisfy capacity requirements with optimal capital cost approach
 - Use existing resources with low fixed operations and maintenance costs
 - Weigh benefits of lower cost combustion turbines or reciprocating engines versus higher cost, more efficient combined cycle units
 - Make appropriate use of bi-lateral market capacity purchases
- ▶ Satisfy energy requirements
 - Meet customers' needs at lowest cost that meets all requirements
 - SMMPA contract
 - Purchases from MISO market
 - RPU owned generation provides known energy hedge to MISO market
 - MISO provides diversity in energy mix (wind, hydro, coal, nuclear, gas)
 - Renewables from market, self-generation, contracts, and customers
- ▶ Satisfy environmental requirements

Planning Considerations for RPU

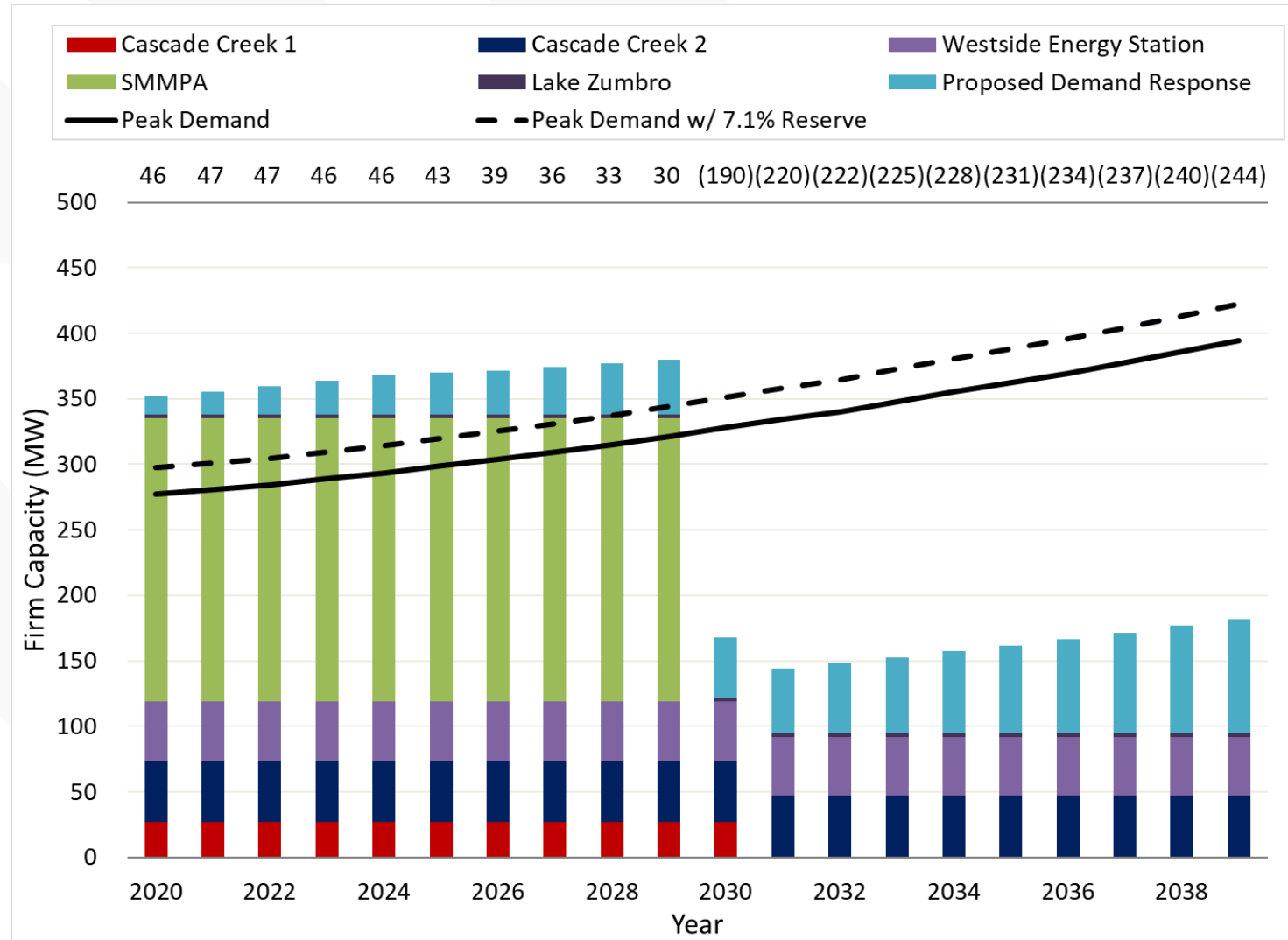
- ▶ Application of renewable scenarios
- ▶ Develop plans that are reliable, low cost and satisfy goals
- ▶ Consider self-build options including natural gas, wind, and solar resources within renewable target (25%, 50%, 75% & 100%)
- ▶ SMMPA (CROD) expires on March 31, 2030

Analysis Results

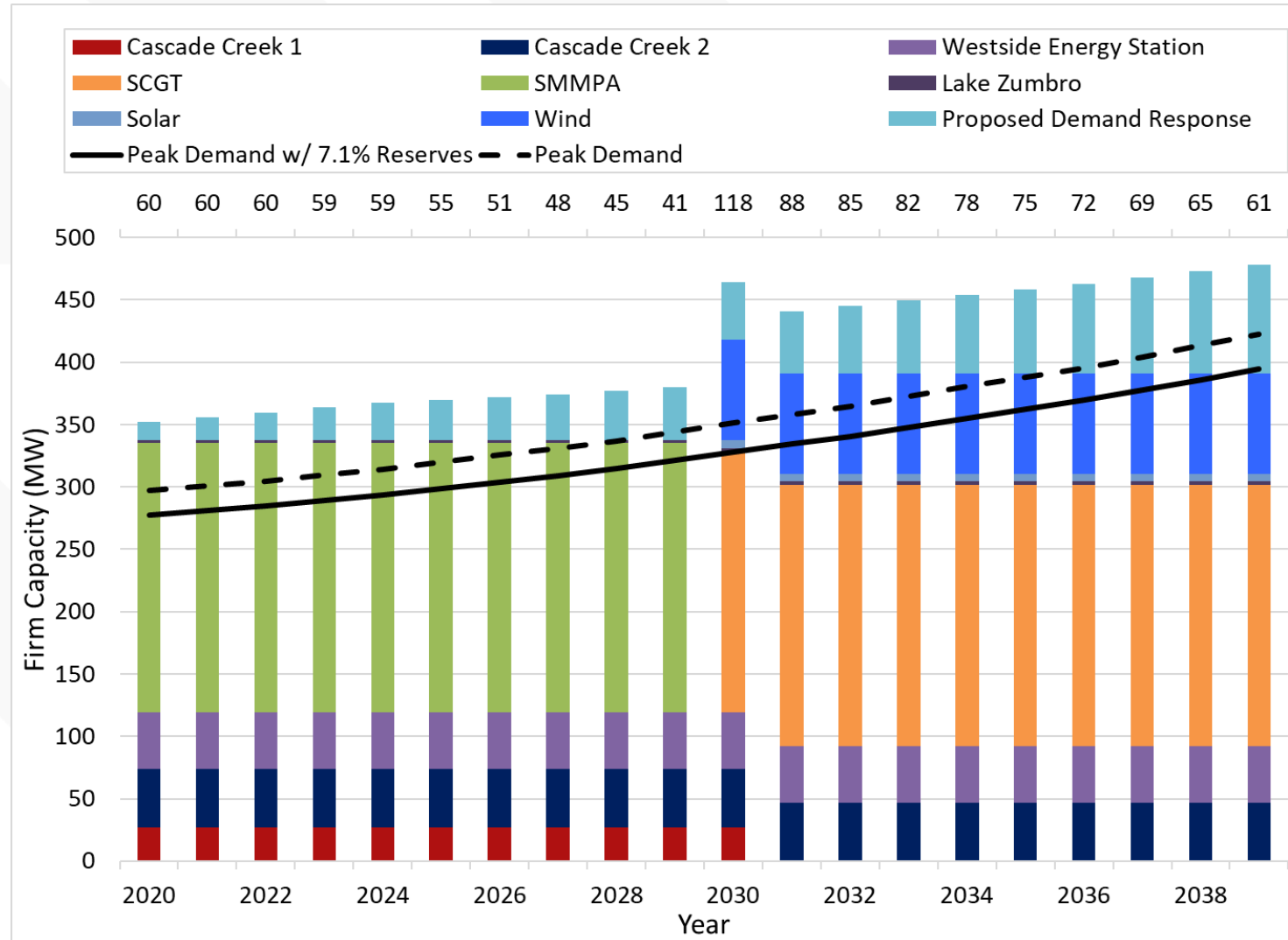
Power Supply Results

Year	Base Case 40% Renewables	Scenario 2 50% Renewables	Scenario 3 100% Renewables	Scenario 4 100% Renewables Reciprocating Engines	Scenario 5 100% Renewable Capacity
2030	220 MW SCGT 50 MW Wind 50 MW Solar	220 MW SCGT 250 MW Wind	220 MW SCGT 450 MW Wind 50 MW Solar	110 MW RICE Unit 350 MW Wind 250 MW Solar 50 MW Battery	350 MW Wind 50 MW Solar 300 MW Battery
2031	-	-	-	-	-
2032	-	-	-	-	-
2033	-	-	-	-	-
2034	50 MW Wind	-	-	-	-
2035	-	-	-	-	-
2036	-	-	-	-	-
2037	50 MW Wind	-	-	-	-
2038	-	-	-	-	-
2039	50 MW Wind	-	-	-	-
Generation Summary	220 MW SCGT 200 MW Wind 50 MW Solar	220 MW SCGT 250 MW Wind	220 MW SCGT 450 MW Wind 50 MW Solar	110 MW RICE Unit 350 MW Wind 250 MW Solar 50 MW Battery	350 MW Wind 50 MW Solar 300 MW Battery
PV (\$000)	\$1,049,946	\$1,051,106	\$1,058,039	\$1,077,171	\$1,165,279
Delta (\$000)		\$1,160	\$8,093	\$27,225	\$115,333
Delta (%)		0.1%	0.8%	2.6%	11%

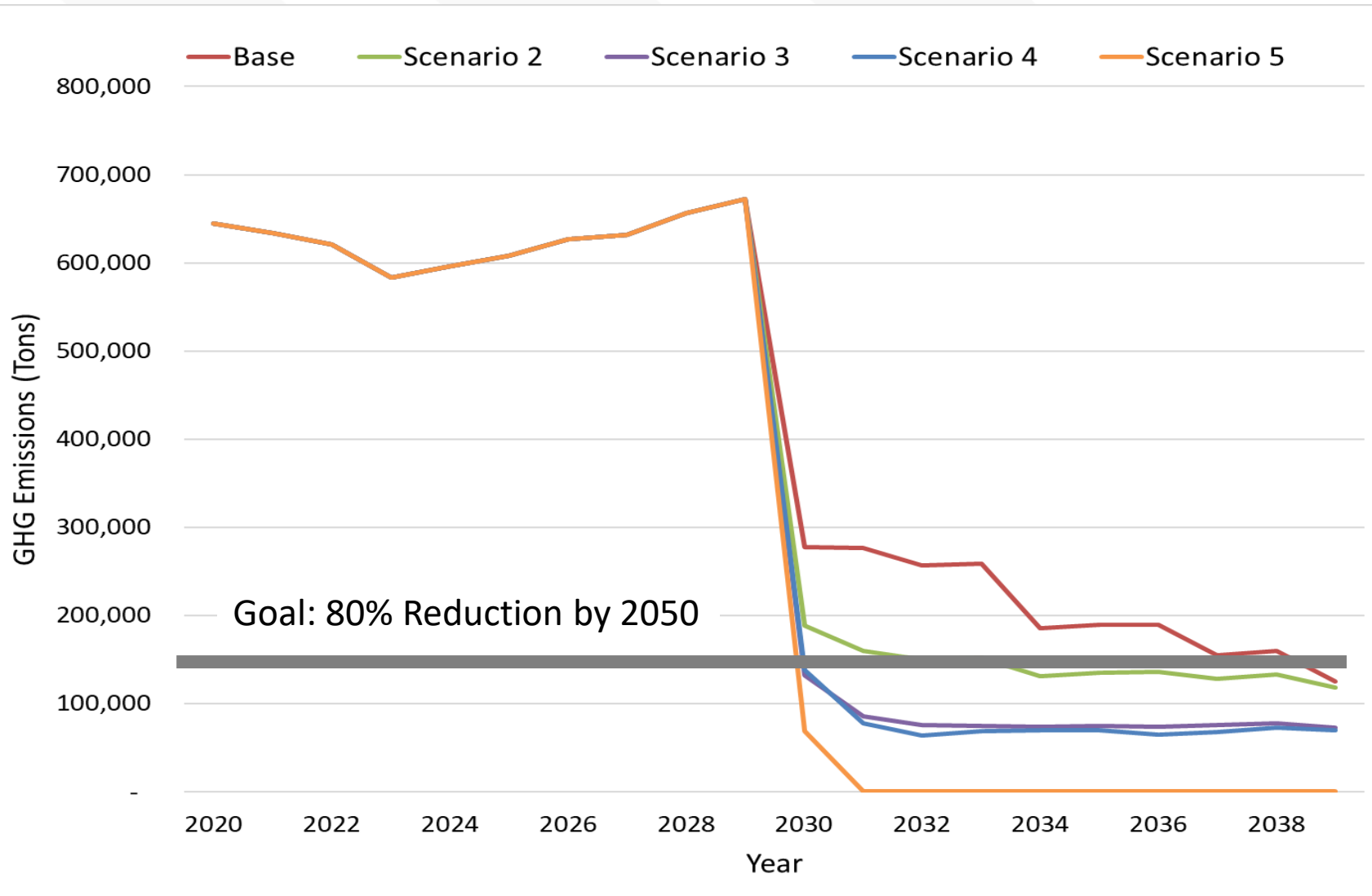
Balance of Loads & Resources



Balance of Loads & Resources – Scenario 3

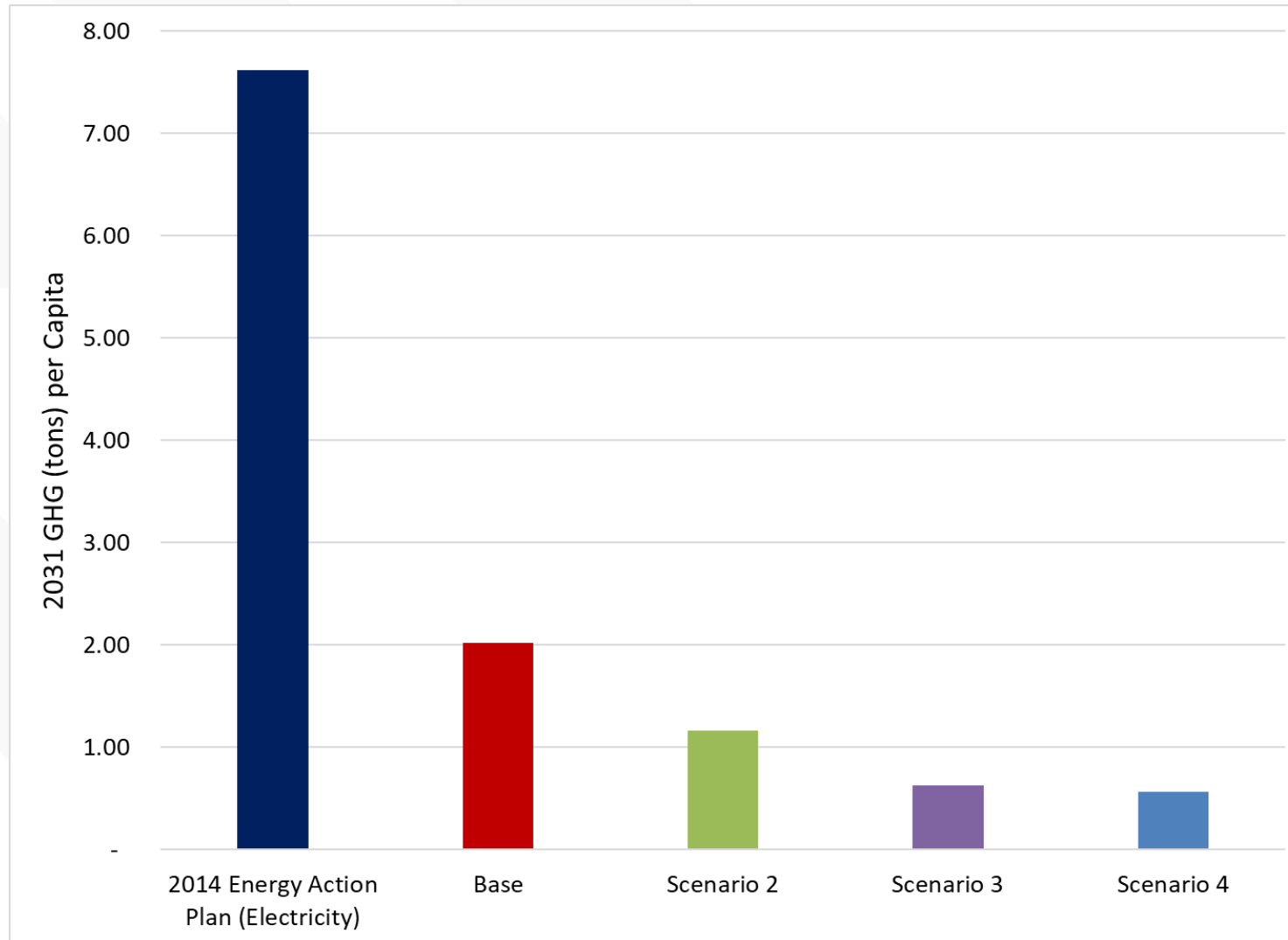


GHG Emissions are Significantly Reduced after CROD

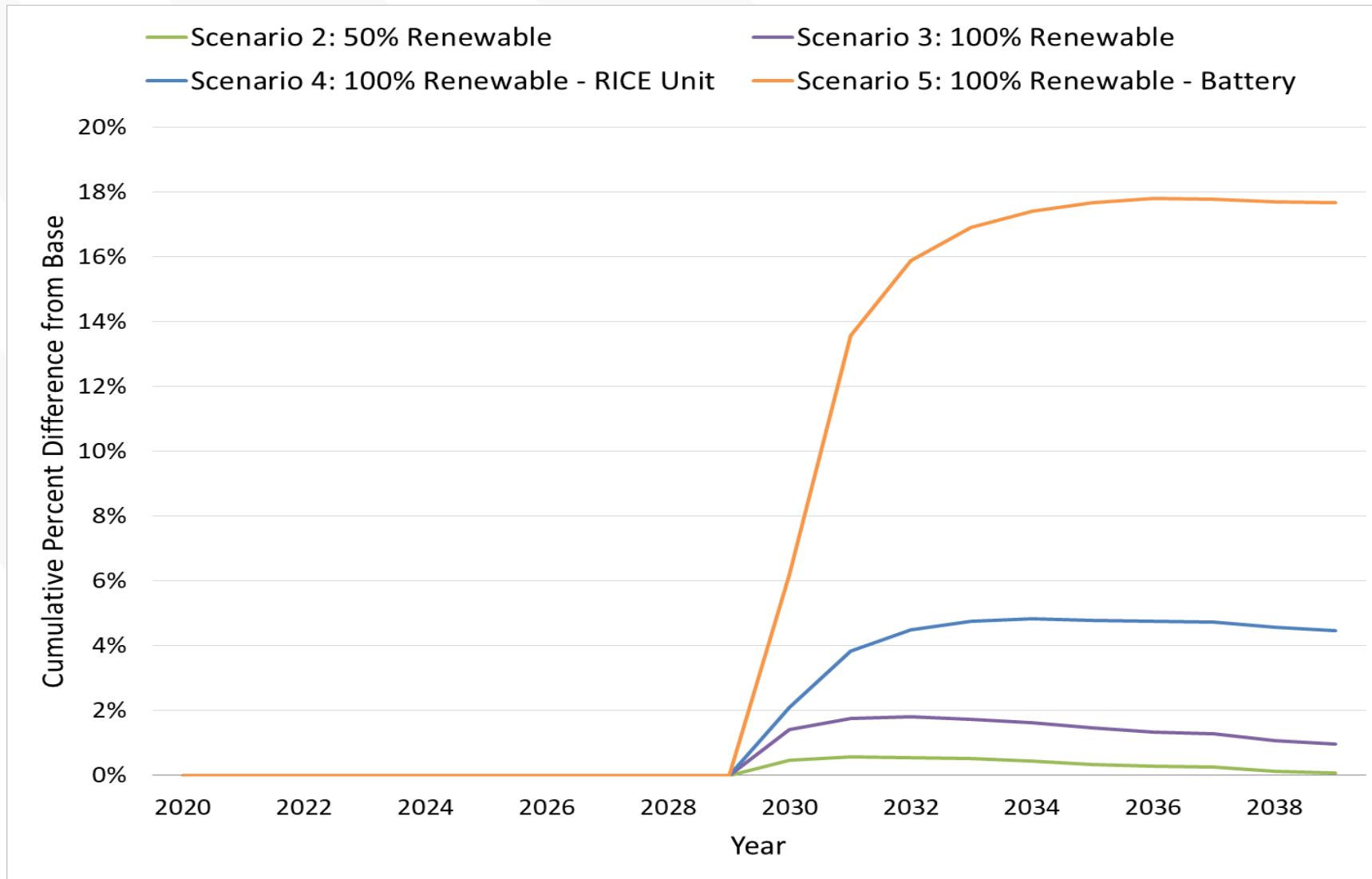


Base Case: 40% renewable energy
Scenario 2: 50% renewable energy
Scenario 3: 100% renewable energy
Scenario 4: 100% renewable energy
Scenario 5: Fossil-free

GHG Emissions per Capita is Reduced after CROD



Impact to Power Supply Rate



Conclusions & Recommendations

Conclusions

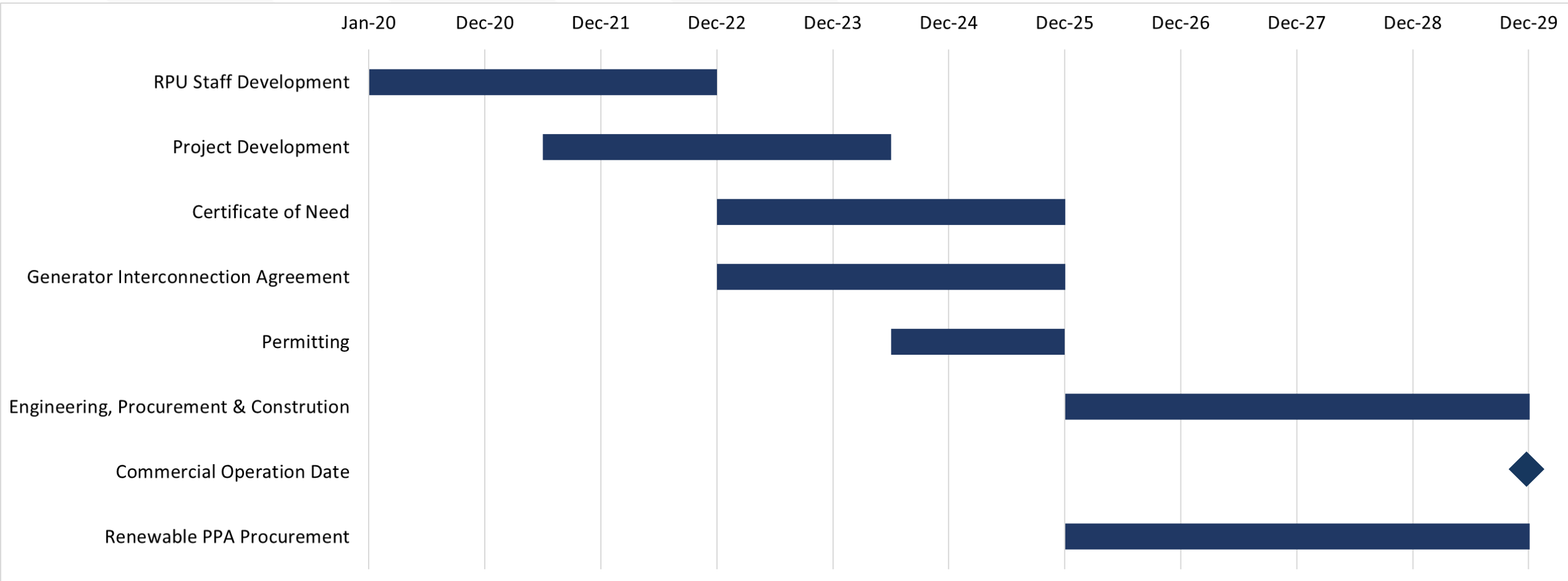
- ▶ The SMMPA contract will expire in March of 2030. RPU will need to establish a replacement for both energy and capacity.
- ▶ RPU is positioned to significantly reduce its dependence on fossil-fueled energy and GHG footprint.
- ▶ Base Case of 40% renewables is the lowest cost option, however Scenario 3 is within RPU customer survey tolerance for renewable additions.
- ▶ The power supply path will:
 - Exceed the State's and City's goals regarding GHG reduction and renewable energy production
 - Provide flexibility to implement emerging technologies in the future
 - Provide flexibility to determine the appropriate mix of wind and solar
 - Provide flexibility to comply with most any new regulations
 - Ability to accommodate continued electrification of the economy

RPU Staff Recommendation

- ▶ Staff is recommending that RPU move forward with Scenario 3
- ▶ Accept and place on file the updated plan after report is finalized
- ▶ Direct staff to begin the process of implementing Scenario 3

Next Steps

Implementation Schedule



Future Considerations

- ▶ Industry trends to stay abreast of:
 - MISO renewable integration
 - MISO capacity credit process
 - MISO interconnection process
 - Transmission costs
 - ITC and PTC
 - Battery costs and MISO battery rules
 - EV adoption rate
 - Electrification
 - New demand response
 - Federal and State legislation