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PART OF BURNS & McDONNELL

Review of Power Supply Study

RAC of CPS Energy
December 6, 2022

Agenda

Areas of Review

- **Modeling Approach**
- **Load Forecast**
- **Existing Resources**
- **ERCOT Market Modeling**
- **New Technology Assessment**
- **Commodity Price Forecast**
- **Risk Analysis**
- **Results**

Study Approach

Typical Power Supply Study Approach

Primary goal of an integrated power supply study is to provide an economic evaluation of a utility’s power supply portfolio over both short-term and long-term planning horizons.

Need to focus on short-term decisions that position utility for long-term success.

Typical Power Supply Study Approach

Typical Power Supply Study Approach

- ✓ Reference Case/Scenario
- ✓ Scenario Alternatives
- ✓ Strategy/Portfolio Alternatives
- ✓ Sensitivities
- ✓ Distribution of Outcomes

Typical Analyses in Addition to Reference Scenario

Scenarios	Adjustments to elements that will not be in the control of utility
Strategies/ Portfolios	Adjustments to elements that will be in the control of the utility
Sensitivities	Stressing one input variable to determine its impact on power supply costs
Distribution of Outcomes	Use of stochastically-developed pricing and cost inputs to generate a range of possible outcomes

Current Study Approach

Scenarios	Portfolios	Sensitivities	Distribution of Outcomes
Reference Scenario plus 3 other scenarios developed by assuming different inputs for key scenario variables (gas prices, carbon prices, technology costs, demand and ERCOT market design)	9 different portfolios developed assuming different types of allowable generating resources and different combinations of retirements/conversions of existing units	4 different sensitivities will be performed on the Reference Scenario	Not performed

1898 & Co. Opinion: The method and assumptions used in the study are reasonable and similar to what is typically expected in such studies

Load Forecast

Load Forecast | Approach

Multivariate Regression

Find and quantify variables that correlate to or influence sales/growth patterns

Project variables to predict future sales/growth

Bottom-Up Approach

Start with component (i.e. Commercial & Industrial Sales) and sub-component (i.e. Residential Bills, Residential UPC) forecasts

Combine components into an aggregated forecast

Use aggregated sales forecast to develop peak forecast

1898 & Co. Opinion: The method and assumptions used by CPS Energy is reasonable and similar to what is typically expected for an IRP study

Load Forecast | Differences

Peak Forecast	**Weather Normalized** vs. **Normalized Load Factor** vs. **Hourly Analysis**
Load Growth	**Minimum Load Model** vs. **Historical Peak Trends**
Minimum Load Model	Not used by 1898 & Co.

Load Forecast | Future Considerations

- Include building electrification impact
- Include Inflation Reduction Act (IRA) and other external program impacts
- Residential Electric Vehicle (EV) Time of Use (TOU) and DC Fast-Charger load shapes need to analyzed further
- Energy Efficiency (EE) & Demand Response (DR) programs savings seems conservative

Other Aspects | RAC Q's

- **Are the population estimates high enough?**
  - Population growth continues the historical trend of approximately 2 percent annual growth
  - This falls in line with the growth of "fast-growing cities" in the US
- **Are EV peak demand estimates reasonable?**
  - EV Peak demand estimates do appear reasonable and have similar expected growth patterns with other cities in the area
  - Load shapes appear reasonable and about as expected, except for Residential TOU and some DC Fast-Charging
  - Similar studies in the area show growth rate to be around 20 percent year over year
- **Are the peak demand/load estimates reasonable?**
  - System forecast estimates appear reasonable
    - Approximate annual load growth of 1.5 percent for baseline forecast
    - Approximate annual load growth of 2 percent considering additional components

Existing Resources

Existing Resources

BASE ASSUMPTIONS

Operations	Cost Assumptions
Unit Retirements	Capital Investments

Key Assumptions

- Capacity (MW)
- Forced Outage Rates (FOR)
- Nonfuel VOM ($/MWh)
- PPA price if applicable ($/MWh)
- Heat rates (if applicable)
- Preventive maintenance
- Other dispatch parameters
- Expected Capacity Factor (CF) for wind and solar (%)
- Emission rates (lbs/mmbtu)
- Committed unit retirements/conversions

1898 & Co. Opinion: The assumptions used in the study are reasonable to what is expected for technology of similar age and size

ERCOT Market Design

Key Assumptions

- **How was the regional ERCOT market configured**
- **Source of data**
- **Load assumptions**
- **Unit retirements**
- **ERCOT interconnection queue and committed resources**
- **New generic technology assumptions**
- **Effective Load Carrying Capability (ELCC) for intermittent resources**
- **Reserve margin**
- **Expected Capacity Factor (CF) for wind and solar (%)**
- **Emission rates (lbs/mmbtu)**

1898 & Co. Opinion: The approach to ERCOT market modeling and the assumptions used in the study are reasonable and similar to what is expected for technology of age and size

New Technology Assessment

New Technologies Assessment

BASE ASSUMPTIONS

Operating Parameters

Cost Assumptions

Technology Maturity

New Technology Cost Forecasts – Renewables & Short-Term Storage

Technology	CPS Energy Approach	Result	Assessment of CPS Energy Approach & Result
Wind	• Publicly available forward price curves and overnight capital costs from reputable sources were combined to create Low, Base, and High forward cost forecasts. • Technology specific modeling parameters (O&M, physical characteristics, etc.) were sourced from reputable sources.	• Overnight Capital Costs generally decline in real dollars over the next decade before leveling off.	• Forecasting approach is reasonable • Base cost curves are used in the Reference Scenario and reflect a reasonable basis for study
Solar			
Li-Ion (2 to 8 hour)			
Geothermal			

New Technology Cost Forecasts

Gas, Nuclear, Hydrogen

Technology	CPS Energy Approach	Result	Assessment of CPS Energy Approach & Result
Traditional Gas (CC, CT, Aero & RICE)	• Publicly available data from reputable sources were combined to create a forward cost forecast. • Technology specific modeling parameters (O&M, physical characteristics, etc.) were sourced from reputable sources.	• Overnight Capital Costs generally decline in real dollars over the study period.	• Approach is typical and reasonable
Hydrogen CT	• Hydrogen technology costs remain same across all scenarios • Publicly available forward price curves and overnight capital costs from reputable sources • New technology with cost uncertainties	• Overnight Capital Costs generally decline in real dollars over the study period.	• Forecast source is reputable • Technology not considered viable until after 2030
Nuclear SMR	• Technology costs remain same across all scenarios except the VMA scenario where the costs are assumed to be higher • Publicly available forward price curves and overnight capital costs from reputable sources • New technology with cost uncertainties	• Overnight Capital Costs generally decline in real dollars over the study period.	• Forecast source is reputable • Technology not considered viable until after 2030

Commodity Price Forecasts

Commodity Price Forecasts

Commodity Price	CPS Energy Approach	Result	Assessment of CPS Energy Approach & Result
Coal Delivered ($/MMBtu)	• Coal supply and rail transportation contract forecast • Forward pricing for spot purchases • 3rd party forecast beyond contract and forwards	• Forecasted prices generally flat in real $'s with increases based on general inflation	• Approach is typical • Reputable source for price forecasts • Flat forecasted pricing in real terms is appropriate give decreasing demand
Natural Gas Delivered ($/MMBtu)	• 3rd party forecast of Henry Hub • Basis forecast • Transportation forecast • Hedging costs and fixed transport costs added "post-processing"	• NG prices reflect current high forward pricing for 2023 • Forecasted prices reflect average annual changes of ~1.8%	• Forecast source is reputable • Currently evaluating info on basis, transport and hedging costs
Uranium ($/MMBtu)	• Internal CPS Energy forecast	• Fairly flat pricing in real terms	• Forecast is similar to public forecast from NREL
Carbon Dioxide Cost ($/ton)	• Forecast from previous year is maintained	• Pricing starts 2027 at modest levels ($5/ton) and almost doubles for 2028, rises to ~$51/ton by 2046	• May conflict with IRA assumptions, unduly penalize fossil units

Risk Analysis

Risk Analysis Overview

Scenario Design Considerations

CRA and CPS Energy are evaluating major themes in the energy market that could inform scenario design. The table below provides a preliminary view of scenario design.

Inputs

CPS Energy Scenarios

ERCOT Scenario	Commodity Prices	Carbon Policies	Technology Costs	Demand	ERCOT Market Design Change
Reference Scenario (REF)	Baseline	Baseline	Consensus	Baseline	Confirmed changes only
Carbon-Based Economy (CBE)	Low	No Price	Consensus	High driven by low prices	Confirmed changes only
Net Zero Carbon Economy (NZE)	Low due to electrification drive	High carbon price	Fast decline	High driven by electrification	Capacity market launched & seasonal reserve margins
Volatile Market (VMA)	High	No price to alleviate inflation pressure	Slow decline due to trade restrictions	Low due to high energy prices	Confirmed changes only

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Focused on CRA's assignment of inputs to CPS Energy Scenarios

Risk Analysis Overview

Forecasted Item	CPS Energy Approach	Result	Assessment of CPS Energy Approach & Results
Natural Gas Prices	Uncertainty defined by EIA scenario forecasts	Captures EIA's highest and lowest scenario prices	Agree with capturing EIA's highest and lowest scenario prices Assignment of Low Economic Growth to the CPS Energy scenario should consider EIA scenario inflation that corresponds to low growth
Coal Prices			
Carbon Dioxide Cost	Same	Zero	Much Higher
Demand	Same	Slightly Higher	Much Higher
Technology Costs	Same	Same	Lower

Risk Analysis | Natural Gas Prices in 2047

CPS Energy Scenarios include EIA's highest and lowest scenario prices, which is good.

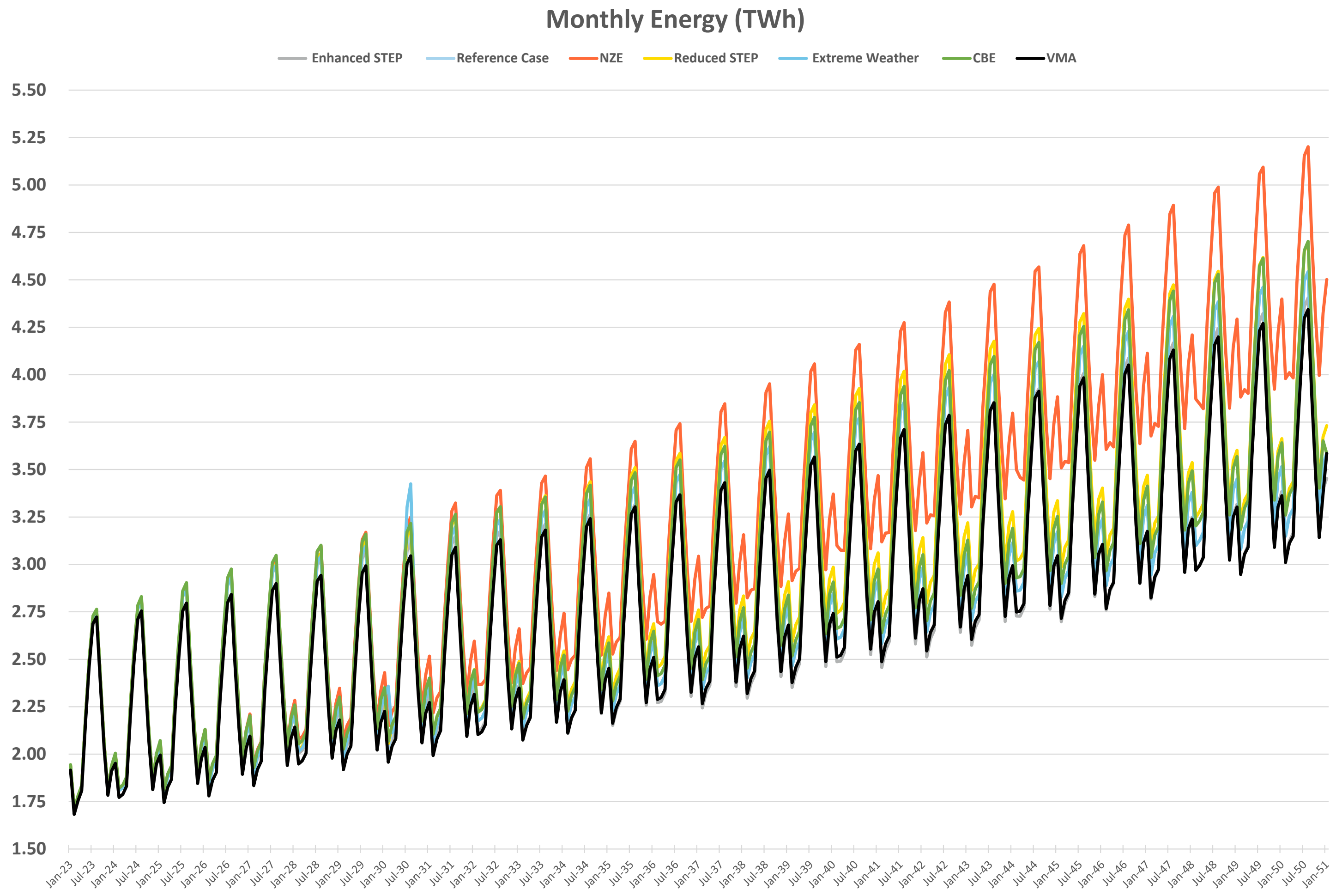
Other than the highest and lowest priced scenarios, EIA scenario prices are similar to EIA's reference case.

EIA Scenario	CPS Energy Scenario	Natural Gas Henry Hub Pricing ($/MMBtu)	
		Real	Nominal
n/a	***Reference***	***$3.37***	***$5.67***
High oil and gas supply	Carbon-based Economy	$2.52	$4.69
Low oil price	n/a	$3.52	$5.99
High economic growth	n/a	$3.83	$6.17
Low renewables cost	n/a	$3.47	$6.24
Reference case	n/a	$3.60	$6.47
High renewables cost	n/a	$3.80	$6.85
No Interstate Pipeline Builds	n/a	$3.93	$7.08
Low economic growth	Net Zero Carbon Economy	$3.40	$7.98
High oil price	n/a	$3.69	$8.64
Low oil and gas supply	Volatile Market	$6.56	$11.07

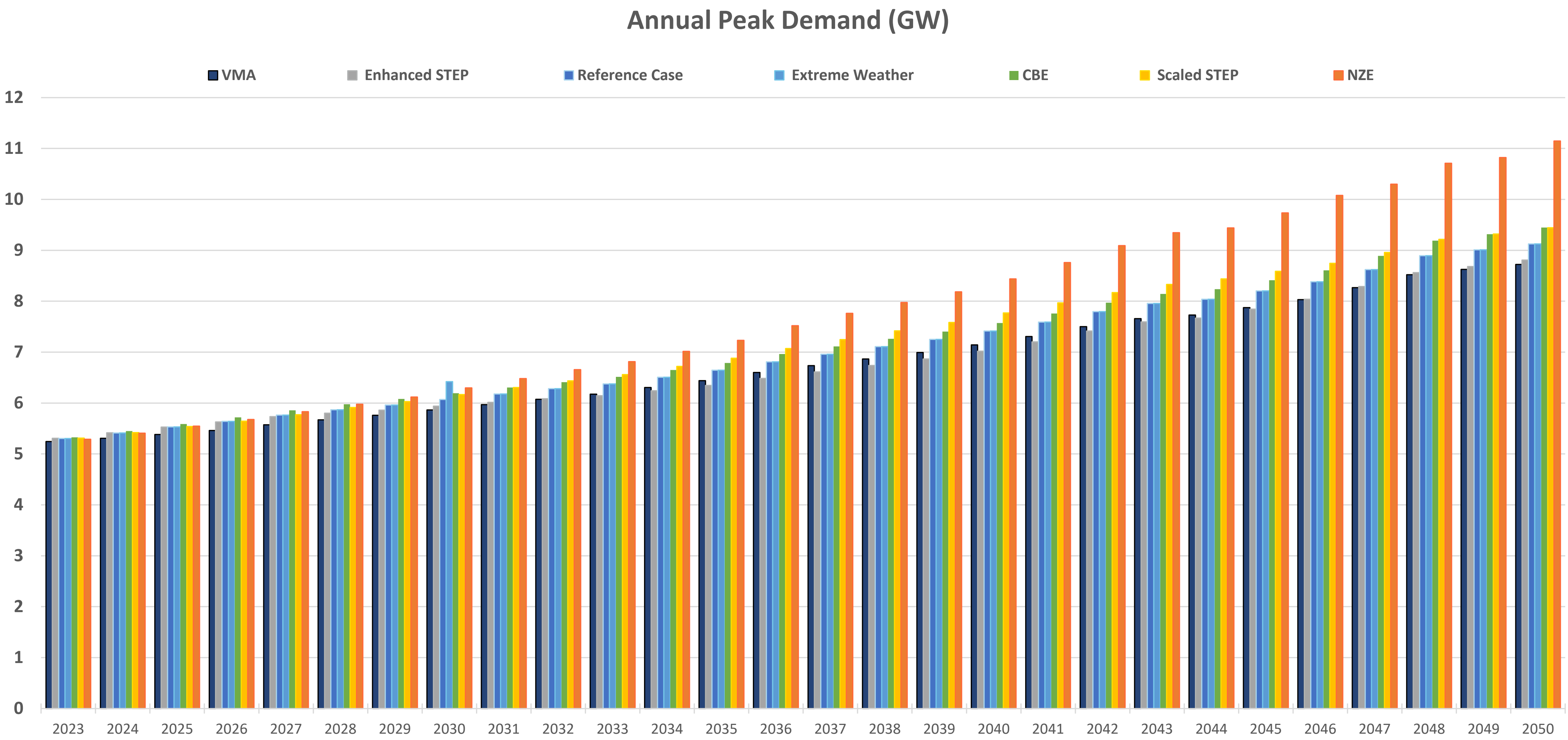
Additional Assumptions and Results Review

Load Forecast for Other Scenarios & Sensitivities

- Additional scenarios compared against the Reference scenario
- NZE Scenario, Enhanced STEP, and Scaled-back STEP sensitivities adjust component forecasts used in the Reference scenario
- Extreme Weather sensitivity, CBE and VMA scenario forecasts adjust the reference case results by a derived factor
- Scenario forecast results fall in-line with expectations



Load Forecast for Other Scenarios & Sensitivities



Load Forecast for Other Scenarios & Sensitivities

Annual Peak Growth Rate

Year	Reference Case	Enhanced STEP	VMA	Extreme Weather	CBE	Scaled STEP	NZE
2023	1.98%	2.02%	0.86%	1.98%	2.39%	2.05%	2.33%
2024	2.06%	2.00%	1.17%	2.06%	2.36%	2.05%	2.25%
2025	2.22%	2.13%	1.44%	2.22%	2.56%	2.21%	2.54%
2026	1.93%	1.77%	1.47%	1.93%	2.32%	1.93%	2.33%
2027	2.19%	1.88%	2.02%	2.19%	2.43%	2.22%	2.71%
2028	1.82%	1.16%	1.77%	1.82%	2.05%	2.44%	2.49%
2029	1.58%	1.04%	1.54%	1.58%	1.71%	2.01%	2.36%
2030	1.84%	1.33%	1.84%	7.74%	1.87%	2.29%	2.93%
2031	1.79%	1.26%	1.79%	-3.79%	1.81%	2.23%	2.96%
2032	1.66%	1.17%	1.74%	1.66%	1.67%	2.07%	2.65%
2033	1.52%	1.02%	1.68%	1.52%	1.59%	1.91%	2.41%
2034	2.06%	1.60%	2.09%	2.06%	2.07%	2.43%	2.95%
2035	2.09%	1.62%	2.15%	2.09%	2.12%	2.40%	3.09%
2036	2.51%	2.22%	2.52%	2.51%	2.56%	2.78%	3.97%
2037	2.20%	1.94%	2.02%	2.20%	2.13%	2.47%	3.22%
2038	2.14%	1.95%	1.95%	2.14%	2.09%	2.40%	2.75%
2039	1.99%	1.86%	1.85%	1.99%	1.99%	2.21%	2.60%
2040	2.25%	2.21%	2.11%	2.25%	2.26%	2.45%	3.14%
2041	2.38%	2.62%	2.32%	2.38%	2.44%	2.55%	3.78%
2042	2.70%	2.95%	2.66%	2.70%	2.76%	2.54%	3.78%
2043	2.06%	2.42%	2.10%	2.06%	2.18%	1.94%	2.81%
2044	1.07%	1.01%	0.91%	1.07%	1.15%	1.31%	1.01%
2045	2.02%	2.28%	1.90%	2.02%	2.10%	1.76%	3.13%
2046	2.19%	2.48%	1.99%	2.19%	2.35%	1.86%	3.51%
2047	2.88%	3.11%	2.94%	2.88%	3.27%	2.41%	2.20%
2048	3.14%	3.28%	3.05%	3.14%	3.38%	2.90%	3.97%
2049	1.29%	1.39%	1.21%	1.29%	1.37%	1.13%	1.06%
2050	1.28%	1.47%	1.16%	1.28%	1.40%	1.33%	3.01%
CAGR	2.03%	1.89%	1.90%	2.03%	2.15%	2.16%	2.80%

Key Results

- **Expansion plan across portfolios**
- **Unit level information**
- **Portfolio generation mix**
- **Matching outputs to input assumptions**
- **Reserve margin**
- **Unit retirements**
- **Expected Capacity Factor (CF) for resource types**
- **Total emissions**
- **Fuel costs**
- **O&M costs**
- **Market purchases and sales**

1898 & Co. Opinion: The model results are consistent with input assumptions and appear to be reasonable

Key Observations - Metrics

- **Five (5) Broad Categories**
  - **System Reliability**
  - **System Flexibility**
  - **Environmental Sustainability**
  - **Affordability**
  - **Work Force Impact**

1898 & Co. Opinion: The metrics used to evaluate portfolios and scenarios are consistent with typical long term power supply study

Key Observations – System Reliability (Resource Mix)

- Resource mix and generation mix help assess system reliability for any portfolio
- Diverse mix of different technologies help offset any risk associated with any given technology
- Capacity mix – P6 and P7 have the most diverse capacity mix, but they also add the maximum resources (10 GW) by 2030. P1, P2 and P4 also have a diverse mix of resources and add the least amount of capacity by 2030. Amongst renewable portfolios, P9 adds the least resources by 2030
- Generation mix – P4, P6 and P7 have the most diverse generation mix. However, P4 is still reliant on coal and P6 and P7 add maximum resources by 2030. P1, P2 and P9 have a robust generation mix

Portfolio Summary

Abbreviation	Allowed Technologies	Action on Existing Generating Fleet	2030 Generation Mix
P1 (Gas)	Gas	Spruce 1 shut down in 2028. Spruce 2 converted to gas in 2027.	
P2 (Blend 1)	All	Spruce 1 shut down in 2028. Spruce 2 converted to gas in 2027.	
P3 (Ren)	Renewables	Spruce 1 shut down in 2028. Spruce 2 shut down in 2027.	
P4 (Blend 2)	All	Both Spruce units run on coal beyond 2040	

Abbreviation	Allowed Technologies	Action on Existing Generating Fleet	2030 Generation Mix
P5 (Ren)	Renewables	Spruce 1 shut down in 2025. Spruce 2 shut down in 2028.	
P6 (Ren)	Renewables	Spruce 1 shut down in 2025. Spruce 2 shut down in 2028. All gas units shut down by 2035.	
P7 (Ren)	Renewables	Spruce 1 shut down in 2025. Spruce 2 shut down in 2028. All gas units shut down by 2040.	
P8 (Ren)	Renewables	Spruce 1 shut down in 2025. Spruce 2 shut down in 2025, and re-opened as gas unit in 2028	
P9 (Ren)	Renewables	Spruce 1 shut down in 2028. Spruce 2 converted to gas in 2028	

Nuclear | Geothermal | Coal
Gas | Gas Toll | Wind
Solar | Other | Storage
Hydrogen | Energy Efficiency

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Cumulative Capacity Additions Between 2023 and 2030 (MW)

Portfolio	P1	P2	P3	P4	P5	P6	P7	P8	P9
Allowed Technology	Gas	Blend 1	Renewables	Blend 2	Renewables				
Combined Cycle (CC)[1]	2,260	1,380	500	1,380	500	500	500	500	500
Reciprocating Internal Combustion Engine (RICE)	606	808	N/A	202	N/A	N/A	N/A	N/A	N/A
Wind[2]	N/A	500	2,700	N/A	2,700	4,000	4,000	2,100	2,300
Solar[3]	880	1,180	1,180	880	1,180	1,420	1,280	1,380	1,180
Short-Duration Storage[4]	50	1,010	3,010	1,155	3,060	4,110	4,110	2,260	1,860
Long-Duration Storage[5,6]	N/A	50	100	-	100	100	100	100	100
Geothermal[6]	N/A	-	60	-	25	275	275	-	-
Hydrogen[6]	N/A	-	240	240	240	240	240	240	240
Nuclear – Small Modular	N/A	-	-	-	N/A	N/A	N/A	N/A	N/A
Total New Capacity	***3,796***	***4,928***	***7,790***	***3,857***	***7,805***	***10,645***	***10,505***	***6,580***	***6,180***
Spruce 2 Gas Conversion	785	785	Retire	Retain w/coal	Retire	Retire	Retire	785	785
Market Purchase 2026[7]	532	102	304	422	893	785	785	1,560	304
Market Purchase 2027[7]	N/A	N/A	253	N/A	947	20	20	1,771	606
Market Purchase 2028[7]	N/A	N/A	559	N/A	1,185	511	511	599	1,562
Market Purchase 2029[7]	N/A	N/A	917	N/A	913	N/A	N/A	600	750

Notes: 1) Includes FlexPower Bundle 500 MW 10-year gas tolling contract; 2) Includes both coastal and west wind; 3) Includes FlexPower Bundle solar; 4) Includes FlexPower Bundle storage, and includes 2-hour, 4-hour, and 8-hour storage; 5) 20-hour storage; 6) Selected only in 2030 due to assumed technology availability; 7) Represents bridged capacity purchase for the year at 23% premium to hourly market price.

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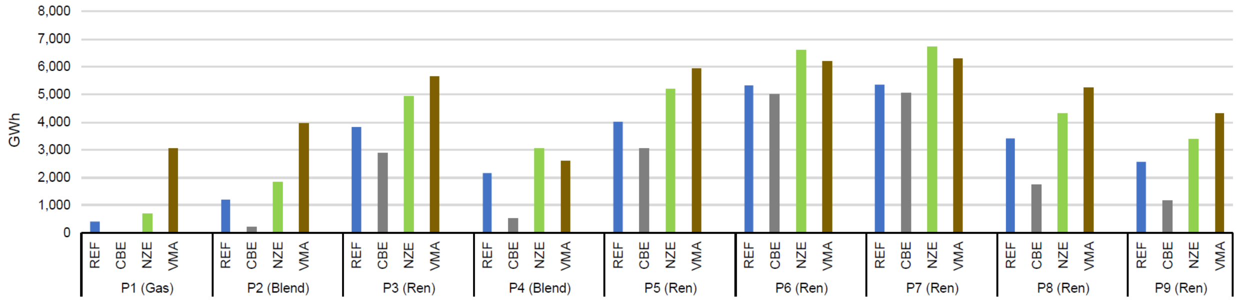
Key Observations – System Flexibility (Market Purchases)

- P1 relies least on market purchases in all scenarios except VMA
- Blend portfolios (P2 and P4) generally have lesser reliance on market energy purchases compared to renewable portfolios
- P6 and P7 rely more heavily on energy market purchases to meet load
- Of the renewable portfolios (P5-P9), P9 appears to rely less on market energy purchases.

Review of Portfolio Performance under Scenarios and Sensitivities

2030 Market Purchases – By Scenario and Portfolio

2030 Gross Market Purchases (Annual Total)



- Natural gas prices have a significant impact on market purchases:
  - Market purchases are generally lower in the CBE scenario because CPS Energy's natural gas plants are expected to dispatch more, reducing purchases from the market. The impact is more muted in P6 and P7 due to the closures of two combined cycle plants by 2030.
  - Conversely, market purchases are generally higher in the VMA scenario where natural gas prices are high. This is despite lower electricity consumption in the scenario. High natural gas prices put gas-heavy portfolios at a disadvantage relative to ERCOT market prices.
- The NZE scenario generally leads to higher market purchases in all scenarios. This is due to lower ERCOT market prices combined with higher electricity consumption resulting from significant electrification growth.

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Key Observations – Environmental Sustainability

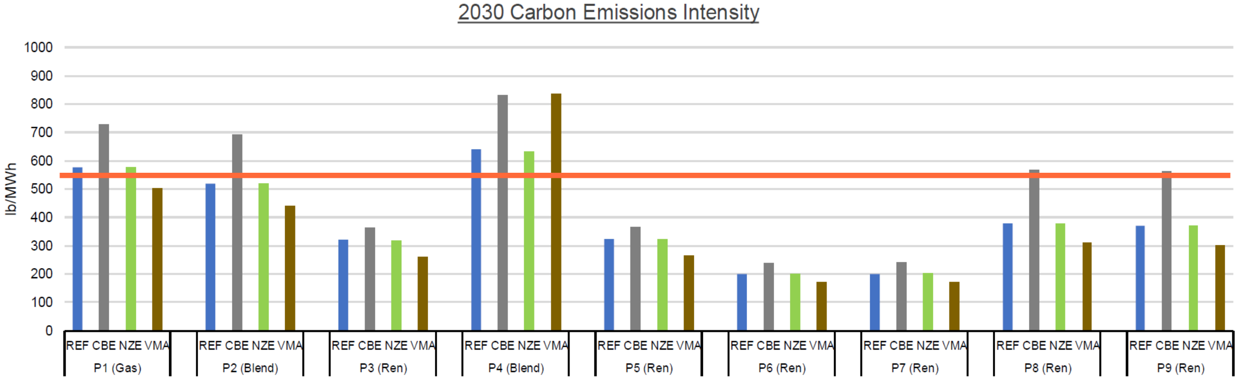
CAAP Goals & CPS Energy Carbon Intensity Metric		
Year	CAAP Goal Reduction (%)	CAAP Goal Carbon Intensity (lbs/mwh)
2016*	**baseline**	**920**
2030	41	543
2040	71	267
2050	100	0

*baseline year for the CoSA CAAP GHG Inventory is 2016

- For 2030, P4 appears not to meet the 2030 CAAP goals
- P6 and P7 have the lowest levels of emissions across all scenarios and exceed 2030 CAAP goals
- P1 is above CAAP goals for the CBE Scenario and is generally close to the CAAP goal for the REF and NZE scenarios. It exceeds CAAP goals under the VMA scenario
- Emissions for other portfolios generally fall in between

Review of Portfolio Performance under Scenarios and Sensitivities

2030 Carbon Emissions Intensity – By Scenario and Portfolio



- The CBE scenario generally results in the highest emission intensity for all portfolios (except P4). This is because low natural gas prices and no carbon prices lead to higher gas plant capacity factors.
- The VMA scenario generally has the lowest emission intensity across all portfolios (except P4). This is because high natural gas prices lead to lower gas generation and more market purchases. In P4, emission intensity is high because of higher coal generation from the two Spruce units, as coal is more competitive relative to natural gas.

Note: ERCOT-average CO2 emissions intensity in 2030 is projected to be 557 lb/MWh in REF, 650 in CBE, 504 in NZE, and 532 in VMA

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Key Observations – Affordability

	Affordability				
	Average Energy Cost ($/MWh)				
	Reference Scenario ($/MWh)	Carbon Based Economy ($/MWh)	Net Zero Economy ($/MWh)	Volatile Market ($/MWh)	Extreme Weather ($/MWh)
	2023 -2030	2023 -2030	2023 -2030	2023 – 2030	2023 – 2030
P1	$58.07	$52.33	$56.89	$59.85	$57.30
P2	$60.04	$54.57	$58.54	$62.92	$60.21
P3	$60.58	$55.95	$57.71	$63.08	$65.07
P4	$59.16	$53.15	$57.51	$60.60	$59.48
P5	$60.47	$55.09	$56.57	$61.53	$65.03
P6	$65.34	$61.12	$60.85	$68.59	$68.13
P7	$65.96	$61.71	$61.40	$69.23	$68.81
P8	$60.67	$54.82	$56.17	$62.15	$63.56
P9	$58.64	$53.58	$55.94	$59.38	$61.70

Legend: Less Favorable — More Favorable

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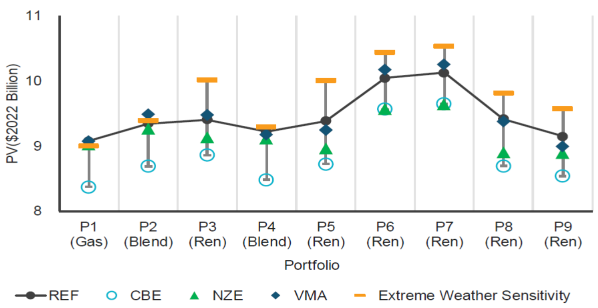
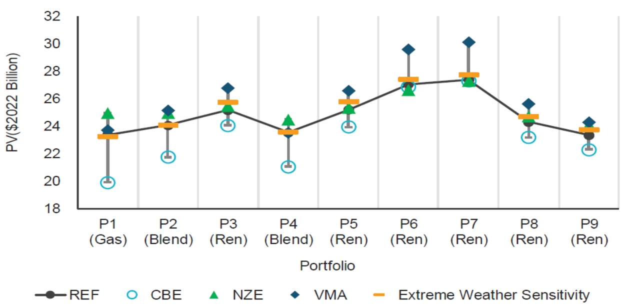
Review of Portfolio Performance under Scenarios and Sensitivities

Present Value (PV) of Revenue Requirements – All Scenarios + Extreme Weather





- In the short term, gas and carbon prices drive the ranges of revenue requirements. Portfolios with more gas capacity benefit more from low gas prices in CBE. Portfolios with more renewable capacity benefit from the faster decline in renewable costs in NZE.
- Over the long term, the risks to revenue requirements are skewed higher for P6 and P7. This is driven by a slower-than-expected decline in renewable costs in VMA, and lower revenues from market sales as ERCOT market prices are suppressed by high renewable penetration in NZE. The risks are skewed lower for P1, P2, and P4 as these portfolios benefit from low gas prices in CBE.
- Both P1 and P4 face the highest cost increases in NZE due to the escalating carbon price, but P4 is hedged against high natural gas prices in VMA because it retains coal.

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- Average energy costs (2023-2030) is another measure to assess bill impacts and affordability
- P1 has the lowest average energy price range across scenarios and also has the least spread in costs across all scenarios indicating better price protection to customers
- P3 has the lowest energy cost in the CBE scenario, but also has the widest spread across all scenarios and extreme weather sensitivity indicating higher price volatility and associated risks
- P6 and P7 generally tend to have higher costs across all scenarios and the extreme weather sensitivity
- Amongst renewable portfolios (P5-P9) P9 tends to have a lower overall cost

Key Observations – Work Force Impact

- In general, retiring fossil fuel based generating units with renewable energy resources can have impacts on the work force
- Renewable resources like wind and solar projects require less people to operate and maintain
- Renewable resources are likely to be more geographically dispersed
- P1, P2 and P4 will likely have the least impact on CPS Energy jobs due to continued operations of existing units or for adding new gas resources, which are expected to be local resources

Integrated Scorecard Summary

Key Observations from Portfolio Metric Results

	Workforce Impact	
	CPS Energy Workforce Impact	Local Economic Impact
	# of Impacted CPS Energy Generation Employees	Capital expenditures for new generation capacity built in greater San Antonio area ($Millions)
	2030	*2023 – 2030*
P1	155	2,758
P2	170	2,004
P3	345	1,310
P4	90	1,787
P5	355	866
P6	355	4,041
P7	355	4,041
P8	295	548
P9	295	548

Note:
1. Lighter shade means "more favorable."

Workforce Impact

- CPS Energy Workforce Impact
  - P4 has the lowest impact on CPS Energy jobs, due to continued operations of both Spruce units and fewer capacity retirements by 2030. New gas plants allow CPS Energy to re-deploy employees from retired plants.
  - P3, P5, P6, and P7 have the largest impact on CPS Energy jobs due to earlier retirements of CPS Energy-owned power plants.
- Local Economic Impact
  - P6 and P7 have the highest capital expenditures in the local area, driven largely by new geothermal capacity.
  - P1 and P2 include the most near-term gas additions, which are expected to be constructed in the local region.
  - Although P5, P8 and P9 add significant renewable capacity, it is expected that most wind and solar would be sited outside of the greater San Antonio area.

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1898 & Co. Opinion: The metrics used to evaluate portfolios and scenarios are consistent with typical long term power supply study

Key Observations – Scorecard

- Color scheme used to highlight relative portfolio performance for each metric
- Individual portfolio performance for different scenarios not specifically mentioned
- Not aware of assigning weights and scoring of portfolios for individual scenarios
- Classification of risk for all portfolios and scenarios summarized as high, medium and low. However, classification guidelines are not clearly defined

Integrated Scorecard Summary

Portfolio Metric Results

	System Reliability & Climate Resiliency				Environmental Sustainability				Affordability				System Flexibility		Workforce Impact	
	Diversity of Generation Mix	Capacity Headroom	Extreme Weather Exposure		Progress Towards City of SA CAAP Goals				Energy Cost ($/MWh)		Present Value (PV) Revenue Requirements		Market Purchases	Dispatchability	CPS Energy Workforce Impact	Local Economic Impact
	Generation Mix (MWh)	Expected Reserve Margin (%)	Rev. Req. Extreme Weather ($Billion)	% of CPS Energy consumption that is met through ERCOT market purchases	% CO2 Intensity Reduction Relative to 2016 (Ref Scenario)	Emission Intensity (lb CO2/MWh)		% reduction in consumption due to STEP	Reference Scenario Average Cost ($/MWh)	Range in Cost in *all* Scenarios ($/MWh)	Ref Scenario ($Billion)	Range Across *all* Scenarios ($Billion)	% of CPS Energy consumption that is met through ERCOT market purchases	% of CPS Energy Capacity that is Dispatchable	# of Impacted CPS Energy Generation Employees	Capital expenditures for new generation capacity built in greater San Antonio area ($Millions)
	2030	2030	2030	2030	2030	2030	2040	2030	2023 - 2030		2023 – 2030	2023 – 2030	2030	2030	2030	2023 – 2030
P1		13.7%	$1.70	1.0%	37%	578	547	9.7%	$58.07	$52-60	$8.58	$7.87-8.58	1%	61%	155	$2,758
P2		15.7%	$2.04	3.1%	44%	518	350	9.7%	$60.04	$55-63	$8.85	$8.19-8.99	4%	57%	170	$2,004
P3		14.5%	$3.26	12.8%	65%	321	161	9.7%	$60.58	$56-63	$8.90	$8.36-8.98	13%	46%	345	$1,310
P4		15.3%	$2.02	6.1%	30%	641	361	9.7%	$59.16	$53-61	$8.72	$7.99-8.72	7%	63%	90	$1,787
P5		15.0%	$3.28	13.5%	65%	325	161	9.7%	$60.47	$55-62	$8.88	$8.23-8.88	13%	46%	355	$866
P6		13.2%	$3.27	19.6%	78%	200	31	9.7%	$65.34	$61-69	$9.54	$9.07-9.68	18%	39%	355	$4,041
P7		13.1%	$3.34	19.7%	78%	202	35	9.7%	$65.96	$61-69	$9.63	$9.14-9.76	18%	39%	355	$4,041
P8		15.4%	$2.79	11.2%	59%	378	160	9.7%	$60.67	$55-62	$8.92	$8.20-8.92	11%	48%	295	$548
P9		14.6%	$2.69	7.9%	60%	371	160	9.7%	$58.64	$54-59	$8.65	$8.04-8.65	9%	46%	295	$548

Nuclear · Geothermal · Coal · Gas · Gas Toll · Wind · Solar · Other · Storage · Hydrogen · Energy Efficiency

Legend: Less Favorable — More Favorable

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1898 & Co. Opinion: The metrics used to evaluate portfolios and scenarios are consistent with typical long term power supply study

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Key Observations

- The study approach seems reasonable
- The assumptions used in the analysis appear reasonable
- The capacity values of renewable resources appear reasonable
- The results of the scenario and portfolio analysis looks reasonable
- No single portfolio performs the best under all scenarios and sensitivities implying that there is a tradeoff between risk and cost and an optimum portfolio needs to be decided by weighing in all factors
- Replacing existing resources with new resources has a cost impact. This shows up especially in P6, where all gas resources are shut down by 2035.
- P1 and P2 perform better across different scenarios and sensitivities compared to P6 and P7 and other renewable portfolios which indicate that CPS Energy gas and coal resources provide good value for CPS Energy portfolio
- Renewable portfolios have a lower emission profile compared to P1 and blend portfolios but are more costly
- Amongst renewable portfolios, P9 costs appear to be less volatile and hence has a lower risk profile

Recommended Portfolio

- No single portfolio performs the best under all scenarios and sensitivities implying that there is a tradeoff between risk and cost and an optimum portfolio needs to be decided by weighing in all factors
- Amongst all portfolios P1, P2, P4 and P9 generally appear to perform better compared to other portfolios across the five broad categories. Amongst these, P4 continues to rely on coal throughout the study period
- Based on the above 1898 & Co. recommends RAC members to consider P1, P2 and P9 for possible options for their recommendation

Next Steps and Additional Analyses

- This study handled solar generation as is typically done for planning studies. Generation profiles have been developed based on historical trends and corelated weather patterns. Generation profiles have also been modified for the extreme weather sensitivity. However, future renewable generation remains uncertain. It could be a good practice in the future to build in renewable generation variability over time that include more low generation event occurrences with longer durations based on historical information
- The assumptions in the extreme weather sensitivity case addresses the variation in renewable energy generation and capacity factors for 2030 only but in addition to that, the other critical risk around renewable generation is number of occurrences and occurrence durations for low generation events, especially for wind.
- Assess the impact of recent capital cost inflation trends in the assumptions for new technologies, something that may not have been possible given the timing of the study