1898 & CO.

PART OF BURNS McDONNELL

Preliminary Review of Information

RAC of CPS Energy
November 17, 2022

Agenda

Areas of Review

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

Development of Scenarios, Portfolios and Sensitivities

Economic Screening / Cost-Benefit Evaluation

Power Supply Plan

Typical Power Supply Study Approach

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

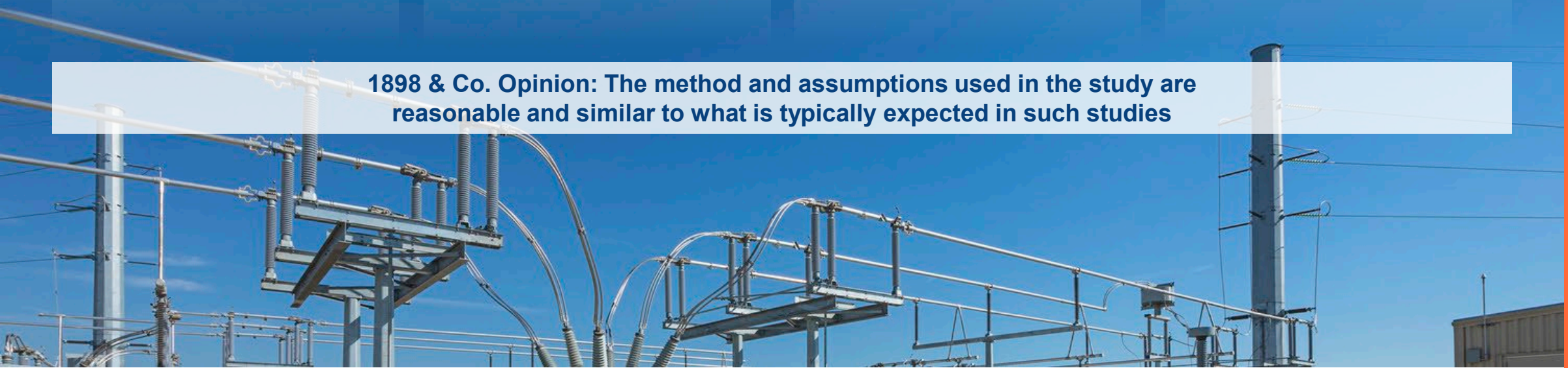
Typical Analyses in Addition to Reference Scenario

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

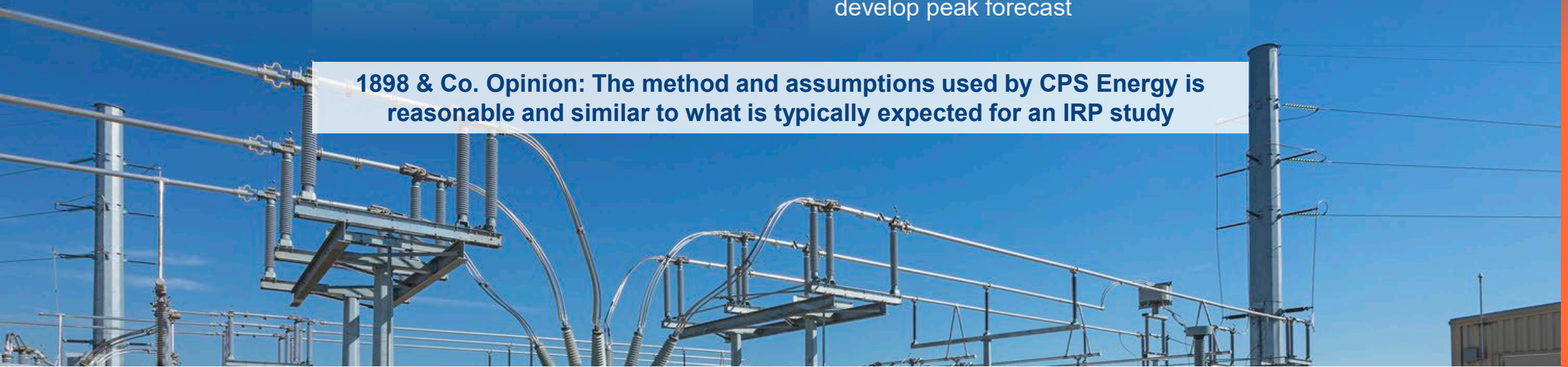
Bottom-Up Approach

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

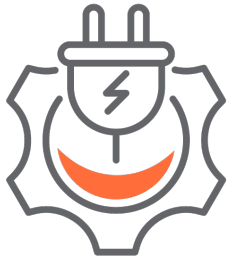
Existing Resources

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

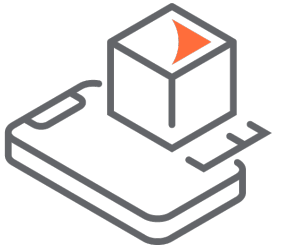
New Technology Assessment

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.

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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CRA Charles River Associates

Inputs

CPS Energy Scenarios

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

Results
(To be completed)

Key Results

- Expansion plan across portfolios
- Unit level information
- Matching outputs to input assumptions
- Reserve margin
- Unit retirements
- Expected Capacity Factor (CF) for resources
- Emission rates (lbs/mmbtu)
- Total emissions
- Fuel costs
- O&M costs

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