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Form 4 Demand Forecast Methods and Models

Forecast Area

The REU Load Forecast is developed for the REU Service Territory. Currently, there is no Direct Access or Community Choice Aggregations within the REU Service Territory. The assumption is this will persist throughout the forecast period. Additionally, it is assumed that there will be no Departed Load or Local Private Supply in the forecast period.

Energy Forecasting Method

The REU Energy Forecast is developed using a bottom-up modeling approach. Residential sales are forecasted as the product of the customer and use per customer model forecasts. Business class sales are forecasted directly using monthly sales models.

The class level forecasts are segmented into heating, cooling, and base load component outputs and integrated into a monthly model of system energy. The result is a system energy forecast which comprehensively integrates the driving factors of energy usage.

Peak Forecasting Method

The REU Peak Forecast is developed using outputs from the system energy forecast and peak producing weather conditions.

Customer Forecasts

Class Sales Forecasts are developed for the following customer classes:

- R1 (Residential Standard)
- RL (Residential Lifeline)
- RM (Residential Master Metered)
- C (Commercial)
- I (Industrial)
- M (Time Metered)
- F (Fixed Usage)

Economic and Demographic Inputs

Economic variables were selected to drive class-level sales forecasts. The table below illustrates the economic variables selected to drive each class-level model.

The list below defines the table mnemonics:

- HH (Households)
- Pop (Population)
- Emp (Non-Farm Employment)
- HHS (Household Size – People per Household)
- Real Price (Real Electric Price)

A red X indicates the variable was used in the customer model, a yellow X indicates it was used to drive the sales model, and the black X indicates it was used to drive both the customers and sales models.

Input	R	C	I	M	F
HH	X				
Pop		X			X
Emp		X	X		
HHS	X				
Real Price	X	X	X		

In addition to economic inputs, end use inputs were used in the Residential Use / Customer model. The end use inputs were developed through the interaction of saturation and efficiency indices.

Economic Data Sources

The list below defines the raw data source for the economic inputs:

- Population (Department of Finance)
- Non-Farm Employment (California Employment Development Department)
- CPI (US Bureau of Labor Statistics)

Household Size is inferred based on Population and REU Residential Customers. Households align with REU Residential Customer historically. In the forecast, Households are inferred based on the Population and Household Size forecast.

End Use Data Sources

End Use Saturation and Efficiency trends were developed based on the EIA's Annual Energy Outlook End Use Forecast for the Pacific Region.

Energy Efficiency Integration

The assumption inherent in the load forecasting models is the energy efficiency program impacts are to maintain their historical pace in the forecast period.

Distributed Energy Resources

The REU Load Forecasting process has been expanded to encompass the integration of DER Forecasts of Solar PV and Electric Vehicles. The Solar PV Forecast involves first projecting Solar Adoption in terms of Capacity (KW). Next a Capacity Factor value is applied to convert the capacity forecast into sales (KWh). Similarly, the Electric Vehicle Forecast involves first projecting the number of Electric Vehicles. Next, an estimate of KWh/EV/Day is applied to convert to a sales forecast (KWh).

Forecast Reasonableness

The forecast integrates economic, demographic, prices and energy efficiency, and climate change assumptions. Forecast reasonableness is assessed based on its

alignment with recent weather normalized growth rates for REU, as well as national and regional projected growth rates from industry surveys.

Historical Forecast Performance

The methods described above have been implemented successfully at other utilities throughout California and the rest of the United States. REU began implementing this approach in 2016, updating its load forecasting approach to be consistent with industry standard practice. The table below depicts the WN Forecast variance since the inception of the new framework.

Year	WN Forecast Variance (WN Actual - Forecast)
2016	1.0%
2017	-0.6%
2018	-1.7%

Weather Adjustment Procedures

The REU weather adjustment process uses data inputs from the Redding Airport weather station. Monthly Heating and Cooling Degree-Day variables (HDDs and CDDs) are used to adjust the weather sensitive class forecasts for normal weather. Normal Monthly HDD's and CDD's were computed over a 10-year calculation range of 2009 – 2018.

Monthly Peak Forecasts are adjusted based on the weather occurring on the day of the peak and two prior days. Monthly Peak HDDs and CDDs are developed by extracting the maximum and average temperature on the day of the peak and two prior days. Cooling Peaks are projected using CDDs defined based on Effective Temperature (50% Average Temperature and 50% Maximum Temperature), while Heating Peaks are projected using HDDs defined based on Average Temperature. Normal Monthly Peak HDDs and CDDs are computed over a 10-year calculation range of 2007 – 2016.

Forecast Calibration Procedures

The forecast models use an ordinary least square regression algorithms to calibrate to historical energy and peak values and estimate model input parameters.

Energy and Peak Loss Estimates

REU System Energy and Peak are forecasted directly. The assumption implicit in the models is the historical average monthly loss factors for energy and peak remain constant throughout the forecast period.

Economic and Demographic Projections

The economic and demographic projections were developed internally. Based on internal discussions, a reasonable employment forecast was developed. The employment forecast sources the Net Migration forecast, which sources a Population Cohort Survival model, driving the Population Forecast.