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Filer:	Alicia Zaloga
Organization:	EQ Research LLC
Submitter Role:	Intervenor Consultant
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Form 4 - Demand Forecast Methods and Models for San José Clean Energy

Geography

San José Clean Energy (SJCE) is a single jurisdiction community choice aggregator operated by the City of San José that has provided electricity service to municipal, commercial, industrial, and residential accounts within the jurisdiction of the city since 2019.

Customer Classes

SJCE customer classes include residential, commercial, industrial, agricultural, streetlights and traffic lights. **Table 1** below maps the IEPR reported sectors, customer class groupings used for forecasting, and rate groups.

Table 1: SJCE Customer Classes

IEPR Sector Grouping	SJCE Customer Class	SJCE Rate Group[1]
Residential	Residential	Res
Commercial	Small Commercial	A1, A6
	Medium/Large Commercial	A10, E19P, E19S
Industrial	Industrial	E20P, E20S, E20T
Agricultural	Agricultural	AG
Street Lights	Street Lights	LS1
Traffic Lights	Traffic Lights	TC1

Data, Methods and Models

SJCE's most recent long-term demand forecast process uses statistical models based upon historical monthly net electricity demand and meter count data by SJCE customer class, historical weather data for the City of San José, and economic and demographic data specific to the City of San José or the San José-Sunnyvale-Santa Clara MSA.

Demand Data

SJCE's long-term forecast process used historical monthly demand and meter count data for the period of January 2021 through September 2024. Note that SJCE began to serve residents and commercial businesses in 2019 with additional rollouts continuing through early 2021 which resulted in significant changes to load and meter count that are not consistent with more current history. Therefore, data prior to 2021 was excluded from sales model estimation. For peak demand model estimation, only 2019 was excluded. **Figure 1** and **Figure 2** below illustrate SJCE's total monthly energy and peak demand history, respectively.

[1] https://sanjosecleanenergy.org/commercial-rates/#rates.

Figure 1: SJCE Historic Monthly Sales

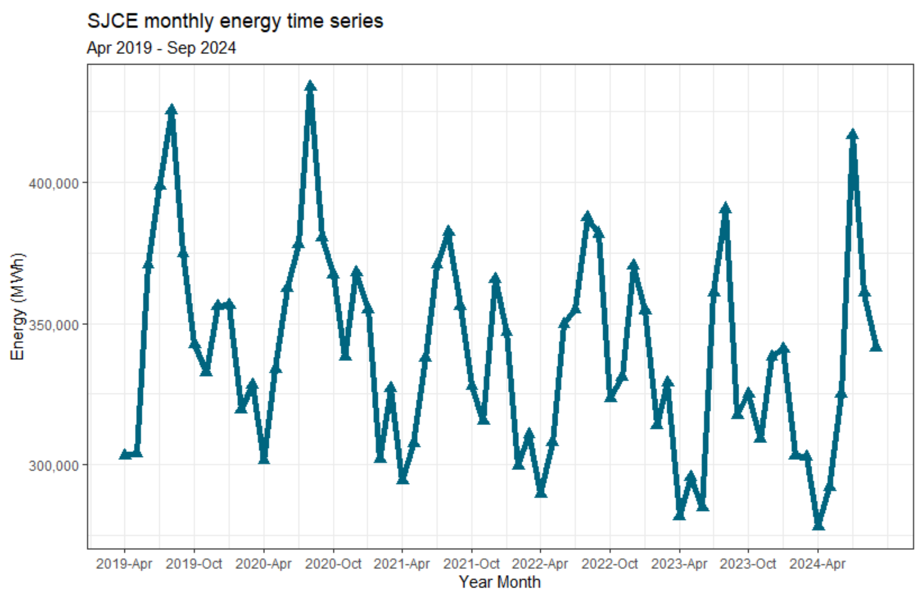
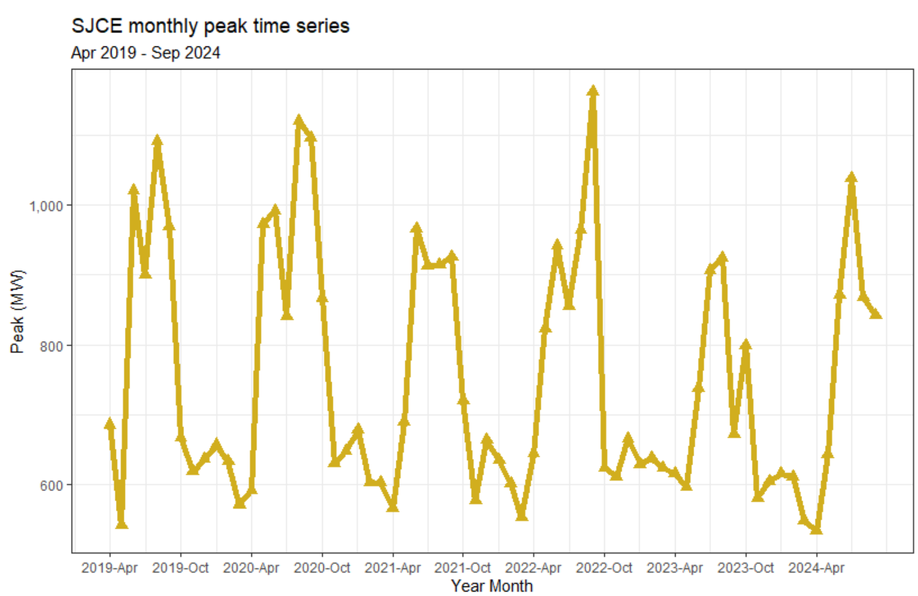


Figure 2: SJCE Historic Monthly Peak Demand



Weather Data, Weather Normalization, and Climate Change

20 years of historical weather data was collected from the San José International Airport weather station, KSJC, to use in weather sensitive forecasting models. Normalized net electricity demand forecasts by sector were generated by simulating the 20-year weather history through the estimated models and selecting the median value of these simulations as the 1-in-2 weather normal forecast. A similar process was used to normalize the peak demand forecasts but using actual peak day temperatures as they occurred and maximum monthly temperatures from the 20-year weather history.

Economic and Demographic Data

Historical economic and demographic data was collected from the FRED online database and the California Department of Finance.[2] Monthly economic and demographic forecasts were developed using historical trends, household and commercial/industrial floorspace projections from the City of San José Planning Division, and economic projections from the June 2024 UCLA Anderson Forecasts for California.[3] [4] The primary economic and demographic drivers used in SJCE's forecasts are total population, total households, commercial/industrial floorspace, and sector employment.

Methods and Models

Seven monthly net energy forecast models were developed by customer class grouping: residential, small commercial, medium/large commercial, industrial, agricultural, streetlights, and traffic lights. Sector peak demand was developed using an hourly shaping process along with a monthly total peak demand model.

Residential

The residential energy demand forecast was prepared using an econometric model specified to estimate net energy demand per residential meter as a function of CDD, HDD, persons per household for the City of San José, and seasonal dummy variables. The forecast for residential energy demand per meter was generated using projections of persons per household. The total residential energy demand forecast was then derived by multiplying the forecasted energy per meter by the total number of projected residential meters. Residential meters were forecasted to grow at a similar rate as the total household projection for the City of San José.

Small Commercial

The small commercial energy demand forecast was generated using an econometric model specified to estimate net energy demand per small commercial meter as a function of CDD, HDD, small commercial employment, and seasonal dummy variables.[5] Once the model was estimated a forecast of small commercial energy demand per meter was prepared using projections of small commercial employment. The total small commercial energy demand forecast was then derived by multiplying the forecasted energy demand per meter by a projection of the total small commercial meters. The forecast for total small commercial meters was developed using projections of commercial floorspace by the City of San José Planning Division and an assumption for commercial floorspace per building (as proxy for floorspace per meter) from EIA's 2018 Commercial Building Energy Consumption Survey, approximately, 16,000 sq ft per meter. [6]

Medium/Large Commercial

The medium/large commercial energy demand forecast was generated using an econometric model specified to estimate net energy demand per medium/large commercial meter as a function of CDD, large commercial employment and seasonal dummy variables.[7] Once the model was estimated a forecast of medium/large commercial energy demand per meter was

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[2] https://fred.stlouisfed.org.
[3] https://www.anderson.ucla.edu/about/centers/ucla-anderson-forecast.
[4] https://www.sanjoseca.gov/your-government/departments-offices/planning-building-code-enforcement/planning-division/development-data/activity-highlights-five-year-forecast.
[5] Small commercial employment was defined as employment for retail and leisure/hospitality sectors.
[6] https://www.eia.gov/consumption/commercial.
[7] Total employment excluding construction, manufacturing, mining, and retail employment.

generated using projections of large commercial employment. The total medium/large commercial energy demand forecast was then derived by multiplying the forecasted energy demand per meter by a forecast of the total medium/large commercial meters. The forecast of total medium/large commercial meters was developed using the same process described above for small commercial meters. Note that HDD was not included in this model due to finding little statistical significance during model fitting. It seems reasonable that larger commercial building customers rely more heavily on gas for heating in cooler months and therefore electricity demand for this group is less responsive to HDD, but this assumption will need further evaluation as building electrification efforts continue to develop.

Industrial

The industrial net energy demand forecast was generated using an econometric model specified to estimate total net energy demand for industrial customers as function of CDD and seasonal dummy variables. The industrial meter forecast was developed using a historical estimate of industrial floorspace per meter and projections of total industrial floorspace from the City of San José Planning Division. Note that no economic driver such as industrial sector employment was used for this forecast since modeling showed little statistical significance. This result was not a surprising result since industrial energy demand has an established reputation for being difficult to predict. Although a linkage between economic activity and industrial energy demand will continue to be investigated, SJCE's current forecasting method for this sector appears reasonable given the historical variability in energy demand for this sector.

Agricultural and Lighting

The agricultural net energy demand forecast is a fixed value based on the average of the most recent months of historical demand data, while the street light and traffic light forecasts were generated using independent exponential smoothing models using season and trend where applicable. The agricultural and lighting classes are not expected to deviate significantly from recent history.

Peak and Hourly

Hourly load forecasts were produced by shaping the monthly energy forecasts. Hourly shaping factors were developed by month and typical temperature week for the residential, small commercial, large/medium commercial, and industrial sectors. As such the load shapes reflect at least one hot week and one cool week in each month for each sector. The monthly energy forecasts were then dispersed by the forecasted load shapes. Hourly agricultural and street/traffic lighting loads were based on seasonal averages. Following the shaping, the hourly forecasts were calibrated based on a monthly peak demand model that used the forecast of the share of total energy demand from the weather sensitive sectors (residential and commercial) and actual peak day temperatures as key explanatory variables.

Forecast Comparison

Figure 3 and **Figure 4** compare annual sales and peak demand forecasts for IEPR 2023 and IEPR 2025 submissions. Compared to IEPR 2023, the current retail sales forecast begins lower and shows less growth over time. This new trend is explained by less optimistic outlooks for population, household, and commercial floorspace growth compared to IEPR 2023. More modest outlooks for these econ/demo drivers also resulted in slower residential sales growth which account for nearly 40% of SJCE's annual sales. When comparing peak demand results, we also see a lower starting level and somewhat less long-term growth compared to IEPR 2023. This is the result of a lower share of weather sensitive load compared to IEPR 2023, primarily due to less expected residential demand, and the addition of more peak demand history. In

IEPR 2023, peak demand modeling only included data from early 2019 through 2022 which saw relatively high peak demand loads compared to current history. Incorporating additional history for peak demand model estimation appears to suggest that normalized peak demand was overestimated for IEPR 2023 but the weather and peak demand relationship will continue to be investigated as more historical data is gathered.

Figure 3: SJCE IEPR Retail Sales Forecast Comparison

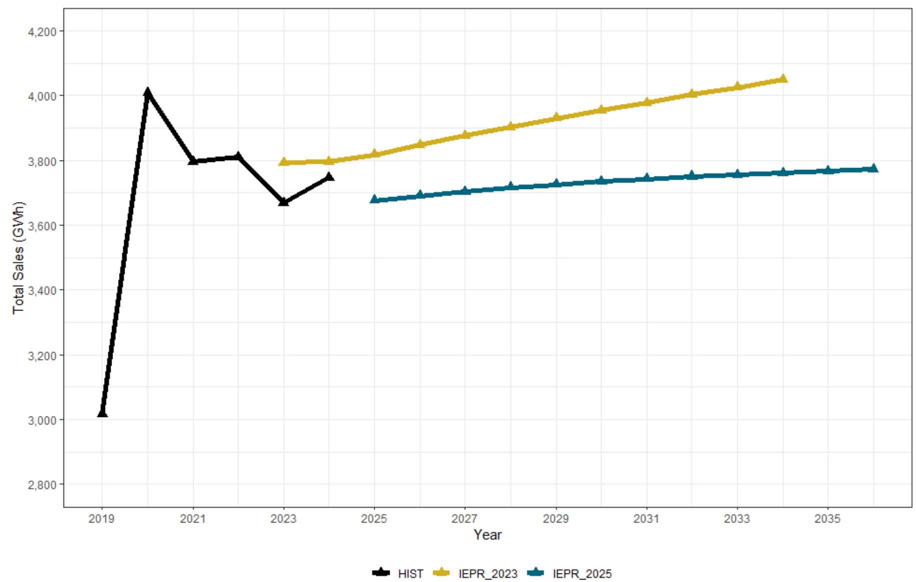
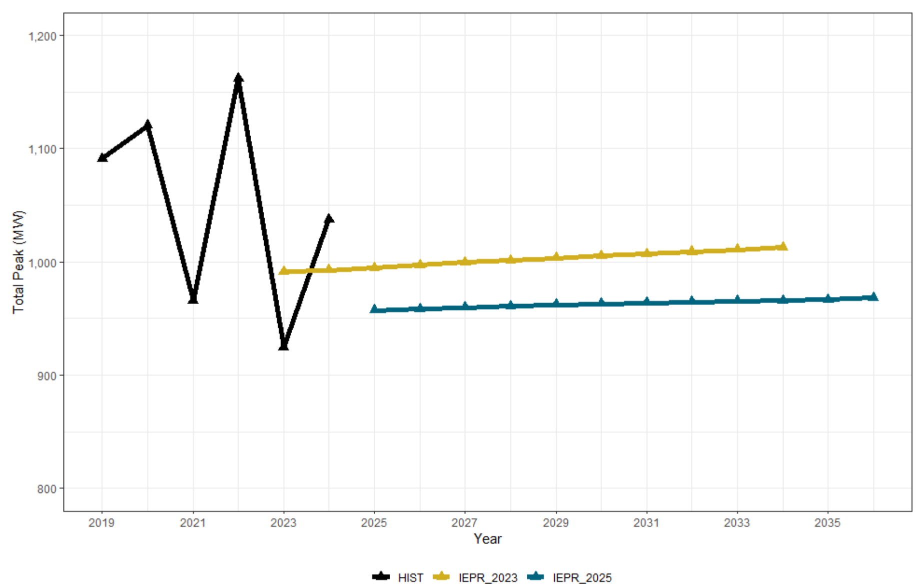


Figure 4: SJCE IEPR Peak Forecast Comparison



Additional Load Modifiers

Since SJCE's forecast for 2025 was based upon statistical models using historical load data from 2021 to late 2024, the impacts of load modifiers such as residential time of use rates and natural market adoption of building electrification technologies and battery storage were assumed to be captured in the historical data and carried forward through the forecast period. These and other potentially significant load modifiers will continue to be evaluated in future forecasting efforts.

PV: SJCE is not including any load modification from PV installations because there are no current or future SJCE programs that would encourage installations to increase beyond the current market trends, which are assumed to already be captured in SJCE's load forecast.

Battery Storage: SJCE is only submitting expected impacts from its Ecohome Battery Storage Rebate program, which aims to install 380 residential home batteries by the end of 2025, and an additional 480 batteries each year through 2028. Other battery storage installations in San Jose are assumed to already be captured in SJCE's load forecast. The most common battery installed in San Jose is the Tesla Power Wall, which has a total storage size of 13.5kWh. The program requires that all customers seeking a rebate must pair the battery with new or existing solar. Because batteries store energy, rather than generating it or consuming it, the annual MWh consumption is assumed to be zero. However, the batteries help reduce net consumption at customer homes during peak hours, so they still have an impact on peak demand. SJCE assumed 80% of the batteries nameplate capacity would be dispatched over a 4-hour period, resulting in a peak demand reduction of 2.7kW per battery. Incentives from SJCE's VPP: Peak Rewards will encourage customers to enroll and have their battery automatically dispatched to maximize net reductions during peak hours.

Building Electrification: SJCE is only submitting expected impacts from its building electrification programs. Other building electrification installations in San José are assumed to be already captured in SJCE's load forecast. SJCE provides a rebate program and zero interest loan program to support the adoption of heat pump water heaters and HVAC systems. The programs aim to install 750 heat pumps per year through 2028. For years 2025 and 2026 it is assumed 65% of heat pumps installed through the program are HVAC systems and for years 2027 and 2028 it is assumed all heat pumps installed through the program are HVAC systems. Per unit heat pump electricity usage and peak demand for San José's climate zone were collected from the California Energy Commission's Single Family Heat Pump Documentation for the 2022 Energy Code Update Rulemaking.

Transportation Electrification/Electric Vehicles: SJCE expects load growth from transportation electrification as the City of San José advances its goal of achieving carbon neutrality by 2030. To support this transition, SJCE is developing several programs, including a direct current fast charging hub pilot to expand access in low-income and disadvantaged communities, and an EV incentive program to increase adoption among low- and moderate-income residents. Because these programs are still under development, SJCE is not including a transportation electrification load modifier in this IEPR demand forecast filing. SJCE plans to incorporate the impacts of these efforts into future submissions once program elements are finalized and associated load growth can be more accurately quantified.

Data Centers: SJCE followed the forecasting methodology presented by the CEC in a Demand Analysis Working Group meeting.[8] SJCE first selected data centers visible to the city, SJCE expects 7 data centers across multiple projects to be built by 2029. Due to a lack of visibility on the status of data center applications, SJCE assumed all visible data centers were under "Group 1: Active applications with completed or to-be completed engineering studies" and therefore applied a 70% confidence level to the nameplate capacity of all selected data centers.

To get the estimated peak load, SJCE then applied the CEC's ramping schedule that assumes each data center starts at 5 MW and ramps up year-over-year until the capacity requested is reached. A 149% year-over-year increase was applied in years 0-5, while a 113% year-over-year increase was applied in years 6+. Finally, SJCE applied a peak demand factor of 67% to calculate its data center peak load estimates.

To improve the accuracy of future IEPR load forecasts and better align resource planning with data center development and transmission build-out, SJCE strongly encourages greater data transparency and coordination between IOUs and other entities intending to serve new, large load customers such as data centers. Access to timely, detailed interconnection and service request information would significantly enhance SJCE's ability to assess potential data center load internally.

Finally, given the significant uncertainty around if and how data center loads will materialize, SJCE urges a cautious approach in future IEPR forecasts when assigning expected data center load to individual LSEs. Overstating anticipated load based on speculative development could lead to premature procurement obligations and create significant affordability risks for existing customers. Data center additions to load forecasts should reflect demonstrated progress on permitting, interconnection, and customer commitments to ensure procurement targets are aligned with actual, confirmed load.