Insights on Electricity (Overall & Household) Market in Singapore: Forecasting Future Electricity Demand & Prices

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Introduction & Problem

Modern society is deeply dependent on electricity – so much so that even brief blackouts can bring daily life to an immediate halt. In that regard, electricity can be said to be the invisible backbone of modern society, and Singapore is no exception.

Singapore's electricity market is a critical pillar of its economy and daily life, powering everything from homes and business to essential services. As a highly urbanised and energy-dependent nation with no natural resources, Singapore relies heavily on imported fuels, primarily in the form of natural gas, to generate electricity. This reliance makes it particularly sensitive to price fluctuations and supply constraints.

In recent years, concerns about energy security, price volatility, and sustainability have come into much more focus. The global Liquefied Natural Gas (LNG) supply crunch in 2022 and rising oil prices have also raised questions about how insulated Singapore is from these shocks. At the same time, growing electricity demand, driven by population growth, digitalisation, and electrification, has added even more strain to the national grid.

Target Audiences

This report is designed to provide value and insights for three key stakeholder groups in Singapore's electricity landscape:

i. **Potential Investors and Energy Retailers**
   Seeking to understand current generation, consumption, and demand growth to assess opportunities for entry or expansion in Singapore's open electricity market
ii. **Policymakers and Public Sector Planners**
   Vested interest in ensuring system reliability, affordability, and long-term energy security amid rising demand and global fuel price volatility.
iii. **Residential Consumers**
   Looking to understand how electricity prices are determined, what factors influence electricity tariffs, and how to navigate the open electricity market in Singapore.

Objectives

i. Present a comprehensive overview of the electricity lifecycle — from generation to end-use consumption — and provide projections for total electricity consumption in 2025 and 2026.
ii. Analyse peak system demand relative to installed capacity, including forecasts of future peak demand. This helps identify growth opportunities in Singapore's power generation sector.
iii. Explore key indicators that shape the household electricity market, including Gross National Income (GNI), dwelling-type consumption trends, and environmental factors such as temperature.

iv. Build a predictive model to forecast low-tension domestic electricity tariffs, offering residential consumers insights to plan their electricity usage and potentially reduce utility costs.

Data Sources:

1. https://data.gov.sg/
    a. Electricity Generation, Monthly
    b. Electricity Generation and Consumption, Annual
    c. GDP in chained 2015 USD by Industry, Annual
2. Energy Market Authority (https://ema.gov.sg)
    a. Peak System Demand
    b. Generating Plant Availability
    c. Electricity Tariffs, Monthly
3. Federal Reserve Bank of St. Louis (https://fred.stlouisfed.org/)
    a. Global price of LNG, Asia (PNGASJPUSDM)
    b. Crude Oil Prices: West Texas Intermediate (WTI) - Cushing, Oklahoma (DCOILWTICO)
4. Monetary Authority of Singapore (https://mas.gov.sg)
    a. Exchange Rate (USD to SGD)

Data Dictionary:

Dataset	Source	Key Variables	Description	Usage
Electricity_annual.csv	1	electricity_generation_GWh electricity_consumption_GWh	Electricity generated annually, in GWh Electricity consumed annually, in GWh	For visualisations and projection of future consumption
tariff_oilgas_quarterly.csv	2, 3, 4	low_tension_domestic sgd_per_usd oil_price_sgd_barrel lng_price_sgd_MMBtu	Low tension supplies-domestic tariff prices (in cents/KWh), exchange rate USD:SGD, oil prices in sgd/barrel, LNG prices in SGD/MMBtu	For predicting tariff, LNG, and oil prices.
Predicted.csv	2, 3, 4	predicted_tariff predicted_oil_sgd predicted_lng_sgd	Predicted values of : Low tension supplies-domestic tariff prices (in cents/KWh), oil prices in sgd/barrel, LNG prices in SGD/MMBtu	For visualisations, output of the prediction model.
predicted_consumption.csv	1	gdp_thousands_usd predicted_electricity_consumption	Annual GDP in thousands USD, predicted annual electricity consumption	For visualisations, output of the prediction model.
peakdemand_capacity.csv	2	peak_system_demand_mw outage_capacity_MW remaining_capacity_MW total_capacity_MW	-Peak system demand of the month (in MW) -How much capacity is under outage (in MW) -How much capacity is remaining (in MW)	For visualisations and predicting of future peak demand.

		percentage_capacity_available lowest_scenario_capacity_MW peak_demand_lowest_capacity_ratio peak_demand_remaining_capacity_ratio	-Total capacity (in MW, = outage + remaining) -Percentage capacity available (remaining/total capacity) -Lowest capacity (based on historic lowest percentage capacity available * total capacity) -Peak demand as a ratio to lowest scenario capacity -Peak demand as a ratio to remaining capacity	
Predicted_demand.csv	2	predicted_peak_demand	Predicted peak demand	For visualisations, output of the prediction model.

Electricity Generation, Consumption, and Consumption Prediction

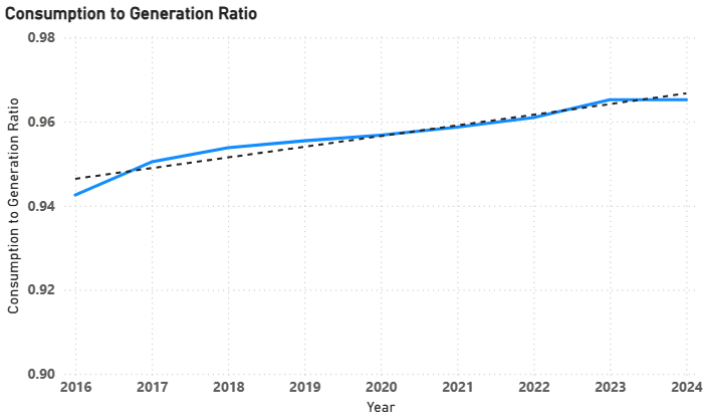

Figure 1: Electricity Consumption to Generation Ratio

The consumption-to-generation ratio has shown a steady increase over the years, indicating that a greater proportion of generated electricity is being effectively utilised. This trend is a positive sign, as it suggests reduced energy losses from factors such as transmission resistance, heat dissipation, and inefficient or poorly maintained infrastructure.

Initial analysis suggested a linear trend in the data, leading to the use of linear regression for forecasting. Given the time series nature of the data, an ARIMA model was also applied. The ARIMA model demonstrated significantly superior performance, achieving **a lower RMSE of 204 compared to 832** for the linear regression model. Based on the ARIMA forecast, electricity consumption is projected to reach 58.1 TWh in 2025 and 59.2 TWh in 2026.

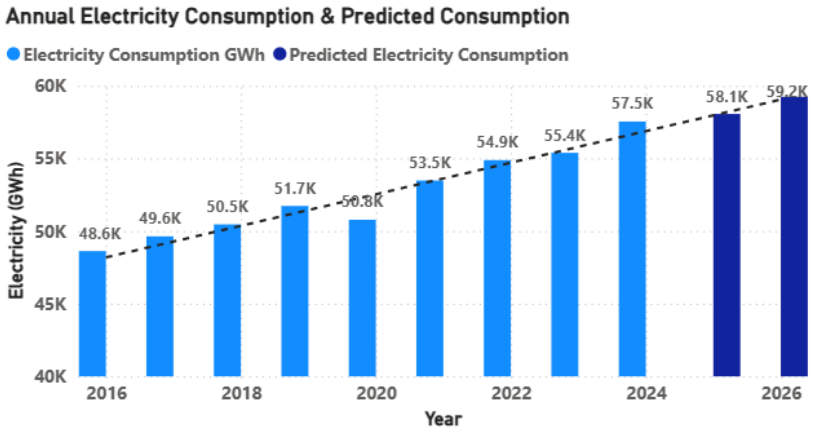

Figure 2: Electricity Consumption and Consumption for 2025 and 2026 Predicted by ARIMA model

Electricity Peak Demand and Capacity

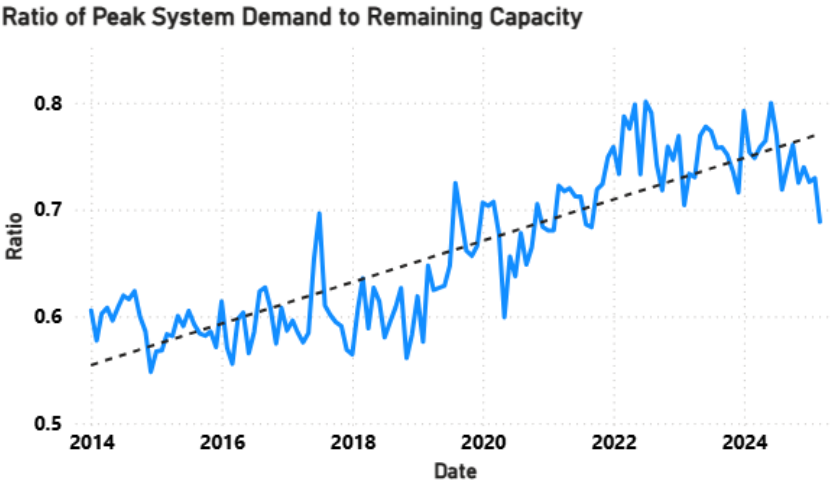

Figure 3: Ratio of Peak System Demand to the Remaining Capacity

The ratio of peak system demand to remaining capacity has gradually increased over time. This indicates that the highest electricity demand at any point is taking up a larger share of the available generation capacity — accounting for plant outages. If this trend continues, there is a growing risk that peak demand may eventually exceed the system's remaining capacity, potentially leading to supply constraints or reliability concerns.

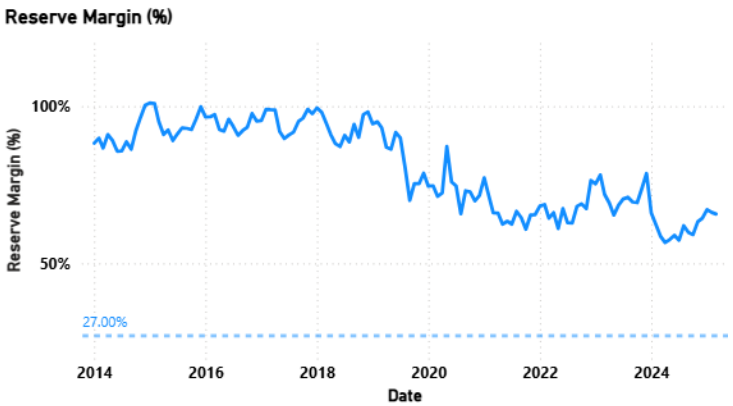

Figure 4: Reserve Margin over time

To ensure a stable and reliable power system, a buffer—known as the reserve margin—is maintained between available generating capacity and peak electricity demand. This margin provides critical headroom to manage unforeseen surges in demand, generator outages, or scheduled maintenance. In Singapore, where the electricity system is heavily dependent on natural gas and operates with limited renewable storage, this buffer plays a vital role in maintaining system resilience. The Energy Market Authority (EMA) sets Singapore's required reserve margin at 27%, aligned with a reliability standard of no more than three loss-of-load hours per year.

As illustrated in Figure 4, the current reserve margin is still well above the required reserve margin of 27%, which is a good indicator.

Predicting Future Peak System Demand

Given the time series nature of the data, ARIMA and SARIMA models were considered as suitable approaches. The ARIMA model was initially tested, but it yielded relatively poor performance, with higher RMSE and AIC values, and a weak fit on the test data—suggesting that the model struggled to capture underlying patterns. This outcome was expected, as electricity demand typically exhibits strong seasonal trends. Subsequently, the SARIMA model was applied, incorporating seasonal components, and achieved significantly better results with an RMSE of 172 and AIC of 1178, compared to 234 and 1514 respectively from the ARIMA model. Based on this improved performance, the SARIMA model was selected to forecast peak system demand through to 2030, as illustrated in Figure 5 below.

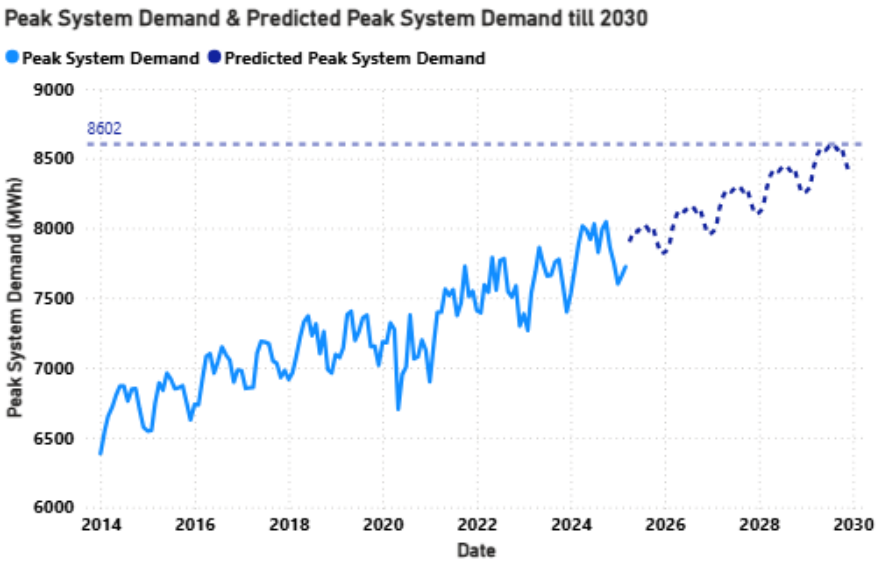

Figure 5: Predicted Peak System Demand till 2030, using trained SARIMA Model

Based on the forecasted maximum peak demand of 8,602 MW by 2030, and aiming to operate at approximately 70% load factoring in the median remaining capacity, it is recommended that Singapore's total generation capacity reach around 14,420 MW by August 2029. This represents a 12.7% increase from the total capacity recorded in March 2025. Such an expansion would provide a comfortable margin, allowing for a 24.2% outage capacity buffer before approaching the 27% reserve margin threshold. Considering the current median outage capacity of 14.8%, this offers a reasonably secure cushion.

Therefore, the recommendation for policymakers is to engage energy retailers—particularly power generation companies, both existing and new—to work towards increasing total generation capacity by approximately 2,000 MW. This would raise Singapore's total capacity from the current 12,797 MW to around 14,800 MW by 2030, representing a targeted increase of about 15.7%. This figure not only meets projected demand growth but also accounts for forecasting uncertainty, including the SARIMA model's RMSE of 178 MW, thereby providing added flexibility to accommodate potential deviations in future peak demand.

Household Sector Market

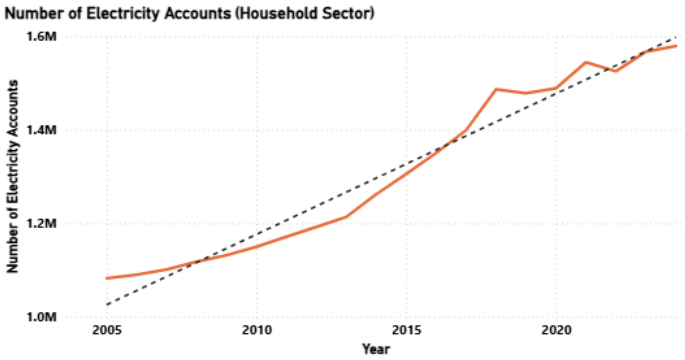

Figure 6: Number of Household Sector Electricity Accounts

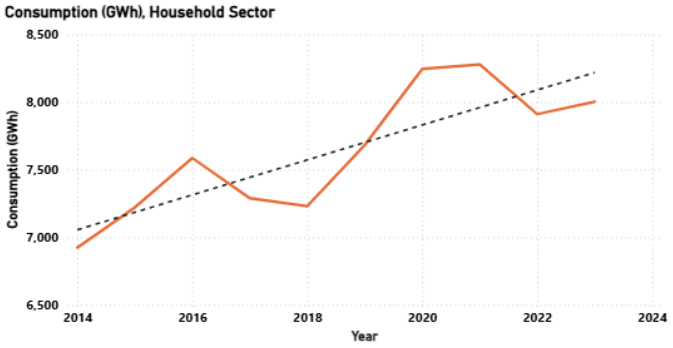

Figure 7: Total Electricity Consumption (GWh) by Household Sector

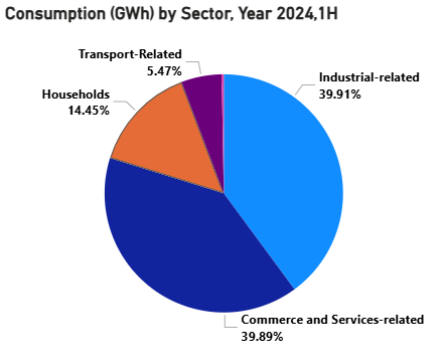

Figure 8: Electricity Consumption by Sector

With Singapore's growing population and the increasing integration of electronics and digitalisation into daily life, both the number of electricity accounts—driven by the rise in households—and total electricity consumption are expected to increase. This trend is evident in Figures 6 and 7. As the household sector ranks as the third-

largest consumer of electricity, there is significant value in understanding its dynamics. Providing residential consumers with clear insights and tools enables them to make more informed choices about their energy usage, potentially leading to cost savings and more sustainable consumption patterns.

The Open Electricity Market (OEM)

One of the key developments empowering consumers in this space is the introduction of the Open Electricity Market (OEM)—Singapore's liberalised electricity retail framework. Launched by the Energy Market Authority (EMA), the OEM was rolled out progressively from November 2018 to May 2019, allowing over 1.4 million households and businesses to choose their electricity retailer. Prior to this, consumers were limited to purchasing electricity from SP Group at regulated tariffs. Under the OEM, they now have the flexibility to select from a variety of price plans—such as fixed-price, discount-off-tariff, or peak/off-peak models—offered by licensed retailers competing on both rates and value-added services.

Consumers who prefer the status quo can still remain on the regulated tariff plan with SP Group. Meanwhile, electricity retailers purchase power from the Wholesale Electricity Market, where prices are determined every 30 minutes based on real-time demand and supply conditions.

This liberalised structure is designed to:

1. Promote competition and price transparency
2. Encourage innovation in retail electricity services
3. Empower consumers to make informed energy decisions
4. Facilitate greater demand-side participation in shaping Singapore's energy future.

As the market matures, continued awareness and engagement will be essential to ensure that residential consumers can fully realise the benefits of this liberalised environment.

Singapore's Fuel Mix and the Influence of Global Energy Prices

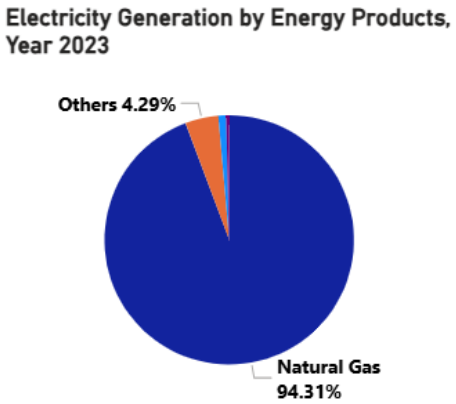

Figure 9: Breakdown on Energy Products used for Electricity Generation

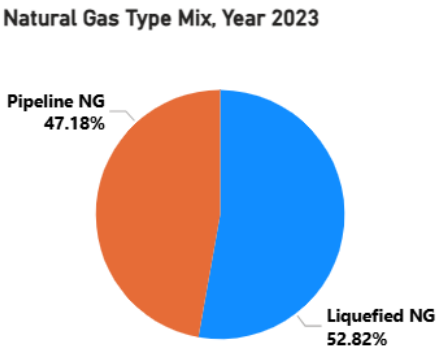

Figure 10: Breakdown on Natural Gas Type Mix

Singapore has progressively transitioned from crude oil combustion to a natural gas-dominant energy mix, with approximately 94% of its electricity now generated from natural gas. This gas supply is almost evenly split between piped natural gas (PNG) and liquefied natural gas (LNG).

PNG is primarily imported from neighbouring countries—Indonesia and Malaysia—via undersea pipelines, while LNG is sourced globally from suppliers such as Australia, Qatar, and the United States.

In Asia, long-term PNG contracts are traditionally indexed to crude oil benchmarks. In contrast, LNG pricing follows its own benchmarks.

As a result, movements in both crude oil and LNG prices have direct implications for Singapore's electricity tariffs, particularly given the heavy reliance on gas-fired power generation.

Predicting Low Tension Tariffs

Given the influence of crude oil and LNG benchmarks on Singapore's electricity tariffs, particularly due to the gas-heavy energy mix, it becomes valuable for residential consumers to have visibility into future tariff trends. This foresight can help them make informed decisions—for instance, whether to lock in fixed-rate contracts with OEM retailers (which often require commitment periods), or to remain on SP Group's quarterly-reviewed low tension tariffs.

To model this, a SARIMAX approach was adopted, acknowledging the impact of external drivers such as crude oil and LNG benchmark prices. A well-performing model with a Root Mean Squared Error (RMSE) of 0.32 was achieved.

However, as the SARIMAX model requires future values of the exogenous variables to generate forecasts, SARIMA models were separately trained to forecast crude oil and LNG prices up to Q4 2026. These predicted fuel prices were then fed into the SARIMAX model to generate a forecast of low tension electricity tariffs for the same period.

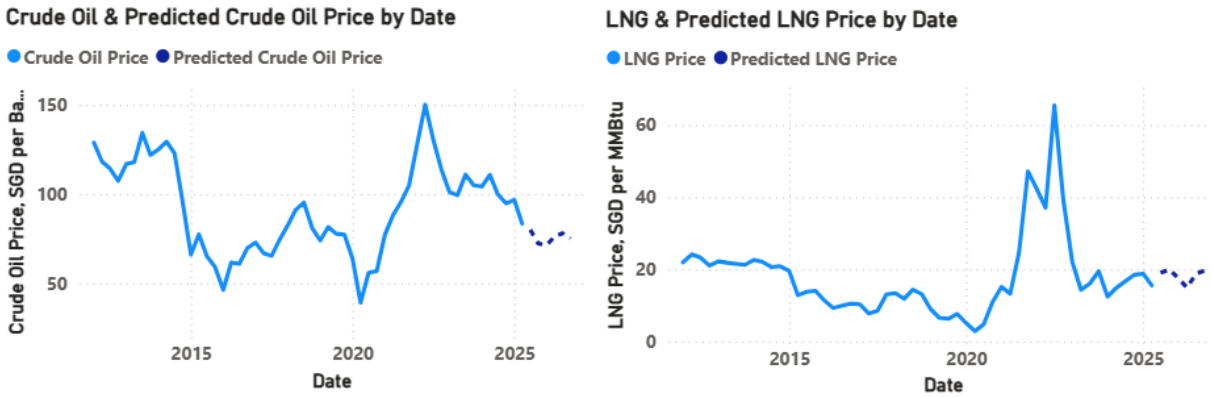

Figure 11: Predicted Crude Oil and LNG Price till Q4 2026.

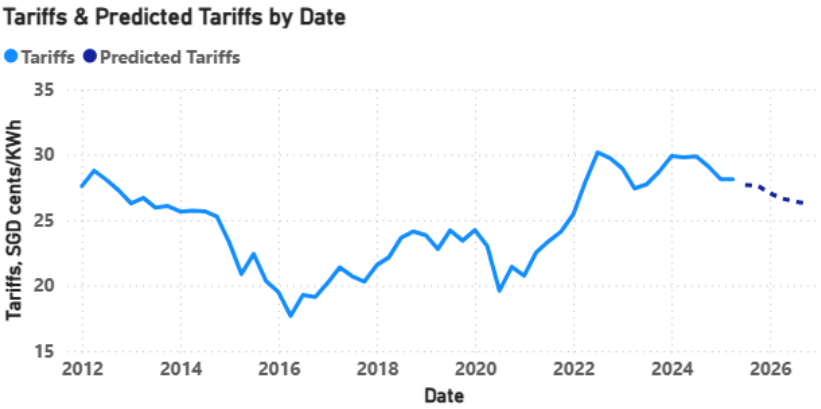

Figure 12: Predicted Low Tension Tariffs till Q4 2026.

As shown in Figure 12, based on the SARIMAX model—trained using the predicted crude oil and LNG prices illustrated in Figure 11— low tension electricity tariff is forecasted to decline to approximately 26.28 cents/kWh by Q4 2026. This represents a 4.3% decrease from the current Q3 2025 tariff of 27.47 cents/kWh.

Retailer	Price Plan	Type	Electricity Rate	Estimated Monthly Bill	Contract Duration
Seraya Energy Pte Ltd (Geneco)	Give Us A Try	Fixed Price	27.00 cents/kWh	$40.50	6 Months
Tuas Power Supply Pte Ltd	PowerFix 6 (Same SP Bill)	Fixed Price	27.00 cents/kWh	$40.50	6 Months

Figure 13: Current Lowest Priced Contract on openelectricitymarket.sg

Given this forecast and current price offerings on the Open Electricity Market (OEM), we recommend that residential consumers consider shorter-term contracts. For instance, a 6-month fixed-rate plan at 27.00 cents/kWh, currently the lowest available, would provide flexibility to reassess and potentially switch to a more competitive plan as tariffs are expected to fall. This approach balances cost efficiency with contractual flexibility in a shifting energy price environment.

Conclusion

Through robust time series models, we have predicted rising peak system demand and provided concrete capacity recommendations to safeguard grid reliability. Policymakers are urged to proactively engage with energy generation companies—both existing and new—to expand generation capacity by approximately 2,000 MW by 2030, ensuring the 27% reserve margin is maintained and the system remains resilient to outages and demand shocks.

For energy retailers and potential investors, these findings signal clear growth opportunities in power generation and innovation in retail electricity plans. As demand increases, there is both a business imperative and public interest in diversifying offerings, improving supply security, and enhancing market competitiveness.

At the consumer level, residential users stand to benefit from better-informed choices in the Open Electricity Market (OEM). With electricity tariffs projected to decline slightly over the next year, short-term fixed-price plans currently offer the best balance between stability and flexibility. Empowering consumers with insights into pricing trends strengthens participation in the liberalised market and promotes smarter energy use.

Ultimately, sustaining a reliable, affordable, and competitive electricity ecosystem in Singapore requires coordinated action—driven by predictive analytics, policy foresight, and informed consumer participation.

Next Steps

To effectively act on the findings of this report, policymakers should promptly formalise and implement plans to expand generation capacity as recommended, ensuring Singapore’s electricity system remains reliable amid rising demand.

Additionally, to empower residential consumers in navigating the Open Electricity Market, developing a user-friendly app is suggested. This app could analyse real-time and forecasted tariff data to recommend the most cost-effective electricity plans, helping consumers make informed decisions tailored to their individual needs.