An Aggregator-Based Market Modelling with an Impact of Risk Under Uncertainty

Forecasted PV and wind output power Scenarios: Initially ARIMA forecasting is done based on available historical data on solar and wind output power.

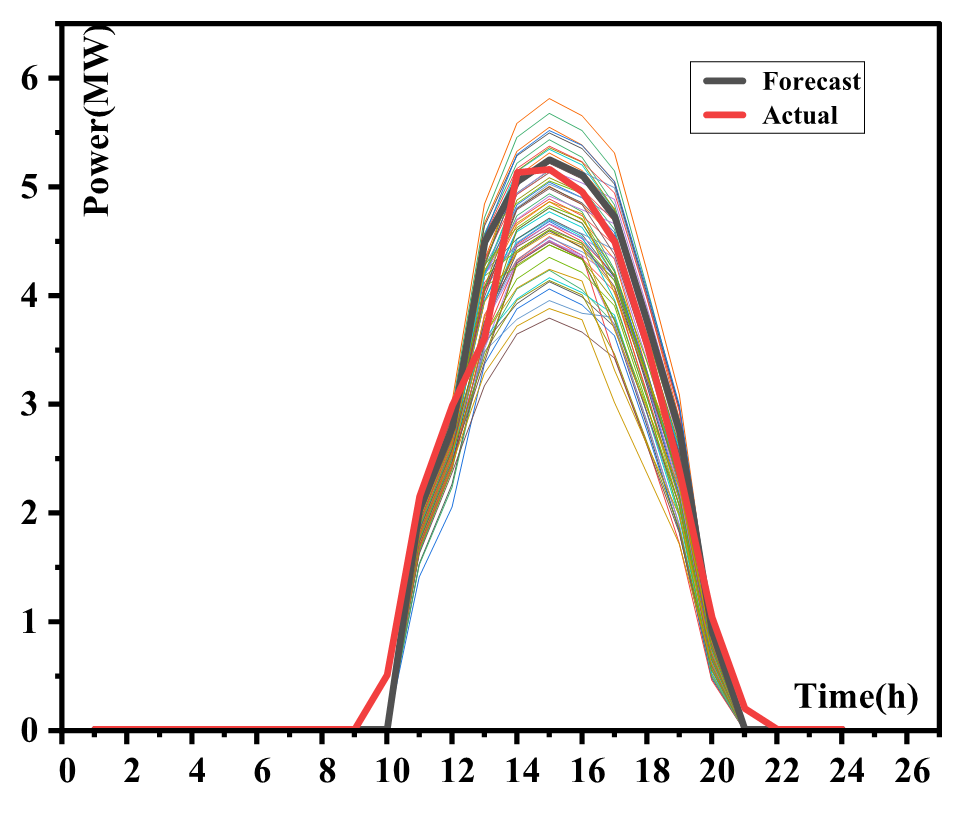


Fig 1: Forecasted solar output power Scenarios

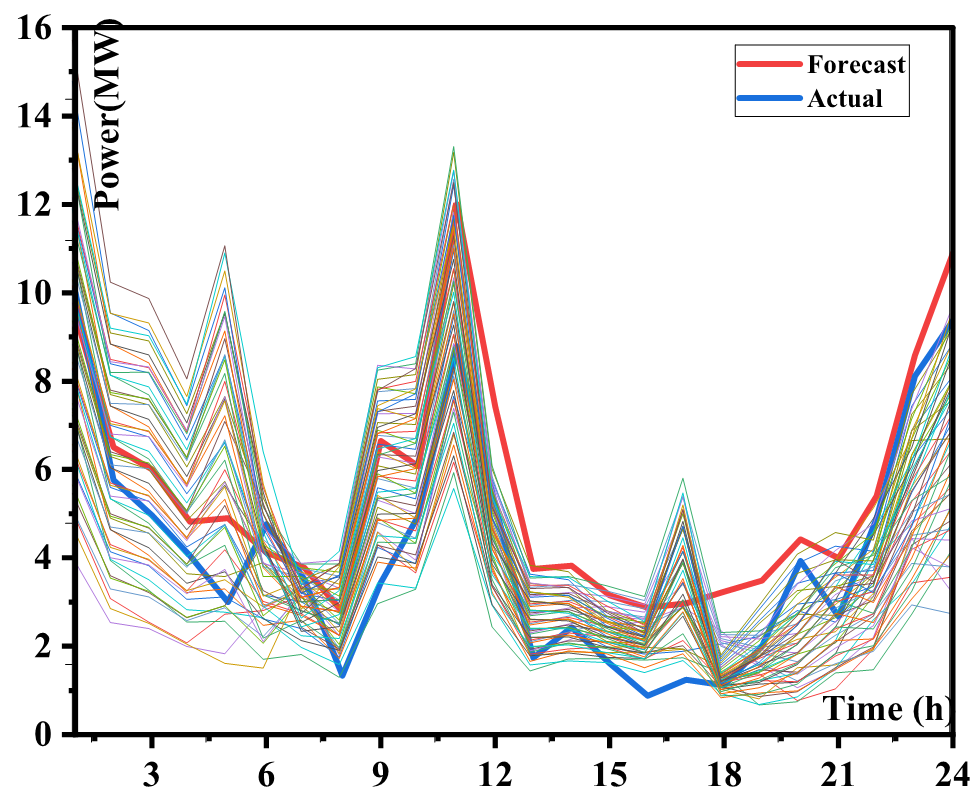


Fig2: Forecasted wind output power Scenarios

Forecasted Scenarios are reduced to five scenarios using the k-means clustering algorithm

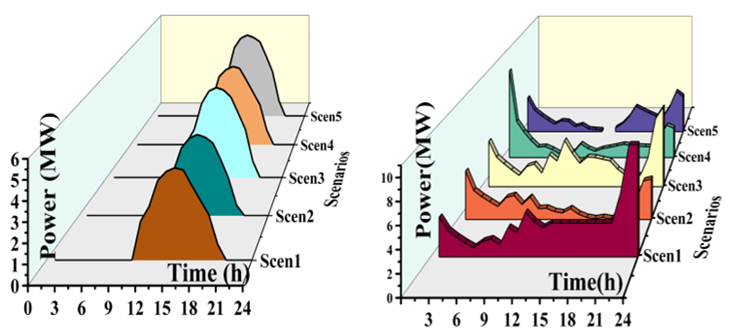


Fig3: Reduced Scenarios of solar and wind output power

For the Reduced scenarios a mathematical market modelling is performed in GAMS software which is a bi-level formulation where aggregators submit their energy bids to an operator and the operator then clears the market and generates price signals. To assess risk incurred in this modelling risk assessment is done using VaR, CVaR method,

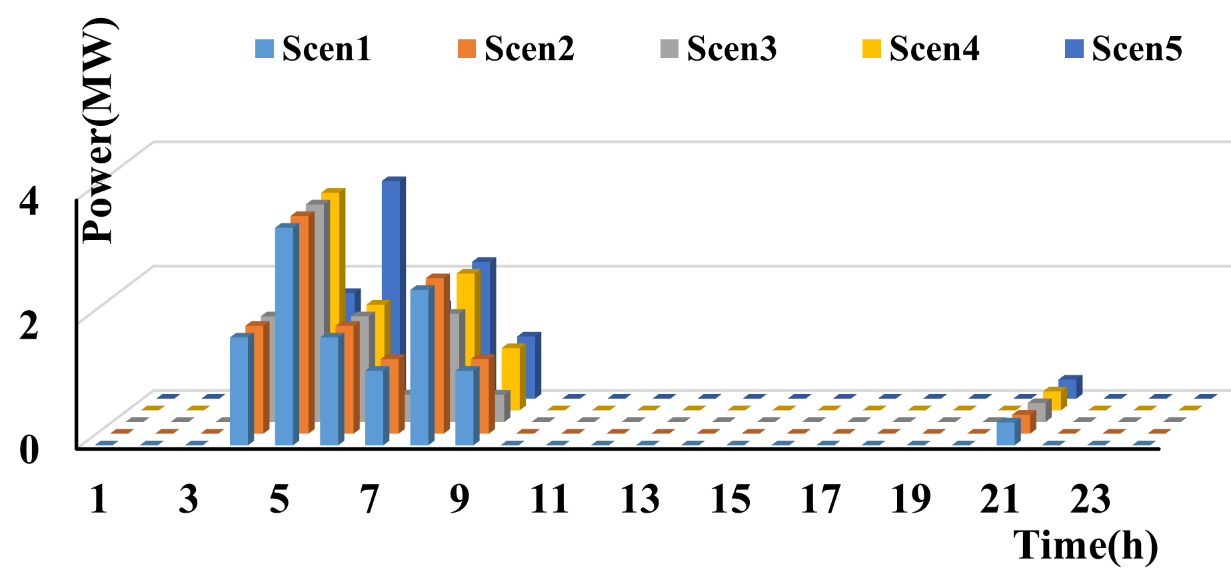


Fig 4: Diesel Generator Production of A1

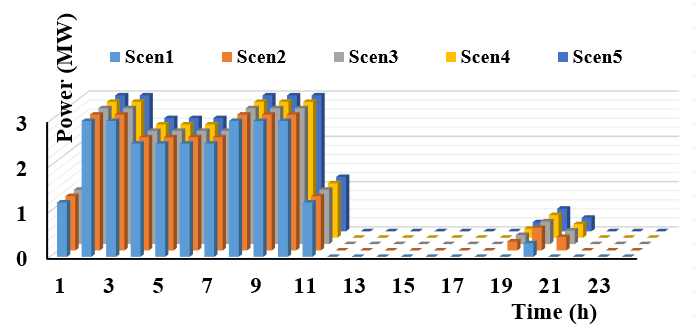


Fig 5: Diesel Generator Production of A2

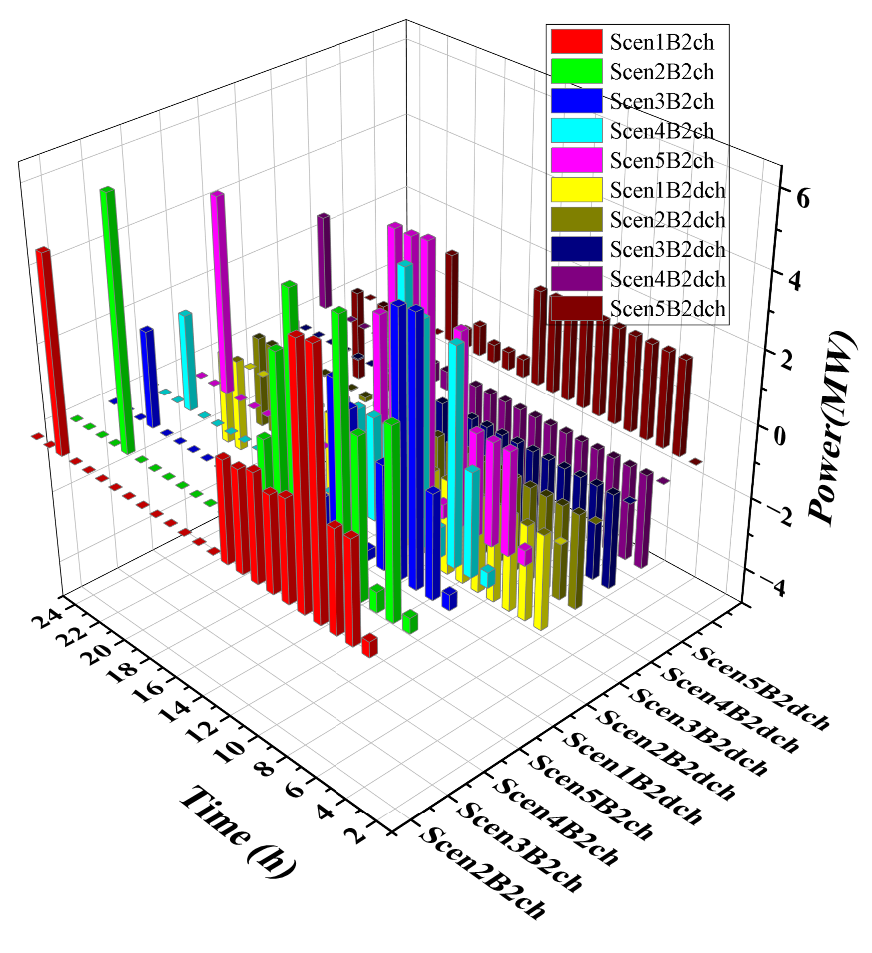


Fig 6: Battery2 of A2 Charging discharging levels

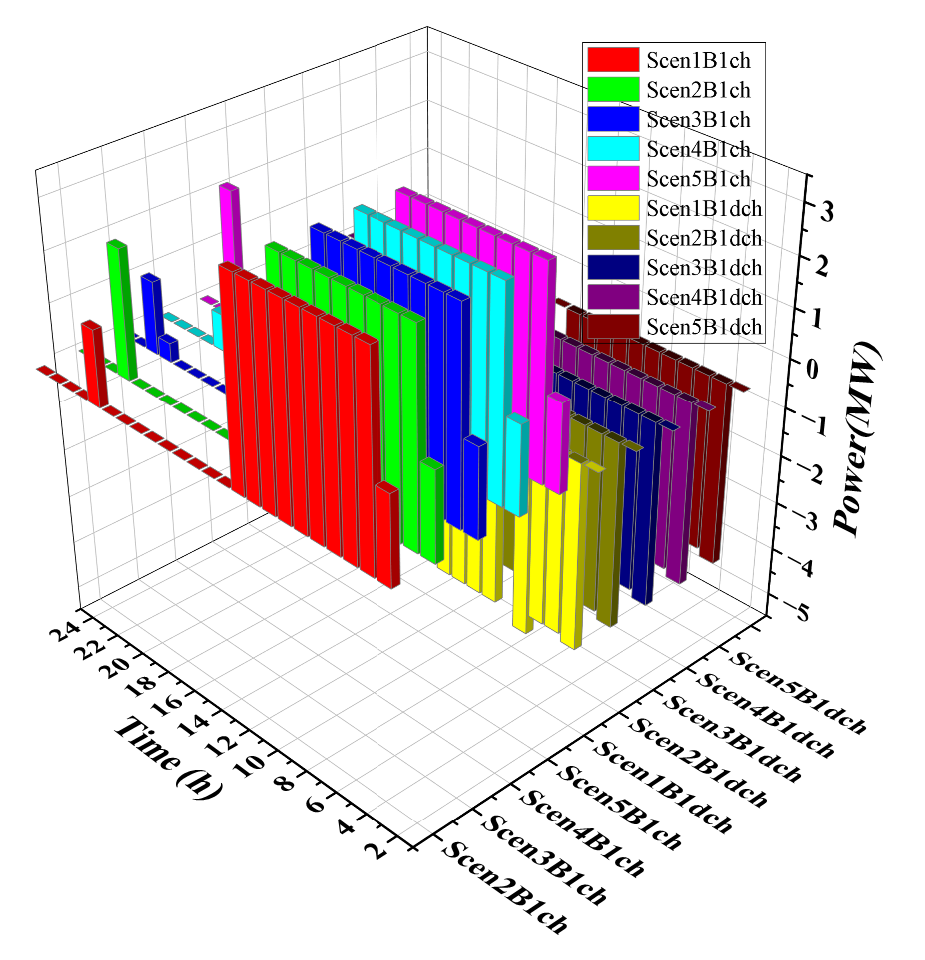


Fig 7: Battery1 of A2 Charging and discharging levels

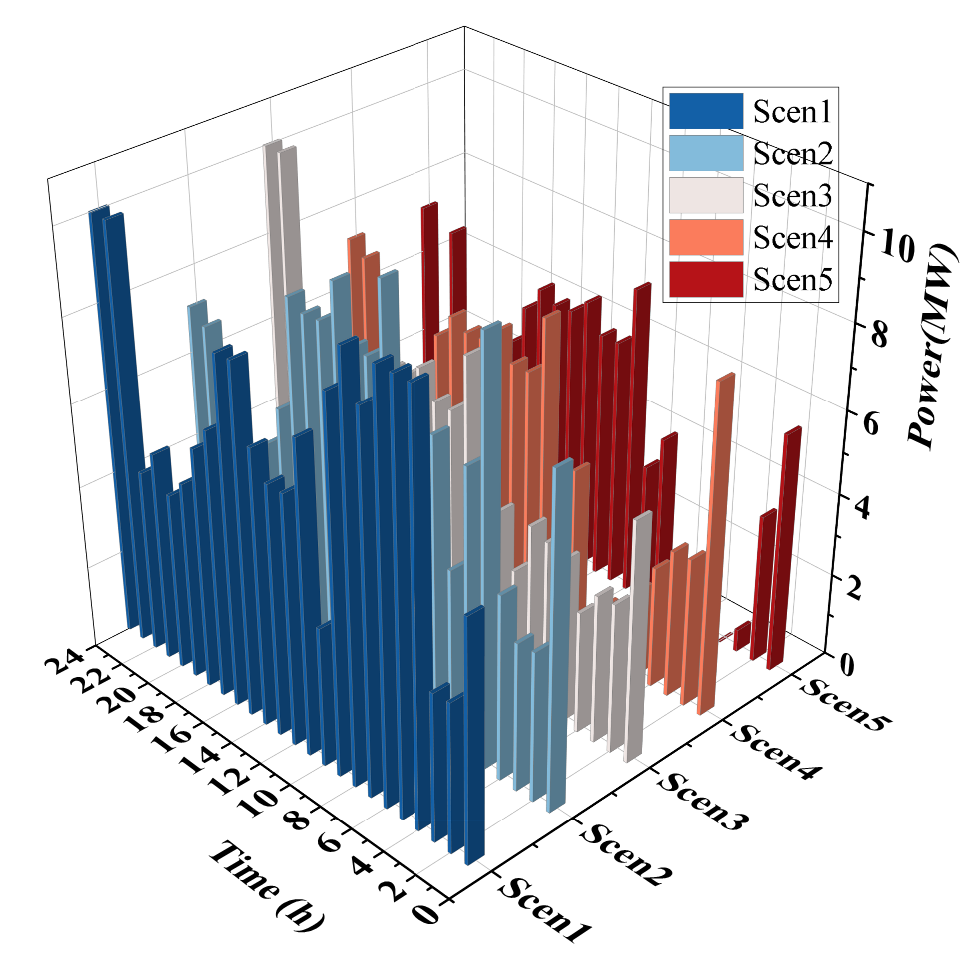


Fig 8: Total Production of A1

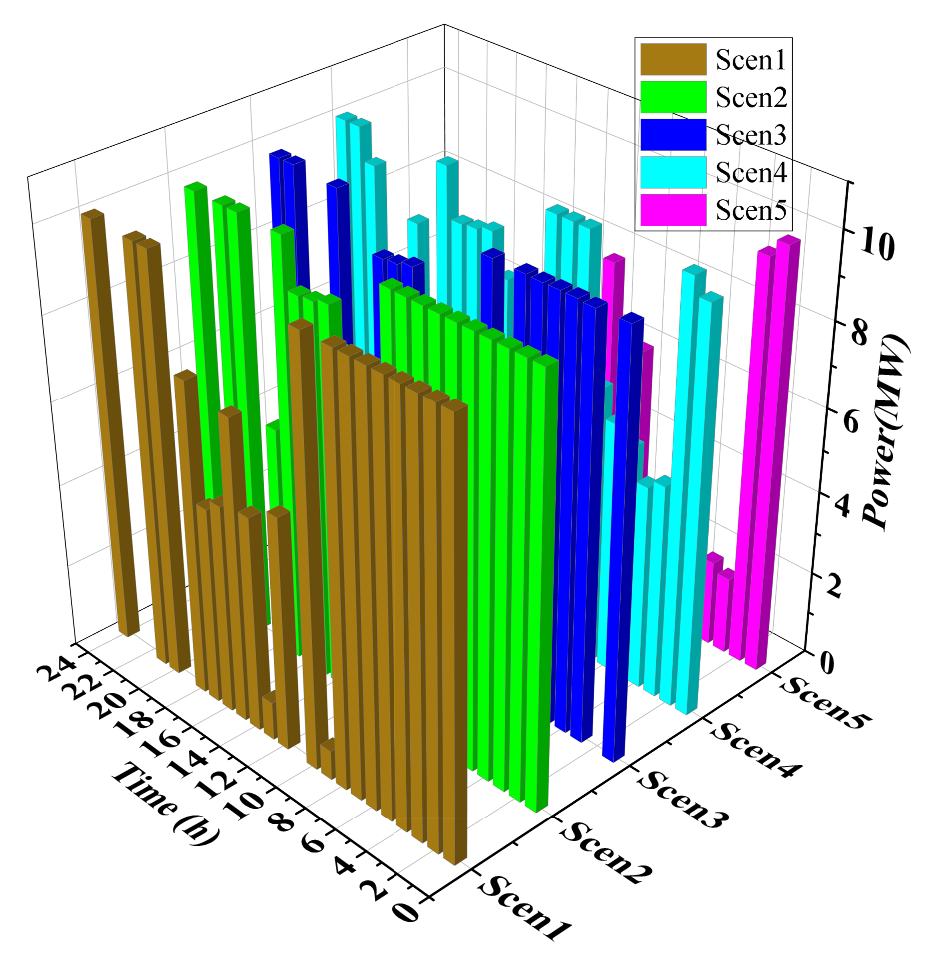


Fig9: Total Production of A2

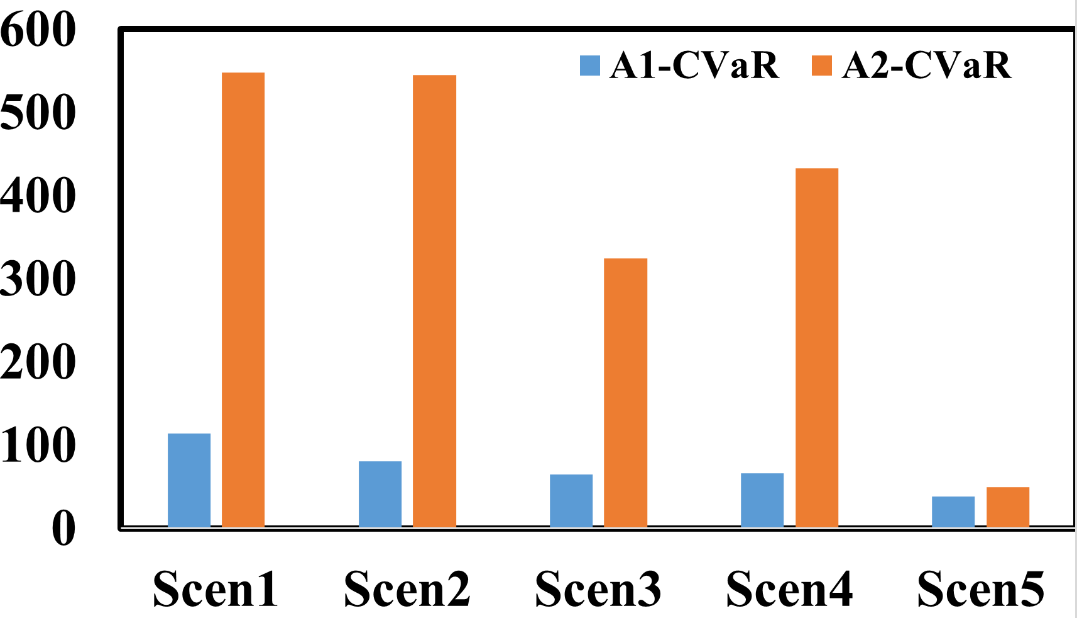


Fig 10: Comparison of CVaR of A1 and A2

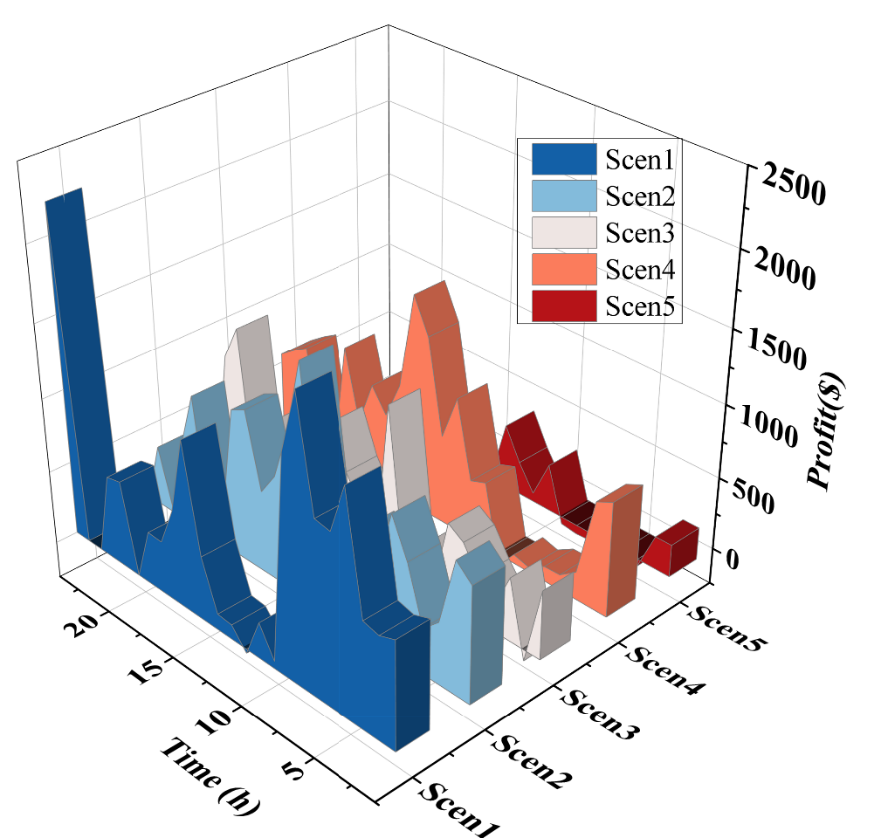


Fig 11: Profit of A1

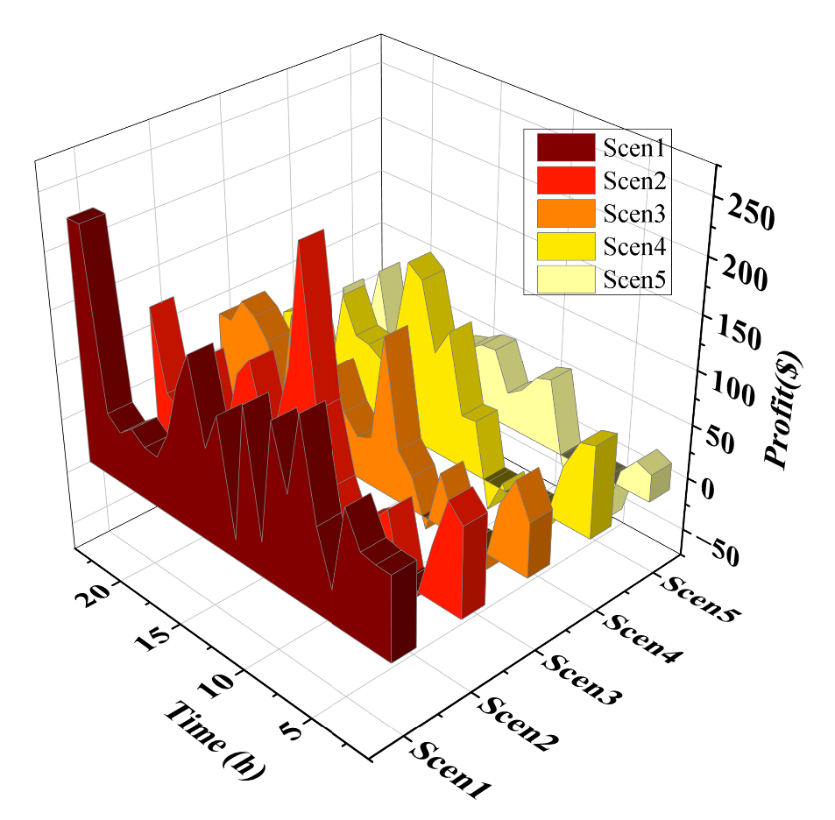


Fig 12: Profit of A2

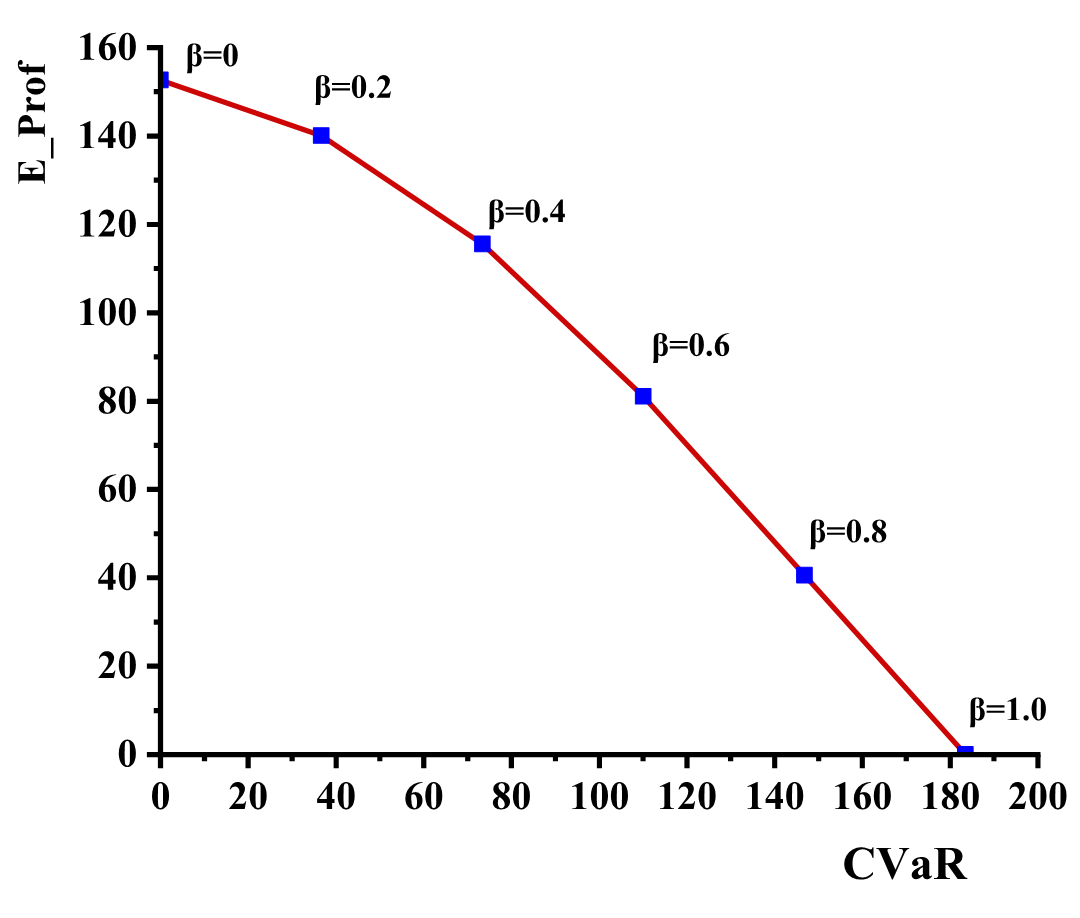


Fig 13: Comparison of CVaR and Profit of aggregator

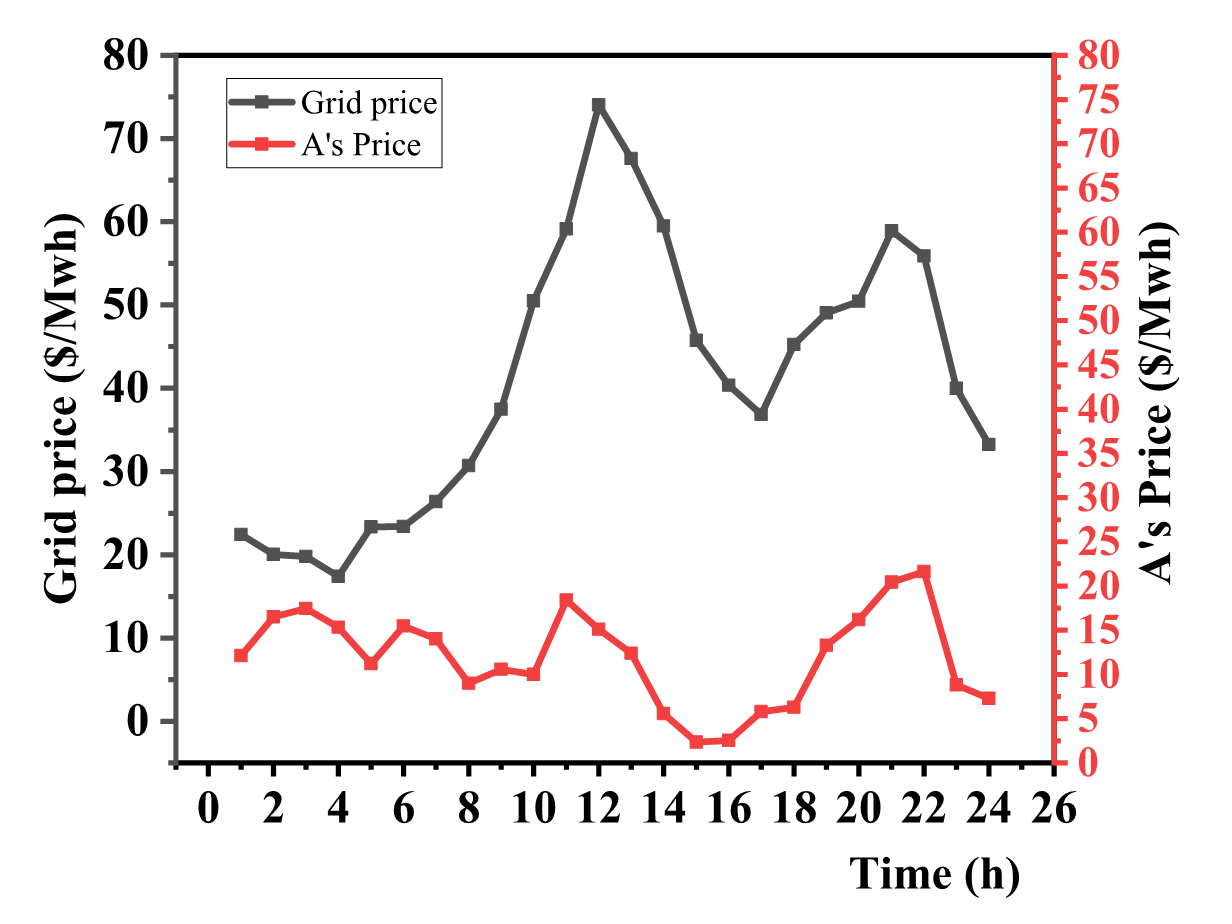


Fig 14: Day-ahead aggregator price signal in comparison with grid price

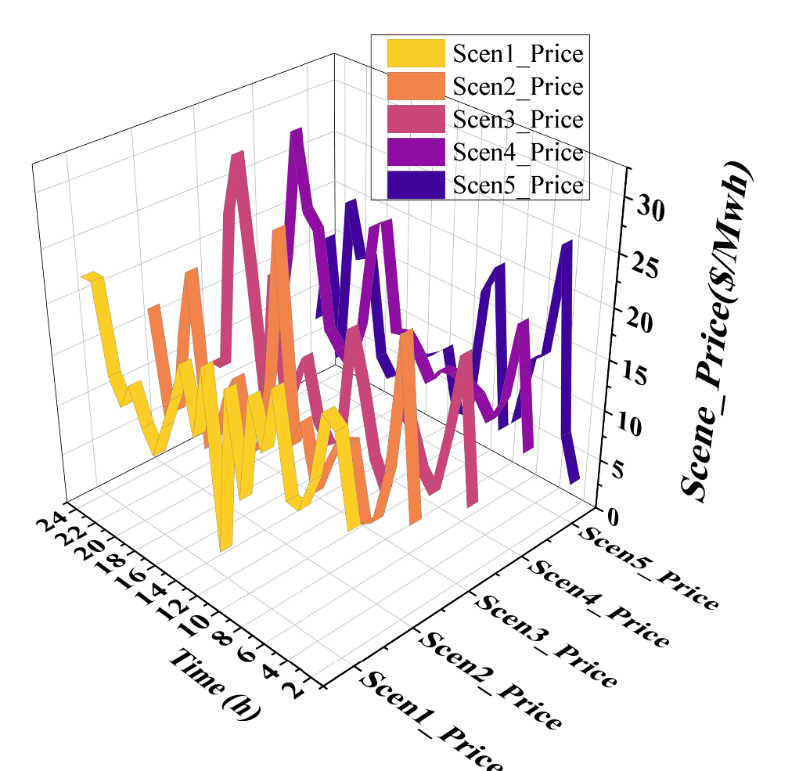


Fig 15: Scenario-based Price signals

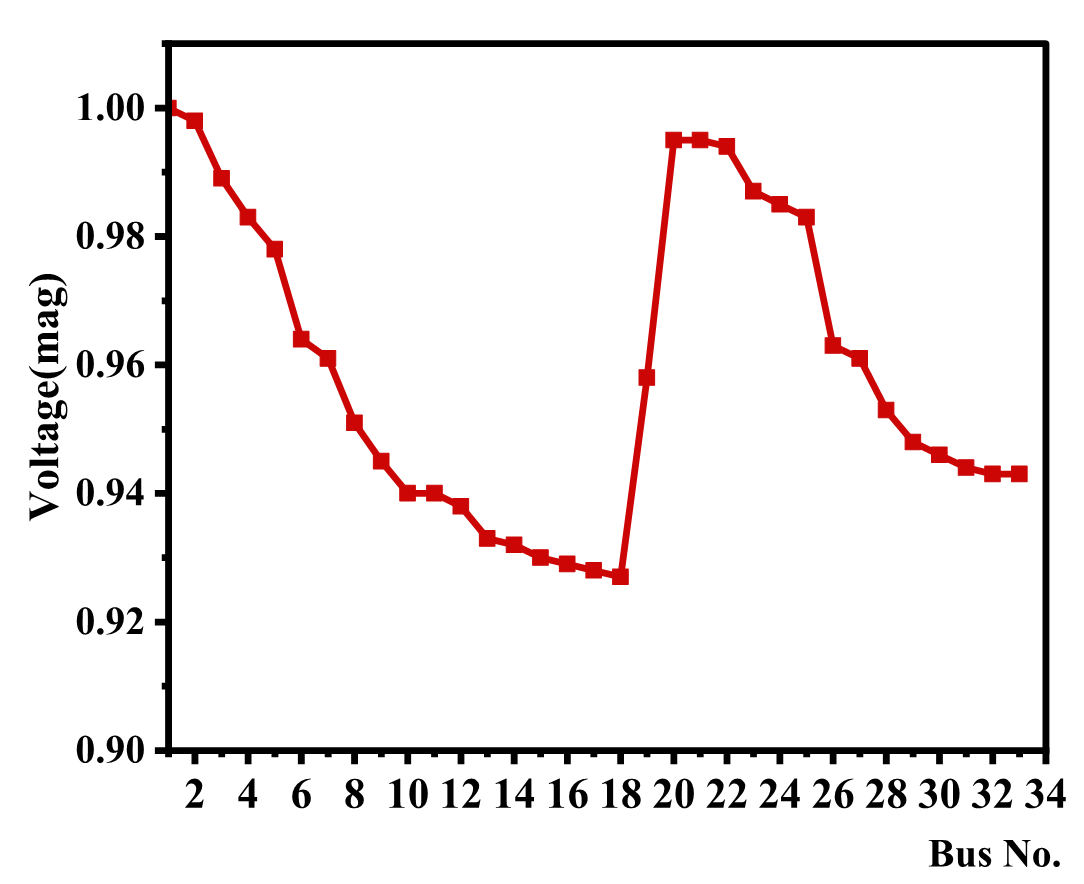


Fig 16: Voltage magnitude of opf execution for modified IEEE 33 bus test system