Model Name	Details	RMSE	MAE	Observation notes
Baseline Model	Values of the previous day for same hour	17.4	14	The baseline model demonstrates satisfactory performance, providing a solid foundation for further analysis and improvements.
Model fit on difference series				
ARIMA (1,1,1,24)	vanila, seasonlaity 24	14.7	12.6	Over prediction, error increases for long horizon
LGBM_DIFF	no tuning	109	101	The model is significantly underpredicting compared to both the baseline and ARIMA models. Additionally, the accuracy of the predictions deteriorates as the holding period increases.
LGBM_DIFF_EXOG_ALL	no tuning EXOG = ALL	156	144	The model is significantly underpredicting compared to both the baseline and ARIMA models, resulting in poor performance.
Using light GBM on actual series				
LGBM	no tuning	13.3	10.5	While the model performs better than the baseline, it struggles to maintain accuracy during peak consumption times each day.
LGBM_EXOG_ALL	no tuning EXOG = ALL	7.7	6	The model performs better than the version without exogenous variables; however, it still does not maintain accuracy during peak consumption times each day. Nonetheless, the magnitude of the errors has been reduced, and there is a tendency for overprediction during lower peak periods.
LGBM_EXOG_1	no tuning - EXOG = dayOfWeek, hour	9.8	7.5	Not better than ALL exogenous variable
LGBM_EXOG_2	no tuning - EXOG = dayOfWeek , Temprature	13	10	Again, not better than incuding all exogenous variables.Resedual increases as horizon increases
LGBM_EXOG_2	no tuning - EXOG = hour , Temprature	8.7	6.9	Again, not as good as including all but capture decent
LGBM_CYC_EXOG	no tuning Cycling EXOG ALL	6.9	5.5	This is a better fit compared to other models
Hyperparameter tuning				
LGBM_TUNNED	tunned	13	9.7	There is slight overfitting, and hyperparameter tuning has not led to improvements in RMSE. However, the errors are normally distributed.
LGBM_TUNNED_EXOG_ALL	tuning EXOG =ALL, Bayesian search	14.4	11.9	The model performs worse than without tuning, possibly due to an insufficient search space. Increasing the random seed and the number of trials may allow for a more exhaustive search.
LGBM_TUNNED_EXOG_ALL	tuning EXOG =ALL, More exhaustive search Bayesian	8.8	6.4	Still not better than without tuning, Improvement of tuning is resulted in randomness in errors. Errors are normally distributed with mean zero
LGBM_TUNNED_CYC_EXOG_ALL	tuning CYC EXOG =ALL for metric MSE, Basien search	9.4	7.1	This does not represent an improvement over the untuned model, suggesting that a more exhaustive parameter search may be necessary.
LGBM_TUNNED_CYC_EXOG_ALL	tuning CYC EXOG =ALL for metric MAE Grid serach with 81 combinarions	28	23	Tuning is not happening properly as the data evaluaton metric is based on historical data and over fitting hampeting test RMSE.