



**15TH NATIONAL
CONVENTION
ON STATISTICS**

03-05 OCTOBER 2022

*Organized by the Philippine Statistical System
Spearheaded by the Philippine Statistics Authority*



On the rolling forecasts of the LightGBM for multi-step forecasting

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[Session Topic]

Crowne Plaza Manila Galleria

_ October 2022; [Time of presentation] AM/PM

Introduction

- LightGBM was used as part of the model of the winning team of the M5 competition.
- Statistical and deep learning models have been used for water and energy demand modeling.
- No one has explored yet the rolling forecasts of the LightGBM for the Philippine data and its comparison to ARIMA models.

Data

- The monthly water demand data was requested from the Freedom of Information (FOI) website.
- The 5-minute energy demand data is publicly available at the IEMOP website

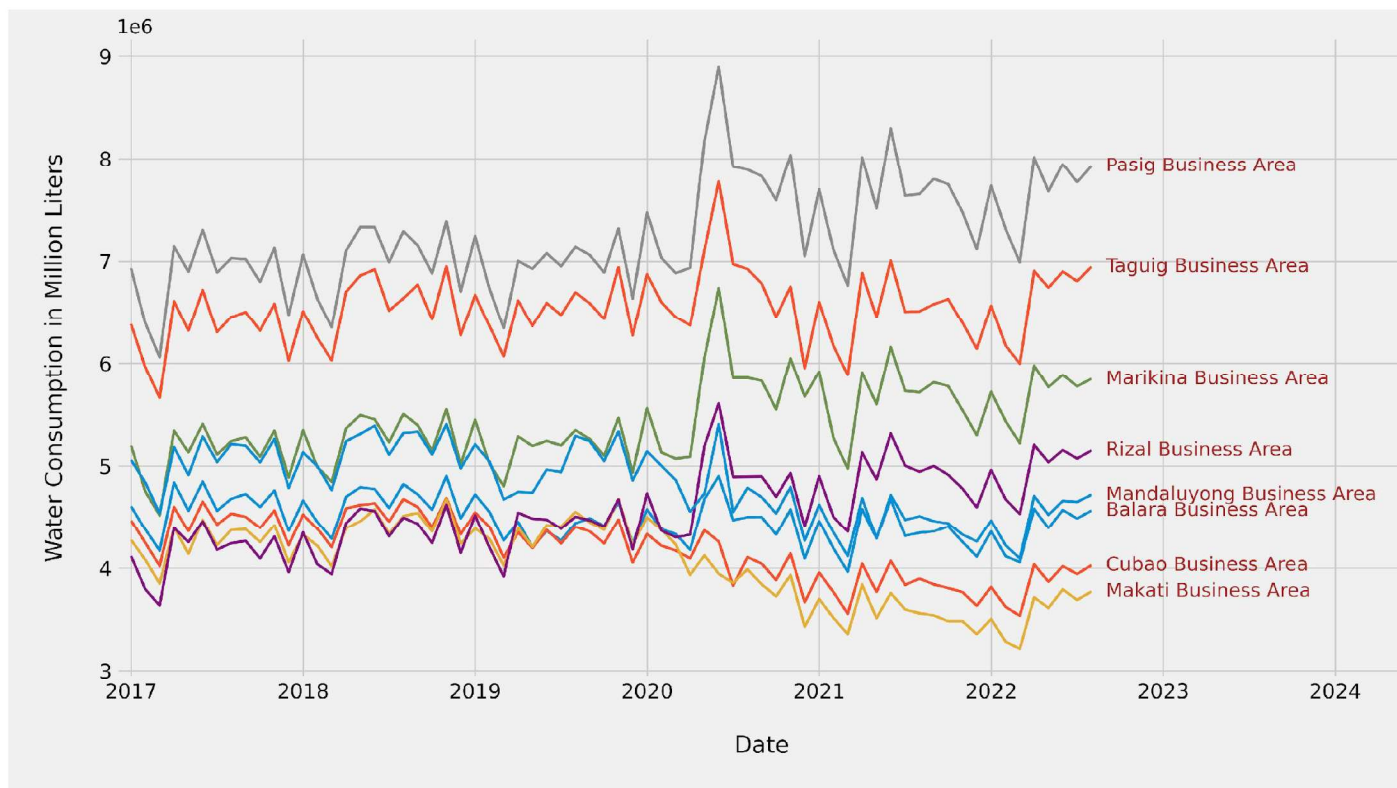
Partition	Water (Monthly)	Energy (5-minute)
Train	January 2017 to December 2021	January 2022 to August 1, 2022
Test	January 2022 to August 2022	August 2-31, 2022
	Total = 68 data points	Total = 69,925 data points



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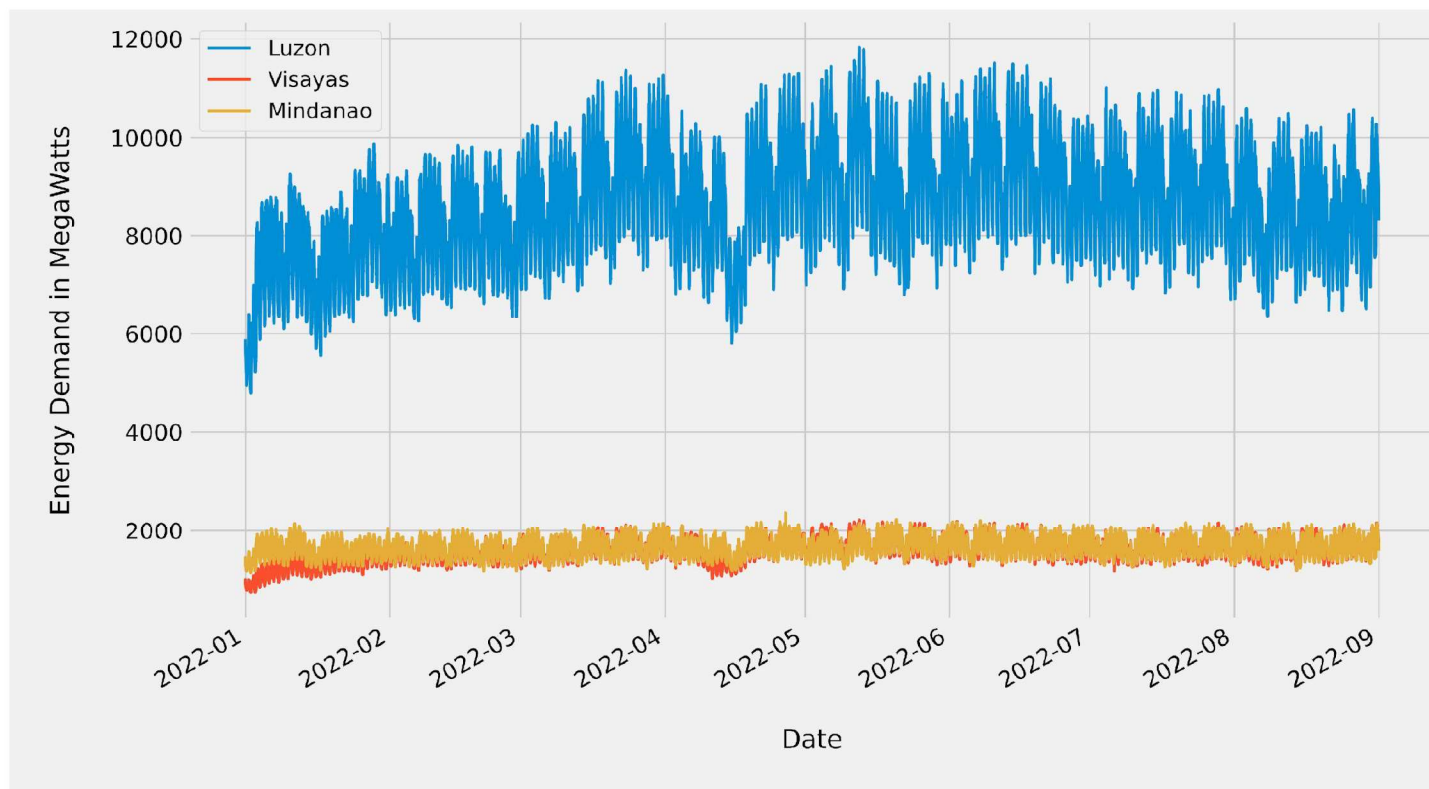
Water Demand Time Series



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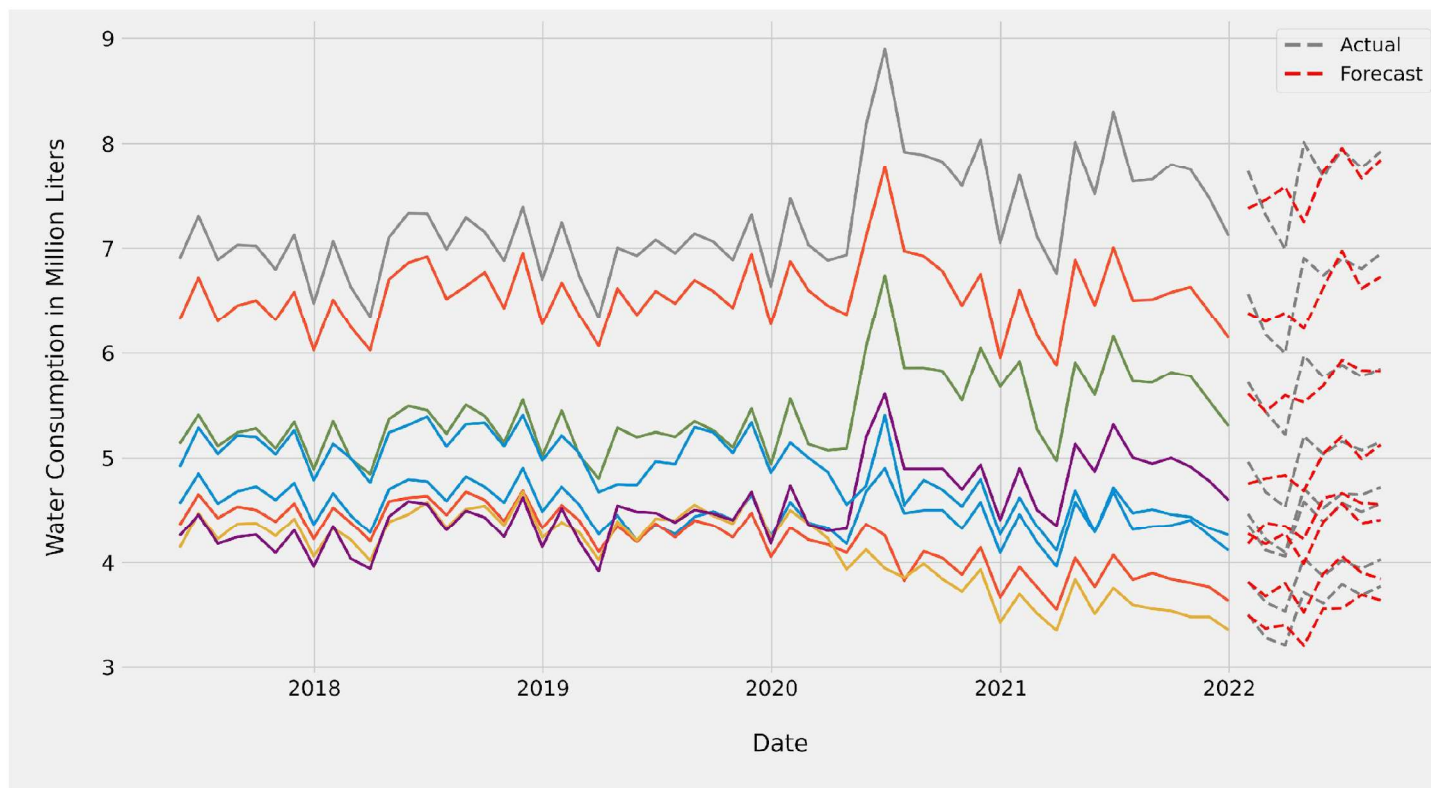
Energy Demand Time Series



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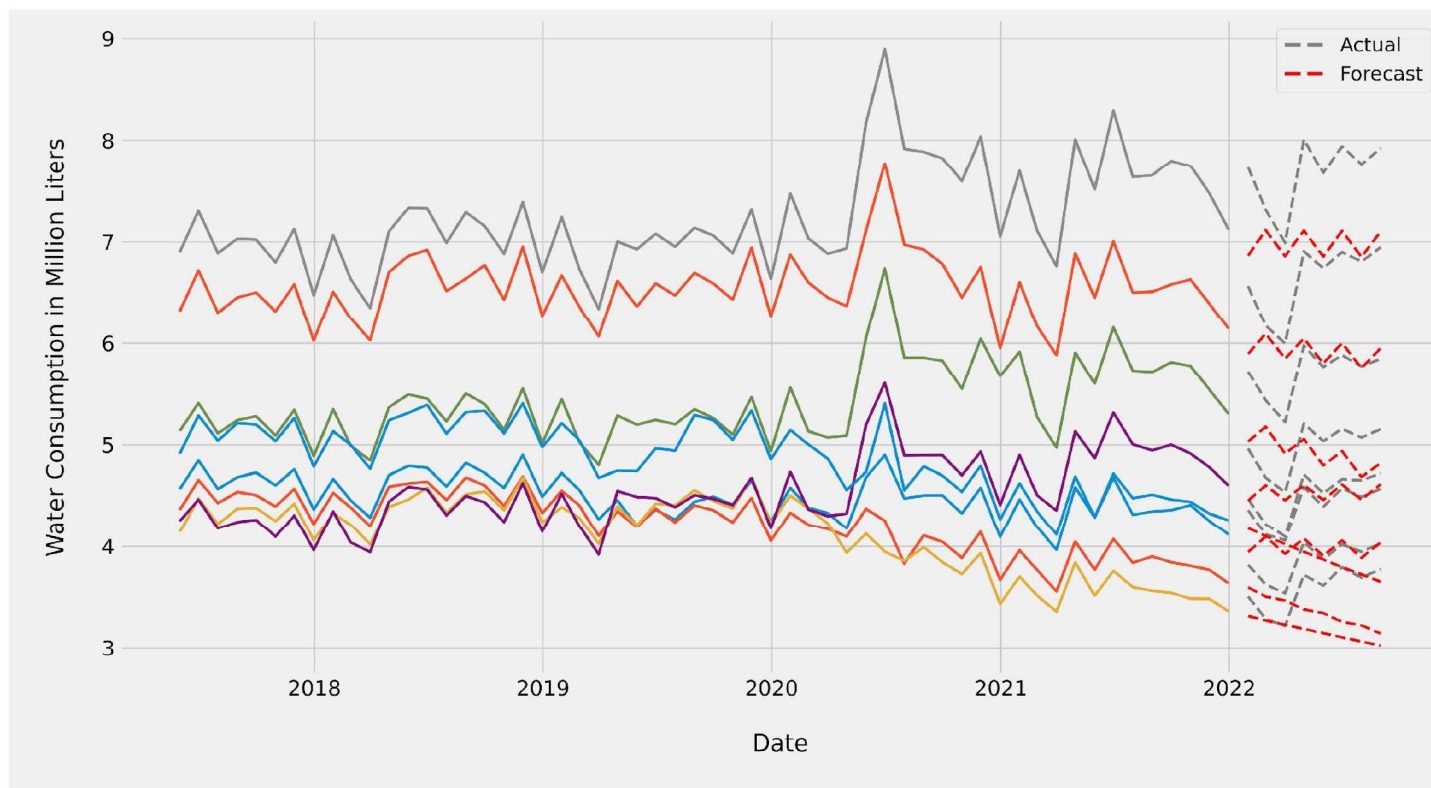
LightGBM Non-rolling Forecasts of Water Demand



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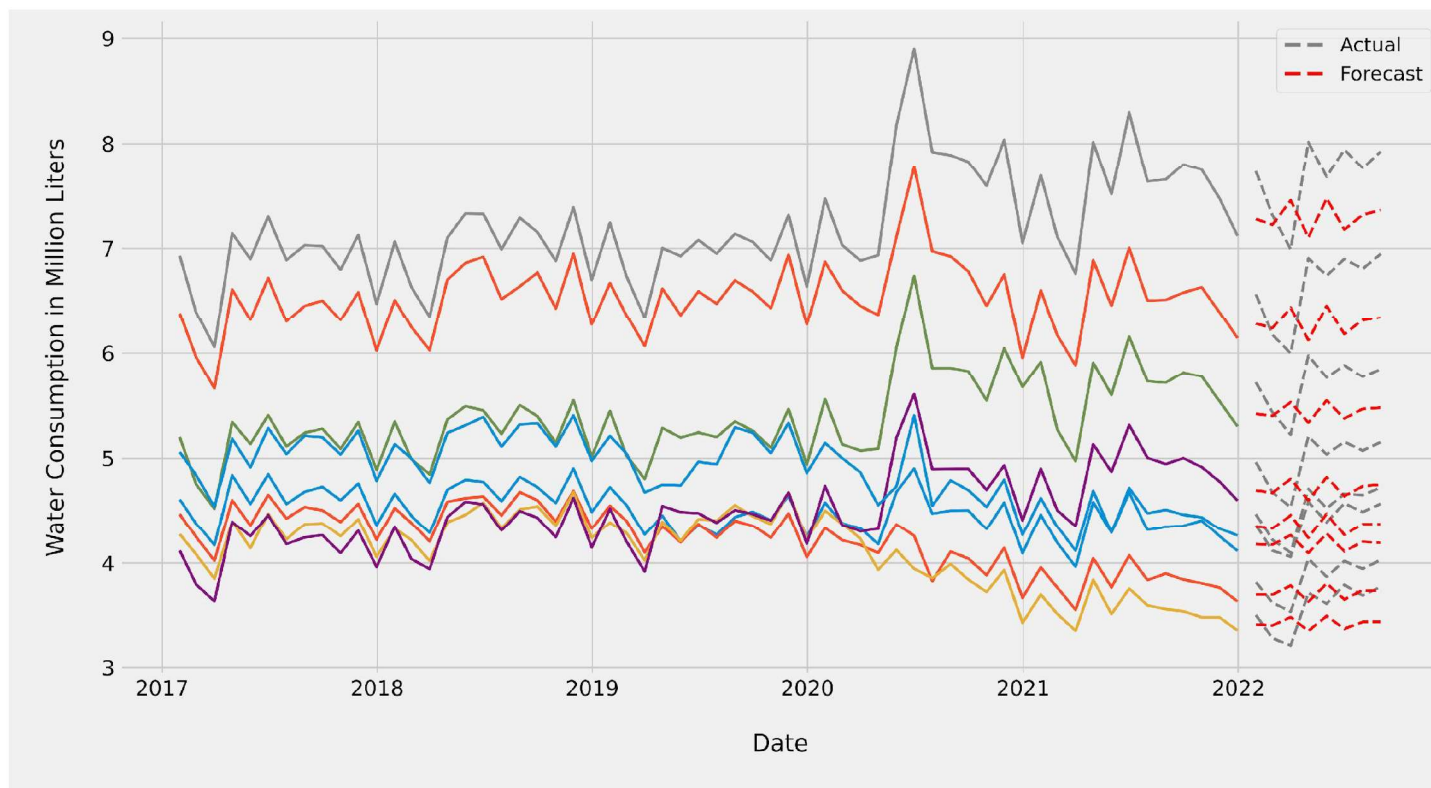
LightGBM Rolling Forecasts of Water Demand



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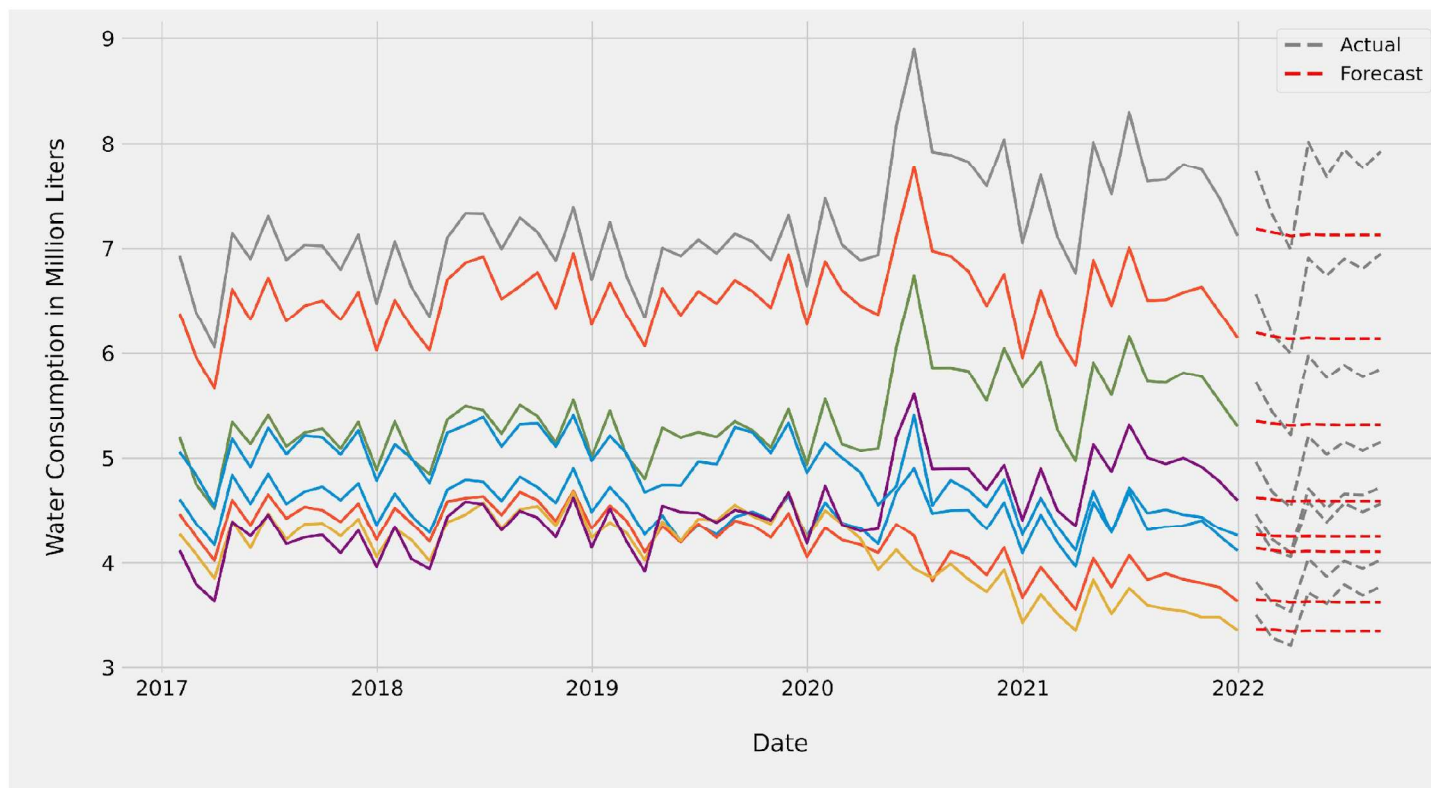
ARIMA(3,1,3) Rolling Forecasts of Water Demand



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ARIMA(3,1,0) Rolling Forecasts of Water Demand



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BA	LightGBM						ARIMA(3,1,3)		
	Non-rolling			Rolling			Rolling		
	MAE	MAPE	RMSE	MAE	MAPE	RMSE	MAE	MAPE	RMSE
Balara	0.15	3.49	0.24	0.41	9.05	0.45	0.24	5.37	0.27
Cubao	0.14	3.64	0.22	0.50	12.54	0.58	0.19	4.94	0.21
Makati	0.15	4.18	0.22	0.41	11.06	0.50	0.22	6.12	0.24
Marikina	0.14	2.53	0.21	0.77	13.40	0.83	0.30	5.19	0.33
Pasig	0.26	3.46	0.37	0.69	8.80	0.75	0.42	5.42	0.46
Rizal	0.16	3.33	0.23	0.44	8.67	0.49	0.29	5.77	0.33
Mandaluyong	0.19	4.28	0.24	0.60	12.94	0.70	0.23	5.02	0.26
Taguig	0.25	3.73	0.31	0.71	10.42	0.79	0.41	6.08	0.46

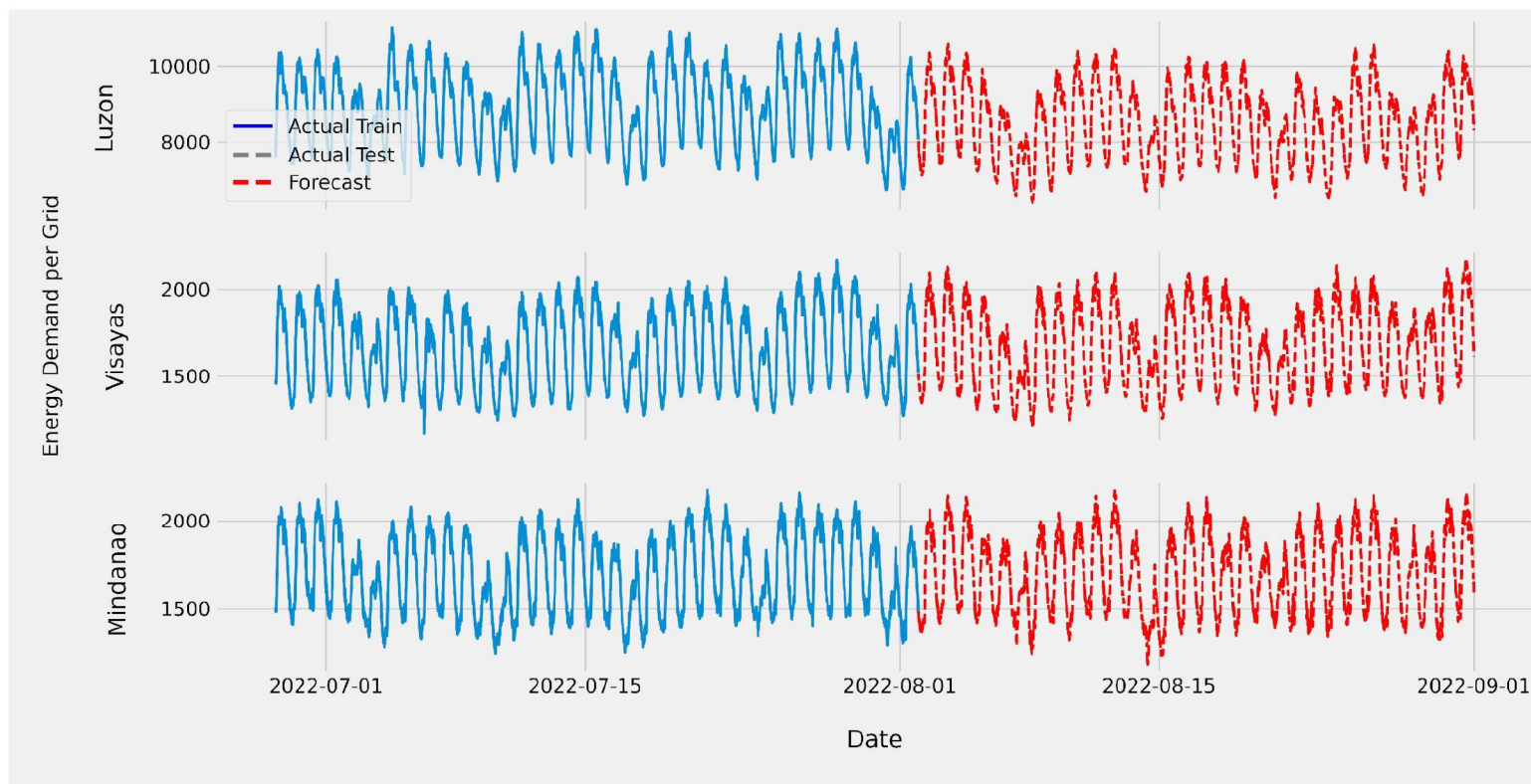
Model Forecast Errors on Water Demand Time Series



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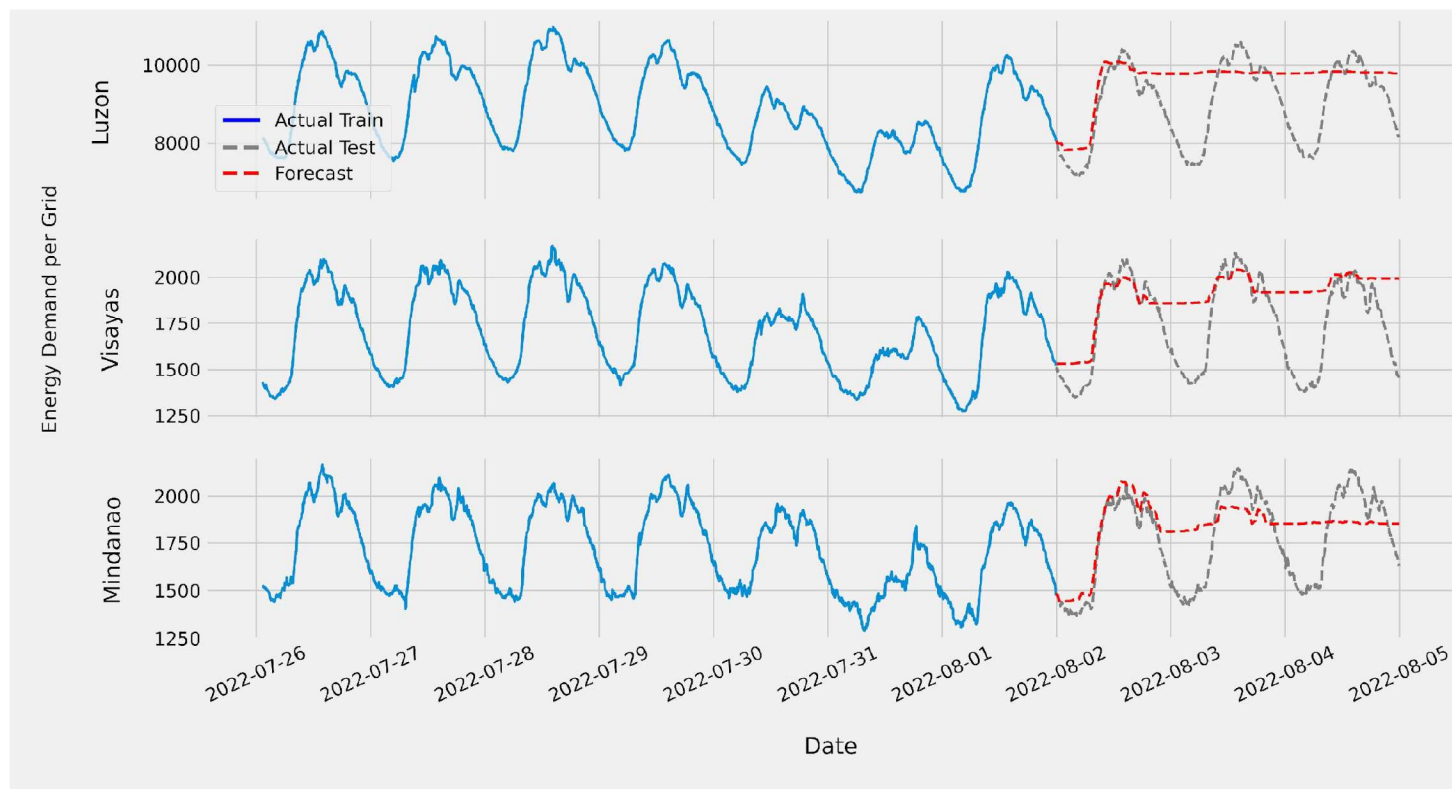
LightGBM Non-rolling Forecasts of Energy Demand



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LightGBM Rolling Forecasts of Energy Demand



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BA	Non-rolling			Rolling		
	MAE	MAPE	RMSE	MAE	MAPE	RMSE
Luzon	0	0	0	752.12	9.10	1025.26
Visayas	0	0	0	171.34	11.12	240.17
Mindanao	0	0	0	149.19	8.95	186.84

LightGBM Forecast Errors on Energy Demand Time Series

Conclusion

- LightGBM roll forecasting is not as good as ARIMA(3,1,3) for water demand modeling if only autoregressive terms are used
- LightGBM can roll forecast up to 19 hours of day-ahead energy demand with good accuracy using one-week past values predictors
- ARIMA is computationally expensive for high-resolution dataset such as the 5-minute energy grid demand
- ARIMA(3,1,0) is not as good as LightGBM with the same predictors

Thank you!



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