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A comparative study of forecasting techniques for sustainable energy systems

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Motivation

- Increase in *electification*
- Surge in *intermittend* energy sources (e.g. solar & wind)
- Increase in energy *curtailment* (energy lost due to grid balancing)

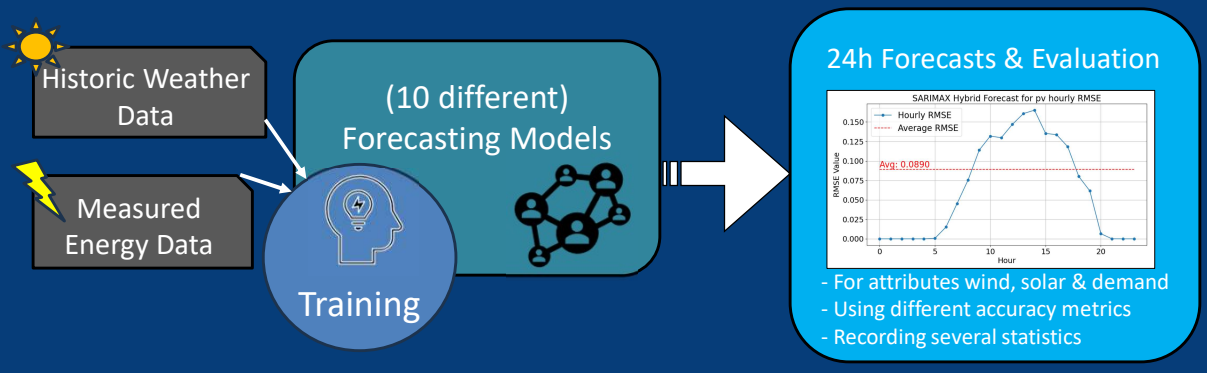
Energy Forecasting

Improves predictability

Enables:

- Control of storage
- Coordinated EV Charging
- *and more*

Methodology



Evaluation

Naive Hour:
Uses the value of the last measured hour as the prediction

Naive Day:
Uses the value of the same hour of the previous day

ARIMA: (Autoregressive integrated moving average)
A common univariate statistical approach

SARIMAX: (Seasonal ARIMA with Exogenous Factors):
A statistical model that uses seasonality and exogenous variables

Telescope:
An automatic feature extraction and transformation tool for Time Series Forecasting

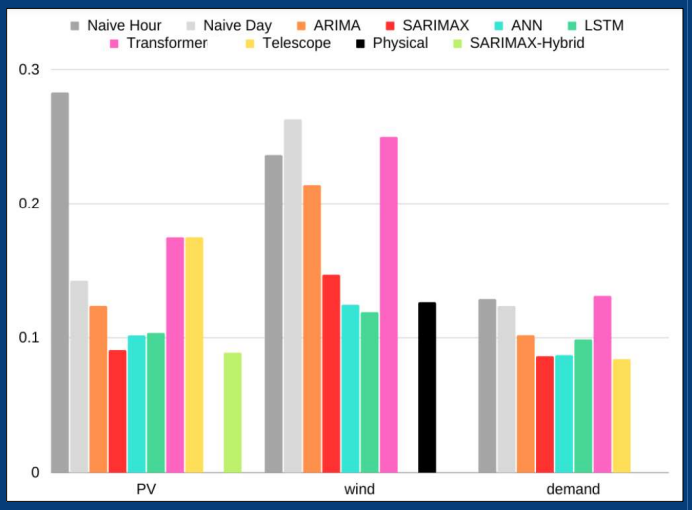
ANN (Artificial Neural Network):
Common machine learning approach

LSTM (Long Short-Term Memory):
Machine learning approach that uses neural networks & so called LSTM cells

Transformer:
Machine learning approach that uses a complex encoding and decoding architecture

Physical:
An approach using the wind turbines power curve in combination with the windspeeds

SARIMAX-Hybrid:
Using SARIMAX in combination with a naive approach



RMSE of the different forecasting attributes (high = bad)

Conclusion

- Various approaches are useful for different applications
- Approaches using neural networks see much success
- Data collection & preprocessing is crucial
- Parametrization of models highly affects outcome

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