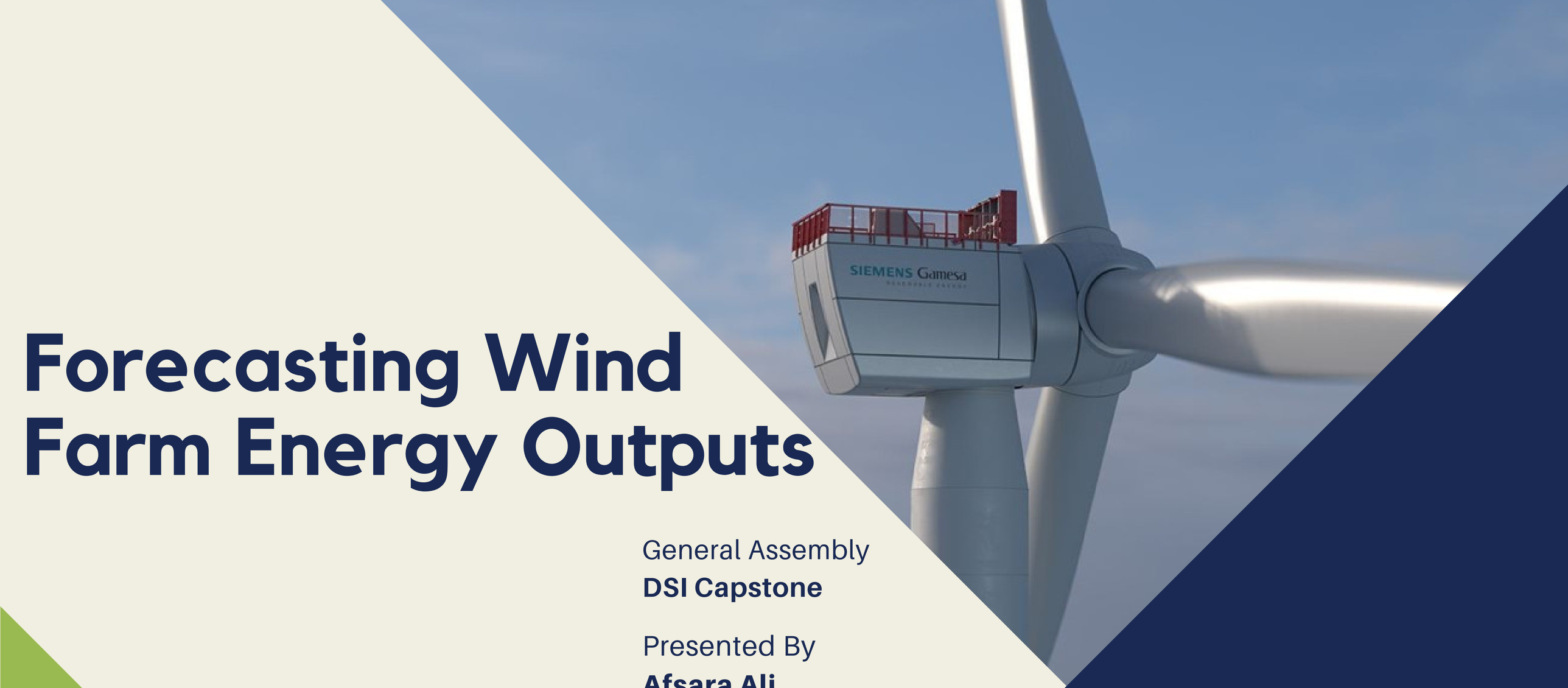
Forecasting Wind Farm Energy Outputs



General Assembly

DSI Capstone

Presented By

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Outline

Advantages

- Wind IS solar power
- Cost-effective
- Creates jobs and supplements income
- Turbines can be built on existing farmed land and ranches
- Blade lifespan is 25-30 years max

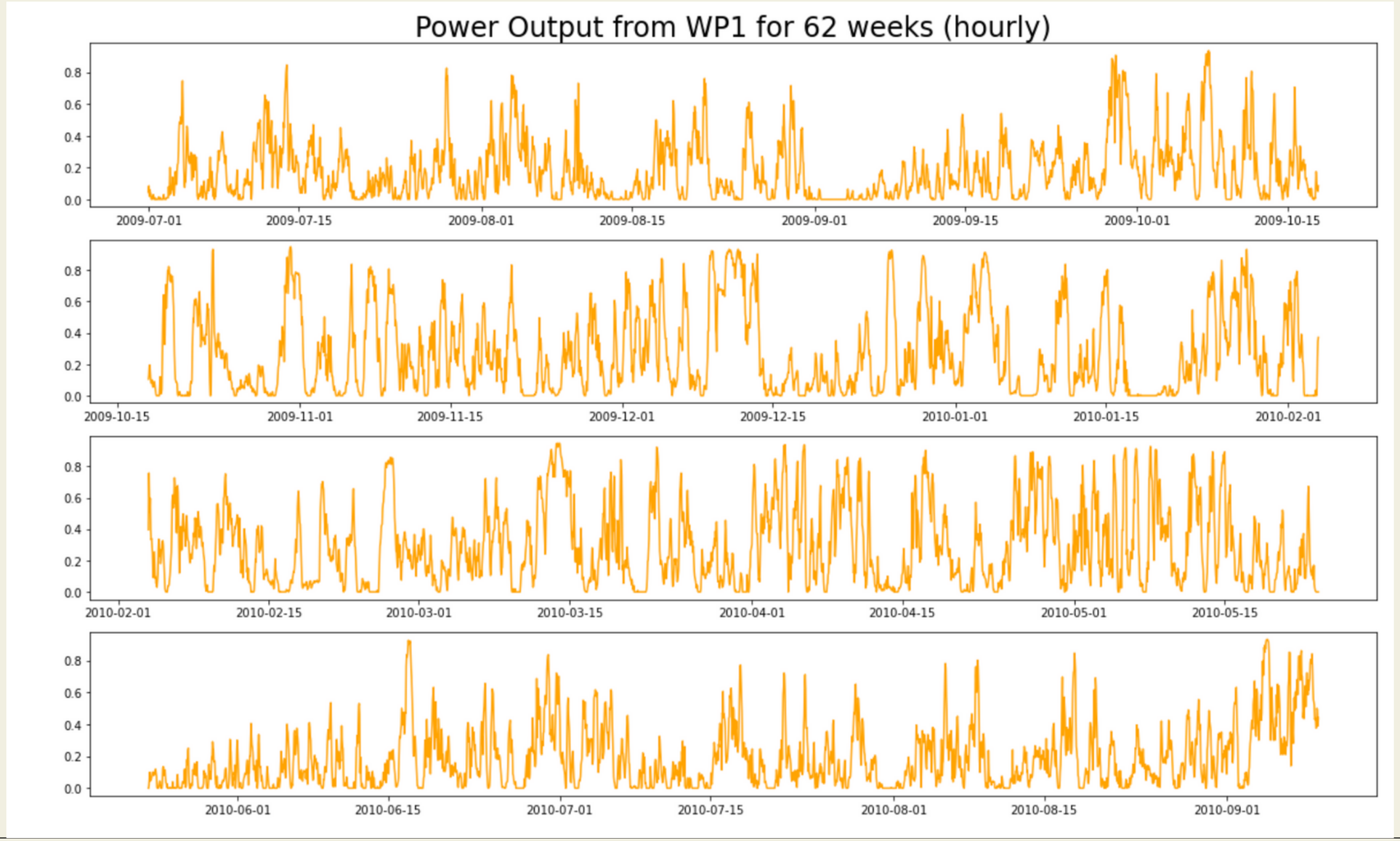
Disadvantages

- Weather-dependent
- Noise pollution & habitat alteration
- Far from urban areas that would benefit most
- Only recently more focused on recyclable components
    - ex. Siemens Gamesa claims its RecyclableBlades are “the world’s first recyclable wind turbine blades ready for commercial use offshore.”

Problems:

How do I forecast wind energy output for wind farms?

Which timeseries model and forecast is most accurate?

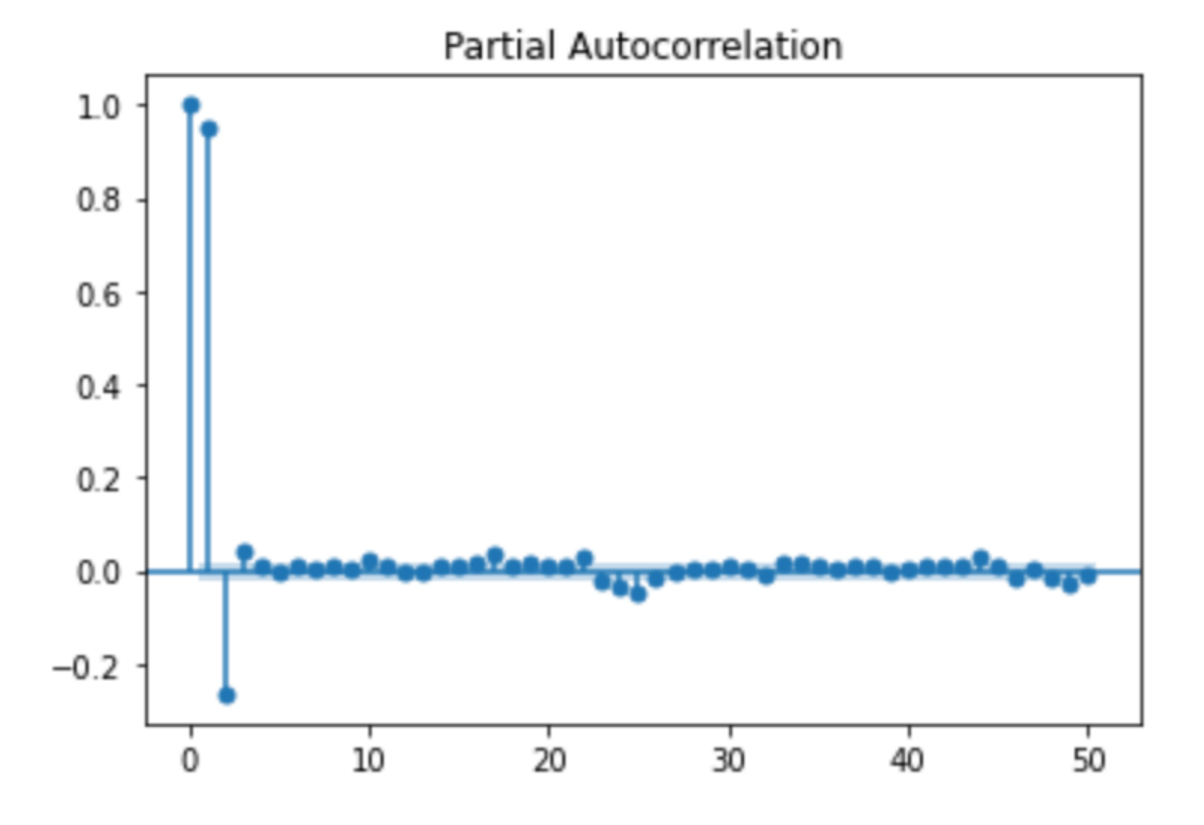

Power Output from WP1 for 62 weeks (hourly)
0.0
0.2
0.4
0.6
0.8
2009-07-01
2009-07-15
2009-08-01
2009-08-15
2009-09-01
2009-09-15
2009-10-01
2009-10-15
2009-10-15
2009-11-01
2009-11-15
2009-12-01
2009-12-15
2010-01-01
2010-01-15
2010-02-01
2010-02-01
2010-02-15
2010-03-01
2010-03-15
2010-04-01
2010-04-15
2010-05-01
2010-05-15
2010-06-01
2010-06-15
2010-07-01
2010-07-15
2010-08-01
2010-08-15
2010-09-01

Model Comparison

AR2 and LSTM were used for comparison against the baseline of 0.31

MODEL	PARAMETERS	RMSE
ARIMA	P=1 D=0 Q=2	0.269
AR1	P=1 D=0 Q=0	0.261
AR2	P=2 D=0 Q=0	**0.27**
LSTM	nodes=2 lags=2 epochs=9	**0.21**

AR2 PACF



This is a classic AR2 model signature. It cuts off after 2 lags and leveling out over time.

App Showcase

Next Steps

MODELS

- adding layers to LSTM
- Tuning other hyperparameters
- generating forecasts for all windfarms in dataset

FORECASTS

- Larger scale
- Trying Monte Carlo
- Incorporating weather conditions
- Adding confidence intervals for LSTM

APP

- Deploying remotely