A Model to Size Offshore Wind Energy Storage for Oil Platforms

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Why Energy Storage?

Grid-independent consumers can lower GHG emissions and combat rising fuel prices and emission taxes by switching to offshore wind power. However, wind alone must rely on supplementary generators due to its intermittency. Localized energy storage (ES) can reduce and eliminate dependency on fossil fuels. This model sizes an ES system to minimise energy required from Back-Up (BU) generators.

Future Development

Known Issues:

- Optimisation based solely on reducing back-up energy requirement, resulting in oversized ES
- No visual on how often certain charging power is reached
- Dumped energy is calculated but not factored into the optimisation

Next Steps:

- Track high ES charging and BU power occurrences
- Cost-based optimisation
- Optimise wind park size
- Investigate grid code implementation
- Grid-Dependent consumers

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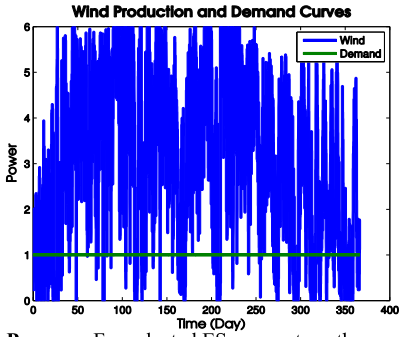
Methodology and Model

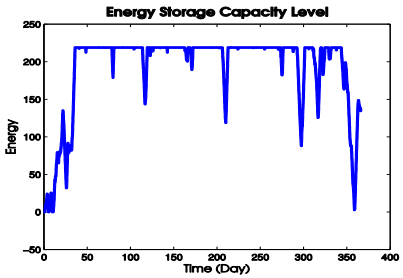
The model is coded using **MATLAB** and is split into three main stages:

1. ES Performance
2. Optimisation of ES
3. Wind Park Comparison

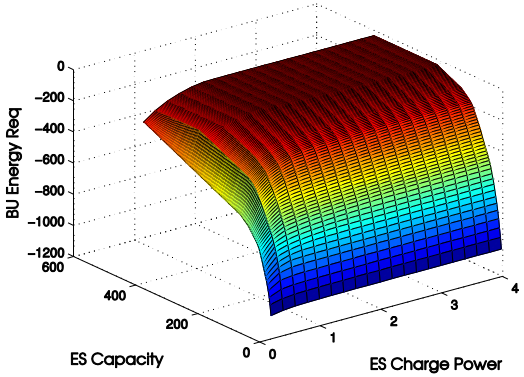
1. ES Performance



Purpose: For selected ES parameters, the difference between normalised wind power data and an off-grid consumer demand curve over a year is extracted and the following is simulated

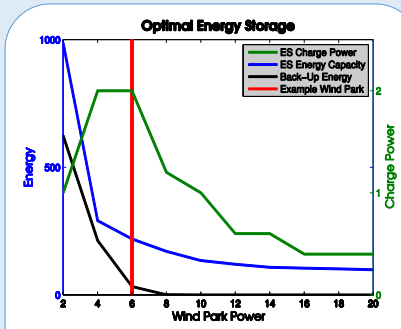


2. Optimisation of ES



Purpose: to find the lowest ES Capacity and Charging Power combination that will require the lowest yearly Back-Up energy through iteration

3. Wind Park Comparison



Purpose: Run optimisation with several different wind-park sizes

ES Parameters:

- Charge/Discharge Power
- Efficiency
- Min/Max Storage Capacity (Energy)
- Initial Capacity

Outputs (Over Time):

- Resultant ES Power/Energy
- Capacity Level Change
- Dump Load/Energy
- Back-Up Power/Energy

Assumptions:

- Constant Demand of 1
- Discharge Power set to match Demand
- Charge/Discharge Efficiency of 0.8
- Initial ES Capacity of 0

Literature:

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