WIND ENERGY INTEGRATION WITH INCREMENT IN FLEXIBILITY OF THE OIL-GAS POWER SYSTEM IN DEEP WATER

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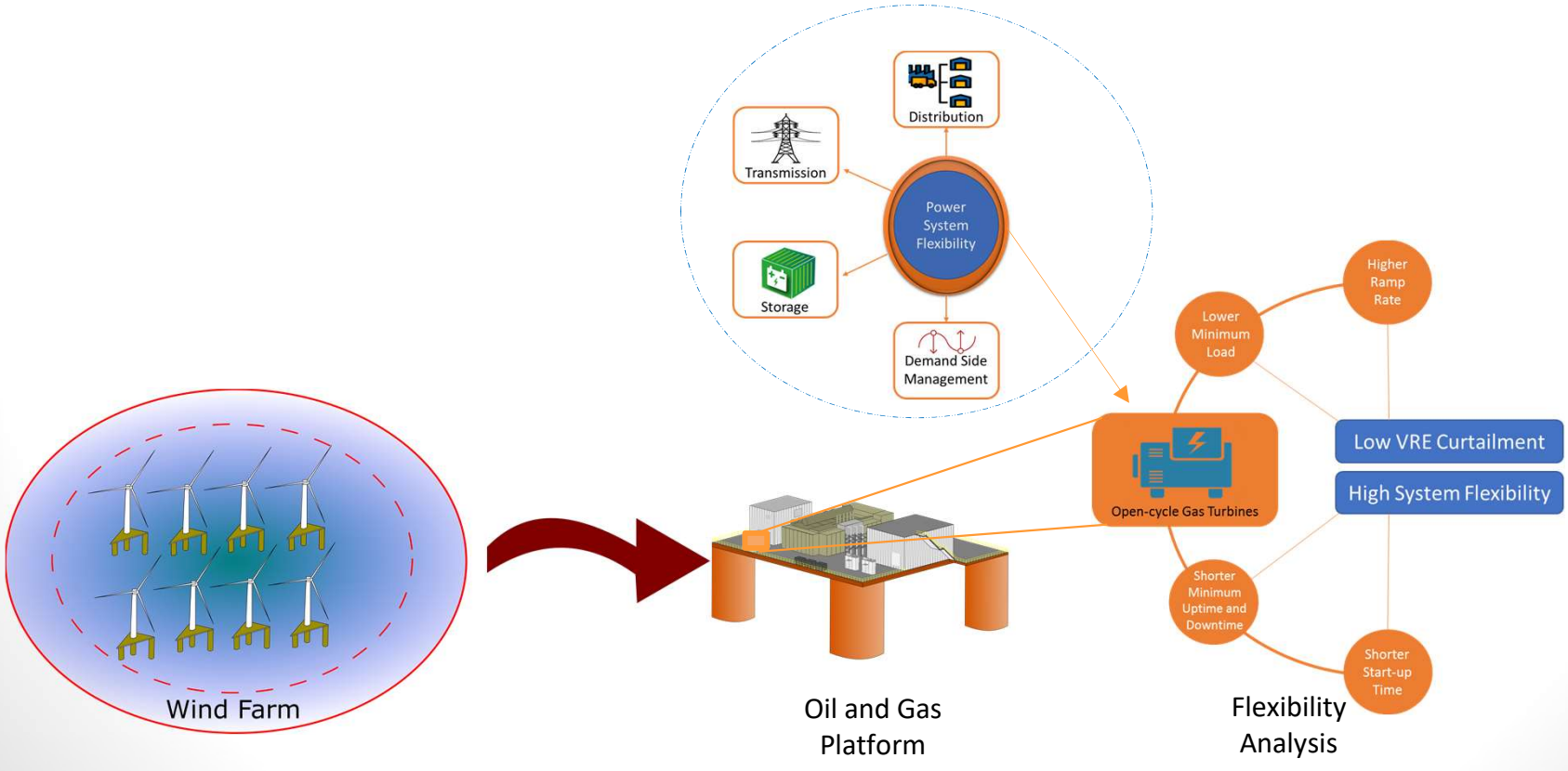
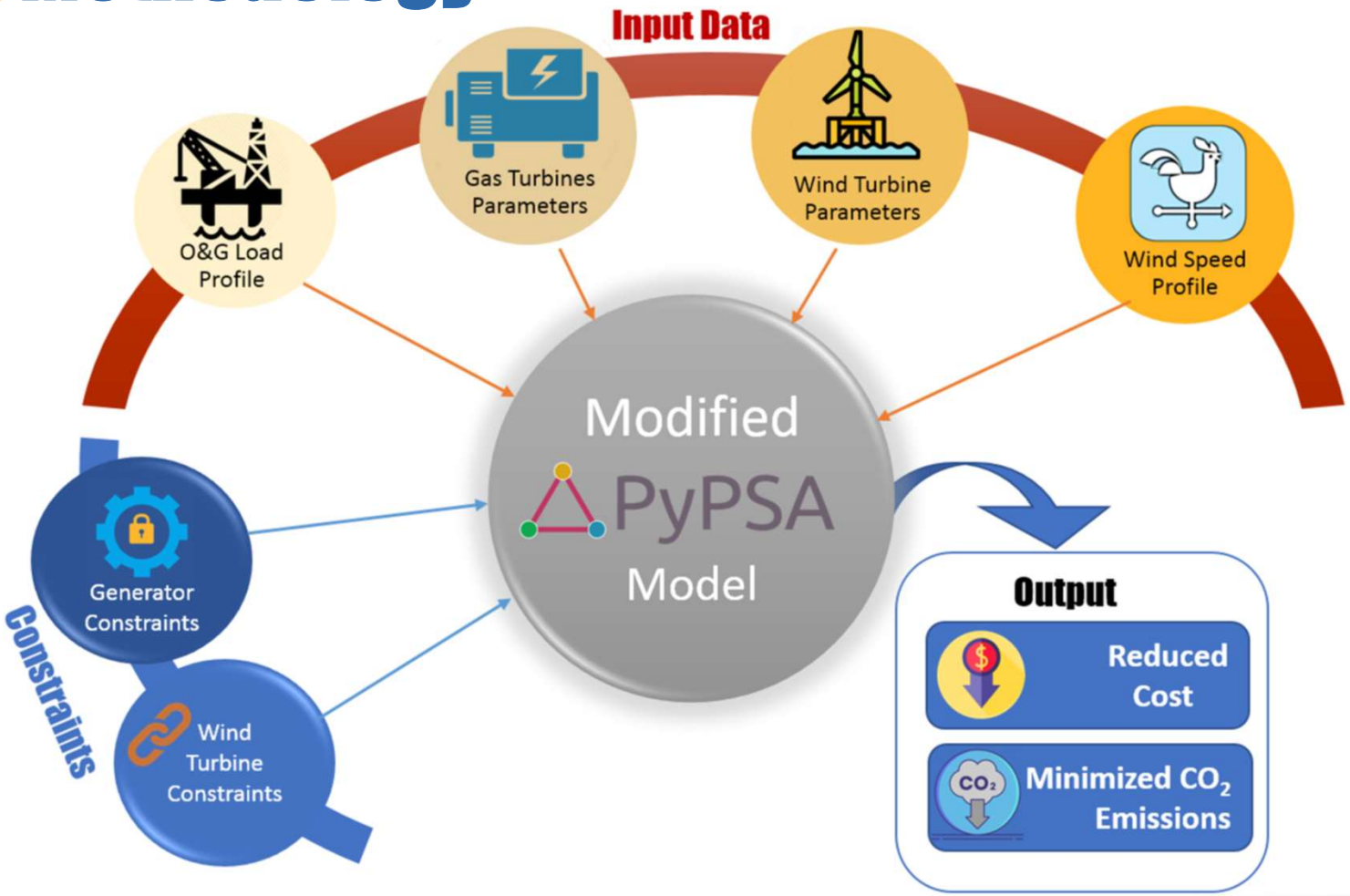


01 Objective

Analyze the power system flexibility to achieve higher shares of wind energy integration

- **Analysis of the Generation-side flexibility of the O&G platform** is the objective of this paper.
- Since, flexibility of the power system is the **ability to accommodate any variation** in the load-generation balance, while maintaining the satisfactory level of performance at any time scale.

02 Methodology



Modified PyPSA Model:
Takes into account the efficiency curve of the generators instead of the constant efficiency value.

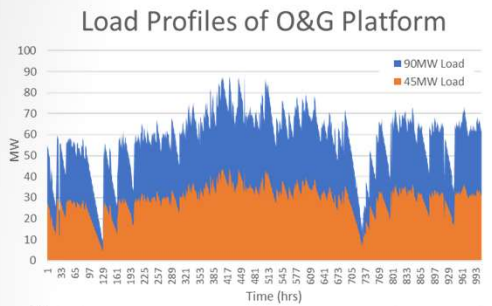
03 Simulation

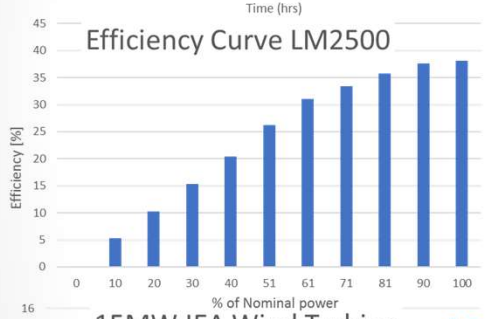
Power System Size

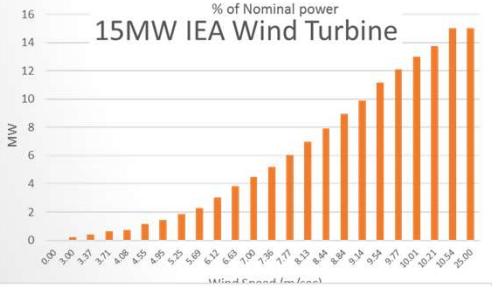
Open-cycle Gas Turbine
= 4 x 33MW

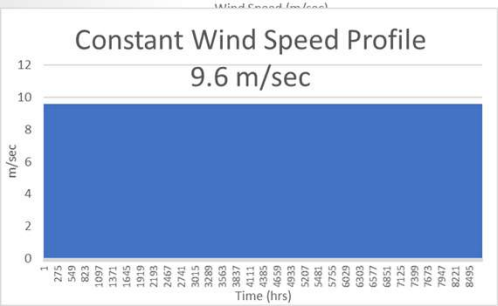
IEA Offshore Wind Turbine
= 4 x 15MW

Input Data





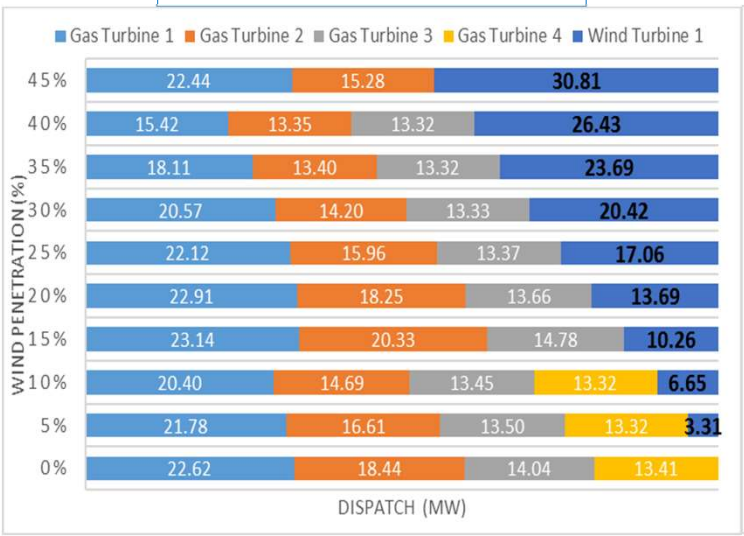




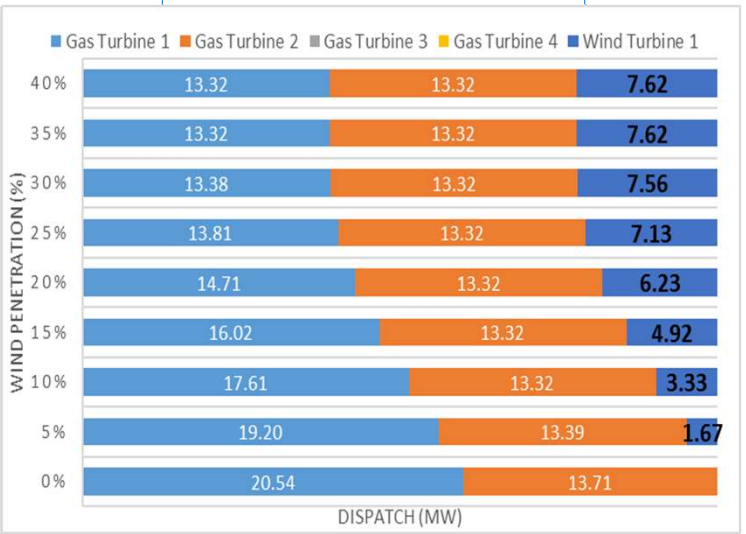
Case Studies

Conventional Constraints

1. Average Dispatch of Conventional Constraints - 68MW Average Load

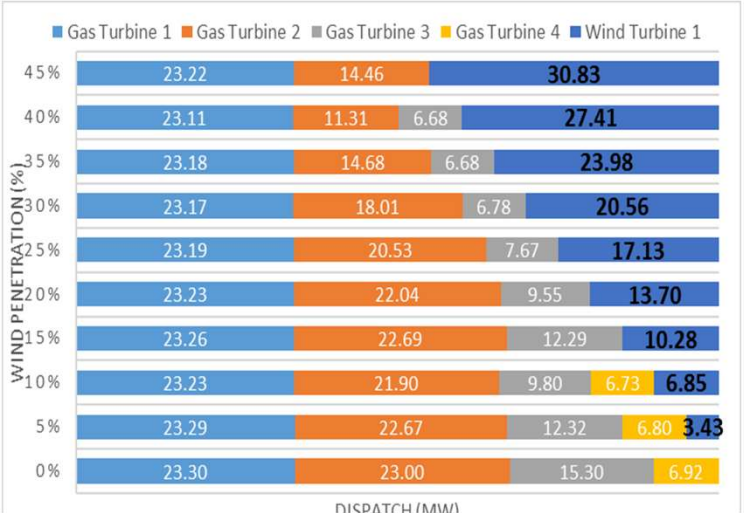


2. Average Dispatch of Conventional Constraints - 34MW Average Load

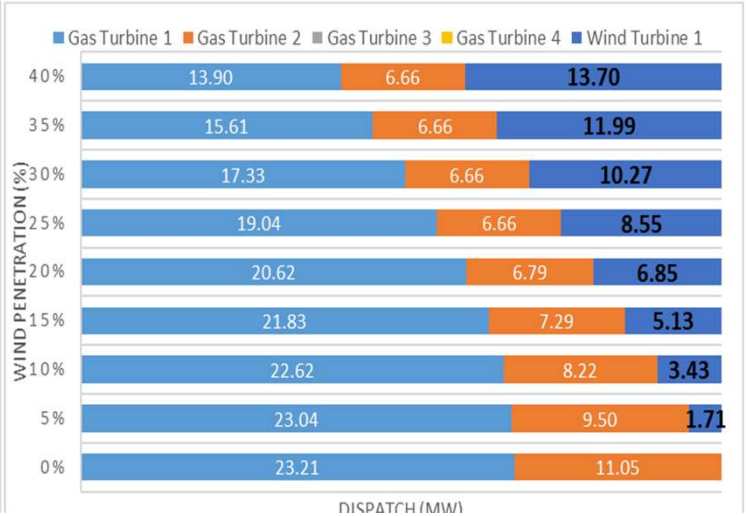


Flexible Constraints

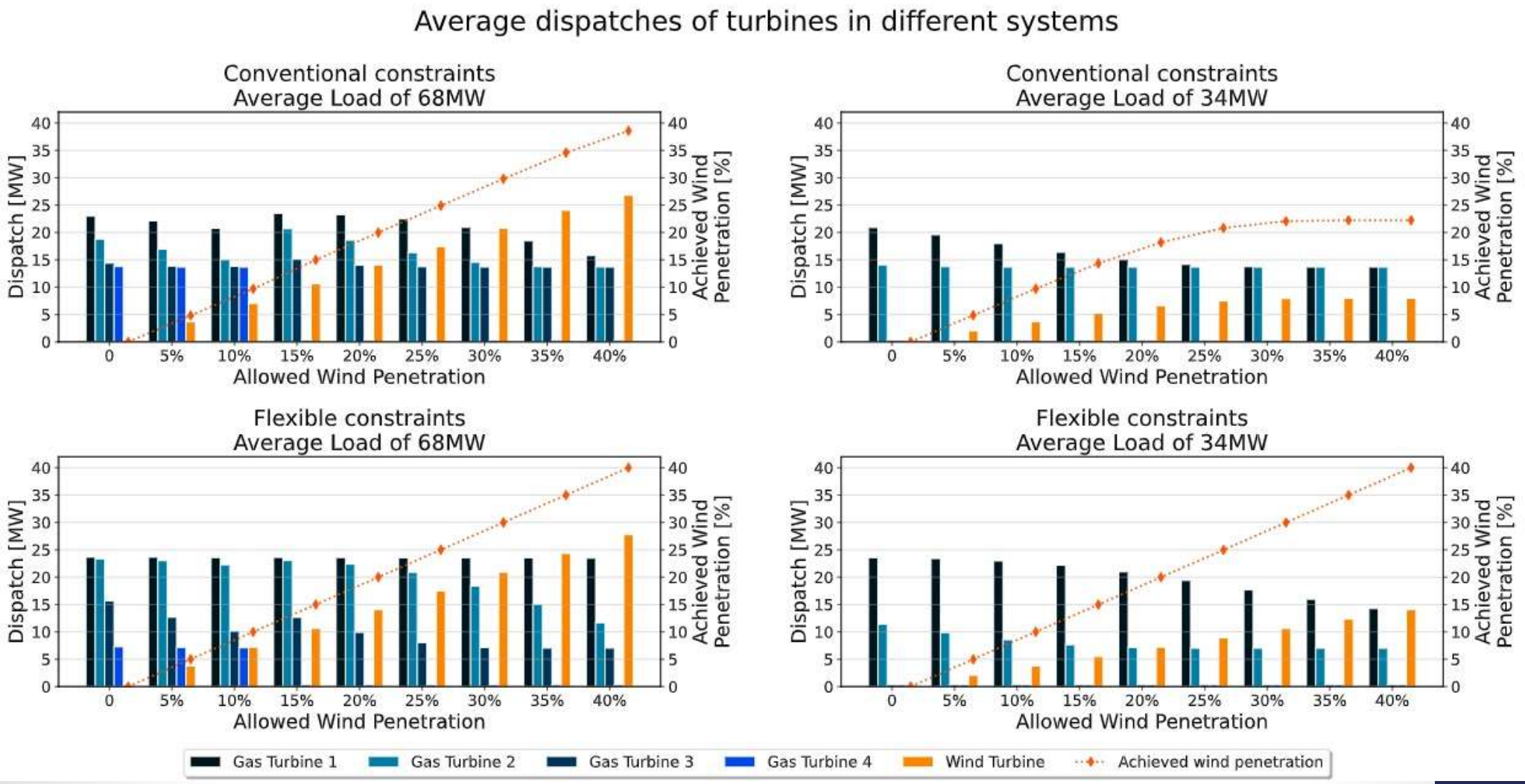
3. Average Dispatch of Flexible Constraints - 68MW Average Load



4. Average Dispatch of Flexible Constraints - 34MW Average Load

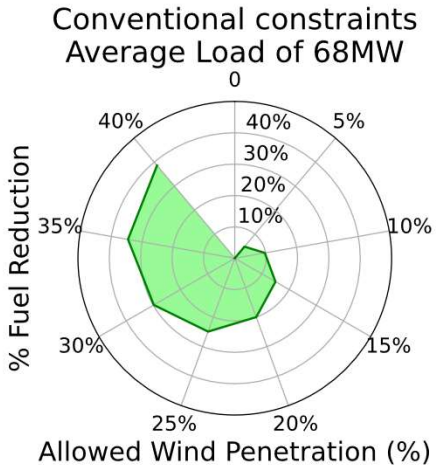


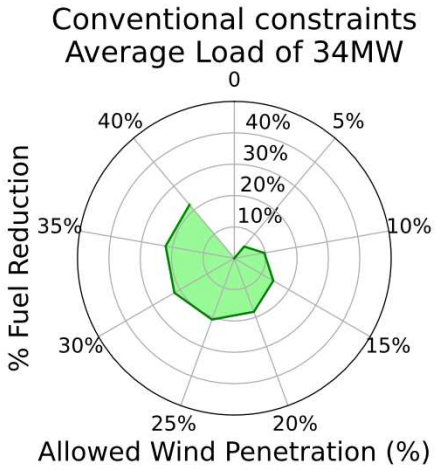
04 Results

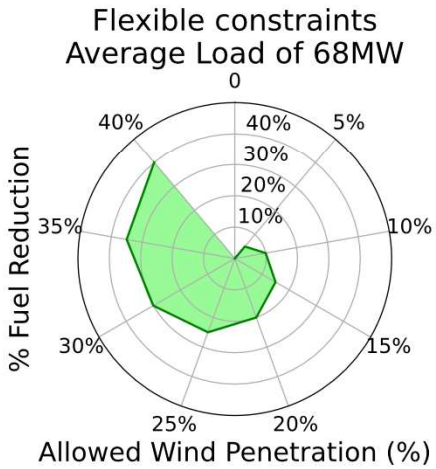

Average dispatches of turbines in different systems
Conventional constraints
Average Load of 68MW
Conventional constraints
Average Load of 34MW
Flexible constraints
Average Load of 68MW
Flexible constraints
Average Load of 34MW
Dispatch [MW]
Achieved Wind Penetration [%]
Allowed Wind Penetration
0
5%
10%
15%
20%
25%
30%
35%
40%
Gas Turbine 1
Gas Turbine 2
Gas Turbine 3
Gas Turbine 4
Wind Turbine
Achieved wind penetration

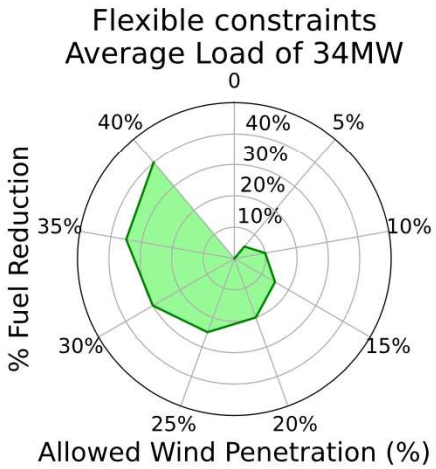
04 Results

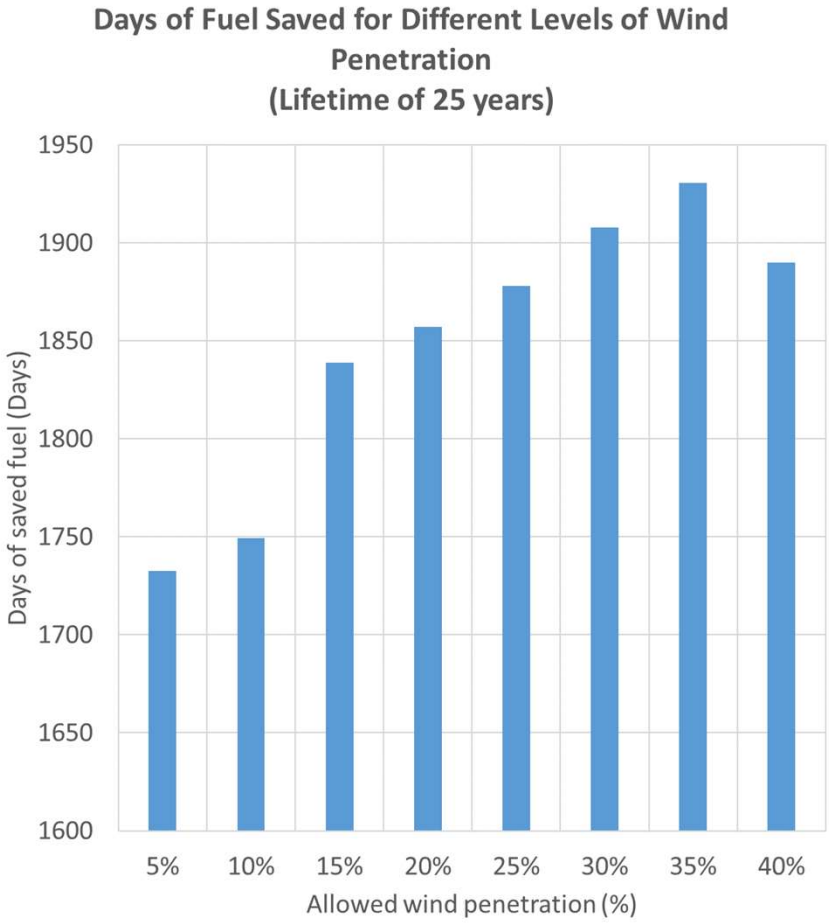
Average Fuel Consumption Reduction at Different Wind Penetration Levels











05 Conclusion

- In our analysis, the flexibility increment of the gas turbines can slightly increase the shares of wind energy.
- The increment in wind energy penetration reduces:
    - The fuel consumption and hence CO_2 Emissions.