EERA – DTOC planning tool for large offshore wind farms

Hasager, Charlotte Bay; Madsen, Peter Hauge; Giebel, Gregor

Publication date:
2015

Document Version
Peer reviewed version

Link back to DTU Orbit

Citation (APA):
EERA – DTOC planning tool for large offshore wind farms

Charlotte Bay Hasager, Peter Hauge Madsen, Gregor Giebel

DTU Wind Energy
A robust, efficient, easy to use and flexible tool created to facilitate the optimised design of individual and clusters of offshore wind farms.
Dansk artikel

Bedre planlægning af havvindmølleparker

DTU Vindenergi står bag stort projekt, der skal effektivisere projekteringen af havmølleparker og give os billigere el.

Selv om havvindmølleparker er uhyre kostbare, og der bruges meget tid på at planlægge dem, er projektudviklerne ikke altid lige gode til at tale sammen. Groft sagt ved den ene ekspert ikke altid, hvad den anden laver, og det koster tid og penge i stor stil.

http://www.dtu.dk/Nyheder/2015/04/Bedre-planlægning-af-havvindmoeller
Use and bring together existing models from the partners
• Develop open interfaces between them
• Implement a shell to integrate
• Fine-tune the wake models using dedicated measurements
• Validate final tool
Concept and implementation

Meteorological data / Cluster layout / Turbine data

Grid data

Wake models

Yield models

System services

Energy yield

Optimised Cluster Design

DTOC Tool

GIS
LCOE
uncertainty
FUGA
WAsP
WRF
WRF/ROMS
CorWind

DTOC Services

eefarm
FarmFlow
WCMS
Net-op
SKIRON
VENTOS
DTOC Design Tool Structure Overview

Local Computer

 DTOC core/server

Parameter Management

- WASP
  - Para 1: 0.5
  - Para 2: 3.445
- FarmFlow
  - Para 1: 2.345
- LCOE
  - Para 1: 9.5
  - Para 2: 3.1416

Data Persistence
- CMD line interface/API

Reporting

DTOC Server

Connector
- FUGA
- WASP/Park
- FarmFlow
- Electrical Issues

Connector
- FLaP
- LCOE
- Uncertainty

DTOC Wrapper

Connector
- SOAP Connector

Remote Servers

- SOAP Connector
- CoWind
- WRF
- etc.

Remote Connector
Local computer: GIS and local web browser
As a developer I can determine the optimum spacing, position, turbine model and hub height of turbines within an offshore wind farm.

Software supports the comparison of many design scenarios.

Comparative reporting enables selection of optimised configurations.

Score for comparison: Levelised Cost of Energy
Optimisation Process

1. Generate Design Options
   - Scenario 1
   - Scenario 2
   - Scenario 3
   - Scenario 4
   - Scenario 5
   - Scenario 6
   - Scenario 7

2. Evaluate Design Options
   - Wake Model
   - Electrical Model
   - Energy model

3. Compare Design Options

4. Iterate steps 1 to 3

Score: Levelized cost of energy

What decision parameter can we use to compare design options?
Validation of wake models

More than 10 wake models have been validated at Horns Rev, Lillgrund and Rødsand 2 offshore wind farms SCADA data from industry Lidar data at Alpha ventus and satellite data has also been used

The benchmark concludes that several models were able to handle the clustering of wind farms
Welcome to Wind & Economy

One of the most challenging tasks for wind farm developers is the optimisation of offshore wind power plants. Our new software tool, Wind & Economy, supports your challenging work with the seamlessly integrated modelling of wind climate, large scale and localized wind farm effects, electrical loss calculations and derivation of economic key figures.

http://wind-and-economy.com/home/
Wind & Economoy: The tool for wind farm optimization

- wind climate
- turbine type selection
- turbine spacing and placing
- interaction between wind farms in clusters with respect to energy production
- LCOE and economic uncertainty
- Scenario approach
- GIS integration

Bringing leading edge modelling to your desktop
Strategic planning

We aim at developing the tool for strategic planners

1) Add environmental aspects and restricted zones
2) Add sea bed and estimate foundation costs
3) Improved cost of energy and O&M module
4) Further detail wind farm cluster effects
5) Include social acceptance

DTU has submitted EUDP2015 proposal (Danish national activity). Overspeed as submitted two proposals in Germany.