EERA –DTOC planning tool for large offshore wind farms

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

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Charlotte Bay Hasager, Peter Hauge Madsen, Gregor Giebel

DTU Wind Energy
EERA DTOC project vision

A robust, efficient, easy to use and flexible tool created to facilitate the optimised design of individual and clusters of offshore wind farms
Bedre planlægning af havvindmølleparker

DTU Vindenergi står bag stort projekt, der skal effektivisere projektering 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.
EERA DTOC main components

- 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
DTOC Design Tool Structure Overview

Local Computer

DTOC Server

Parameter Management

Data Persistence

CMD line interface/API

Reporting

DTOC core/server

Scenario Management Server

WASP
- Para 1: 0.5
- Para 2: 5.6345

FarmFlow
- Para 1: 2.345

LCOE
- Para 1: 9.5
- Para 2: 3.1416

Remote Servers

DTOC Wrapper

 arose FUGA

WASP/Park FarmFlow

Electrical Tissues

Local Wind

Remote Connector

Remote Connector

SOAP Connector

SOAP Connector

SOAP Connector

SOAP Connector

CorWind

WRF

etc.
Local computer: GIS and local web browser

Web application

Scenario: DTOC WP5 Base Scenario meteo WRF
- Project: DTOC WP5 Base Scenario (Race Bank)
- Tree: DTOC WP5 Base Scenario Tree
  - Scenarios: DTOC WP5 Base Scenario
  - Scenarios: DTOC WP5 Base Scenario meteo
  - Scenarios: DTOC WP5 Base Scenario meteo WP5
  - Scenarios: DTOC WP5 Base Scenario meteo WRF
- Scenario: DTOC WP5 Base Scenario meteo WRF

Scenario Properties

Wind Farm Parameters
- Race Bank
  - Parameters
  - Location
  - Wind Farm Shape
  - Wind Turbines
  - Substations
  - Cables
- Dudgeon
- Inner Dowsing
- Lincs
- Lynn
- Sheringham Shoal
- Triton Knoll A
- Triton Knoll B

Wind Turbine Type Parameters

Model Parameters
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

What decision parameter can we use to compare design options?

Score: Levelized cost of energy
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
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.
Project partners