EERA –DTOC planning tool for large offshore wind farms

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

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EERA –DTOC planning tool for large offshore wind farms

Charlotte Bay Hasager, Peter Hauge Madsen, Gregor Giebel

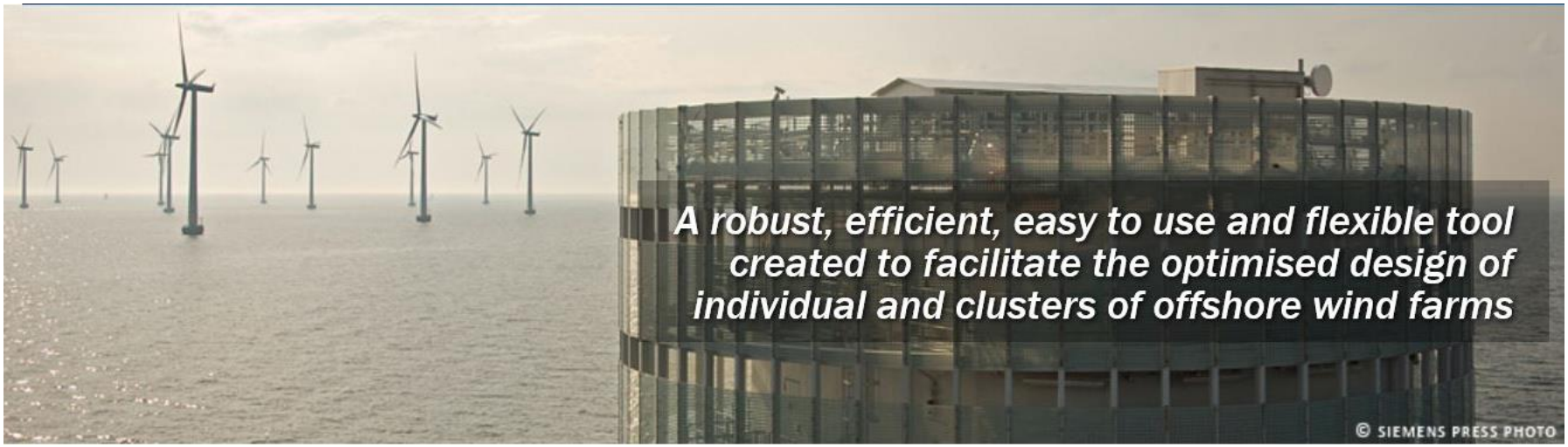
DTU Wind Energy

EERA DTOC

THE EUROPEAN ENERGY RESEARCH ALLIANCE
DESIGN TOOLS FOR OFFSHORE WIND FARM CLUSTER

Support by

EERA DTOC project vision



Dansk artikel

Bedre planlægning af havvindmølleparker

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

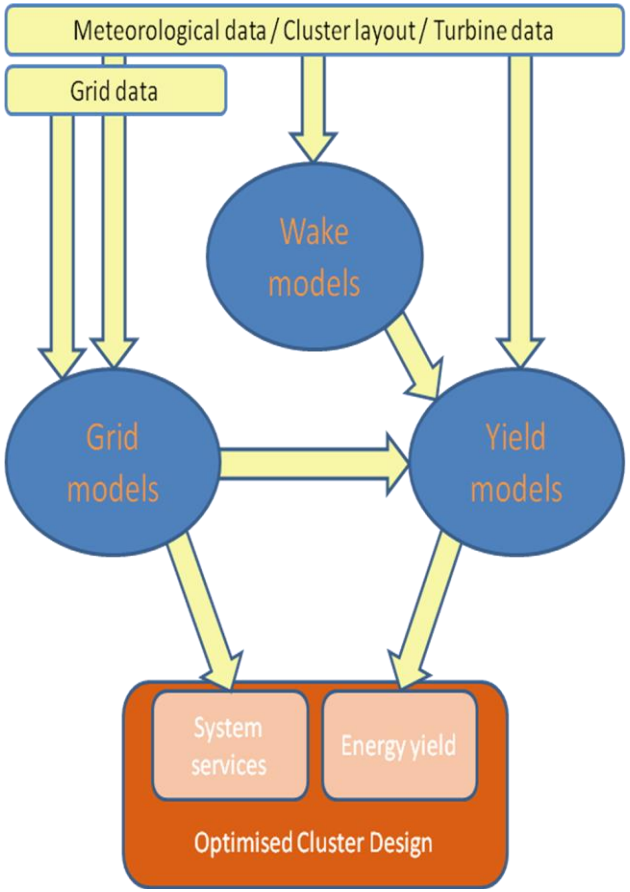
Selv om havvindmølleparker er uhyre kostbare, og der bruges meget tid på at planlægge dem, er projektudviklerne ikke altid lige gode til at tale sammen. Groft sagt ved den ene ekspert ikke altid, hvad den anden laver, og det koster tid og penge i stor stil.

http://www.dtu.dk/Nyheder/2015/04/Bedre-planlaegning-af-havvindmoeller

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



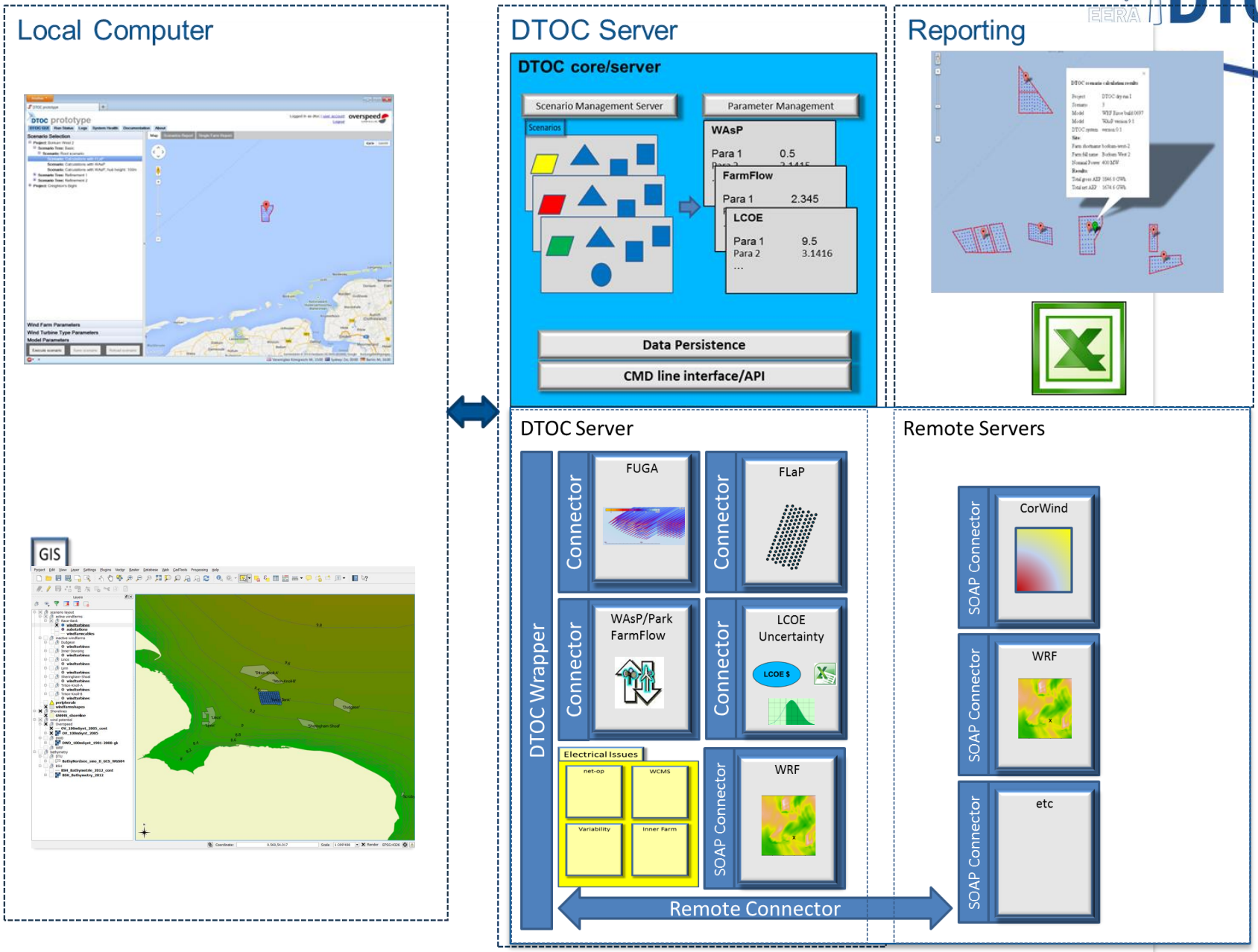
DTOC Tool

- GIS
- LCOE
- uncertainty
- FUGA
- WAsP
- WRF
- WRF/ROMS
- CorWind

DTOC Services

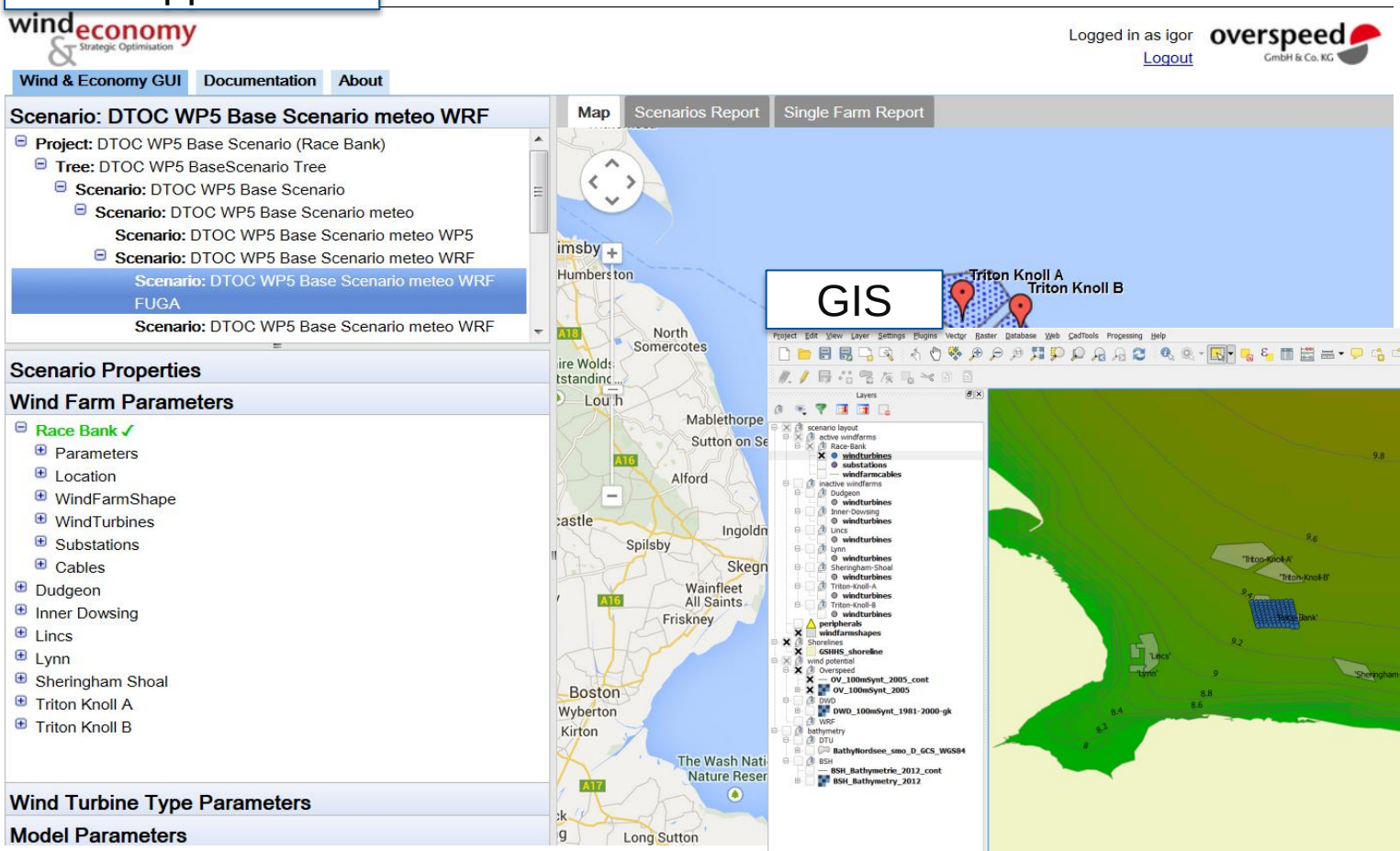
- eefarm
- FarmFlow
- WCMS
- Net-op
- SKIRON
- VENTOS

DTOC Design Tool Structure Overview



Local computer: GIS and local web browser

Web application



Optimisation process

- 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

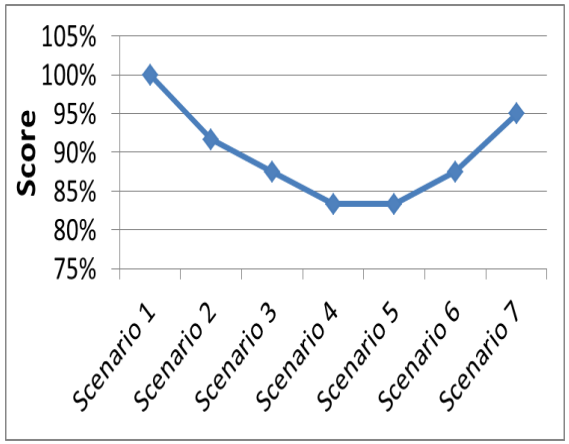
2. Evaluate Design Options

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

Validation of wakes 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

Wind & economy

wind & economy Strategic Optimisation

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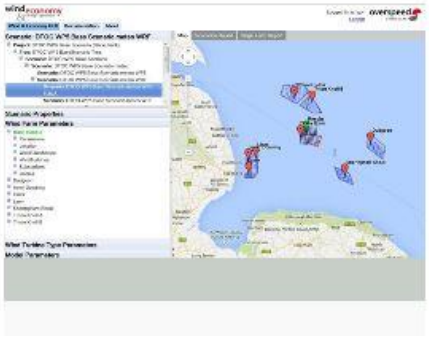
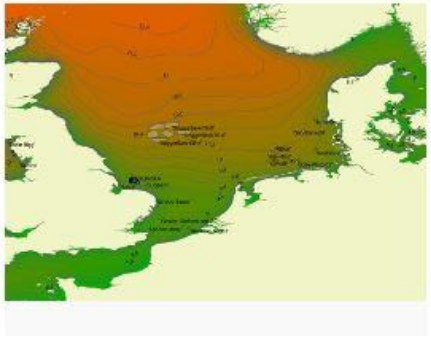
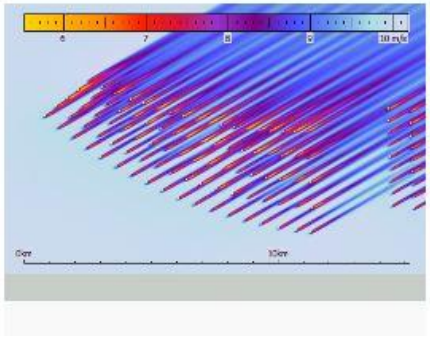
  - GIS Integration
  - Uncertainty Modelling for Risk Management

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/

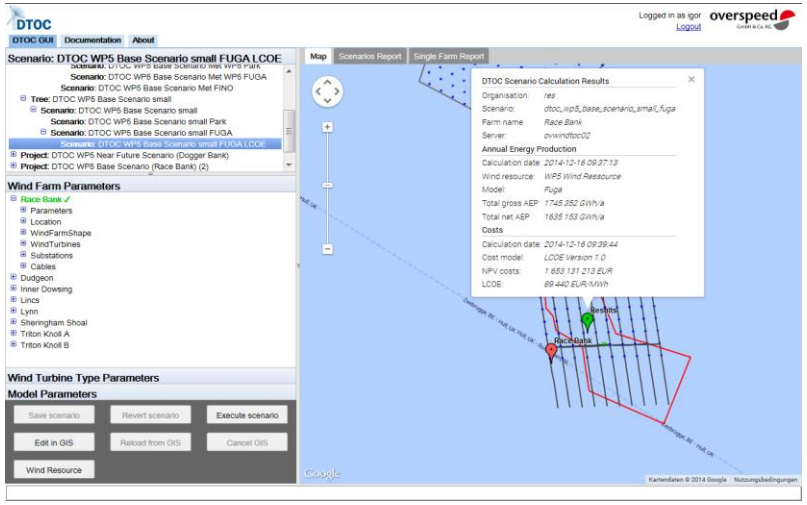
Wind & Economoy:
The tool for wind farm optimization

- 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.

Project partners

EERA European Energy Research Alliance

EERA DTOC

DTU

CENER ADItech

Fraunhofer IWES

ECN

University of Strathclyde Glasgow

ForWind Zentrum für Windenergieforschung

KAΠE CRES

SINTEF

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