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

# Exploitation Plan

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## Document information

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# Contents

# 1 EXECUTIVE SUMMARY

The product that resulted from the EERA-DTOC project, a design tool for offshore wind farm clusters, is marketed under the brand *Wind&Economy*. With the *Wind & Economy* software, wind farm developers have access to a tool which may model the large scale effects of wind farm clusters and large wind farms in order to optimise the wind farm layout with respect to energy production and economics (levelised costs of energy), including turbines and infrastructure costs.

The current product is an advanced prototype, requiring additional work for a real end-user suitable version. To finance this development, Overspeed is looking for an external investor/business angle with an investment of approximately 300,000 EUR

Further public events to attract future customers will be the EWEA Annual Event in Paris, November 2015, where version 1.0 will be presented, after financial close with an investor.

# 2 INTRODUCTION

The goal of this Exploitation Plan is to present the status and the upcoming activities to exploit the EERA-DTOC project results, in particular the software tool developed in the project.

The goal is to:

- Support the exploitation process of the DTOC tool;
- Support the marketing activities for the DTOC tool.

This includes:

- Collection of unique selling points;
- Presentation of next actions;
- Time schedule.

# 3 SUMMARY OF PRODUCT DESCRIPTION

*Optimised offshore windfarms*

One of the most challenging tasks for wind farm developers, the optimisation of wind power plants in the middle of large offshore wind farm clusters, is tackled by the new software tool *Wind & Economy* which was presented at the EWEA offshore conference in Copenhagen in March 2015. In large offshore clusters, like the German Bight and Dogger Bank, the regional wind climate itself changes by the influence of the big number of turbines, and the wake effects of the big arrays are much more pronounced than known from onshore installations.

*EU R&D project*

*Wind & Economy* is a spin-off from the EU-funded R&D project DTOC, Design Tools for Offshore Wind Farm Clusters. This project initiated and led by the European Energy Research Alliance (EERA), brought together models from leading edge research and practical needs and experiences of high-impact industry partners.

*Levelised costs of energy*

With the *Wind & Economy* software, wind farm developers have access to a tool which may model the large scale effects of wind farm clusters and large wind farms in order to optimise the wind farm layout with respect to energy production and economics (levelised costs of energy), including turbines and infrastructure costs. In order to offer simple integration with existing wind farm design work flows, a conventional GIS is closely integrated into the software product.

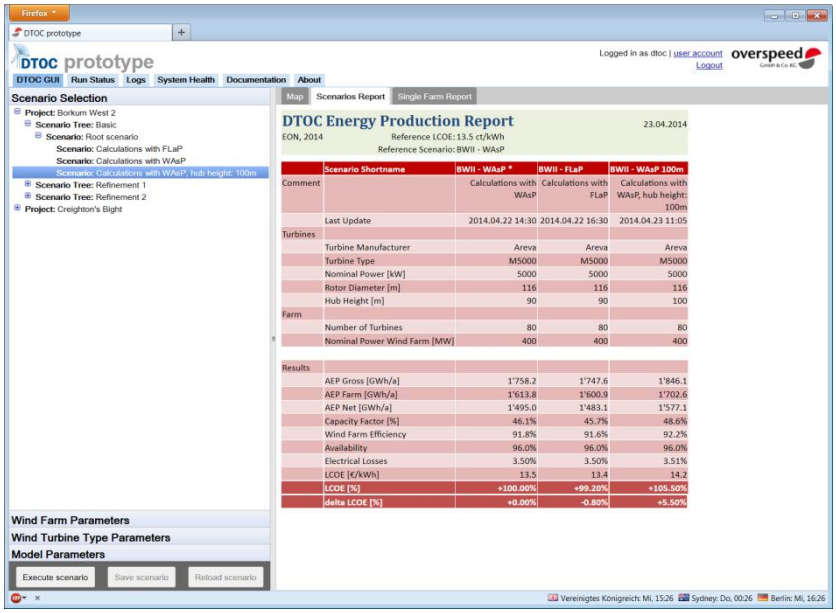
*Strengths of* Wind & Economy

A big advantage of the close cooperation of researchers, end-users and software developers is the seamless coupling of meteorological, wind farm effect and economical models which are not only from leading edge research and optimised for large offshore wind clusters, but are also verified with actual off-shore applications and measurements.

Other highlights of the *Wind & Economy* software include the support of strategic planners for defining areas for new offshore clusters, optimisation of the onshore grid connections, and the simulation of ancillary services like balancing power and voltage support from offshore wind farms, thus supporting the integration of the large amount of power into the electricity supply systems.

Figure 1 and Figure 2 shows the DTOC Prototype Energy Production Report and DTOC Prototype layout.

At present the tool is for offshore applications. A possible onshore tool is under consideration.




| | Scenario Shortname | BWII - WAsP * | BWII - FLaP | BWII - WAsP 100m |
|---|---|---|---|---|
| Comment | | Calculations with WAsP | Calculations with FLaP | Calculations with WAsP, hub height: 100m |
| | Last Update | 2014.04.22 14:30 | 2014.04.22 16:30 | 2014.04.23 11:05 |
| Turbines | | | | |
| | Turbine Manufacturer | Areva | Areva | Areva |
| | Turbine Type | M5000 | M5000 | M5000 |
| | Nominal Power [kW] | 5000 | 5000 | 5000 |
| | Rotor Diameter [m] | 116 | 116 | 116 |
| | Hub Height [m] | 90 | 90 | 100 |
| Farm | | | | |
| | Number of Turbines | 80 | 80 | 80 |
| | Nominal Power Wind Farm [MW] | 400 | 400 | 400 |
| Results | | | | |
| | AEP Gross [GWh/a] | 1'758.2 | 1'747.6 | 1'846.1 |
| | AEP Farm [GWh/a] | 1'613.8 | 1'600.9 | 1'702.6 |
| | AEP Net [GWh/a] | 1'495.0 | 1'483.1 | 1'577.1 |
| | Capacity Factor [%] | 46.1% | 45.7% | 48.6% |
| | Wind Farm Efficiency | 91.8% | 91.6% | 92.2% |
| | Availability | 96.0% | 96.0% | 96.0% |
| | Electrical Losses | 3.50% | 3.50% | 3.51% |
| | LCOE [€/kWh] | 13.5 | 13.4 | 14.2 |
| | LCOE [%] | +100.00% | +99.20% | +105.50% |
| | delta LCOE [%] | +0.00% | -0.80% | +5.50% |

Figure 1: Presentation of DTOC Prototype Energy Production Report

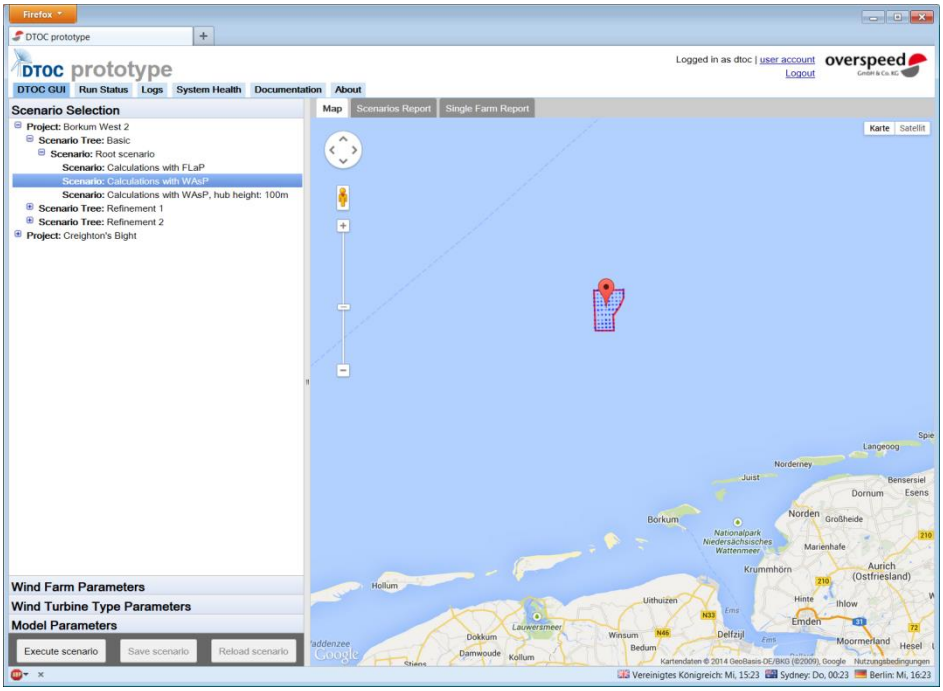



Figure 2: Presentation of DTOC Prototype

# 4 PROPERTIES AND UNIQUE SELLING POINTS

- Addressing wind farm developers and strategic planners;
- Supporting the user in its goal, efficient optimisation of the layout of offshore wind farms and efficient planning of large offshore areas;
- With respect to
    - Wind climate turbine selection
    - Turbine spacing and placing
    - Electrical infrastructure
    - Interaction between wind farms in clusters with respect to energy production
    - Wind resource
    - Limitations of usage
    - Grid connection;
- Clear workflow for layout, variation and comparison of variations in wind farm layout, called scenarios;
- Integrated comparative reporting;
- Multi-user mode;
- Includes economic calculations for benchmarking different layout scenarios via the LCOE;
- Seamless integration of leading edge models for wind climate and wind farm interaction calculations;
- Validation of integrated models with offshore applications;
- Integration of state-of-the-art wind farm wake models, supporting the effects of large scale wind farms and long distance wakes;
- Consideration of the non-uniform wind climate over large sea areas, including the change of wind climate by other existing or planned offshore wind farms;
- Coupling to GIS software for editing of locations and properties;
- Consideration of limitations and other exploitation by GIS approach.

# 5 IPR

During the project, it has been a focus to keep the IPR definitions clear and explicit.

The current IPR status is:

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|---|---|
| Interfaces and file formats: | Open |
| DTOC platform: | Overspeed |
| Calculation models (wakes, electric, wind resource): | The respective modeller or public domain |

Overspeed will lead the marketing and sales activities of the platform. As product, a combination of the DTOC platform and the models FUGA, WAsP, WRF and CorWind (remote) has been defined and is marketed via the brand *Wind&Economy*.

# 6 EXPLOITATION ACTIVITIES

Actually, the exploitation activities already started at the end of 2014, leading to a side-event at the Copenhagen EWEA offshore event in March 2015 and an exhibition stand. In addition, a new web page was set up for *Wind & Economy* (http://wind-and-economy.com/home/) and is updated constantly.

From the software development point of view, the current product is an advanced prototype, requiring approximately a 12 person month of additional work for a real end-user suitable version. To finance this development, Overspeed is looking for an external investor/business angle with an investment of approximately 300,000 EUR (including management and intensive marketing).

Further public events to attract future customers will be the EWEA Annual EVENT in Paris, November 2015.

The tentative time schedule is as follows:

- Exposé to potential investors — July 2015
- Financial close with an investor — September 2015
- Version 1.0 — November 2015
- Presentation on the EWEA Annual Event in Paris — November 2015
- Discussion and business plan for *Wind & Economy onshore* — May 2016

In total, the consortium, the lead partners, the External Advisory Board and the project reviewers see a large potential for the exploitation of the final software product.

While smaller national projects may extend the integration of single purpose models, future funding in the framework of EU R&D projects may also lead to structural extension to new application fields, like OandM strategies and wind farm operations.

In recent weeks, there have been activities to acquire additional funds from national funding bodies:

- Integration of the Fraunhofer wind farm model FLaP-FOAM, Germany, BMWi;
- Advanced optimisation of wind farm structure, Germany, BMWi;
- Dedicated applications for strategic planners including Denmark, (Innovationfund Denmark, proposal), and sea bed conditions