EERA-DTOC Software

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

Support by

SEVENTH FRAMEWORK PROGRAMME

Tool design and development process

- Vision and Requirements: User stories
- Model candidates
- System design
- Prototypes
- Version 0.8

Integration task

EERA-DTOC portfolio of models

Name	Partner	Status	Programs	Input/ output	Script/ GUI	Database interface	IPR	Com
CFDWake	CENER							
CorWind	Risoe DTU	Ope						
CRES-farm	CRES	Ope						
CRES--flowNS	CRES	Ope						
DWM	Risoe DTU	Ope						
ECNS	ECN	Beta						
EeFarm	ECN	Alpha						
Farm-farm interaction	ECN	Ope						
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Wake models

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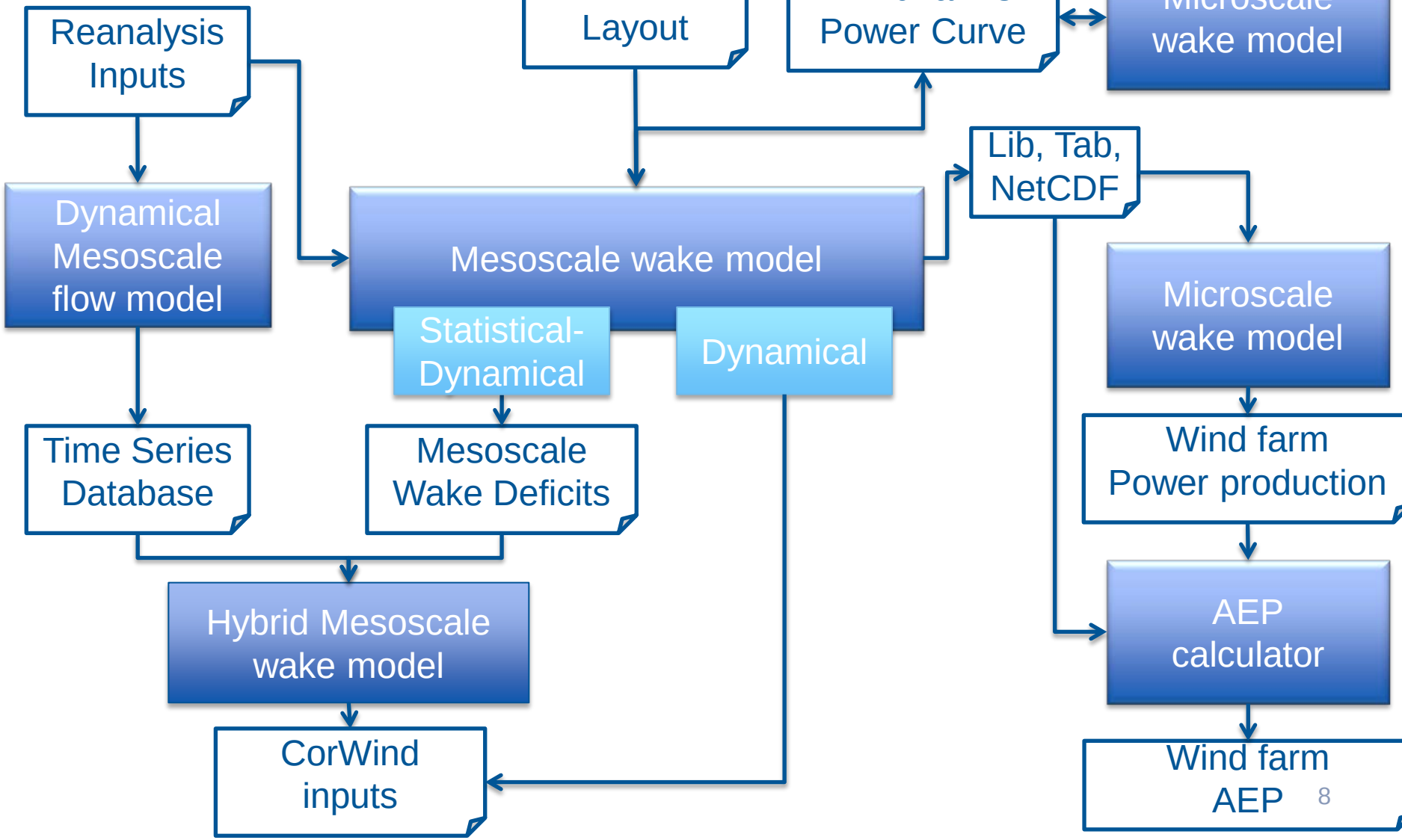
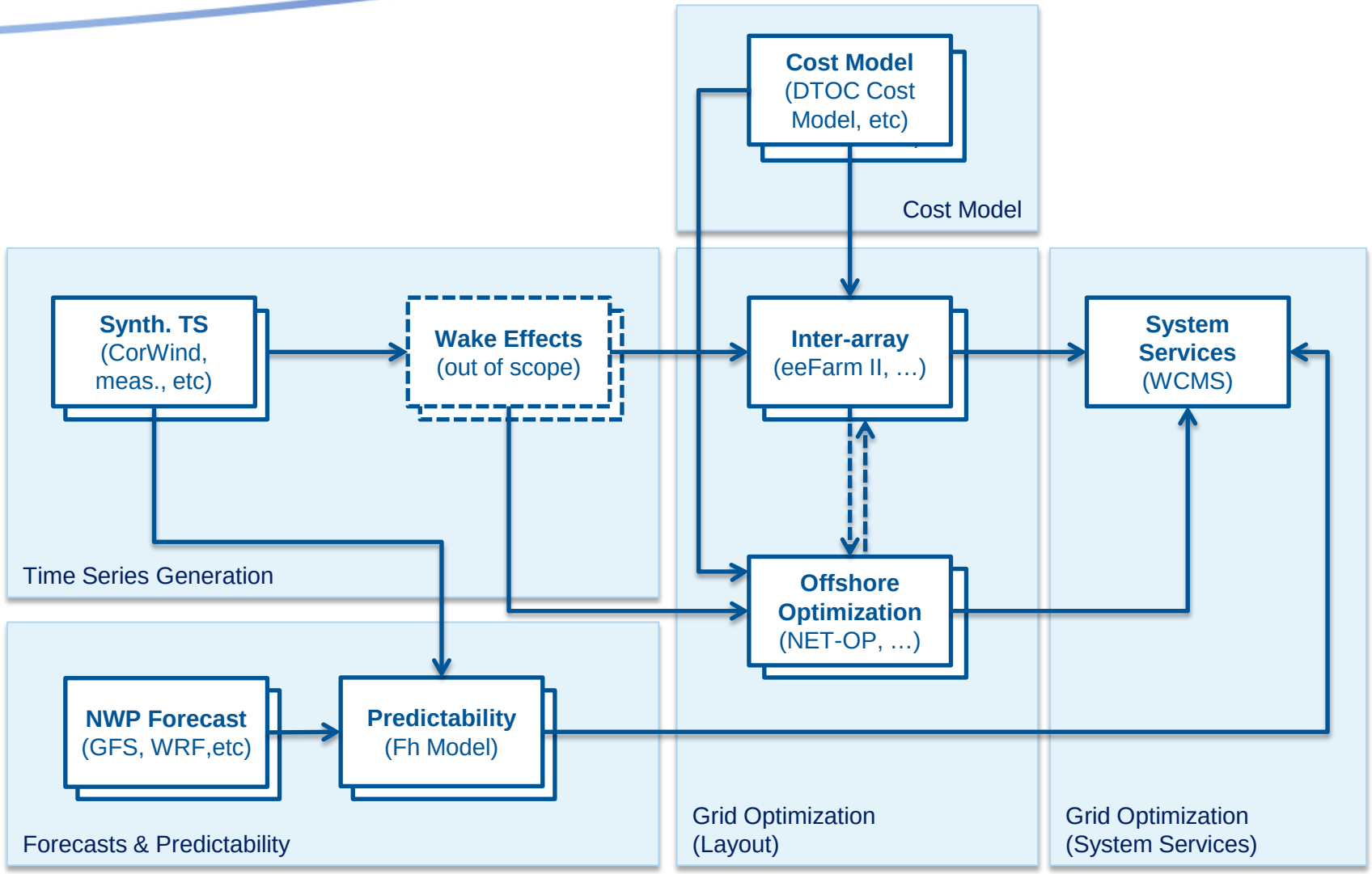
Electrical models

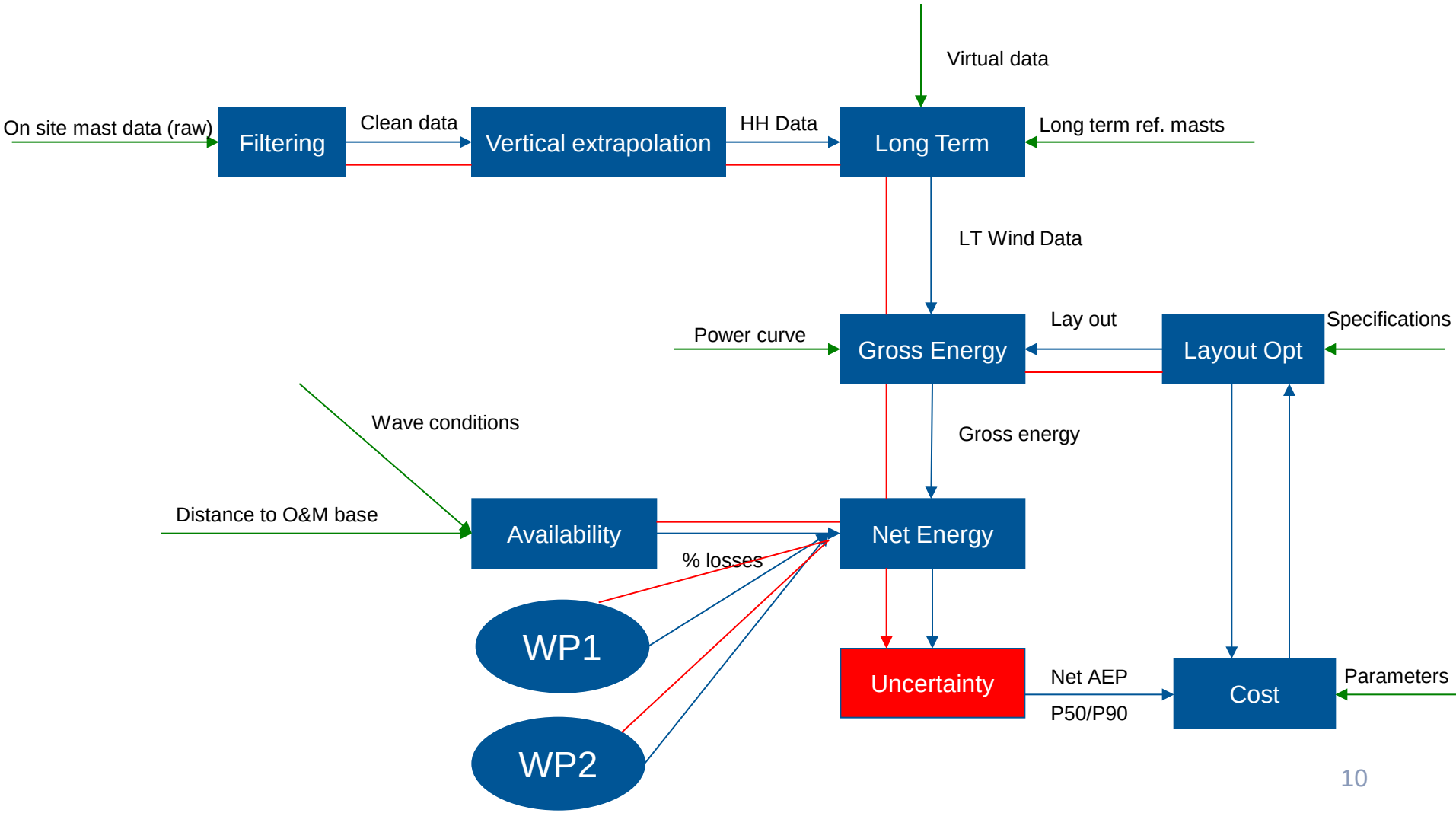
Model Workflow Wind Climate



Model Workflow “Electrical”



Yield modelling



User Requirements

Vision and Work Flow

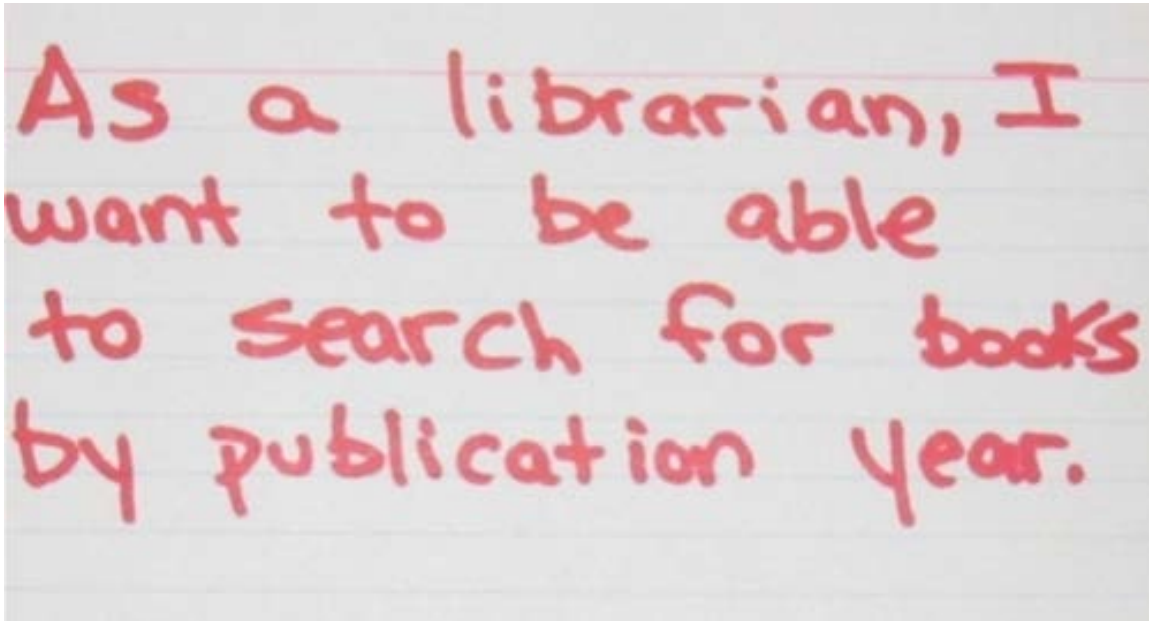
EERA-DTOC vision

- A **robust, efficient, easy to use** and flexible tool created to facilitate the **optimised design** of individual and clusters of offshore wind farms.

- A keystone of this optimisation is the precise prediction of the future **long term wind farm energy yield** and its associated uncertainty.

User Story

As a <user> I want to be able to <goal>



Selected User Stories

- As a developer I can determine the wake effects of neighbouring wind farm clusters on a single wind farm.
- As a developer I can determine the optimum spacing, position, turbine model and hub height of turbines within an offshore wind farm.
- As a strategic planner I can determine the optimum strategic infrastructure to accommodate offshore wind farm clusters.
- *14 relevant user stories in total*

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

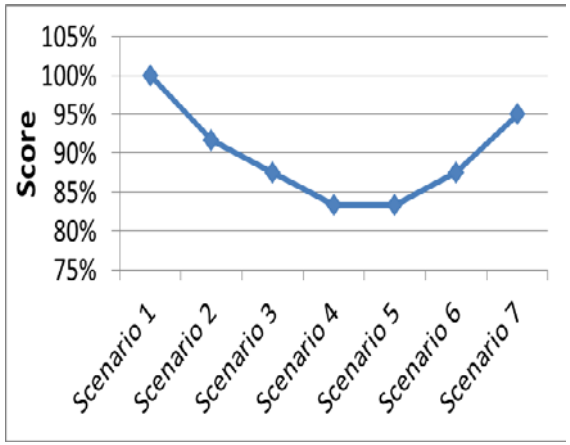
2. Evaluate Design Options

Wake Model

Electrical Model

Energy model

3. Compare Design Options

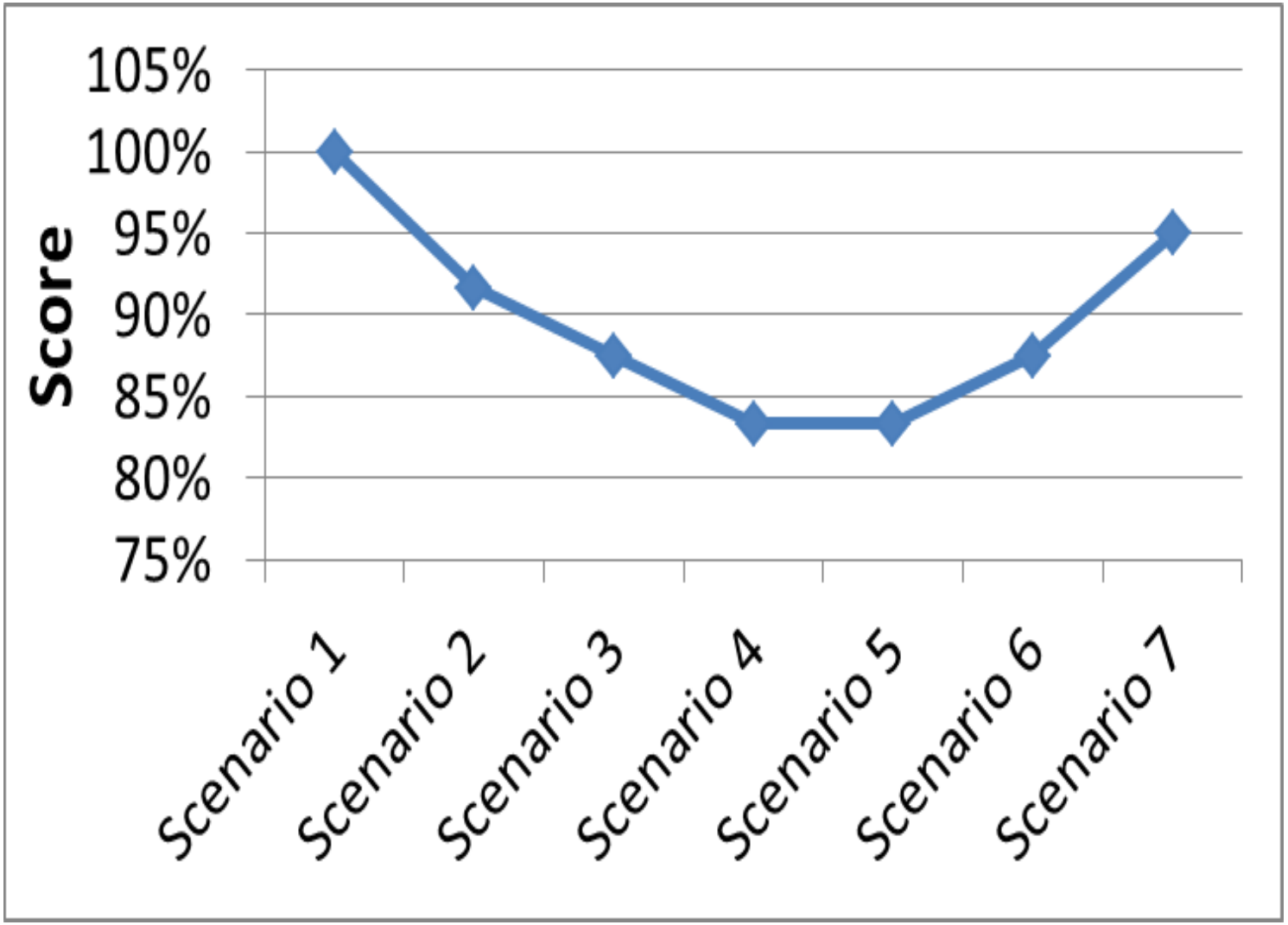


4. Iterate steps 1 to 3

Score: Levelized cost of energy

What decision parameter can we use to compare design options?

Comparison of scenarios



Software Implementation

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Run on Windows, on a single PC

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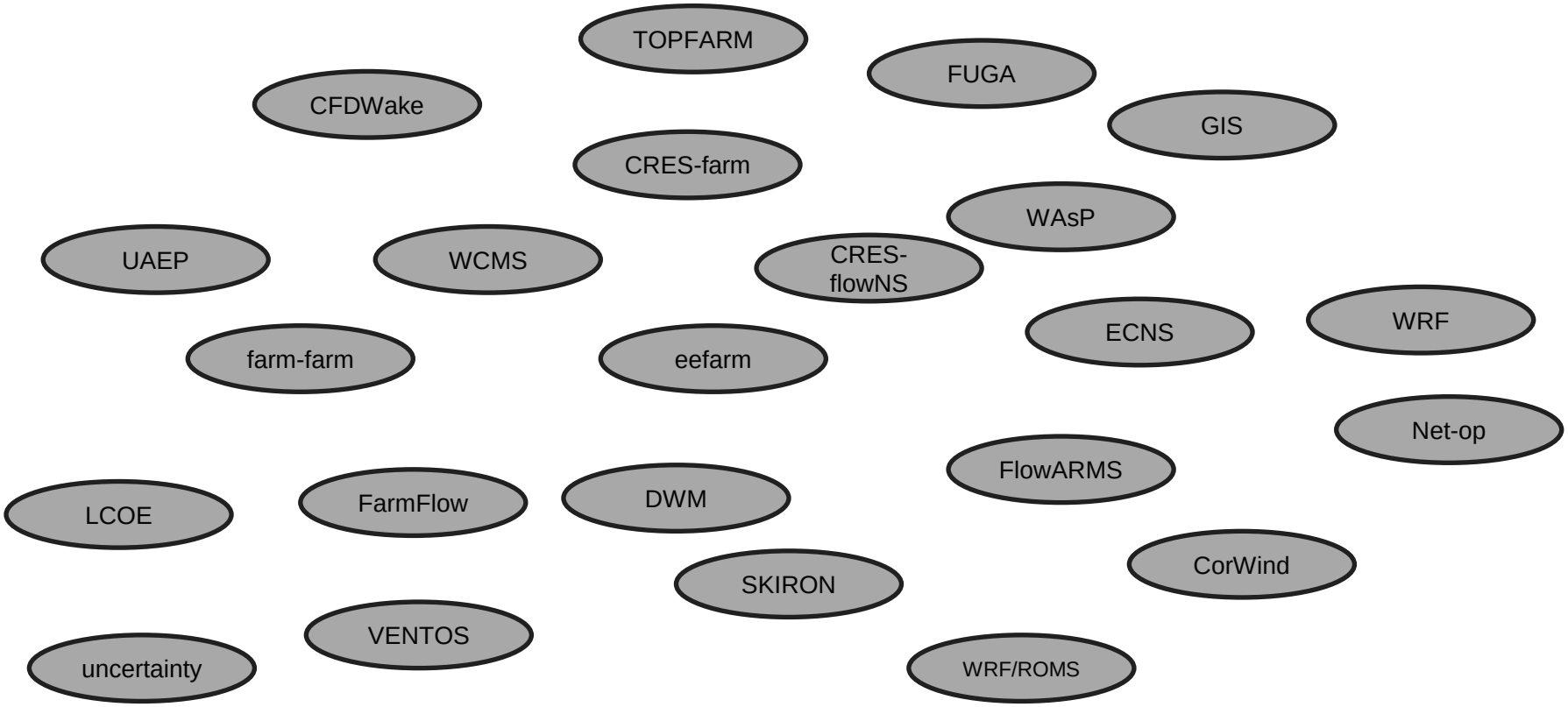
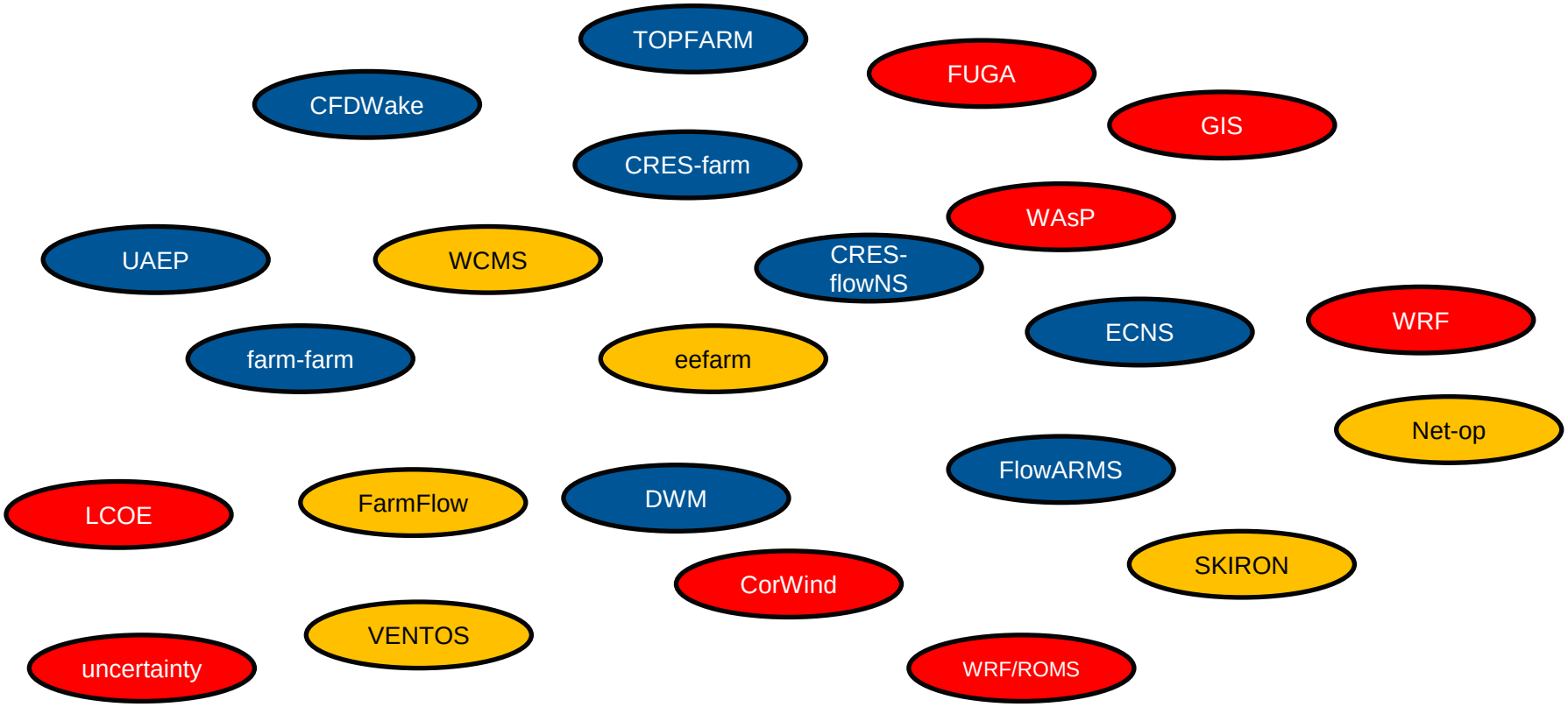
Runs on Cluster under UNIX/Linux

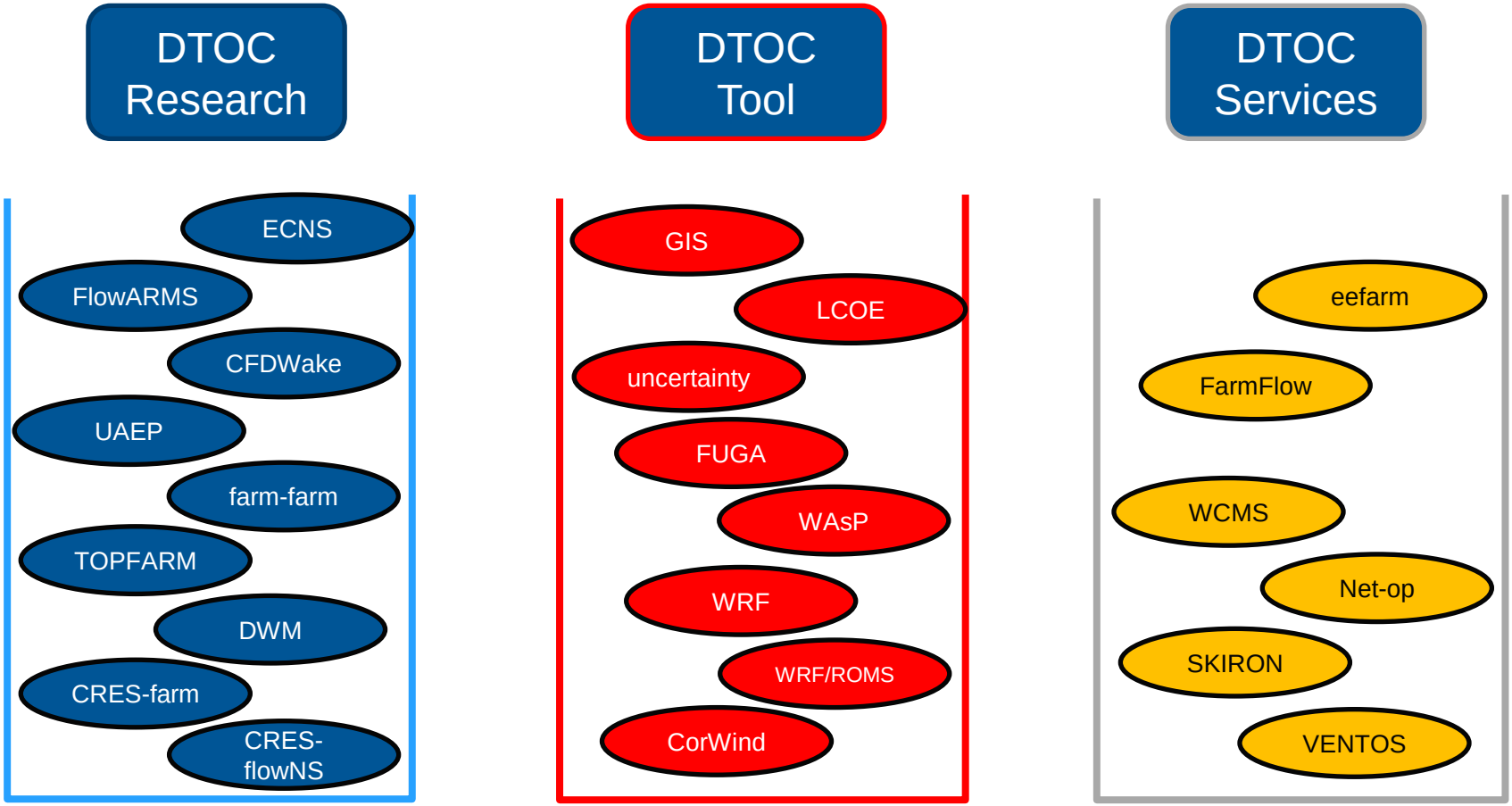
Model candidates



Model candidates: Categorisation



Selection and Implementation



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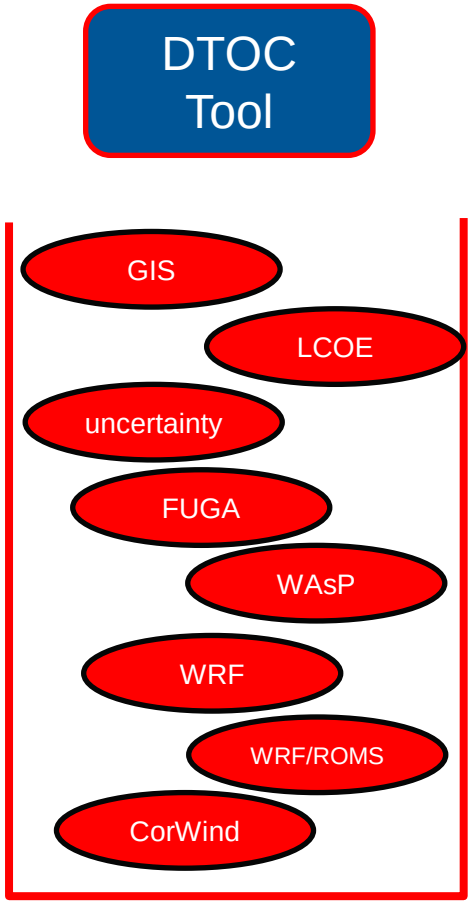
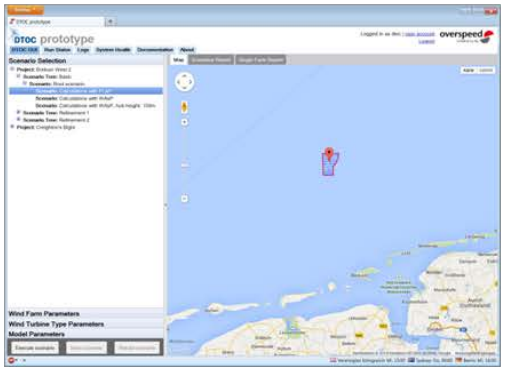
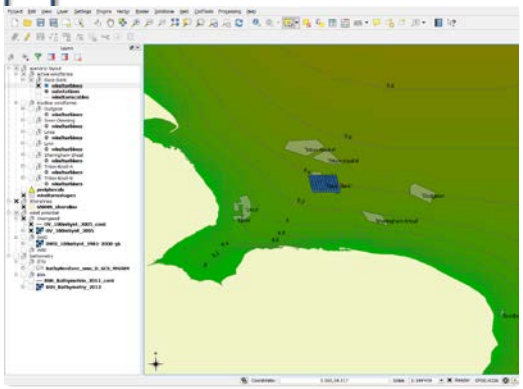


DTOC Design Tool Structure Overview

Local Computer



GIS



DTOC Server

DTOC core/server

Scenario Management Server

Scenarios

Parameter Management

WAsP
Para 1 0.5

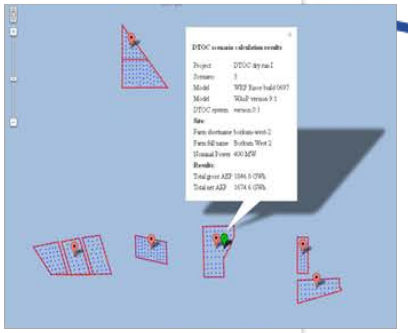
FarmFlow
Para 1 2.345

LCOE
Para 1 9.5
Para 2 3.1416
...

Data Persistence

CMD line interface/API

Reporting



DTOC Server

DTOC Wrapper

Connector — FUGA

Connector — FLaP

Connector — WAsP/Park FarmFlow

Connector — LCOE Uncertainty

Electrical Issues

SOAP Connector — WRF

Remote Connector

Remote Servers

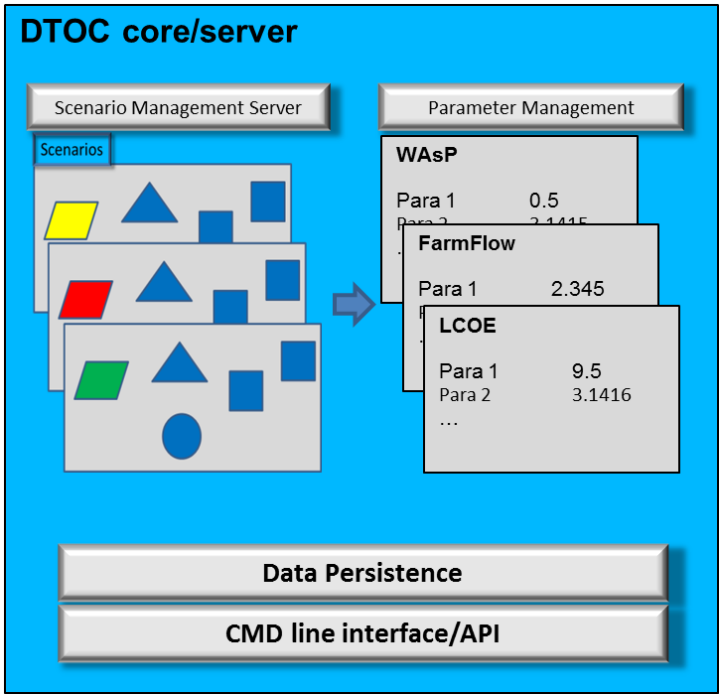
SOAP Connector — CorWind

SOAP Connector — WRF

SOAP Connector — etc

DTOC Core on Server

DTOC Server/Core



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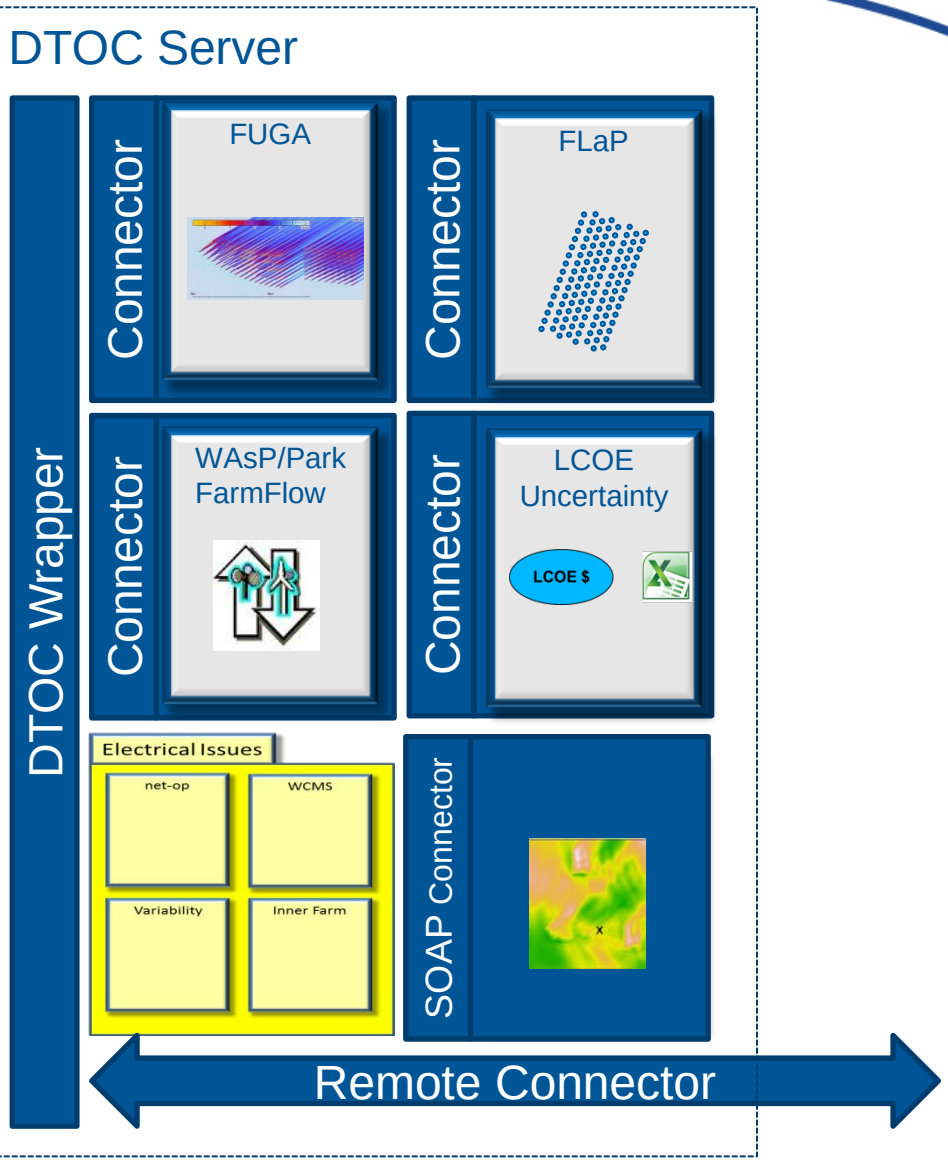


Remote applications

Remote Connector

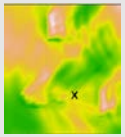
Remote Servers

SOAP Connector

CorWind

SOAP Connector

WRF

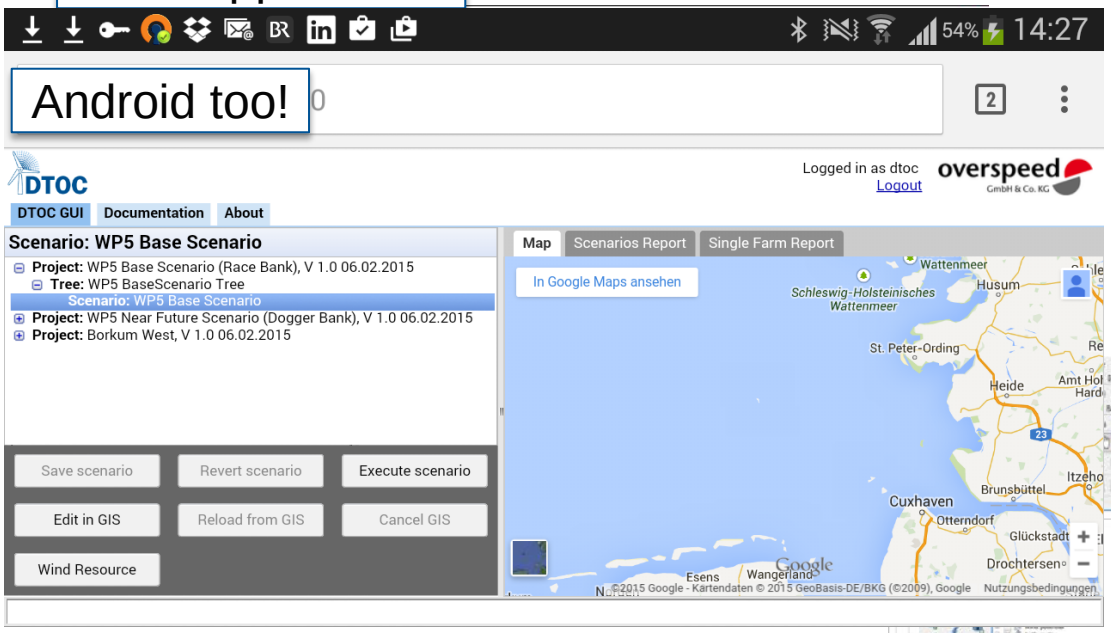


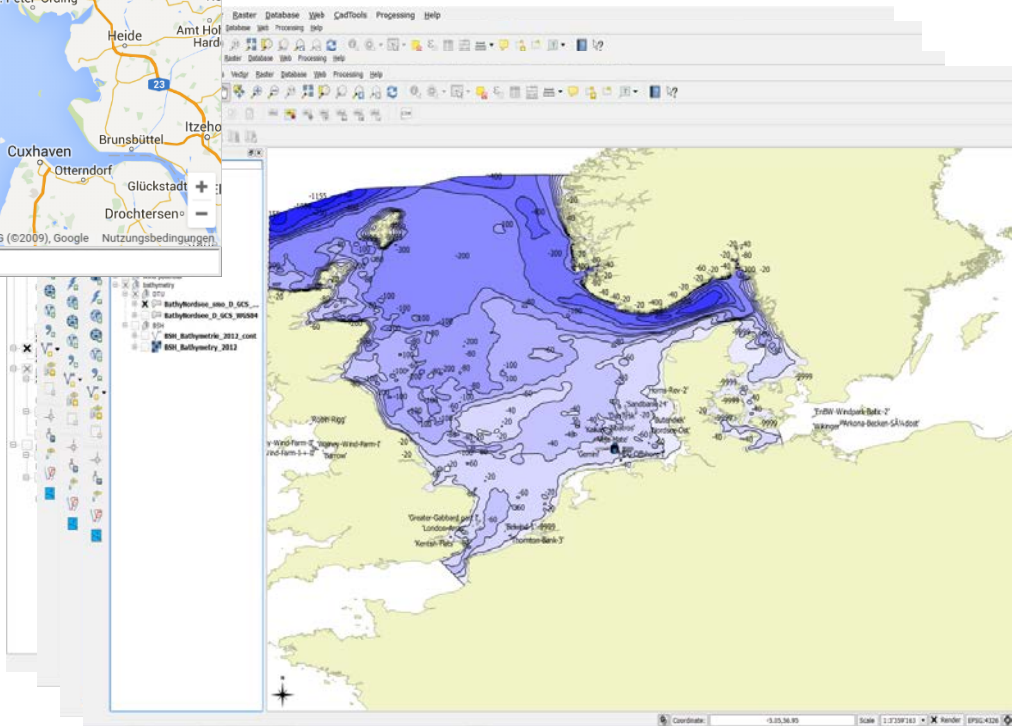
SOAP Connector

etc

Local computer: GIS and local web browser

Web application





Data

Commercial tool: Wind & Economy

Software Demo

Optimisation process

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***Comparative** reporting enables selection of optimised configurations.*

Score for comparison: Levelised Cost of Energy

“Demo”

Conclusions

Leading edge offshore modelling

- 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 existing or planned other offshore wind farms

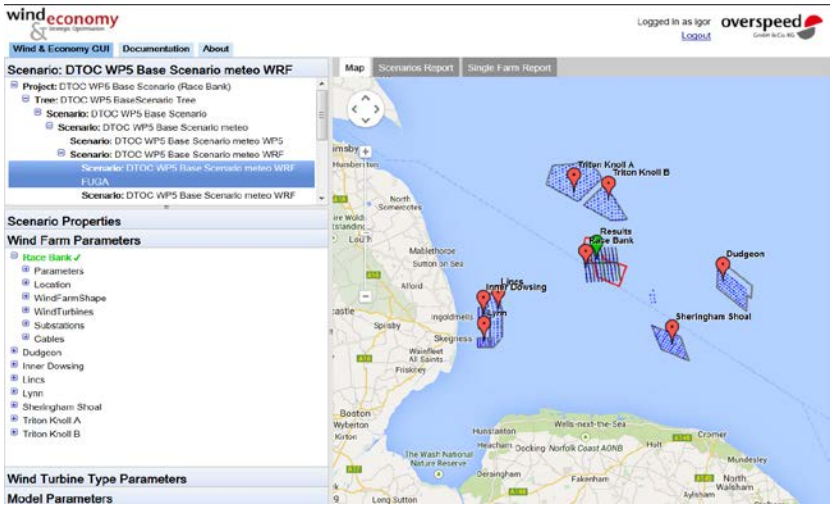
Wind & Economoy:
The tool for wind farm optimization

- 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



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