



# MULTIDISCIPLINARY (INTEGRAL) WIND FARM DESIGN ANALYSIS & OPTIMISATION

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**Deltares**

**TNO** innovation  
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## PROBLEM STATEMENT/ DESCRIPTION

- › Design of large wind farms has a **multi-disciplinary nature** involving many models, processing large amounts of data to create an optimal design
- › The **economic criteria** for an optimal wind farm design are changing (LCoE → NPV)
- › Other criteria whether **environmental or social** are becoming equally important in the evaluation of tenders
- › **System-scale effects** expected to influence the design of individual wind farms
- › Increasing pressure of many North Sea functions require an integral understanding to **create synergy and avoid conflicts**

## QUESTIONS TO ADDRESS

- › What is LCoE and or NPV or RoI for a specific project?
- › Determine optimal Wind Farm power or determine space needed to generate a specific amount of energy
- › Compare technology choices, e.g. WT or support structures in integrated way
- › Improve the business case and grid integration e.g. by installing storage (hydrogen)
- › Optimal ratio's for overplanting in relation to grid capacity
- › How to integrate other functions of the North Sea with wind energy?

## PROJECT RESULT

- › A **community developed, integrated, open source design framework**, available for the project partners & sponsors.
- › The output can be used during the **design phase and the operational phase**
- › The framework will consist of **free and/or proprietary models**
- › Increase knowledge and insight by the partners on **integral effects** of the wind farm **performance, design optimisation** and **integration in the environment**.
- › Tool is adaptable & expandable by users towards future needs

# DEVELOPMENT METHOD FOR WF MDAO

- › An **open framework** to be developed, available to the partners to plug in tools/models and make use of other partner's knowledge/tools.
- › The cost/performance/environmental models can be **open source** and/or remain **proprietary**.
- › Initially cost and performance models/tools to be supplied by the R&D partners, with options to add your own tools.
- › To minimise the development risk, **early prototypes** of the tool will be made available which can be evaluated by the partner(s).
- › **Improved prototypes** will be made available periodically for testing and usage.
- › Future developments can include **novel techniques** such as AI.
- › Implementation priorities to be **jointly** defined by project partner assemblies.

## POTENTIAL PARTNERS

- › TNO
- › Deltares
- › .....
- › .....

R&D Education

- › .....
- › .....
- › .....
- › .....

Wind farm development

- › .....
- › .....
- › .....

Offshore contractors

Stakeholders

TenneT?  
PBL?

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# FUNDING OF DEVELOPMENT OF WF MDA&O TOOL

Total cost is estimated to be in the order of ~ M€ 2.5

Sources of funding MMIP (MOOI) or HER (Renewable Energy Scheme):

Subsidy 50% of the costs with 10-20% extra subsidy for small and medium-sized businesses; knowledge institutions can receive up to 80% subsidy. Maximum subsidy per project is € 4 million.

MMIP (e.g. budget sources)

- › Industry participation (40%) k€ 1000 (in kind and/or €)
- › Subsidy (50%) k€ 1250 (€)
- › R&D (10%) k€ 250 (in kind)

A nighttime photograph of a city street. In the foreground, a curved pedestrian bridge with a metal mesh railing is visible. The background shows multi-story buildings with lit windows and green light trails from a moving vehicle or light source. The overall scene is illuminated by city lights, creating a vibrant urban atmosphere.

› **THANK YOU FOR YOUR  
ATTENTION**

Take a look:  
**[TNO.NL/TNO-INSIGHTS](https://www.tno.nl/tno-insights)**



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## QUESTIONS

- › What is the main value of such a system for you/(r) organisation?
- › What would make this initiative more valuable or better fitting your needs?
- › Which role do you see for your organisation in development of a tool like this (project board, developer, tester, supplier of models/tools, sponsor)?
- › What is the key for you to join this initiative?
- › Would you like to join this initiative?



# NORTH SEA

