IEA Wind TCP
Task 37 Overview

WIND ENERGY SYSTEMS ENGINEERING

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iea wind

Task Objectives & Expected Results

Project Objectives and Outcomes

- Improve quality of systems engineering by practitioners through development of best practices and benchmarking exercises

- Promote general knowledge and value demonstrations of systems engineering tools and methods applied to wind energy RD&D

Collaboration areas

- Reference wind turbines and wind farms – extending towards hybrids and renewable energy parks

- Evaluating wind technology in the broader energy system context – market evaluation, sustainability impacts, etc

A complete wind energy system includes the plant's energy production, turbine costs, and balance of station and operational expenses, as well as the plant's impacts on the electric grid, local communities, and the environment.

Work Package Overview

WP1

Guidelines for integrated wind turbine and plant software frameworks

WP2

Series of reference turbine and plant designs for supporting integrated analysis activities

WP3

Work towards best practice recommendations on Multi-disciplinary Design, Analysis and Optimization (MDAO) applied to wind systems

WP4

Workshops with other IEA Wind Tasks on state-of-the-art in MDAO
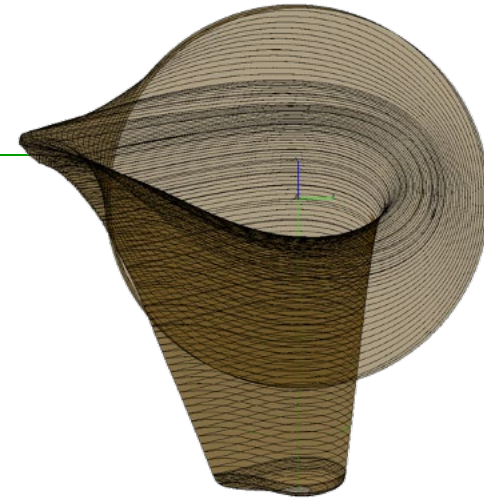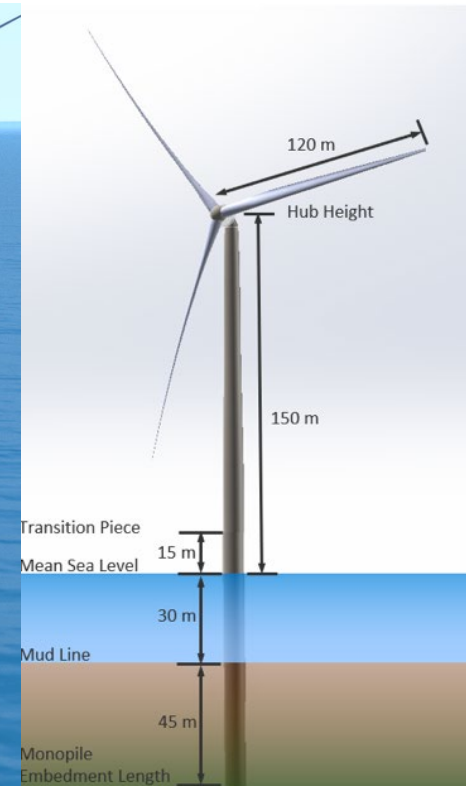
(new in Phase II)

Technical Results: WP1 (Frameworks)

- **Formalization of the common software framework as the WindIO project**
  - https://github.com/IEAWindTask37/windIO

- **Significant progress on developing an "ontology" suitable for wind plant wake flow analysis and layout optimization**

- **Collaboration to extend the framework to cover all remaining turbine components (drivetrain, towers, monopiles, floating platforms, moorings, etc)**

Technical Results: WP2 (Reference Systems)

- **IEA Wind 15MW Reference Wind Turbine completed through tight NREL-DTU collaboration:**
  - All Task 37 RWTs:
    https://github.com/IEAWindTask37/
  - Fixed bottom report:
    https://www.nrel.gov/docs/fy20osti/75698.pdf
  - Floating platform report: (forthcoming)

- **Significant media attention:**
  - https://www.nrel.gov/news/program/2020/reference-turbine-gives-offshore-wind-updraft.html
  - https://www.offshorewind.biz/2020/02/14/nrel-unveils-15mw-reference-offshore-wind-turbine/
  - https://www.rechargenews.com/wind/us-unveils-15mw-open-source-wind-turbine-after-global-project/2-1-756058
  - https://www.windpowermonthly.com/article/1682050/windtech-digital-15mw-turbine-offers-help-scaling

- **IEA Wind 10 MW / 3.4 MW turbines also released:**
  - https://www.nrel.gov/docs/fy19osti/73492.pdf

Technical Results WP3 (Case Studies)

WP3 Case Studies in MDAO (Plant)

- Realistic boundaries that gradient-based methods struggle with
- Second round of optimization underway with ongoing discussion of methods and results (collaborative journal article planned)
- Participants: BYU (lead), NREL, DTU, TU Delft, Innogy, UL AWS Truepower, Qubit Engineering, and IFPEN (pending))
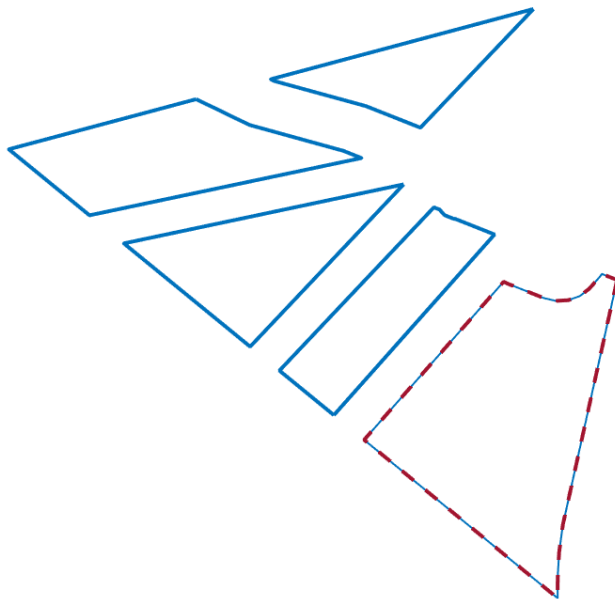
Case Study 3:
- Single region
- Non-uniform
- Concavities

Case Study 4:
- Multiple regions
- Discontinuities

Technical Results WP4 (Workshops on MDAO state-of-the-art)

IEA Wind Task 32/37 Workshop on System Design for LIDAR-Based Control

- Held October 2019 following the NAWEA conference
- Identified 4 promising applications of Lidar-assisted control:
  1. Increasing annual energy production
  2. Decreasing capital expenditure costs by reducing design loads
  3. Extending turbine lifetime by reducing operating loads
  4. Enabling wind turbine class upgrades

Torque paper written & accepted based on workshop findings

Thank You!!

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