Job Information

Organisation/Company: *Wind Energy Institute, School of Engineering and Design, Technical University of Munich*

Research Field: *Wind Energy*

Researcher Profile: First Stage Researcher (R1)

Country: *Germany*

Application Deadline: November 30th

Type of contract: *Temporary (3 years)*

Job Status: Full Time

Offer Starting Date (Vacancy Opening): *November 1st*

Is the job funded through the EU Research Framework Programme?: YES

Marie Curie Grant Agreement Number: 101168673

Is the Job related to staff position within a Research Infrastructure?: NO

Offer description

TWEED Project

TWEED is looking for 12 talented and motivated Doctoral Candidates (DCs) with the skills, knowledge and enthusiasm to work as part of a network to advance the field of digitalistion within the wind energy sector.

The "Training Wind Energy Experts on Digitalisation (TWEED)" Doctoral Network (DN) aims to train the next generation of excellent researchers equipped with a full set of technical and complementary skills to develop high-impact careers in wind energy digitalisation.

Co-funded by the European Commission through the Horizon Europe Marie Sklodowska Curie Doctoral Networks Programme, the TWEED network offers 12 Doctoral Candidates (DCs) positions to provide high-level training in the new emerging research field of Wind Energy Data Science and Digitalisation.

An outstanding research-for-innovation programme, and a unique training programme that combines hands-on research training, interactive schools and hackathons, innovation management and placements with industry partner organisations has been designed for the DCs who will participate in the network. Alongside the exciting research topics related to wind energy data science, the research programme also includes state-of-the-art technology to develop a new Wind Energy Data Science Hub that will facilitate a virtual research environment to foster

collaboration, data sharing and testing of innovative solutions to significantly increase the value of wind energy.

The network will provide an interdisciplinary and inter-sectoral context to foster creativity in tackling wind energy data science and digitalisation challenges by developing solutions for commercial exploitation.

DCs will be trained in business innovation to extend their focus beyond the academic context, to be able to identify added-value products or services with the guidance from established researchers and entrepreneurs. As a result, a research-for-innovation mindset will be developed to provide enhanced career prospects for the fellows, equipping them with a complete set of thematic, technological and innovation skills.

DCs are expected to i) conduct high quality, original academic research in the fields of Wind Energy, Digitalisation, Data Science and Computer Science, ii) participate in the network's planned training-dissemination activities and mobility plan, iii) collaborate with fellow researchers, with the goal of advancing and promoting the network's objectives.

The most talented and motivated candidates will be selected to participate in the network's interdisciplinary collaborative research training, preferably starting in February 2024. The assessment shall be carried out by the TWEED recruitment team.

Two DC positions are available at TUM within the TWEED project:

DC2: Digital wind park co-design

Scope and objectives:

Wind farm control has emerged as a key new technology for improving yield and managing lifetime. However, beyond power and loads, wind farm control has the potential to reach additional goals. This project aims at expanding the applicability of wind farm control to reduce the environmental footprint of a wind plant. This is obtained by including AI-enabled wind farm control directly in the park layout optimization. Using this approach, wind farm control is not used as a retrofit option but is embedded directly in the park design. This concept is called co-design, i.e. the simultaneous design of layout and digital controls. This project will explore co-design for the reduction of the surface area of the park, to reduce land occupation, satisfy exclusion zones due to environmental constraints (protected areas, wildlife habitats, distance from inhabited areas, etc.). Co-design will be implemented as a large-scale constrained optimization problem, using as design variables the turbine positions and their setpoints according to ambient conditions. Setpoints will be computed based on an AI-enabled farm flow model, using wake steering. The new capability will be showcased by redesigning existing wind parks. Onshore parks with multiple constraints (complex terrain, proximity to villages/protected areas/forests/etc.) will be particularly considered. The characteristics of the new designs will be compared to the existing ones, using various quantitative metrics that capture economic and environmental aspects (LCOE, power density, overall occupied surface area).

Expected results:

The fellow will develop a co-design framework, to simultaneously define the park layout and its park-level control laws. The framework will be applied to the redesign of existing parks, quantifying the benefits that are generated by the new co-design approach. It is expected that it will be possible to design denser parks for similar LCOE, which -depending on cases- might imply a smaller occupied area for similar installed capacity, or a higher capacity for similar occupied area. The fellow will acquire a broad knowledge on AI, large-scale optimization, digital controls, flow modeling, wind park design.

Planned secondments (3 months)

1. DTU (hosted by Dr. Ju Feng, M24-M26): large-scale optimization for wind park co-design.

2. ENGIE Laborelec (hosted by Dr. Ariane Frere, M35-M37): assessing how co-design can help reduce land occupation while satisfying boundary constraints, reducing the park footprint.

DC3: Digital controls for noise mitigation

Scope and objectives:

To satisfy noise emission constraints in populated areas, wind turbines are typically curtailed, i.e. operated at reduced rotor speed. When wind turbines operate in this quiet mode, they produce less power, which in turn can decrease the economic profitability of the park. Today, quiet operation is simply triggered based on the time of the day (for example, at night time). This project will develop novel digital controls to mitigate noise emissions, improving on today's simple on-off quiet mode. Instead of time of the day, the new controller will consider the current ambient conditions, which will be detected in real-time based on SCADA operational data. Based on the detected ambient conditions, noise emissions will be estimated for the individual turbines in the park, together with the directivity of the emissions and the noise levels around the park. Based on these predictions, power and yaw misalignment setpoints will be computed for the individual turbines to maximize power output, while satisfying noise levels at points of interest. This constrained optimization problem will use the TUM AI-enabled park flow model, using also the suite of noise emission tools developed at TUM. This large-scale optimization problem will be solved offline, producing ambient-condition-dependent turbine setpoints, which are then interpolated at run-time based on current conditions. The new noise-abating wind farm control method will be integrated with a standard power maximization wind park controller, obtaining the ability to smoothly transition between standard and quiet operational modes. The novel controller will be showcased on onshore wind farms in close proximity to inhabited areas. Performance of the new control logic will be quantified in terms of relevant metrics (yield, satisfaction of noise constraints, etc.).

Expected results:

The fellow will develop a framework for the design of noise-abating wind farm control laws. It is expected that, using these new procedures, it will be possible to satisfy noise emission constraints while at the same time significantly improving yield compared to today's simple quiet-mode on-off

approach. It is expected that an improved yield will be obtained by better distributing noise emissions throughout the farm, for example by boosting power through wake steering at turbines that are farther away or contribute less to noise (because of directivity). Similarly, it is expected that a smaller number of turbines will have to be curtailed. The fellow will acquire a broad knowledge on large-scale optimization, digital controls, noise modelling, flow modelling.

Planned secondments (3 months)

1. UNIZAR (hosted by Prof. Julio J. Melero, M24-M26): noise and environmental constraints in the development of onshore wind parks.

2. ENGIE Laborelec (hosted by Dr. Ariane Frere M35-M37): seamless integration of noise mitigation with other wind turbine and farm operational modes.

Requirements

Research Field: Engineering, Wind Energy, Data Science, Computer Science

Education Level: Master Degree or equivalent

Skills / Qualifications:

- Applicants must be proficient in the English language.
- Master degree or equivalent obtained by the time they are appointed. Students currently in the final year of a Master's degree are encouraged to apply but should note that if selected, they will be expected to start their PhD in the first quarter of 2025.

Specific requirements:

- *A master or equivalent degree in Engineering*.
- *A strong background in wind energy; specific knowledge on the topic of the applied-for position is a plus*.
- *Excellent programming skills*.
- *Excellent writing and communication skills in English; knowledge of German is non-mandatory, but constitutes a plus*.
- *Ability to work in a multi-cultural team and independently.*
- *Willingness to follow the mobility plan of the programme (conduct secondments in the country of the host institute or abroad)*.
- *The successful candidate must also fulfill the requirements for admission to a PhD program at the School of Engineering and Design, Technical University of Munich*.

Languages: English

Level: Excellent

Additional Information

Benefits

You will work under a 36-month employment contract with the competitive conditions and salary adapted to the living costs in each host country, set by the MSCA Doctoral Networks (DN). The MSCA DN programme offers a highly competitive and attractive salary and working conditions. The successful candidates will receive a salary in accordance with the MSCA regulations for DCs, according to the national rules of the country with full social security benefits.

The successful candidate will receive a financial package plus an additional mobility and family allowance according to the rules for Doctoral Candidates (DCs) in an EU Marie Skłodowska-Curie Actions Doctoral Networks:

- Living Allowance of *€ 3440/month*.
- Mobility allowance of €600/month to be paid to all DCs recruited.
- Family allowance of €660/month to be paid depending on DCs family status

The gross salary will be calculated by deducting the applicable employer taxes and social security contribution for each country, from the amounts mentioned above, *and will be aproximately equal to € 3.150/month for a single person and € 3.665/month for a person with a child*. Additional deductions may apply based on your personal circumstances and local tax/social security regulations.

In support of families with young children, flexible working hours will be offered to the DC whenever it is feasible within the requirements of the project.

Following the EU's commitment to DEI, the TWEED network and {Host institution} encourages and promotes the participation of under-represented groups such as women in technical careers, people from diverse economic and ethnic backgrounds, people with disabilities, those who identify as neurodivergent and LGBTQA+. The {Host institution} community aims to exercise a policy of equal opportunities at all times.

Additional information can be found in Information Note for Marie Sklodowska-Curie fellows in Doctoral Networks.

Eligibility criteria

All applicants must, at the date of the recruitment, comply with the following ELIGIBILITY CRITERIA:

- Candidate status: At the time of recruitment, applicants must not hold a doctoral degree or equivalent.
- Mobility Rule: Applicants can be of any nationality. However, applicants must not have resided or carried out their main activity (work, studies, etc.) in the country of the recruiting

organisation for more than 12 months in the 3 years immediately before the appointment. This excludes short stays such as holidays or compulsory national service

Candidates are required to document in their applications their compliance with the eligibility criteria. To prove their eligibility, candidates can use supporting documents such as studies, residense or work certificates.

Selection Process

The selection process complies with the guidelines set forth in the European Charter for Researchers, including the Code of Conduct for Recruitment of Researchers.

Candidates will be requested to provide their consent for their application documents to be shared among the members of the recruitment team for review (including other institutions than the institution to which they originally addressed their application). Additionally, they will be requested to consent (or decline) to having their application forwarded to another host institution within the network, should their profile be better suited for a different position. Personal documents and information of the candidate will be treated confidentially.

Eligibility check

- The Recruitment Team of TWEED will gather the information from all candidates and will check that they comply with the eligibility criteria and that the applications are complete, in English, and submitted before the deadline.
- The initial check of the eligibility criteria will have to be formally approved by the host institution at the time of recruitment of the appointed candidates.
- Ineligible candidates will be notified via email.

Assessment

A Selection Committee will be set up at the host institution, led by the Main Supervisor. The Selection Committee will assess all candidates according to their academic profile, personal motivation, relevant background, professional experience, scientific knowledge, transversal skills, soft skills and English proficiency. The Selection Committee will short-list at least the best 3 candidates.

Interview

The Selection Commitee will interview the short-listed candidates and will produce a ranked list of candidates that qualify for the position.

Decision

According to the procedure established in TWEED, the Selection Committee will submit its list of preferences to the Supervisory Board (the project's governing body). The SB will prepare the final ranking of candidates for each position.

Communications

Candidates will be informed of the status of their application during the selection process.

How to apply

The application must include:

- Detailed CV:
    - Candidate personal information
    - Information about graduate and postgraduate degree and qualifications
    - Work experience
    - English proficiency
- Eligibility information, countries of residence for the last 3 years
- Motivation letter
- The names and contact information of two referees.
- Written agreement of the permission to share information with the TWEED project Recruitment Team.
- Identification of other possible positions at TWEED in which you may be interested or which have also been applied for.

The application should be sent *by email to:* *secretary.lwe@ed.tum.de*

Work location

Number of offers available: 2

Company/Institute: *Wind Energy Institute, School of Engineering and Design, Technical University of Munich*

Country: *Germany*

City: *Garching, Munich*

Postal Code: *85748 Garching*

Street: *Boltzmannstr. 15*

About *Wind Energy Institute at TUM*

The Wind Energy Institute at TUM conducts research on a broad range of topics in the general field of wind energy, with a focus on multidisciplinarity and a system-level perspective. The Institute, led by Prof. Carlo L. Bottasso, is internationally well known for its cutting-edge research, and has

collaborations with many of the leading research institutions and companies in Europe, the USA and Asia.

Contact

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www.tum.de

Main contact of the project: tweedproject@unizar.es