June 2015

Dear wind energy enthusiast,

The NEWA consortium invites you to contribute with data to the generation of a database of wind measurements over Europe with the purpose of training and validating the model chain of the New European Wind Atlas.

The New European Wind Atlas (NEWA) project kicked off in March 2015 to produce, over the next five years, the best database of wind characteristics in Europe and a new generation of flow models to exploit this database.

Regardless of the fidelity of the models developed in the project, the final value of the Wind Atlas resides on the capabilities of the consortium to run a systematic model validation and uncertainty quantification process. While the most detailed model validation will be done in connection to large experimental campaigns executed within the project, these data will not be sufficient to cope with the full variety of wind climates and topographic conditions across Europe. To this end, the project launches this *Call for Wind Data* in order to seek contributions from external partners.

This data collection phase will run for the first two years of the project (until March 2017). This document will guide you on the scope of the project, the validation objectives and the data provision and licensing procedures that are in place to manage and preserve your contribution.

On behalf of the wind energy community, the NEWA consortium is grateful for your contribution and acknowledges your shared responsibility at improving the outcome of this/your project.

Yours sincerely,

Javier Sanz Rodrigo (CENER), Exploitation and Dissemination Manager

Jakob Mann (DTU-Wind), Project Coordinator

NEWA Call for Wind Data

1. Introduction to NEWA

Objectives

The project is funded through an ERA-Net Plus instrument, of the European Commission's 7th Framework Programme, participated by 9 funding agencies from 8 EU Member States and Associated Countries: Belgium, Denmark, Germany, Latvia, Portugal, Spain, Sweden and Turkey. The main **technical objectives** of this initiative are twofold:

i. to contribute to a significant reduction of the cost of wind energy by mitigating risks related to the design and operation of large-scale wind turbines based on enhanced knowledge of wind conditions;
ii. to better quantify the European wind energy potential and provide data and models that can improve spatial planning tools and operations, ensuring an effective and efficient deployment of wind power.

Uncertainty on the wind resource is the most relevant target variable since this is directly linked to the financial risk on project deployment. Hence, the NEWA project establish a key performance indicator of less than 3% uncertainty on flat homogeneous terrain and less than 10% uncertainty elsewhere concerning wind energy production and wind conditions that affect the design of wind turbines.

The NEWA consortium

Structure and Deliverables

NEWA is coordinated by DTU and counts with the participation of 31 partners. The project structure is composed of three large technical work packages:

- **WP2 Full scale experiments and data collection (lead by DTU)**: to provide input data relevant for NEWA in terms of surface characteristics for models, satellite offshore wind data and existing tall mast data; and prepare and execute a series of field experiments for model validation under different terrain conditions and wind climates across Europe. In particular, the following experiments are envisaged:
    - Northern Europe combined mesoscale experiment with focus on coastal and near-shore
    - Forested hill experiment in Kassel, Germany
    - Double hill experiment in Perdigao, Portugal
    - Complex terrain experiment with a strong mesoscale component at Alaiz, Spain
    - High altitude ridges in Turkey
- **WP3 model chain (CENER)**: to develop a probabilistic wind atlas and associated downscaling methodologies for site suitability and high-resolution predictability assessment; implement an open-source multi-model platform to integrate the model chain with high-performance-computing capabilities; and to systematically validate the model chain through iterative benchmarking making use of observational datasets gathered in WP2.
- **WP4 NEWA database (Fraunhofer-IWES)**: to define the most suitable wind atlas output parameters based on stakeholder consultation; to develop and set up the NEWA database, the user interface and produce end-user guidelines.

Consistent with the open research data philosophy of the Commission, the NEWA consortium will make every effort to release **open-access data and open-source codes** as they become available throughout the project. A research roadmap and an exploitation plan will support future scientific and commercial uses of the project results.

International Cooperation

The NEWA consortium is open to international cooperation to further strengthen its know-how and enhance the impact at a global level. The atlas will benefit from and supplement the development of the Global Wind Atlas coordinated and supervised by the International Renewable Energy Agency (**IRENA**). Stakeholder consultation will be pursued through European Technology platforms like the European Energy Research Alliance (**EERA-Wind**) and the Wind Energy Technology Platform (**TPWind**), as well as the **IEC 61400-15** working group, in charge of the development of a standard for wind resource assessment, energy yield and site suitability. Strong synergies are found with the **Atmosphere to Electrons (A2e)** research initiative of the U.S. Department of Energy (DoE) in relation to high-fidelity modeling, experimental campaigns and model evaluation. The International Energy Agency (**IEA-Wind**) **Task 31 "Wakebench"** will be the target forum to extend benchmarking activities to a wider range of models and coordinate a joint international model evaluation process. **New IEA-Wind Tasks** on **lidar** measurements, **wind forecasting** and **systems engineering** are also potential forums for NEWA international partnership and outreach to neighboring research communities.

2. Data Provision Strategy

While the detailed validation activities will be primarily based on the high-fidelity experiments conducted throughout the project, the data won't be sufficient to evaluate the wind atlas in its full extent in terms of the diversity of wind climate and topographic conditions across Europe. To this end, an important initial task of the project is to reach wind energy stakeholders in order to collect as much data as possible.

Regardless of the quality of the flow models, the wind atlas will be as good as the validation data it is based upon. It is important that the wind industry, met offices and research community take responsibility in contributing to the NEWA experimental database.

This *Call for Wind Data* aims at providing guidance to potential data providers on which data is most useful for the project and how the data will be handled and protected. The call will be open during the first two years of the project (**until March 2017**) to allow sufficient time to collect enough data.

3. Validation Scope and Objectives

The European wind atlas will cover all the EU Member States as well as their exclusive economic zones, both onshore and offshore, with the exclusion of any overseas department or territory. A period of at least 10 years will be simulated. The most suitable period will be defined based on the best long-term representativeness and the largest validation data availability.

The scope of NEWA is focus on wind resource assessment and site suitability applications. Hence, the primary objective is to validate atmospheric variables that are relevant for spatial planning and wind farm design, notably: wind resource, vertical wind shear and veer, turbulence intensity, extreme winds and wind predictability.

The atlas will represent the gross wind resource free of wind farm wake effects. Incorporating these effects is part of the wind farm design process and simulation tools should be able to correct the atlas outputs to account for existing wind farms. Hence, the validation of wake models and net energy yield (i.e. production data) is of secondary importance and only in specific cases it will be considered to demonstrate the usage of the wind atlas.

Oceanic conditions, relevant for site suitability studies offshore (waves, currents, soil), are out of the scope of the project but will be useful to diagnose errors from mesoscale models, which will not include sea-air coupling.

4. Variables of Interest

The following variables of interest are identified, sorted in decreasing priority level considering the scope of the project:

1st level: Tall met-mast wind speed data in well-exposed (wind energy) sites.

- Objective: target variables directly related to the most relevant intended uses of the wind atlas.
- Range: Europe
  - Tall-mast wind speed: Preferably above 40 m and approaching multi-megawatt turbine hub-height levels (70 m and above).
  - Wind direction: preferably at the same level or close to the tall-mast wind speed.
  - Turbulence intensity: preferably at the same level or close to the tall-mast wind speed.
  - Wind shear: At least two velocity levels, preferably in the range 40-100 m.

- Wind veer: At least two wind direction levels, preferably in the range 40-100 m.

2nd level: Additional met data in addition to tall-mast data.

- ➢ Objective: to diagnose and classify model performance in terms of atmospheric and oceanic conditions.
- ➢ Range: Specific sites that are complementary to the NEWA experiments
  - Air pressure: at surface level.
  - Air temperature: At least two levels of temperature, or differential temperature (better though less common), as separated as possible in the first 40 m, to compute the surface Richardson number and characterize atmospheric stability.
  - Water temperature: As close as possible to the sea surface, and in accompanied by at least one air temperature level, to compute the water-air Richardson number.
  - Wave height, direction and speed: to characterize the sea state.
  - Sonic anemometer measurements: at least at 10Hz to retrieve turbulent fluxes and other turbulence characteristics like the Obukhov length.

3rd level: Synoptic data from surface observations, as free of local effects as possible.

- ➢ Objective: Complement level 1 database with a more densely populated network of historical observations to evaluate long-term mean and extreme wind climatology.
- ➢ Range: Europe
  - Wind speed, direction at 10 m (WMO convention). Other (taller) heights are also welcomed.
  - Air pressure.
  - Temperature at 2 m.

4th level: Wind farm operational data.

- ➢ Objective: to evaluate wind farm wake models and wind power predictability.
- ➢ Range: Specific sites for demonstration
  - Wind farm static data: coordinates of the turbines and their specifications (rotor diameter, hub height, power and thrust curves).
  - Hub-height wind speed and direction: depending on how much flow distortion is introduced by operating turbines this data may be included in the tall-mast database (1st level).
  - Wind farm production data: SCADA data from the turbines including power, status, nacelle position and speed and curtailment level.

Data from level 1 will be a must have for the project. Level 2 data will be good-to-have especially where dedicated boundary layer experiments are not planned, for example, offshore. Level 3 data is useful where level 1 data is sparse or inexistent. Finally, level 4 data will be handled by individual partners of the project that would like to demonstrate the application of the NEWA model-chain in connection to existing wind farm projects.

As for the measurement period, as long as possible, preferably taking place in the last 15 years. Old measurements, especially historical measurements covering several decades are also welcomed in order to study extreme wind climatology and long-term wind variability and predictability.

5. Data Requirements

The following specifications are intended to facilitate the homogenization, set up and quality assurance of the experimental database. Considering the large variety of data sources to manage, we strongly encourage the data provider to help meeting these requirements:

- Data should be available in terms of time series at 10-min intervals.
- We recommend supplying quality-checked calibrated data when available, where suspicious data has been flagged or removed. Please use the value -9999 to flag wrong or missing data. Data processing like time series reconstruction or tower-shadow corrections should not be incorporated.
- As baseline, the duration of the measurement period should be at least one year in order to include all relevant seasonal variability. Of special interest is to count with long-term stations covering periods of at least 10 years in order to analyze inter-annual variability and long-term mean and extreme wind climatology and predictability.
- Comma separated text format seems like easy to handle: one station per file with all the variables in columns using meaningful variable names (including measurement level) in the top row.
- Date/time convention: YYYYMMDD (first column for date) HHMM (second column for time). Please use UTC when possible or specify the time zone of the measurements as part of the metadata.
- File naming convention: StationName_Source_level.txt, where “level” = [1,2,3] as described before, “Source” is the name of the data supplying organization and “StationName” is a mast identifier/name.
- Metadata: In addition to the data file, background information about the mast should be provided in free format. This includes: mast coordinates (Lat/Lon or UTM, please provide UTM zone), set up (variables/levels), photos and maintenance reports if available.
- SCADA production data (level 4) will be treated on a case-by-case basis when appropriate.

These intermediate data files will be transferred to a database server, centrally managed by DTU.

6. Data Licensing

The IRPWind programme has recently produced a report outlining a strategy on access granting data for wind energy research [1]. While open-access data is a strong motivation in the NEWA project, it is more realistic to consider different levels of access rights depending on the data owner interests. The Wakebench Model Evaluation Protocol [2] has a chapter on data provision, licensing procedures and guidelines to remove barriers on data accessibility for model validation purposes.

Table 1: Data accessibility levels and typical sources and licensing terms [2].

	Level	Definition	Source	Duration	License
0	Open-access	Data freely available from a web-based database	Public website, journals	Unlimited	*Green* or *Gold* open-access
1	Public	Available to the public after paying a fee	Public websites, journals	Unlimited	*Hybrid* open-access, Copyright
2	Members-only	Available to registered users of a service, association, etc	Private website	Membership	Terms and conditions
3	Project-based	Available for project members	Private website	Project	Consortium agreement
4	Group-based	Available for a group within a project	Private website	Task	NDA
5	Individual-based	Available for a delegate of the owner within a project	Private communication	Task	NDA
6	Private	Only the owner has access	Fully private	Task	Unlicensed

Table 1 lists seven data accessibility levels ranging from open-access (level 0) to fully private (level 6). Industry data is by default private and may be made accessible to NEWA through appropriate licensing agreements. A non-disclosure agreement (NDA) is typically the solution to transfer access rights to a delegate organization (level 5), to a group (level 4) or to the whole consortium (level 3). While the NDA will be typically bounded by the duration of the project, the data owner should consider the possibility of granting access to the data beyond the project duration as part of the NEWA experimental database.

Data accessibility will be handled operationally at the experimental database through user accounts, each one associated with different access rights. The data is centrally stored at DTU and mirrored to the relevant partners involved in WP2.

Out of the experimental database, a number of validation datasets will be extracted for model benchmarking. These datasets address specific validation objectives and, therefore, only contain the essential data to evaluate model performance. Validation activities will be managed online at the Windbench.net benchmarking platform [3]. This website, managed by CENER, also allows access control through user account settings. A benchmark manager administers accessibility to the benchmark participants based on the access rights associated to the validation data. It will be often the case that blind exercises are conducted where only the benchmark manager has access to the validation data and only the validation results are published. This level 5 method via a trustful delegate organization may be the only solution to some industry partners that would otherwise not be able to share their data.

A **Data Management Plan** is established in NEWA in order to inform about how the data will be handled during the project and beyond. Each dataset is associated to a license that rules the conditions for accessing, using and protecting the associated IPR.

7. Data Collection Committee

The following NEWA representatives are available for support during this data collection phase of the project. If you are willing to contribute, please contact one of them:

- Michael S. Courtney (mike@dtu.dk, DTU, Denmark), mike@dtu.dk
- Paul Kühn (Fraunhofer-IWES, Germany), paul.kuehn@iwes.fraunhofer.de

- Elena Cantero (CENER, Spain), ecantero@cener.com
- Hans Bergstrom (Uppsala University, Sweden), Hans.Bergstrom@met.uu.se

They will guide you with technical matters as well as finding solutions for data licensing based on Data Management Plan of the project. For general questions you can also contact Javier Sanz Rodrigo (jsrodrigo@cener.com), Exploitation and Dissemination Manager of the project.

8. Acknowledgements

As a data sponsor to the NEWA project your organization is entitled to receive visibility for your contribution unless you prefer to remain anonymous. This will be acknowledged at the project website, dissemination events and main publications of the project.

Those organizations that provide a substantial contribution of data will be offered the position of **Associate Partner** in the project, having priority access to results and databases of the project within the limits established in the Consortium Agreement.

9. Support

The NEWA project counts with the support from a ERA-Net Plus consortium composed by the European Commission and 9 funding agencies from 8 member states:

- Public Service of Wallonia, Department of Energy and Sustainable Buiding (Belgium)
- Department of Economy, Science and Innovation Flemish Government (Belgium)
- Danish Energy Authority (Denmark)
- Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (Germany)
- Latvijas Zinatnu Akademija (Latvia)
- Fundação para a Ciência e a Tecnologia (Portugal)
- Ministerio de Economía y Competitividad (Spain)
- The Swedish Energy Agency (Sweden)
- The Scientific and Technological Research Council of Turkey (Turkey)

References

[1] Hasager CB, et al. (2015) Strategy on access granting to data used in the IRPWIND and wind energy research projects in general. Deliverable 2.19 of the Integrated Research Program on Wind Energy (IRPWind), G.A. 609795, March 2015

[2] Sanz Rodrigo J, Moriarty P (2015) Model Evaluation Protocol for Wind Farm Flow Models. First edition. IEA Task 31 Report to the IEA-Wind Executive Committee, June 2015

[3] Sanz Rodrigo J, Gankarski P (2015) WINDBENCH: Benchmarking of Flow Models for Wind Applications. https://www.windbench.net/, Last accessed on June 2015