ERA-NET Plus

"New European Wind Atlas"

Full Proposal Application Form

All fields must be filled in using Arial font, size 11, single-spaced.
Applications should be submitted as a PDF file, formatted in DIN-A4.

Please note that full proposals either incomplete, using a different format or exceeding length limitations of any sections will be rejected without further review.

Project title

Development of a new European Wind Atlas

Acronym (max. 10 characters)	**NEWA**

Project duration	**60**	**Months**

Total requested funding	13,054,038€

Keywords: Please indicate three to seven keywords representing: the scientific content; specific aim(s) and topic(s) (see Call text; the methodological and technological approach(es).

Wind resource atlas, turbulence, extreme winds, uncertainties, wind turbine micrositing.

Publishable project abstract (max. ½ page)

Please note that this abstract will be published on the NEWA website if your project is selected for funding

The wind energy industry is still troubled by many projects showing considerable negative discrepancies between calculated and actually experienced production numbers and operating conditions. The New European Wind Atlas is aimed at reducing these uncertainties, and is structured around three areas of work, to be implemented in parallel.

1. Creation and publication of a European wind atlas in electronic form, which will include the underlying data and a new EU wind climate database which will as a minimum include: wind resources and their associated uncertainty; extreme wind and uncertainty; turbulence characteristics; other adverse weather conditions and their probability of occurrence; the level of predictability for short-term forecasting and assessment of uncertainties; guidelines and best practices for the use of data especially for micro-siting.
2. Development of dynamical downscaling methodologies and open-source models validated through measurement campaigns, to enable the provision of accurate wind resource and external wind load climatology and short-term prediction at high spatial resolution and covering Europe. The developed downscaling methodologies and models will be fully documented and made publicly available and will be used to produce overview maps of wind resources and other relevant data at several heights and at high horizontal resolution.
3. Measurement campaigns to validate the model chain used in the wind atlas. At least five coordinated measurement campaigns will be undertaken and will cover complex terrains (mountains and forests), offshore, large changes in surface characteristics (roughness change) and cold climates.

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Project description

1. Background and rationale

Wind power is the one renewable energy source with the widest and most successful deployment over the past 20 years, with an accumulation from 3 GW to 200 GW of global installed capacity[1]. In 2010, five European countries already sourced more than 10% of their electricity from wind. However, despite the significant potential of wind power as major source of energy and the expected increase in Europe's overall installed capacity, global demand for wind energy is still large[2].

The European Wind Energy Initiative (EWI) – one of the European Industrial Initiatives of the SET-Plan – was launched in 2010, aiming to increase the coordination and effectiveness of public funding to wind energy R&D projects. An important strategic objective of EWI is to accelerate the **reduction of costs**[3] of wind energy in order to improve the competitiveness of this renewable source and meet the 20% share of the final EU electricity consumption by 2020. For this purpose, the accompanying Technology Roadmap[4], highlights the need for **more accurate mapping of wind conditions for estimating wind resources and loads** for wind turbine design.

Wind resource assessment is associated to the planning phase of wind energy development, which can last several years from site prospecting to wind farm design and financing. Detailed and robust information about the relative size of the wind resource across an area is crucial for the commercial evaluation of a wind farm[5]. Wind turbines that are located in areas with suboptimal wind conditions produce expensive electricity. Thus, to take advantage of specific sites with maximum efficiency and to minimize the cost of wind power, it is essential to have a detailed wind resource mapping. Today a number of well-established models and methodologies exist for estimating resources and design parameters. These can work well if good local data are available for models' calibration or verification. But the wind energy community is still hampered by projects having large negative discrepancies between calculated and actual experienced resources and design conditions[6] – small changes in wind speeds have great impacts on the commercial value of a wind farm, e.g., if the average wind speed at a given site is estimated with an error of 10%, the corresponding error of the power production is more than 20%. Discrepancies can be introduced at any point in the modelling chain, i.e. insufficient input data to deficient physics and resolution in any of the models, model linking issues, insufficient resolution or errors in surface topographical data.

There is, therefore, a clear need for more accurate modelling in order to increase the accuracy of the wind resource assessment. In addition, more accurate modelling will also enable the identification of regions with poorly exploited wind resources, fostering the implementation of more wind farms' projects that will contribute to increase Europe's wind energy production and **boost economic growth**[7]. It is recognized that this objective only can be accomplished by coordinated research and development focusing on the **creation of a new European wind atlas, including a wind - climate database, and on the improvement of models for wind energy physics[8]**.

1.1 State-of-the-art in wind resource assessment and limitations

At national and regional level, wind atlases have been produced which assess the wind speed to be expected in particular areas. At European level, a wind atlas was published by Risø National Laboratory for the European Commission in 1989[9]. As of today, this remains the only public atlas covering several EU Member States in a uniform way. Still, the 1989 atlas does not cover new EU Member States (Figure 1.1), has a coarse resolution, and was developed using a model for wind assessment – WAsP (Wind Atlas

[1] 2011 Update of the Technology Road Map for the SET-Plan, JRC SETIS Work Group.
[2] Capacities Map 2011 - Update on the R&D Investment in Three Selected Priority Technologies, EUR 25024 EN.
[3] Wind European Industrial Initiative Team. EWI 2013-2015 Implementation Plan. Produced by TPWind Secretariat, version 3, February 2013
[4] SEC (2009) 1295. Communication from the Commission "on Investing in the Development of Low Carbon Technologies (SET-Plan) – A Technology Roadmap".
[5] Wind Energy - The Facts, Part I, 2009.
[6] Petersen EL, Troen I, Jørgensen HE, **Mann J**, (2014) The new European Wind Atlas. "Energy Bulletin", International Sustainable Energy Development Centre under the Auspices of UNESCO (ISEDC). In production.
[7] Petersen, E. L., 2012. The new generation of tools for prediction of wind power potential and site selection. In: Proceedings of the International Conference on Wind Energy: Materials, Engineering and Policies (WEMEP-2012).
[8] New EU Wind Energy Atlas (2011): Proposal for an ERANET+ project. Produced by the Wind Energy Technology Platform Secretariat; Brussels.

Analysis and Application Program) – based on a linearized flow model[10].

Currently, wind assessment technology is facing an inflection point from linear flow models to more sophisticated methods based on non-linear flow models combined with mesoscale models developed independently by meteorological and engineering communities. This inflection point is occurring due to the availability of the necessary computational resources, and to the advent of better meteorological and experimental databases. Since the late 80's, the de facto standard model for wind assessment has been WAsP which estimates the effect of the micro-scale (0.05-5 km scale) terrain and vegetation variations on the wind resource. As wind turbines have grown, such a micro-scale approach needs to be complemented with the modelling of the planetary boundary layer (PBL) and associated temperature gradients within the PBL. Whereas the micro-scale flow models can be seen as bottom-up approaches for wind resource assessments over a smaller area, the use of meso-scale models has since the 1990ies[11,12,13] offered a top-down approach to wind resource estimations over large areas to produce wind atlases. However, the meso-scale models cannot accurately predict the wind variability caused by micro-scale features.

Country	Coverage in European Wind Atlas from 1989	Covered in other mapping methods	Covered in the new Wind Atlas
EU27			
Austria		•	•
Belgium	•		•
Bulgaria		•	•
Cyprus			•
Czech Republic		•	•
Denmark	•	•	•
Estonia		•	•
Finland		•	•
France	•		•
Germany	•		•
Greece	•	•	•
Hungary		•	•
Ireland	•	•	•
Italy	•	•	•
Latvia		•	•
Lithuania		•	•
Luxemburg	•		•
Malta			•
The Netherlands	•		•
Poland		•	•
Portugal	•		•
Romania		•	•
Slovakia		•	•
Slovenia		•	•
Spain	•		•
Sweden		•	•
UK	•	•	•
Other countries			
Turkey		•	•
Armenia		•	
Croatia		•	
Georgia		•	
Norway		•	
Russia		•	
Switzerland		•	

Figure 1.1: Different wind atlases coverage [Wind Energy - The Facts, Part I, 2009].

State-of-the-Art in wind power meteorology is facing several research challenges that need to be overcome in order to decrease the uncertainty of wind energy production and wind conditions to less than 10%: A main objective of the NEWA project is to fundamentally change the state-of-the-art during the course of the project by developing and introducing a new methodology for the assessment of wind conditions. The development will be based on dedicated large scale wind measurement campaigns, which focus on situations important for wind power utilization. The methodology to be developed will be validated by local measurements, and include detailed turbulence models; considering extreme winds, extreme shears, high wind variability, among other extremes. The development of such a highly accurate methodology represents the main challenge in the new Wind Atlas research project. The measurement campaigns which will form the basis for the development of the new methodology will for the first time make full use of new measurement techniques like the windscanner lidar system.

Mesoscale models are, in general, not specifically developed for wind energy applications, and the models will be adapted and tested for this purpose. The choice of models skill and validation criteria will be elaborated. High resolution data on surface conditions (e.g. land-use and topography) will be evaluated and adapted for use in the models. Microscale models will be linked to the mesoscale models in a consistent way. Today there are two approaches[14]: Direct dynamical down scaling and the "Lib-file" method developed for the 1989 European Wind Atlas. A generally approved method is highly needed so that data generated by the mesoscale model can be adapted and collated for use in various microscale models. The Microscale-mesocale model-linking will be established and validated using high quality field data – in particular the data obtained in the experimental campaigns in the project.

Preliminary investigations[15] show that using several mesoscale models and using a weighted average, the so-called ensemble average, could reduce the bias of the predicted wind resources. This will be further validated and extended to external design parameters. A method for estimation of the wind resource uncertainties will be developed by relating prediction errors to the ensemble spread producing a

[9] Troen I, Petersen EL (1989) European Wind Atlas, Risø National Laboratory, Roskilde. ISBN 87-550-1482-8. 656 pp.
[10] Troen I, Bass A (1986) A spectral diagnostic model for wind flow simulation in complex terrain. Proceedings of the 1986 European Wind Energy Conference, Rome, Italy.
[11] Petersen, E. L., et. al.: 1998, Wind power meteorology. part i: Climate and turbulence, *Wind Energy* 1(s 1), 25-45.
[12] Petersen, E. L., et. al.: 1998, Wind power meteorology. part ii: siting and models, *Wind Energy* 1(2), 55-72.
[13] Hahmann A. N. et al, 2014, Validation and comparison of numerical wind atlas methods: the South African example. European Wind Energy Conference & Exhibition 2014, Barcelona, Spain.
[14] Badger J., Frank H., Hahmann A. and Giebel G. Wind climate estimation based on mesoscale and microscale modeling: statistical-dynamical downscaling for wind energy applications. *Journal of Applied Meteorology and Climate*. DOI:10.1175/JAMC-D-13-0147.1, 2014
[15] Landberg L. 2014, A science-based commercial look at meso-scale modelling. European Wind Energy Conference & Exhibition 2014, Barcelona.

probabilistic wind atlas using similar techniques as applied to weather forecasting methodologies.

A major reason for the shortcomings of the existing models in the context of wind energy is the lack of suitable validation data. Only very few measurement campaigns of sufficient scope and data quality are available for the validation of microscale models, such as the Bolund hill[16]. For the development and validation of the models, experiments are designed for situations important for wind energy and at the same time challenging for the models, e.g. complex terrain, forested sites, offshore and cold climate.

Validation of mesoscale models is inherently difficult due to the size of the grid cells and and a relatively unknown discrepancy between numerical and physical resolution. Measurement methods will be developed which improve the validation of model results with experimental data. The model chain will be comprehensively tested and validated using high quality climatological and shorter term datasets. Uncertainties will be quantified, and the potential short to long term wind predictability quantified in terms of climatic area and terrain characteristics. Combined, the partners of the NEWA consortium have developed a range of state-of-the-art models, which will be used in the model chain (see section 3.3.2 for an exhaustive overview of the models and approaches represented).

1.2 Concept and objectives

1.2.1 NEWA technological concept

In this project a New European Wind Atlas will be developed to be used as a **standard for site assessment**. The new Atlas, based on improved modelling competencies on atmospheric flow, together with the guidelines and best practices for the use of data, should become a key tool not only for manufacturers and developers, but also for public authorities and decision-makers, by **reducing overall uncertainties in determining wind conditions**.

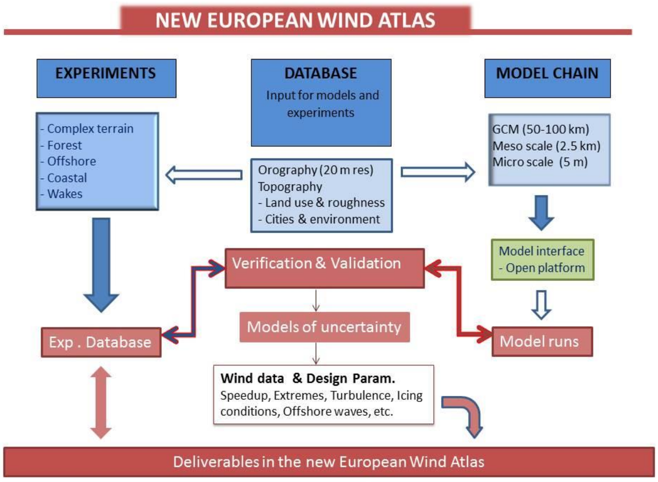


Figure 1.2: Flow chart showing the structure of the new EU Wind Atlas[6]

The new Atlas, the structure of which is presented in Figure 1.2, will involve the development of new dynamical downscaling methodologies as well as improvements and extensions of the models involved, with high temporal and spatial resolution. The Atlas will take advantage of newly created long term datasets and incorporate comprehensive information about wind conditions for all stages of wind projects' life-cycle.

Overall, the new Atlas will provide a **unified high resolution and freely available data-set of wind energy resource in Europe**. The statistics in the atlas will cover Europe with a resolution 20-30 meters in at least 10 wind turbine relevant heights. This statistical downscaling is built on at least 10 years of mesoscale simulations with a resolution of 2-3 km. These mesoscale data will also be publicly available. The area coverage is the EU countries and 100 km offshore plus the Baltic and the North Sea (see Figure 1 in WP2). In addition to wind resource information, the new Atlas will give measures of wind variability, wind power predictability from day-ahead to decadal[17] as well as parameters for wind turbine design.

1.2.2 Scientific and Technological (S&T) objectives

The main objective of NEWA is the development of a new European Wind Atlas and the improvement of advanced models towards the **reduction of uncertainties to less than 3% for flat homogenous terrains** – strategic **key performance indicator** for "Resource assessment and spatial planning" of the

[16] Berg J, Mann J, Bechmann A, Courtney MS, Jørgensen HE (2011) The Bolund Experiment, Part I: Flow over a steep, three-dimensional hill. Boundary-Layer Meteorol. 140: 1-25

[17] Doblas-Reyes FJ, García-Serrano J, Lienert F, Pintó Biescas A, Rodrigues LRL (2013) Seasonal climate predictability and forecasting: status and prospects. WIREs Climate Change, 4, 245-268, doi:10.1002/WCC.217.

European Industrial Initiative on wind energy **– and to less than 10% for any terrain**, as suggested by The European Wind Energy Technology Platform (TPWind)[18]. This overall goal is broken down into several **technological and scientific objectives**:

- **Development of a high-value data bank from a series of wind measurement campaigns**
  Current tall wind turbines are often placed in remote areas on steep ridges and in forested terrain. This project aims to provide a detailed and accurate description of the wind flow at selected sites in such terrain based on well-instrumented meteorological field experiments covering a wide range of topographical and climatological conditions. The produced data will be public available and can be used by private and public partners to develop models and engineering tools.
- **Development of methodology and improvement of advanced models for wind farm development, wind turbine design conditions, spatial planning, and policy promotion**
  This project aims to determining the wind conditions with a very low uncertainty when planning wind farms. Hence it is necessary: to develop the essential models (based on results from the experimental campaigns) so that they are tailored to the Wind Atlas and can provide results with accuracy unseen today. How to link the wind resource information provided by the micro- and meso-scale models is an intense research area – NEWA aims to establish a new methodology for the coupling between the two, which will be open-source knowledge contributing to innovative research in wind energy.
- **Creation and publication of a European Wind atlas (database on wind data, environmental and other constrains)**
  The new European Wind Atlas database to be developed will include: wind resources and external design parameters and their associated uncertainty; the level of predictability for short to long term forecasting; guidelines and best practices for the use of data, (particularly relevant for micrositing). The Atlas will cover all EU Member States and a group of Associated Countries, as well as their exclusive economic zones, and restricted areas (Natura 2000 sites, military areas). The interface of the NEWA database will include an interactive web-based map with a responsive.
- **Verification and estimation of uncertainty**
  An uncertainty map will calculate the confidence of the Wind Atlas and the intensity to which in situ measurement must be employed before development of a wind farm. The uncertainty will be verified by a large number of wind climate data and wind farm production data covering the total area including offshore areas. The experimental results will also be used especially for theoretical work, developing new procedures for uncertainty calculations.

1.3 Expected impacts

By developing a new Wind Atlas, this project will contribute to:

- **The reduction of the cost of electricity** generated by wind farms by mitigating risks related to the design and operation of large-scale wind turbines through an enhanced knowledge of wind conditions;
- **Better quantification of European wind energy potential**, and provision of data and models that can improve spatial planning tools and operations, ensuring an effective deployment of wind power.

The most significant implication of the new Wind Atlas is that a reduction of technical and financial uncertainties will accelerate the penetration of wind energy in the EU which should be beneficial for local industry. As a result, this project will contribute to **preserved/enhanced employment in the European wind energy sector**, as well as to a significant reduction in the cost of energy and CO_2 emissions. The reduced cost of energy will **increase competitiveness of the European wind industry**. The reduction of uncertainties will decrease the financial risk for investors, making wind energy a more attractive investment. This way, the project will **help Europe to maintain a strong position in terms of wind energy knowledge, technology, and deployment.**

The creation of the new Wind Atlas and the development of improved models **is only possible with the incentive of the NEWA ERA-NET PLUS Programme**. Although strongly committed to the project's objectives, the consortium alone would not be able to mobilise all the resources needed to reach the expected S&T advancements (as described under section 3.2) as early as 2019.

[18] Strategic Research Agenda. Market Deployment Strategy from 2008 to 2030 (2008) European Wind Energy Technology Platform (TPWind), July 2008

2. Description of the workplan: overall and at the work package level

Table 2.1: Work Plan tasks and responsible participants.

WP No.	WP: Task Description	Participant(s) responsible for the WP
1	**Project Management** Task 1.1 – Overall management of the project and risk contingency planning Task 1.2 – Formal responsibilities of the Coordinator within the project Task 1.3 – Administrative responsibilities of the Coordinator within the project Task 1.4 – General tasks through the project for the Coordinator	DTU
2	**Full scale experiments & data collection** Task 2.1 – Site selection Task 2.2 – Development of guidelines for experiments Task 2.3 – Long term measurements at the campaign site Task 2.4 – Development of experimental database Task 2.5 – Existing experiments in database Task 2.6 – Collection of existing tower measurements Task 2.7 – Provision of surface characterization for Meso and Micro scale modelling Task 2.8 – Offshore satellite data Task 2.9 – Northern Europe combined mesoscale experiment Task 2.10 – Forested hill experiment in Kassel Task 2.11 – Double hill experiment at Perdigao Task 2.12 – Complex terrain experiment with a strong mesoscale component at Alaiz Task 2.13 – High altitude ridges in Turkey Task 2.14 – Large-eddy simulations for additional idealized test cases and experimental sites	DTU
3	**Model chain** Task 3.1 – Design of a probabilistic wind atlas methodology Task 3.2 – From day-ahead to decadal wind power forecasting Task 3.3 – Downscaling to microscale for site assessment and high-resolution predictability Task 3.4 – Implementation of the model chain Task 3.5 – Model benchmarking	CENER
4	**New European Wind Atlas database** Task 4.1 - Definition of wind atlas output parameters Task 4.2 - Models for siting parameters, extremes, turbulences, predictability etc. Task 4.3 - Beta production run of the model chain Task 4.4 - Uncertainty quantification of model chain Task 4.5 - Development of the NEWA database Task 4.6 - Final production run of the model chain Task 4.7 - Link to the Global Wind Atlas & national wind atlases Task 4.8 - Development of interface to NEWA Task 4.9 - Final database	IWES
5	**Communication, Dissemination, Outreach and Exploitation** Task 5.1 – Communication, Dissemination and Outreach – spreading results Task 5.2 – Exploitation	CENER

Table 2.2: Work package description.

WP Number	**1**	**Start Month:**	**1**	**End Month:**	**60**
WP Title	**Project management**				
Activity Type	**MGT**				
WP Leader	**DTU**				

Work Package Objectives

- Ensure a smooth execution of the project including communication between the consortium, the NEWA ERA-NET PLUS Secretariat and the National Funding Agencies, so that all knowledge is created, managed and disseminated in a coordinated and coherent manner and that all technical activities, financial and legal aspects and other issues are managed to a high standard.
- Ensure all aspects of the NEWA ERA-NET PLUS requirements for communication and reporting are met.

Description of work and role of participants

The Coordinator (Jakob Mann from DTU) will have overall responsibility for the work, but a dedicated Management Support Team will assist in all administrative matters. **Partners will also assist the Coordinator as required.**

Task 1.1 – Overall management of the project and risk contingency planning (lead by DTU)
The Coordinator will review reports to verify consistency with the project tasks and deliverables before transmitting them to the National Funding Agencies and the NEWA ERA-NET PLUS Secretariat. Any minor deviations from the project plan will be reported to the Steering Committee (SC) members. The SC will consider the problems and, where appropriate, make recommendations for implementing the contingency plan(s) associated with the work package(s) in question. Where alternative contingency plans are needed the Coordinator together with the Management Board will draft these including recommendations to the SC. The Coordinator will ensure that conclusions from the SC are communicated to all members and included in the project plan. In the event of more serious problems, the SC will convene to determine the best route forward and the Coordinator will advise the NEWA ERA-NET PLUS Secretariat of the problem and seek their approval for the proposed solution.

Task 1.2 – Formal responsibilities of the Coordinator within the project (lead by DTU)

- Control of progress during the project, ensuring that the project schedule is met – review of all reports before they are transmitted to the NEWA ERA-NET PLUS Secretariat;
- Review of project progress against the economic, industrial, technological, and operational objectives and targets;
- Resolution of any potential partnership instability and conflict;
- Organisation of the Steering Committee meetings and General Meeting, management board meetings, Kick-Off Meeting mid-term and final seminars;
- Preparation of the quality assurance plan.

Task 1.3 – Administrative responsibilities of the Coordinator within the project (lead by DTU)

- Collation of all deliverables; milestone reports; yearly interim reports (which will include a summary of the main conclusions from SC meetings); and a common publishable and public final report submitted to the EC, funding agencies, and other partners, describing the activities and outcomes of the work.
- Resolution of any administrative or contractual issues.

Task 1.4 – General tasks through the project for the Coordinator (lead by DTU)

- Monitoring the project quality control, consensus formation and management procedures;
- Logging of correspondence and ensuring prompt response;
- Establishing and maintaining procedures for identification, collection, indexing, access, filing, and maintenance of all documents and data relating to the project;
- Maintenance of the Consortium Agreement.

Work Package Deliverables		**Delivery month**
D1.1	12 month interim report	12
D1.2	24 month interim report	24

D1.3	36 month interim report		36
D1.4	48 month interim report		48
D1.5	60 month public final report		60
D1.6	Report on gender, societal and ethical issues		54
Work Package Milestones		**Delivery month**	**Means of verification**
M1.1	Mid Term Assessment	30	Report submitted
M1.2	Final project report	60	Report submitted

WP Number	2	Start Month:	1	End Month:	51
WP Title	Full scale experiments & data collection				
Activity Type	RTD				
WP Leader	DTU				

Work Package Objectives

- Provide input data relevant for NEWA:
  1. Surface characteristics data for micro- and meso-scale models onshore
  2. Satellite data offshore for wind statistics
  3. Existing tall mast wind data
- Prepare and execute a series of full scale meteorological field experiments to be used for model validation
- Deliver in easily accessible databases all input and measurement data to other WPs and to the general public

Description of work and role of participants

Task 2.1 – Site selection (DTU, IWES)

The precise selection of sites is fixed except for the Turkish site called Mut (see, Task 2.13), which has to be confirmed (Figure 1) as well as the exact route for the ferry experiment. Additional support to extra instrumentation for selected tall mast will also be considered.

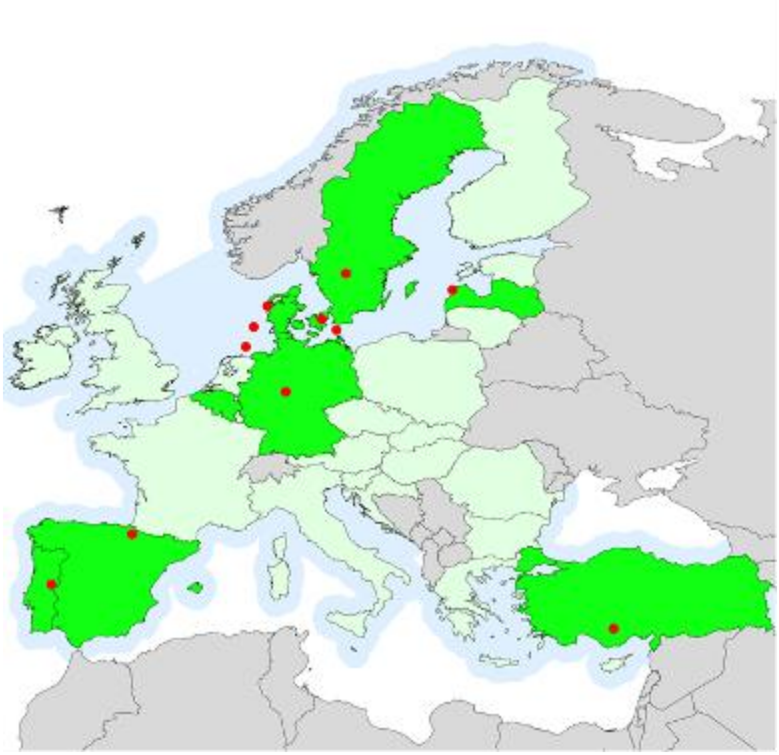


Figure 1: Approximate positions of the experimental sites in Portugal, Spain, Germany and Turkey together with the many stations available for the Northern European meso-scale experiment. The green countries are partners in NEWA, while the light green is the EU showing the coverage on land of the wind atlas. The light blue shows the coverage offshore.

Task 2.2 – Development of guidelines for experiments (CENER, UPORTO, ATM-PRO)

In order to provide coherence to the experiments general guidelines are needed. For example, what is the terrain information needed at every site? An overview of the minimum number of parameters to measure to make meaningful comparison with models will be provided. Intensive campaigns should be a single period of approximately half a year, not several smaller periods, which would be logistically too demanding.

The experiments will be designed using numerical simulations done by many partners, i.e. long-term mesoscale simulations to characterize the wind climate and define suitable measurement periods and sites; microscale simulations, RANS or LES, to define instrument layout with emphasis on the top-priority needs of model validation. LES simulations e.g. of the Perdigao site shall help to identify locations, where flow phenomena of relevance for wind energy application such as a recirculation of the flow occur. The deliverable is a report with guidelines which links to existing model evaluation protocol and framework (windbench.net) and work on experimental planning taking place in the “windscanner.eu” project.

Task 2.3 – Long term measurements at the campaign site (UPORTO, IPE, ERI VIRAC, ATM-PRO)
The guidelines mentioned above will also provide uniform demands to the climatological or long-term (approx. 3 yrs) measurements that have to be done at all sites. Defining a set of common criteria to set-up experiments will facilitate post-processing and site comparability.

Task 2.4 – Development of experimental database (IZTECH, TUBITAK MRC, DTU, UCM, CENER, IPE, ERI VIRAC)
All experimental data, also fast time series and satellite data, will be stored in a database. In order to be useful the access speed will need to be optimized. We will use the open source and free MariaDB (mariadb.org) to achieve the speed and accessibility. Previous work from DTU on the Global Wind Atlas and other projects will be exploited.

Task 2.5 – Existing experiments in database (TUBITAK MRC, IPE, ERI VIRAC)
To test the functionality of the database, existing and previously not publicly released data from the Bolund[19] (flow over a small escarpment), Falster[20] (Flow over a forest edge) and other experiments will be uploaded and made available for the partners and later to the general public. Sweden and other countries will be able to share data gathered from earlier national measurement campaigns during the NEWA project.

Task 2.6 – Collection of existing tower measurements (CENER, UCM, IPE, ERI VIRAC, Vestas)
CENER will produce a *call for wind data* that will be launched at the beginning of the project in order to gather measurement campaigns from external industrial partners throughout Europe. Large industry players like Vestas and Iberdrola have already expressed interest in sharing this kind of data with NEWA. Wind data from turbine relevant heights will be collected to validate the model chain. Coordination with the European Centre for Medium-range Weather Forecast (ECMWF) will be done to cover the EU domain. The national/regional weather offices in the ERA-Net countries will have highest priority. Homogeneous quality-control throughout the whole database is paramount. In addition to public data Vestas will provide data in anonymous form to be used by DTU under a NDA for bench-marking. The bench-marking itself will be published. Data from already funded new tall mast will be also included in the database wherever possible. For example, a new tall tower of between 150 m to 180 m will be erected at Izmir Peninsula by IZTECH. Also, an example of a dataset to be included is 738 wind observational sites in the NE of the Iberian Peninsula, gathered and managed by UCM to cover the climatic area around the Alaiz experiment. The quality control procedures developed with this database[21] will be extended to the European database to produce a homogeneous validation dataset for the wind atlas.

Task 2.7 – Provision of surface characterization for Meso and Micro scale modeling (Nazka Mapps, 3E)
Input data for meso scale and micro scale levels have to be generated at a high quality to be used in the development of the model chain and the final wind database.

The data used for surface characterization for meso- and micro-scale modelling should address the following characteristics:
- High quality in terms of thematic accuracy

[19] Bechmann A, Sørensen NN, Berg J, **Mann J**, Rethore P-E The Bolund Experiment, Part II: Blind Comparison of Microscale Flow Models, Boundary-Layer Meteorology 141(2) 245—271, 2011
[20] Dellwik E, Bingol F, **Mann J** Flow distortion at a dense forest edge Quarterly Journal of the Royal Meteorological Society 140(679) 676—686, 2014
[21] Jiménez, P. A., J. F. González-Rouco, **J. Navarro**, J. P. Montávez, and E. García-Bustamante. "Quality-control and bias correction of high resolution surface wind observations from automated weather stations". J. Atmosph. Ocean. Techn. 2010B, 27, 1101-1122.
Etor E. Lucio-Eceiza, J. F. González-Rouco, **J. Navarro**, H. Beltrami, et al. “Quality control of surface wind observations from weather stations and buoys in Norht Eastern North America”. 2014. In preparation.

- Appropriate temporal and spatial resolution
- Consistent coverage in the Area of Interest
- Affordable (cost-effective)
- Reproducible (in order to capture changing land cover/use)

The currently most detailed and reliable wall-to-wall land-use database covering Europe is the Corine Land Cover. The first Corine Land Cover inventory available is from 1990, with new versions published in 2000, 2006 and 2012 (still in production). The Corine Land Cover inventory consists of 44 classes, with a Minimum Mapping Unit (MMU) of 25 ha (5 ha for detected land cover changes between different versions). It is produced by semi-automatic classification of high resolution satellite imagery with a spatial accuracy of <= 25m.

However, many more detailed land-cover/use layers exist on European scale (eg.: Urban Atlas). Combining these layers into a new and relevant classified land cover/use layer using the results from sensitivity analysis with mesoscale models can improve existing surface characterization for Meso and Micro scale modelling.

The use of state-of-the-art Earth Observation (EO) data sources to create new and improved surface characterization layers for Meso and Micro scale modelling will be studied as well. EO data from ESA's new Sentinel mission in combination with advanced semi-automatic image analysis techniques like Object-based Image Analysis (OBIA) offer a new potential in this aspect. Nowadays, a wide range of satellite EO data is available ranging from 0.5m spatial resolution to > 250m. The Sentinel mission will provide free optical and SAR EO data. Similar alternative data are available via other EO sources eg. SPOT-5, RapidEye, FORMOSAT, Landsat, etc.

Sub-tasks:

1. Requirements and gap analysis optimal surface characterization for Meso and Micro scale modelling based on Land Cover/Use information (NAZKA)
2. Study of existing and new EO data sources and image analysis techniques for an improved European surface characterization for Meso and Micro scale modelling (NAZKA)
3. Sensitivity analysis of EO input parameters on mesoscale model output, including existing ECMWF boundary/initial conditions as control (3E).

Task 2.8 – Offshore satellite data (DTU, IZTECH)

The atlas should extend off-shore approximately 100 km plus The North Sea and The Baltic (see Figure 1) and use ESA satellite data to validate the offshore wind resources. Satellite remote sensing of ocean surface winds will quantify the temporal and spatial wind statistics from 1987 to present, at spatial scales from 25 km down to 1 km. The coastal zones will be mapped till distance ~ 2 km. A combination of satellite remote sensing observations from passive microwave (SSM/I, AMSR-E), scatterometer (QuikSCAT, ASCAT, OSCAT) and synthetic aperture radar (SAR from ERS, Envisat, Sentinel-1) will be established.

Task 2.9 – Northern Europe combined mesoscale experiment (DTU, IWES, IPE, ERI VIRAC, LEGMC, UU, WeatherTech, DNV-GL)

This activity is a true integration and coordination of national efforts as asked for in the call. It integrates efforts in Germany, Denmark, Sweden and Latvia. The purpose of the experiment is to validate mesoscale models, both statistics and short-term prediction and more detailed models of coastal regions. The experiment maps near shore wind resources (0-10 km with lidars on the coast, 0-100km with conically scanning lidars on ferries, several masts both on- and off-shore. It should also be used to assess downscaling to wind turbine relevant heights and to assess the potential benefits of assimilation of wind data into short-term prediction models. The experiment will play an important role in the use of offshore satellite data (M2.4) because the way these data are extrapolated to wind turbines heights depends on atmospheric stability. This can be provided by the mesoscale models (WP3), but that connection has to be investigated in more detail experimentally.

More detailed description of the mesoscale experiment (DTU, IWES, IPE, ERI VIRAC, LEGMC, UU, WeatherTech)

Aim of the experiment is to produce a dataset for the validation of meso-scale models applied to coastal and offshore regions, possibly with additional and more detailed data close to the land-sea discontinuity that are also suitable for a comparison with micro-scale model outputs. Besides the prevailing wind and wave conditions and its coupling also effects of atmospheric stability and land-sea transitions are of interest. All three of these issues, the atmospheric stability, the wind-wave coupling and the transition effects, are key challenges for the modelling of offshore wind resources.

To assess and cover the regions of interest, the selection of the most suitable measurement technologies is critical. IWES will combine a LiDAR measurement for the vertical wind profile from a ship that is travelling on a regular route from one cost to the other (e.g. a ferry line, already tested by IWES) with long-range scanning LiDAR devices (provided by ForWind and/or DTU) that measure from the coast up to several kilometres upon the sea. The wind measurements are to be supplemented with suitable measurements of the prevailing waves and currents as well as temperature measurements for the assessment of the atmospheric stability. The measurement systems are in principle available but have to be adjusted and synchronized in a way to produce the optimal measurement output: scan trajectories have to be designed and selected, the ship-based measurement system has to be complemented with additional sensors.

DTU has obtained funding for an experiment to scan near coastal wind resources with pulsed wind lidars. NEWA can supplement this experiment and the data should be shared. DTU has several masts up to 160 m at Høvsøre, less than 2 km from the North Sea. Further inland we have two 250 meter masts that are currently being instrumented.

Several tall mast operated in the region will supplement the experiment. These include several tall masts owned by the Latvian military along the Latvian coast that could be instrumented by the project**.** Sweden has many tall meteorological towers. A new 180 m tall mast somewhat further inland will be erected in the fall. NEWA might help instrumenting the tower more than the already obtained funding allows. An intensive campaign with remote sensing instruments is also planned at the site in which the 180 m tall mast will be erected. The aim is to better understand the horizontal variability of the vertical structure of the atmosphere over patchy forests. UU, WeatherTech, and DTU will collaborate in the planning and execution of the campaign.

Task 2.10 – Forested hill experiment in Kassel (IWES, IPE, ERI VIRAC)

The flow over forested hills is notoriously difficult to model and is a scientific challenge[22]. This experiment will become the standard reference for models coping with that problem.

Centred around the existing 200 m mast of Fraunhofer IWES at Rödeser Berg near Kassel an experiment on patchy forest over hilly terrain will be conducted. The Forested Hill Experiment will comprise long term mast based measurements of at least one year. These will be complemented by an intensive measurement campaign of several months using multiple lidars and scanning lidars.

The uncertainty in the estimation of flow characteristics is notoriously high in this kind of terrain and the modelling of the flow is at the forefront of research. Thus, the Forested Hill Experiment at the site near Kassel will provide highly valuable data sets to meso- and micro-scale modellers. A large variety of instrumentation – including sonic anemometers and a ceilometer allow investigations to model performance with regards to atmospheric stability, boundary layer structure and seasonality among others.

a) Coordination of the Forested Hill Experiment

This subtask facilitates the Forested Hill Experiment at Rödeser Berg near Kassel (Germany). It includes the design and coordination of the intensive observation period at Rödeser Berg. To maximize the output of the experiment for the modelling community a kick-off workshop will be held at the beginning of the project to coordinate the needs of the modelling community with the available measurement technology and the detailed experimental layout of the campaign.

b) Long-term mast measurements – Installation of new mast

[22] Belcher, S. E., Harman, I. N. and Finnigan, J. J.: 2012, The wind in the willows: flows in forest canopies in complex terrain, Annual Review of Fluid Mechanics 44, 479–504.

The Forested Hill Experiment builds on existing infrastructure, e.g. 200 m mast and lidars to the highest extent. Additionally, met mast(s) equipped with cup- and ultrasonic anemometers (partly provided by DTU) will be erected in the agricultural area upwind of Rödeser Berg at the Kassel site. The aim is to create a validation data set for a horizontal extrapolation and spatial validation using different models. This task includes the necessary planning permission procedures, the purchase, erecting and removal of the mast.

c) Long-term mast measurements – Operation of met masts (at least one year)

This task is responsible to keep the met masts (200 m + new mast) for the period of the Forested Hill Experiment near Kassel. Also standardized data collection and online quality control will be carried out. Maintenance and will be carried out.

d) Data analysis and evaluation

The experimental data collected with the met masts and lidars during the Forested Hill Experiment will be systematically evaluated with regards to their site specific wind conditions at the different mast sites and meteorological conditions. The effects of the forested surroundings vs. open terrain and the patchy structure of the terrain on the wind resource and the design wind conditions will be evaluated.

e) Conducting intensive measurement campaign

This WP is responsible to keep all Fraunhofer lidars running during the intensive campaign of the Forested Hill Experiment. 3E, ERI VIRAC, DTU, ForWind and others will also provide instruments including lidars. Also standardized data collection and online quality control will be carried out. A currently running pilot experiment is shown in Figure 2.

f) Forested Hill Experiment documentation and dissemination of data
A brief report of the Forested Hill Experiment summarizes the both campaigns, i.e. the long term and intensive measurements. A scientific open-access paper on the experiment will also be published.

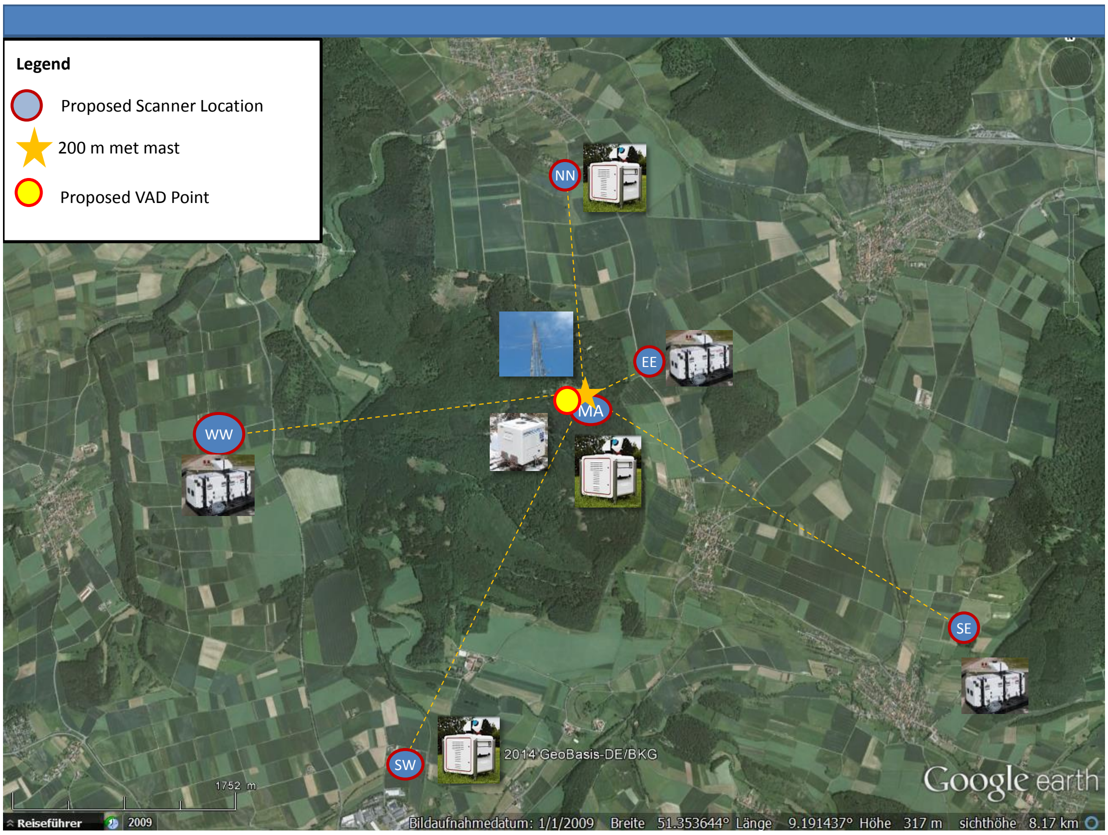


Figure 2: A pilot experiment with six lidars from DTU and Forwind surrounding the 200 m mast at Rödeser Berg near Kassel. The experiment is taking place in July 2014 and is funded through windscanner.eu.

Task 2.11 – Double hill experiment at Perdigao (UPORTO, INEGI, IPMA, LNEG, ForWind)

The purpose of this experiment is to study how an upstream hill with flow separation affects the mean wind speed and turbulence at a down-stream hill. We shall also investigate how and if the presence of a turbine on the upstream hill will affect the flow separation behind the hill. Fortunately, there is a turbine on one hill already, but apart from that the experimental infrastructure is largely missing. Forwind will support the experiment with up to three scanning long range lidars. In this experiment there is a strong interest in participation from American colleagues from NCAR, Notre Dame University and other universities. Within the NEWA project, several partners will lease some instruments from NCAR provided that they will come with even more instruments and expertise for the Perdigao experiment. The particular interest of Perdigão is (i) Synoptically driven over multiple hills, (ii) flow over a vegetated hill in a roughness regime that has received little attention, (iii) extensive surface energy budget evaluation for different land cover types, (iv) interaction of thermal circulation and synoptically driven winds, (v) vertical variation of surface layer properties under different stratification conditions, and (vi) data for a natural but somewhat less complicated flow configuration of interest in microscale modeling.
The experimental apparatus shall comprise three 100 m masts plus circa ten masts with height varying between 60 and 80 m able to receive equipment from partners and fitter with energy supply and data collection systems. Short term campaigns are also foreseen using meteorological balloons.
Portugal is well covered in what concerns terrain orography and roughness, although this information needs to be adapted and refined to be used in the modelling procedures. Data from Task 2.7 will be adapted by LNEG for the national territory modelling input and suitably refined for the Perdigao experiment area (approx. 10km x 10km around the experiment location), based also on *in situ* roughness classification.

Figure 3: The topography of Perdigao. Note the two long ridges. The prevailing winds are perpendicular to the ridges.

Task 2.12 – Complex terrain experiment with a strong mesoscale component at Alaiz (CENER, UIB)
The focus of this experiment is testing of the model chain in complex terrain in an area with strong mesoscale variability. We will perform an experiment where the existing tall masts at the site are supplemented with a row of masts extending northwards to an upstream ridge. This row will be supplemented with ordinary conically scanning lidars as well as long-range scanning lidars.
Scope/objectives: A systematic evaluation of the model-chain from mesoscale to microscale is proposed with focus on the Alaiz mountain where CENER's Test Site is based as well as several operating wind farms from Acciona. The focus area is about 30x30 km and suitable for the study of high-resolution mesoscale-to-microscale models with strong coupling between terrain and thermal stratification.
At mesoscale level it is worth studying the link between the synoptic activity along the Ebro valley with the regional wind climate and with the mountain flows. A network of more than 700 surface stations along the Ebro valley will be used to study the wind climatology and its role in the flow behaviour around the Alaiz mountain.
At microscale level, several elements merit attention: 1) the interaction between the mountain and an upstream ridge to the North (Sierra de Tajonar); 2) the wake effects between CENER's test turbines and Acciona wind farm to the South; 3) the interaction between terrain and forest canopy.

The experiment will consist of two phases:

1. A long-term campaign to characterize the local wind conditions and the surface boundary conditions along the Alaiz/Sierra de Tajonar transect
2. An intensive campaign with the deployment of remote sensing devices and additional instruments

Long-term (at least 1 year)

- REF "Inflow" for microscale CFD models: A site should be placed in roughly horizontally-homogeneous conditions to characterize the incoming wind profile using a sodar giving both wind and temperature profiles.
- Mast-based transect AA passing by MP5 mast: long-range measurements with masts along the prevailing wind direction to capture speed-up effects and vertical profiles at key topographic sites.
  - CENER's Alaiz masts: 4 x 118 m
  - 8x80m met-mast from Iberdrola equipped with sonics (at least 3 levels of velocity, temperature/humidity, fluxes at least at two levels)
- Surface energy balance (designed and installed by UIB): to characterize wall boundary conditions and surface-layer fluxes

Short-term (a few months)

- Tall profiles: Supplement "inflow" to characterize the wind at greater heights of the atmospheric boundary layer at key locations (hill-tops, valleys). Conventional Lidar/Sodar systems and additional anemometers available from partners.
- Long-range scans: using scanning lidars, map the distribution of wind at vertical and horizontal planes, notably along mast AA transect.
  - Scanning lidar from MP5 or from "Higa de Monreal" (peak to the East of Alaiz) scanning the AA transect.
- Turbulence fields: a windscanner will map flow fields of velocity and turbulence in areas of large spatial variability (wakes, recirculation zones, forest edges, etc).
  - Map the area between CENER's met masts and Acciona's Alaiz wind farm.

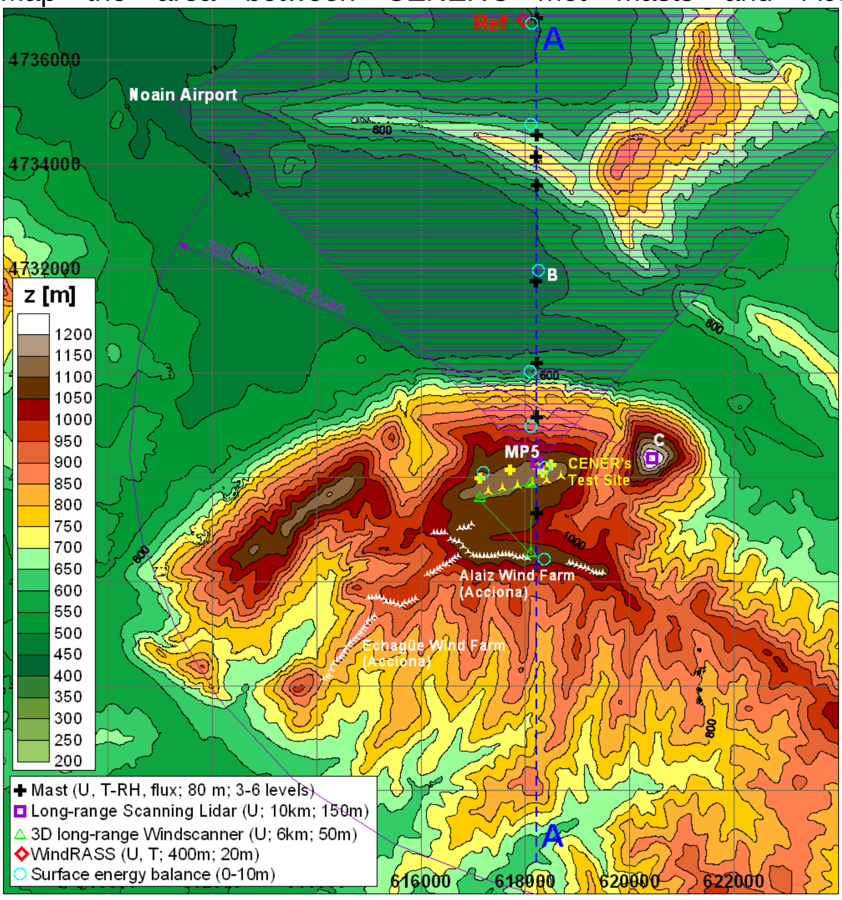


Figure 4: Preliminary layout of instruments for the Alaiz experiment. The black crosses are masts erected in the

NEWA project along with several lidar and sodar systems on the same line.

Task 2.13 – High altitude ridges in Turkey (TUBITAK MRC, Borusan)

The scientific goal in this experiment is to study flow over a 1600 m tall plateau cut through by several steep canyons. Experience from similar terrain show that the combination of plateaus and steep canyon can imply harmful dynamic loading on the wind turbines. The experiment is therefore well suited to challenge the micro-scale models' ability to predict load generating turbulent flow. In addition, this experiment will cover cold climates. The site called Mut is 100 km from the south coast of Turkey, and there are lots of licensed and potential wind turbine sites in the vicinity. A total capacity of more than 1 GW will be installed in this area in the near future, so improving the knowledge of flow in this kind of terrain could have a large beneficial impact. In all other experiments the backbone of the layout is masts with anemometers, temperature sensors etc. In this experiment it will be the other way around. Once we have gained the experience from including lidars in the other experiments we will try to base the measurement mainly on Doppler lidars (primarily from DTU), but still include a few relatively low meteorological masts.

Task 2.14 – Large-eddy simulations for additional idealized test cases and experimental sites (ForWind, KULeuven, DTU, UPORTO)

Additional numerical experiments with a large-eddy simulation (LES) model offer the possibility to obtain spatially and temporally highly resolved data under controlled environmental conditions. One objective of the application of large-eddy simulation models in this task is the generation of additional data sets for less complex test cases than the experimental ones that can be used for the verification of meso- and microscale models further developed in WP3. E.g., to complement the „Northern Europe combined Meso-scale Experiment", the development of internal boundary layers in cases of land-sea or sea-land transitions shall be simulated with LES, where the complexity of the real coastline and processes in the atmospheric boundary layer is reduced by prescribing a straight-line boundary between land and sea. The land-sea transition will be prescribed as a step change in roughness and surface temperature. Simulations will include situations with the development of low-level jets for an offshore oriented flow. Low level jet events are extremely important for wind energy applications, as strong wind speeds come along with strong vertical shear of the wind profile and comparatively high turbulence levels in these events. Therefore, models used for generating the NEWA in WP4 should be able to simulate low-level jets with a sufficient accuracy. Another LES experiment in which a more heterogeneous transition between land and sea will be prescribed resulting in huge horizontal wind speed gradients aim at delivering data that can be used to check the accuracy of the horizontal diffusion parameterized in meso- and microscale models and to improve parameterization in these models in WP3.The advantage of the LES simulations compared to field experiments is the total control over the boundary conditions of the experiments as well as the possibility to increase the complexity of the problem step by step. The first step in this task will be the explicit definition of additional idealized test cases identified to be required by the stakeholders.

The second objective of this task is to apply LES to assist the planning of detailed positions of measurement equipment to be installed at the experimental sites (especially the Perdigao site described in Task 2.11) already discussed in Task 2.2. The LES models used in this task will be validated in comparison with data from selected experiments in WP2. Once validated the LES data will allow for a verification of meso- and microscale model results for additional virtual measurement sites at the experimental sites as discussed in Task 2.2.

Work Package Deliverables		**Delivery month**
D2.1	Final site selection and experimental plan	3
D2.2	Guidelines for planning and execution of experimental campaigns	6
D2.3	Plan for collection of existing European tall tower data	6
D2.4	Execution plan for Northern European combined meso experiments	6
D2.5	Execution plan for the Kassel forested hill experiment	15
D2.6	Data base and report for large-eddy simulations for additional idealized test cases	18
D2.7	Tall meteorological masts stations description report	21
D2.8	Data base and report for large-eddy simulations for planning of the	21

	Perdigao experiment		
D2.9	Description of database of elevation and roughness characteristics		21
D2.10	Description of database with satellite derived offshore wind covering at least the last 20 years		21
D2.11	Data report for the Kassel forested hill experiment		24
D2.12	Execution plan for the Perdigao double hill experiment		24
D2.13	Data base and report for large-eddy simulations for the Kassel forested hill experiment		30
D2.14	Scientific Journal paper on the Kassel forested hill experiment		30
D2.15	Execution plan for the Alaiz experiment		30
D2.16	Data report for the Perdigao double hill experiment		33
D2.17	Data base and report for large-eddy simulations for the Perdigao experiment		36
D2.18	Execution plan for the Turkish hill plateau experiment		36
D2.19	Data report for Northern European combined meso experiments		36
D2.20	Scientific Journal paper on the Perdigao double hill experiment		39
D2.21	Data report for the Alaiz experiment		39
D2.22	Data report for the Turkish hill plateau experiment		45
D2.23	Scientific Journal paper on Northern European combined meso experiments		45
D2.24	Scientific Journal paper on the Alaiz experiment		45
D2.25	Scientific Journal paper on the Turkish hill plateau experiment		51
Work Package Milestones		**Delivery month**	**Means of verification**
M2.1	Specification of additional idealized test cases	6	Web release
M2.2	Experimental database operational and first historical data loaded	9	First data uploaded
M2.3	Climatological data from at least three tall meteorological data loaded in database	12	Data uploaded
M2.4	Elevation and roughness characteristics for Europe loaded in database	21	Database completed
M2.5	Offshore satellite data available in database	21	Database completed
M2.6	All measurements available in database for the Kassel forested hill experiment	24	Database completed
M2.7	Climatological data from all tall meteorological data loaded in database	30	Database completed
M2.8	All measurements available in database for the Perdigao double hill experiment	33	Database completed
M2.9	All measurements available in database for the Northern European combined meso experiments	36	Database completed
M2.10	All measurements available in database for the Alaiz experiment	39	Database completed
M2.11	All measurements available in database for the Turkish hill plateau experiment	45	Database completed

WP Number	3	Start Month:	1	End Month:	60
WP Title	Model Chain				
Activity Type	RTD				
WP leader	CENER				

Work Package Objectives

This WP deals with the development of the model chain that will be used in WP4 for the production of the European wind atlas database. The models will be designed and optimized throughout the project by continuous benchmarking using validation data compiled in WP2. The main objectives are:

- Development of advanced multi-scale wind assessment methodologies to improve spatial planning and wind farm design tools
- Development of advanced wind power forecasting models from day-ahead to seasonal and decadal prediction horizons to improve operational wind power management systems
- Development of an open-source model chain platform to interconnect models working at different scales and fidelity levels
- Establish a framework for collaborative model development, benchmarking and to provide input to the uncertainty quantification methodologies associated to the model chain used in WP4.

Description of work and role of participants

Task 3.1 – Design of a probabilistic wind atlas methodology (DTU, CIEMAT, ATM-PRO, ITU, ForWind, UL, UU, WeatherTech)

The NEWA model chain will be based on a multi-model ensemble of mesoscale models to produce a probabilistic wind atlas with a horizontal resolution of a few kilometers and covering a period of at least 10 years. The probabilistic database will allow a more comprehensive approach to mean and extreme wind climatologies as well as the associated uncertainties.

Previous studies have shown that there is not a unique setup of WRF ((Weather Research and Forecast Model) that results in the most accurate results in all meteorological conditions, i.e. the performance of the planetary boundary layer scheme and other parameterizations may depend on atmospheric stability and external conditions (like orography).

This task will gather mesoscale modellers to design a strategy for the most suitable ensemble, based on a harmonized setup and a unified model chain, for the target variables of the wind atlas. The unified wind atlas methodlogy is formulated in this task.

Task 3.2 – From day-ahead to decadal wind power forecasting (IC3, CENER)

The probabilistic mesoscale model chain will be complemented with climate predictions to produce predictability information at different scales/horizons: hours, days, weeks, seasons and decades. This predictability information will address operational costs of wind farms related to the lack of predictability of wind power and met-oceanic weather conditions. Together with the wind resource assessment information of the atlas it will be possible to improve spatial planning tools considering life-cycle cost models of wind farms. As a result financial risks will be also better evaluated throughout Europe.

CENER and IC3 will bring together their experience on short-term (FP7-SAFEWIND) and seasonal to decadal (FP7-SPECS) predictability assessment to develop forecasting models in the intermediate sub-seasonal range from a few days to months. This is especially relevant to quantify offshore installation and operation and maintenance logistic costs.

Task 3.3 – Downscaling to microscale for site assessment and high-resolution predictability (IWES, CENER, BSC, Cenaero, ITU, UPORTO, LNEG, ERI VIRAC, Vestas, DNV-GL, METUWIND, UU, WeatherTech)

Site assessment tools require modelling at microscale range to characterize design parameters such as turbulence intensity, wind shear and extreme winds. These site-dependent wind conditions will be systematically biased by mesoscale models due to lack of resolution[23]. This task will develop microscale models and downscaling techniques to better integrate long-term spatial planning and high-resolution design and forecasting tools.

Dynamical and statistical downscaling methods will be developed using a consistent physical interface. The

[23] Larsen et al 2012, http://dx.doi.org/10.1175/JAMC-D-11-090.1

details of this coupling will have implications on the choice of the parameters to store in the wind atlas database and on the best way to compile statistics to drive the microscale models. Relevant topics for physical downscaling include the integration of thermal stratification, forest canopies and wind turbine wakes in microscale models and the nesting of boundary and initial conditions from mesoscale to microscale[24]. From the statistical point of view, it will be investigated how to integrate outputs from the mesoscale and microscale models to produce long-term annual energy prediction estimates. To this end post-processing techniques will be developed to account for the meandering of the wind in complex terrain and within wind farms, dynamics that are not simulated by RANS turbulence models.
A meshing tool will be tested and used, providing structured meshes in complex terrain, which can be used by any solver, as well as a new turbulence model using partially averaged Navier-Stokes-equation (PANS) solvers, calibrated for different atmospheric settings. An algorithm for the automated selection of relevant flow cases for a cost-effective WRF-OpenFoam dynamic downscaling methodology for annual energy prediction will be developed.

Task 3.4 – Implementation of the model chain (DTU, BSC, CENER, 3E, UPORTO)
A multi-model platform is envisaged where different codes covering different modelling scales can be interconnected to produce the relevant outputs. The models will also range different fidelity levels, from fast linearized to costly large-eddy simulation models, and will allow different licensing options, from open-source to commercial software. This concept follows on the success of the ANEMOS European consortium that developed a platform to provide wind power forecasting services, based on research and commercial tools, developed over a series of EU research and demonstration projects (ANEMOS, ANEMOS.plus, SAFEWIND).
An open-source programming language will be used to integrate the different models and manage the interaction among them. A reference open-source model chain will be defined, based on WRF and open-source CFD codes, such as OpenFoam, for the mesoscale and microscale range respectively, to serve as benchmark for collaborative model development. It will be publically released so other researchers external to the project can test it and contribute to the benchmarking activities.
The open-source platform will be installed and parallelized to run in high-performance computing facilities accessible to the consortium partners. This will allow applying for national and European computational resources to run the wind atlas database and other costly simulations of the project. Furthermore, the platform will be installed by BSC at the petaflop MareNostrum HPC facility of Spain, to gain access to the PRACE European supercomputing research infrastructure. A proposal to apply for PRACE HPC resources will be formulated in order to enhance the production of the NEWA wind atlas runs.

Task 3.5 – Model benchmarking (IWES, CENER, UCM, ForWind, ATM-PRO, Cenaero, ERI VIRAC, Vestas)
The purpose of the experiments in WP2 is to challenge the predictions made by the model chain developed in WP3, and thus producing a more reliable wind atlas in WP4. In order to stimulate the development a number of blind comparison benchmarks will be formulated to assure and gauge the quality of the predicted parameters and to be able to improve the modelling along the project duration to optimize the wind atlas model chain. A hierarchy of benchmarking exercises will be developed in order to target specific objectives of the model chain at increasing levels of complexity. Benchmarks will be based on data generated in WP2 from experiments and high-fidelity LES simulations on idealized and experimental conditions. Variables of interest and performance indicators will be identified to anticipate experimental needs and guide model developers. CENER will manage the benchmarking process through the windbench.net portal adopting and improving the model evaluation protocol defined in the IEA Task 31 Wakebench.
Blind benchmarks will be open for external participation, notably through the IEA Task Wakebench. Strong-sense benchmarks will be produced from the high-quality experiments of the project. These are engineering standards that define a comprehensive framework for model testing, the requirements for model intercomparison and a set of acceptance criteria considering the intended use of the models. These test cases will be complemented with idealized test cases based on high-fidelity LES simulations, a database of long-term meteorological measurements and production data from weather services and industrial partners collected in WP2. For the model region of Germany the NEWA will be evaluated based on a pool of wind

[24] see http://iopscience.iop.org/1742-6596/524/1/012115, for an initial attempt

turbines and publically available data form high measurement masts. Additional masts (100) and wind farm data (25) will be provided by Vestas under an NDA.

Work Package Deliverables		**Delivery month**
D3.1	Description of the probabilistic wind atlas methodology	12
D3.2	Description of the predictability assessment methodology	12
D3.3	Description of downscaling methodologies	12
D3.4	Report on the hierarchy of benchmarks	12
D3.5	Open-source model-chain (software and manual), beta version	24
D3.6	Report on open platform interfacing and user's guide	24
D3.7	First Benchmarks report	24
D3.8	Second Benchmarks report	36
D3.9	Third Benchmarks report	48
D3.10	Open-source reference model-chain (software and manual), final version	24
D3.11	Publish paper on the NEWA model-chain	60

Work Package Milestones		**Delivery month**	**Means of verification**
M3.1	Open-source reference model-chain released publically	24	Web release
M3.2	Model chain ready for production run of the wind atlas	42	Model set up and tested for HPC

WP Number	4	Start Month:	1	End Month:	60
WP Title	New European Wind Atlas database				
Activity Type	RTD				
WP leader	IWES				

Work Package Objectives

The individual tasks of WP4 are derived from the following major objectives:

- Prepare the NEWA database by defining the wind atlas output parameters based on a stakeholder analysis and a review of modellers and developers, developing models for extracting siting parameters, extremes turbulences etc. from the wind atlas data, and quantifying the uncertainty of the model chain;
- Develop and set up the NEWA database (to be filled with the results of the final production run of the model chain), and make sure that it is open to the users through a developed interface and also after the end of the project.

Task 4.1 - Definition of wind atlas output parameters (ForWind, IWES, UPORTO)

The aim of this task led by ForWind is to define the output parameters of the model chain a) to include the stakeholder's interest in the model development and b) to facilitate the comparability of model results.
In a first step, a stakeholder analysis reveals all relevant parameters (including their specific priority and characteristics) for future wind power deployment in Europe. Special attention will be paid to the needs of industry partners in the project and their experiences and suggestions. Included parameters are: wind resource estimation and wind conditions for wind turbine design, such as the reference and extreme wind speeds, turbulence and shear, and also quantification of the site specific uncertainties associated with these quantities. In a second step modellers and developers of the data base decide on a set of output parameters with respect to technical and scientific feasibility.

Task 4.2 - Models for siting parameters, extremes, turbulences, predictability, etc. (IWES)

The backbone of the wind atlas is a database of at least ten years of meso-scale model runs covering Europe in a resolution of at least two kilometres. The purpose of this task is to downscale and use these data for the prediction of site specific extreme winds (e.g. the 50-year wind), turbulence and predictability, by applying the models developed in Task 3.3. Based on Task 3.3 the comparison with data and between models will define the final uncertainty of the parameters.

Task 4.3 - Beta production run of the model chain (CIEMAT, CENER, IC3, BSC, ForWind, DTU, UPORTO, ATM-PRO)

The beta production runs are carried out in this task. Mesoscale test runs are performed on the final domain for the first time The intention is to find the best setup in terms of input data (e.g. atmospheric data, oceanographic data, land use data), model configuration (grids, nesting) and in terms of physical schemes. The assessment of the different model setups is based on a comparison of model results with data from the measurements taken in the project. All models of the model chain will be improved continuously when validated against measurements that are taken in the project or have been made available for the project. Furthermore, different initialization and forcing data are tested to understand and quantify the sensitivity of used models. Depending on the gained experiences the computational resources for the final production are estimated by each partner and either joint or individual applications to European HPC infrastructures are prepared.

Task 4.4 - Uncertainty quantification of model chain (DTU, IWES, UPORTO, UCM, ForWind, DNV-GL)

Following the model evaluation activities carried out in WP3 for the continuous improvement of the model-chain, this task will deal with uncertainty quantification of the wind atlas outputs.
The ensemble mean of the production run will be compared with the observational database gathered in WP2 to determine the ability of the model-chain at reproducing the temporal and spatial variability of the wind climatology using various statistical error metrics. This assessment will render information about potential model systematic biases.
If errors are calculated for the individual ensemble members to build a weighted-averaged ensemble mean, then the spread of these weights can be used to assess uncertainty. The spread of ensemble

models is considered as an indicator of modelling uncertainties. The spread of models is evaluated by diverse plots and diagrams (for example Rank histograms and spread error plots) but such diagrams are usually obtained from area-averages excluding the spatial variability of uncertainties. The spatial variability of uncertainties can present a strong effect when a model is validated over wide areas with climatic heterogeneity like the European area. New uncertainty evaluation tools will be developed that account for spatial variability to produce maps on uncertainties for the output variables of the wind atlas.

Task 4.5 - Development of the NEWA database (Nazka Mapps, UU, WeatherTech, IPE, ERI VIRAC)
Definitions and database setup for the wind atlas, and exploitation & guidelines for siting procedures are developed.
To feed the NEWA map interface, the use of a read/write spatial relational database will be studied. The use of a spatial database is a requirement to render cartographic maps from the NEWA database, include dynamic GIS operations and allow a dynamic exploitation and guiding of siting procedures.
Typical input layers for constraint mapping to guide siting procedures are environmentally protected areas (Nature 2000 sites), military areas, potentially flooded areas, specific features (eg. Underground/above-ground obstacles), etc. These layers can be extracted from existing data sources from the European Copernicus program (former GMES (Global Monitoring for Environment and Security)) or European agencies like the European Environment Agency (EEA). If required, more detailed information can be achieved at national or sub-national instances.

Task 4.6 - Final production run of the model chain (CIEMAT, ForWind, DTU, CENER, IC3, DNV-GL)
When completing thorough testing of the developed model chain final production kicks off. This includes the migration of models to the desired HPC infrastructure in case the beta production has been performed elsewhere. Three partners (CIEMAT, DTU, ForWind) commit to carry out mesoscale atmospheric simulation for Europe from Reanalysis data for a time period of 10 years using the best setup figured out in Task 3.1 and during the beta runs. Simulations with LES and many other microscale models that are included further down in the model chain are performed at the measurement sites using the final mesoscale results as input. One or a weighted average of a few microscale models will be used to down scale the meso-scale statistics everywhere in Europe on a grid with a resolution of 20-30 m and at ten wind turbine relevant heights. All data will be freely available at the end of the project and archived in the NEWA database according to the catalogues of output parameters defined in “Task 4.1: Definition of wind atlas output parameters”.
Final products will be a meso-scale grid and a defined methodology for downscaling to local conditions with open source software yielding an estimate of the appropriate wind conditions at the site and including an estimate of the spatially and temporally based uncertainty for the obtained results depending on the model types and coupling options selected.
The short to long-term predictability models developed in Task 3.2 will be used to produce predictability maps at various horizons according to the end-user needs.

Task 4.7 - Link to the Global Wind Atlas & national wind atlases (DTU, TUBITAK)
NEWA will offer to host national and global wind atlases to serve as placeholders until the NEWA final database is in place. The project will take contact with recent national wind atlas owners to utilize their results and compare with beta runs of the NEWA.

Task 4.8 - Development of interface to NEWA (Nazka Mapps, 3E, ERI VIRAC)
The interface to NEWA must present the European Wind Atlas for multiple user levels. The user must be able to consult, select and download information from the NEWA database through an interactive web-based map. The map should be accessible through all common-used browsers and on multiple devices (desktop PC, tablet, mobile).

The developed interface should have access to the NEWA database and present results in the form of maps. The use of modern (open source) web technologies, languages and JavaScript libraries (HTML5, CSS3, JavaScript, Leaflet) to build the map interface instead of traditional Geographic Information System (GIS) viewers will be studied. The use of these techniques instead of traditional web-based mapping has the advantage of higher flexibility, performance and a fully customized design.

A typical web (map) application architecture consists of a database, application server and user interface. The development of the NEWA database is covered in WP 2.4 'Development of the NEWA database'. To feed the NEWA interface, the use of a spatial database in combination with a map (application) server will be studied. The map server will render the data into cartographic maps and should make use of open standards like the OpenGIS Consortium (OGC) mapping standards (WMS, WFS, WCS, etc.). The use of open source JavaScript libraries like 'Leaflet' to develop the user interface will be studied.

The possibility to provide access to the NEWA database directly from the interface will be studied as well. Entitled users must be able to extract/download information from the NEWA database through the map interface, but the option to provide access to the database via the use of OGC standards (WM(T)S, among others) or API keys will be studied as well.

Specific attention will go to user design and experience. By making use of mockups and wireframes, different types of user interfaces will be tested with the user community in order to develop a complete yet most user-friendly interface visualisation.

Task 4.9 - Final database (DTU)
The final database will be hosted by DTU through a 200 - 500 TB storage facility donated to NEWA by DTU, and possibly mirror images will be hosted by other partners. End users have expressed interest for weekly or monthly updates of the mesoscale runs after the final database has been completed. NEWA will based on this demand pursue an agreement with a commercial partner about the continuation of the database after the end of the project with the following business plan: The partner will host the NEWA database for free, but access to any updates of the meso-scale runs that are produced after the end of the project will be charged. Another avenue to secure the NEWA database for the future is to engage with International Renewable Energy Agency (IRENA) for hosting after project end. That process has been commenced. Finally, any NEWA partner may choose to maintain the database after project end depending on their financial situation.

Work Package Deliverables		Delivery month
D4.1	Report on definition of wind atlas output parameters: Catalogue of output parameters stored in the data base and output parameters of the model chain	12
D4.2	Report on models for siting parameters, extremes, turbulences, predictability etc.	42
D4.3	Report on model adjustments and specifications for final production run based on results from beta production run	44
D4.4	Report on uncertainty quantification of model chain	42
D4.5	Report on definitions and database setup for the Wind Atlas	36
D4.6	Guidelines for siting procedures	36
D4.7	Report on link to Global Wind Atlas and national wind atlases	36
D4.8	Final prototype NEWA interface with user guidelines	56
D4.9	Final database	60

Work Package Milestones		Delivery month	Means of Verification
M4.1	Completed beta production run: HPC facilities for the production run are granted; Fixed model setting for all models in the model chain	42	Computations completed and data quality verified
M4.2	Completed final production run	57	Computations completed and data quality verified
M4.3	Final database	60	Database online and user test successful

WP Number	5	Start Month:	1	End Month:	60
WP Title	Communication, Dissemination, Outreach and Exploitation				
Activity Type	OTHER				
WP leader	CENER				

Work Package Objectives

- Develop a Dissemination and Data Management Plan that will enable widespread publication of the project results.
- Ensure the Consortium's ability to exploit the projects results through knowledge sharing, documentation and training.
- Consider how the socioeconomic impact of the generated knowledge and technology should be used to influence decision making institutions and end-users investments.
- Establish a research roadmap and Exploitation Plan to support future scientific and commercial uses of the project results.

Description of work and role of participants

This WP will be lead by CENER, in close cooperation with DTU. **Partners will also assist the EDM** (Exploitation and Dissemination Manager) **as required.**

Task 5.1 – Communication, Dissemination and Outreach – spreading results (lead by CENER and DTU)

The dissemination and communication activities will be performed as a continuous process with a timeline right from the beginning of the project and will involve all consortium partners.

DTU, together with CENER, will establish how best to disseminate the project results with the partners of the consortium and publically. Every effort will be made during the course of the project to disseminate information about the goals of the project, ongoing activities, progress, results and the potential benefits and opportunities afforded by the development of the project concept. A specific part of dissemination/outreach activities will possibly be subcontracted to a third party, including communication material (design, set-up and maintenance of the project website and the project identity to be used in all publishable media) and workshops. The consortium is currently in dialogue with the European Wind Energy Association (EWEA) to take part on these activities and effectively help to disseminate project results with the involvement of the whole European area.

The dissemination and communication strategy will be defined to target different groups: stakeholders, policy makers, general public, scientific community (researchers and students), relevant industrial sectors, national and regional authorities.

Dissemination activities will include, inter alia, for the general public:

- Creation of a project website (that will be updated continuously on the progress of the project and will be used as a repository of publishable reports);
- Publication of the results in the Commission's public websites and on the NEWA ERA-NET PLUS Joint Call brochure. The consortium will provide periodic reports that include a publishable summary of such quality that the Commission and the NEWA ERA NET PLUS Joint Call Secretariat can publish it right away in the public domain and will be understandable for a lay audience;
- General public events (e.g. seminars, open days at host institutions);
- Non-scientific press articles (e.g. CORDIS Wire, Outreach Magazine) and development of newsletters on the progress of the project.

Moreover, the following scientific dissemination activities are envisioned:

- Participation in conferences and workshops (e.g. EWEA Conference, EAWE Torque Conference, IEA Task 31 Wakebench and Task 11 Topical Expert Meetings, EERA WG1 workshops);
- Participation in and presentation at two NEWA status seminars (mid-term and final seminar);
- Elaboration of open-access publications through journals as well as self-archiving repositories;
- Set up of open model design benchmarks (WP3), managed at windbench.net to seek international collaboration through IEA-Wakebench and other forums;

- Publishing of the experimental database through winddata.com, as soon as the data are quality-checked and documented;
- Publishing of open-source model-chain codes through windbench.net, as soon as the codes are verified and documented;
- Publishing of the European Wind Atlas database through the IRENA Global Wind Atlas GIS web platform.

Additionally, the research results will be disseminated internationally through expert meetings organized within the IEA Task 31 Wakebench.

The measures proposed for communication and dissemination of project results will increase the impact of the project in the following way:

- Attract the interest of potential partners and public or private investors;
- Draw the attention of national governments and regional authorities;
- Encourage talented students and scientists to join the consortium research groups and enterprises;
- Enhance partners' reputation and visibility at local, national and international level;
- Generate market demand for the project results – enhance exploitation potential.

Two workshops will be organized, one at the beginning of the project addressing end-user requirements and another one at the end of the project to summarize results, provide guidelines on the use of the NEWA databases and promote the exploitation plans of the project. These public workshops will be jointly organized with annual meetings.

In addition to these European-wide workshops, additional dissemination activities will be conducted at national level in some countries (e.g. Germany). This includes the set-up of a national industry mirror group, which is informed about the project plans and results and is invited to give advice and feedback to the project.

A Dissemination and Data Management Plan will be established at the beginning of the project on how the research data shall be handled during the project duration and beyond. Dissemination procedures for research results and data will be established to guide project participants and ensure open-access and long-term preservation.

Task 5.2 – Exploitation (lead by CENER)

The EDM will be responsible for the Exploitation plan for the Use and Dissemination of the Knowledge. This plan will include agreements between the parties as to the conditions for access to background IPR and the license agreements for use of both background and foreground IPR. These conditions will also be included in the Consortium Agreement, elaborated based on the DESCA model. The plan will detail how to exploit the project results in terms of additional R&D, commercialization and financing. In specific, the following items will be included in the Exploitation Plan:

- European Wind Atlas database: pre-agreement with IRENA for maintenance within the Global Wind Atlas database;
- Experimental database;
- Open-source model-chain codes;
- Other exploitation items related to the specific developments of each partner.

As a result of the project, the consortium will identify knowledge gaps (experimental and modeling). A NEWA research roadmap will summarize this as background to guide future uses of the databases in other research projects. This roadmap will be initially implemented by the setting up of a European network using appropriate coordination and support actions under H2020 or COST. An application will be presented during the last term of the project to support this networking activity.

Work Package Deliverables		Delivery month
D5.1	Project website and identity	3
D5.2	Dissemination and Data Management Plan	6
D5.3	Public workshop on end-user requirements	12
D5.4	General public events	24, 36, 48
D5.5	Press articles (non-scientific) and e-Newsletters	12, 24, 36, 48, 60

D5.6	Exploitation Plan		60
D5.7	Project results' description for the Joint Call brochure		60
D5.8	Public workshop on NEWA results and guidelines for end-users		60
D5.9	Participation in and presentation at NEWA mid-term seminar		30
D5.10	Participation in and presentation at NEWA final seminar		60
D5.11	Research roadmap for NEWA databases		60
Work Package Milestones		**Delivery month**	**Means of verification**
M5.1	Dissemination and Data Management Plan implemented	60	Dissemination and Data Management Plan approved
M5.2	European Wind Atlas database released publically	60	European Wind Atlas published

3. Research hypothesis(es) and workplan

In section 3, we contextualize the work plan presented in Chapter 2 by first outlining the core research hypothesis and questions. We proceed by drawing out the main advancements offered in terms of methodology as well as the depth and scope of cooperation. After, we present the work plan rationale and provide a detailed risk analysis. Finally, in a subsection dedicated to implementation aspects, we present the consortium (with a description of resources and infrastructures) as well as the management structure.

3.1 Description of the research hypothesis(es)

Four main research hypothesis and lines of enquiry form the core of the project:

Selection of the best model chain output

Here we propose a **multi-model ensemble philosophy**, at the same time requiring that both the models and the downscaling from meso- to micro-scale are theoretically well. Experience from meteorology shows that an ensemble of models that are run with slightly different initial conditions or slightly different formulations of the physics produce good estimates of the uncertainty and the mean of the models has on average less error than any of the individual model. This method will be investigated for wind energy purposes and used for the final atlas (cf. also section 3.3.4).

Propagation of uncertainties through the model chain

The progression of uncertainties through a model chain is one of the **cutting edge research questions** in the wind energy industry. All project developments are based on projections of uncertain estimates over a short term, to long term resource estimates. A more thorough understanding and description of the propagation of the uncertainty through each stage in the model chain is an investigation that can yield overall reduction in resource assessments through targeted remedial actions. The goal of these investigations is to reduce the long term resource estimate error in complex terrains to 10%. A significant error reduction will come by understanding of the propagation of uncertainty in the model chain.

Models for siting parameters, extremes, turbulences, predictability, among others

The backbone of the wind atlas is a database of at least ten years of meso-scale model runs covering Europe in a resolution of at least two kilometers. **The question in this task is how to downscale** and use these data for the prediction of site specific mean winds, extreme winds (e.g. the 50-year wind), turbulence and predictability. Even over flat terrain meso-scale models will, due to their limited spatial and temporal resolution, underestimate the 50-year wind. Robust techniques correct for that should be developed and tested.

Will higher fidelity micro-scale models finally be superior?

Large-eddy simulation (LES) is due to its computational complexity not going to be used for the final wind Atlas, but it is going to be used for the experimental complex terrain sites in NEWA. The few applications of **LES in complex terrain have so far not yet proven superior to the simpler Reynolds-averaged Navier Stokes** (RANS) solvers[25]. Eventually, LES is most likely to prove superior to RANS, but it remains to be demonstrated in practice. The nesting of LES into meso-scale simulations for micro-scale wind predictions **introduces a particular scientific challenge. It is the determination of the turbulent boundary conditions in the LES**, as turbulent fluctuations with time scales between seconds and tens of minutes are not resolved in the meso-scale simulations that are used to drive the LES.

3.2 Progress beyond the state-of-the-art

As detailed in the state-of-the-art section (1.1), the NEWA project will be innovative and will bring significant scientific and technological progress in the area of wind resource assessment. Reflecting the scientific and technological objectives, as described in 1.2, specific objectives advancing beyond state-of-the-art are described in Table 3.1. Following this table, the project contribution to economic advancements and European wind industry competitiveness is described.

[25] http://link.springer.com/article/10.1007%2Fs10546-011-9637-x

Table 3.1: Contribution of the project to advancement of knowledge.

WP	Objectives	Current status	Advancement of knowledge
2	Development of a high-value data bank from a series of wind measurement campaigns	DTU and many other institutions have databases with data from experiments, but only a few are publicly available. The existing European Wind Atlas is based on a few measurement campaigns in complex terrain, and none with measurements above 50 meters, where present day wind turbine rotors reside.	In this project, existing experimental data from different institutions will be released. Additionally, intense measurement campaigns will be carried out to build and validate the developed models covering complex terrains, offshore, large changes in surface characteristics (roughness change) and cold and rough climates. By the end of the project all the experimental data will be freely available encouraging further development of models.
3	Development of methodology and improvement of advanced models for wind farm development, wind turbine design conditions, spatial planning and policy promotion	Wind farm design tools are based on a combination of stationary microscale model simulations and onsite observed wind climate statistics. Spatial planning tools are based on long-term integration of deterministic meteorological models at relatively low spatial resolution of some kilometers. These tools are generally not interconnected and depend on a wide variety of models developed without a systematic quality assurance specific for wind energy applications.	The NEWA model-chain will be developed with the following objectives: • Multi-model ensembles will produce a probabilistic wind atlas providing the mean resource and the associated uncertainty • A consistent downscaling methodology between mesoscale and microscale models to seamlessly relate spatial planning and design tools onshore and offshore • A reference open-source model-chain for a collaborative development of wind engineering applications and standards • An uncertainty quantification associated to the model-chain to guide end-users • A collection of model benchmarks based on high-fidelity experiments in a wide range of terrain and climatic conditions.
2, 3	Verification and estimation of uncertainty	The previous atlas had uncertainties of 5 --10% for reasonable flat topography whereas it was largely unknown for mountainous terrain	The new atlas will have uncertainties of less than 3% for flat homogenous terrains, and to less than 10% for any terrain, concerning wind energy production and wind conditions that affect the design of turbines.
4	Creation and publication of a new European Wind atlas	A number of national wind atlases exist today, but they do not provide a consistent and comprehensive coverage of the entire territory of the EU, which results in a lack of verified and publicly available data on European wind conditions. Further to this, the 1989 atlas, published by Risø National Laboratory for the EC, does not cover new Member States and was developed using standard climatological data being less suited for wind energy purposes.	The new European Wind Atlas database will include the following advancements: • A consistent wind atlas covering the entire territory of the EU (EU-27) and some Associated Countries; • It will have a substantially improved, quantified and validated accuracy; • The wind atlas will consist not only of the mean wind speed climatology, but also include design wind conditions, e.g. extreme wind speeds, turbulence intensity; • It will provide wind speed time series data for a 10 year time period for each grid cell for grid integration. • It will be extensively validated by wind speed and wind farm production measurements.

International competitiveness

The European wind energy sector has been crucial in restoring EU's economy to health. It has been growing fast and, despite the current crisis, is likely to continue to grow, being established as a driver for economic growth over the next twenty years. In 2010 the wind energy sector contributed with €32.43 billion to the EU's GDP, which corresponded to 0.26% of the EU's total GDP in that year. The EC should therefore see wind energy as not only a solution to climate change, but also a way to boost economic growth and competitiveness[26].

In 2009, Europe retained the highest wind market share of 48.0% of the world's installed cumulative wind energy capacity (158.5 GW). At the same time, Europe has maintained a prominent position with some of the most important wind turbine and component manufacturers. Nevertheless, as other large-scale industries take off in regions like India and China, the margin of European installed wind power could rapidly decrease[27] – in 2007, almost 45% of all installed wind capacity was located in Europe, which showed the largest absolute growth; since then, Europe has been surpassed by Asia, which in 2010 was world leader based on added capacity, accounting for 55% of all wind turbines installed in that year[28].

In NEWA, the development of a new generation of flow models will significantly contribute to the reduction of technical and financial uncertainties. The increased security for investors and thus easier financing will in turn result in more investments in wind energy. This accelerated penetration of wind energy in the EU will be of benefit for the local industry. The new models can thus contribute to increased employment in the EU wind energy sector and significantly reduced cost of energy and helping to achieve the CO2 targets. As mentioned, a reduction in the cost of energy will significantly contribute to increase the competitiveness of the European wind industry.

3.2.1 Relation to the aim and scope of the Call

The proposal **addresses the objectives of the NEWA Call text**, as outlined in Figure 3.1. Within these objectives we highlight the following two on international cooperation and training and outreach activities, since the Technology and Economic objectives are addressed in other sections throughout the proposal.

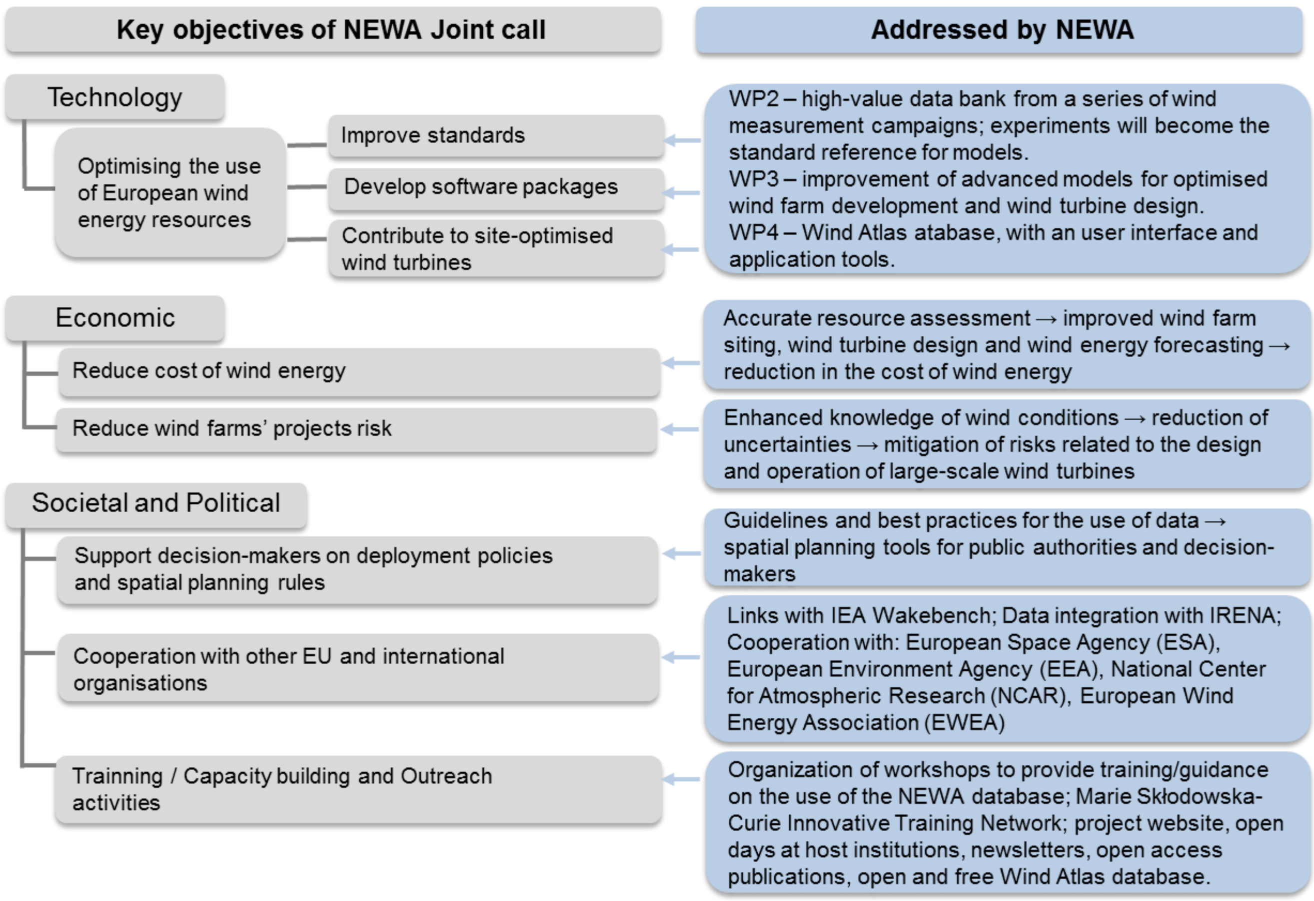


Figure 3.1: NEWA relation to the NEWA Call text.

[26] The impact of wind energy on jobs and the economy, 2012. A report by the European Wind Energy Association.
[27] Capacities Map 2011, Dr. Ales Gnamus, Institute for Prospective Technological Studies
[28] The impact of the Wind Power on European Natural Gas Markets, Irene Vos, International Energy Agency, 2012

International Cooperation: The consortium will seek international collaboration to further strengthen its know-how and enhance the project's impact at a global level. In specific, NEWA partners will establish a strong collaboration with the U.S. Department of Energy (DoE), which has launched "The Wind Program" (http://wind.energy.gov) that among other things supports NEWA related subjects under their Atmosphere to Electrons (A2e) Initiative. In particular, the consortium will establish close partnerships with the National Center for Atmospheric Research (NCAR), University of Colorado (CU), National Renewable Energy Laboratory (NREL, which is funded by DoE), and National Oceanic and Atmospheric Administration (NOAA), for the investigation of wind turbine performance under variable atmospheric conditions.We will also cooperate with the International Energy Agency (IEA), which is running a task to produce best practice guidelines wind energy flow modeling within a truly international network of participants.

Within Europe we will collaborate with the European Space Agency (ESA) on the use of satellite imagery for offshore winds, the European Wind Energy Association (EWEA) on dissemination, and TP Wind will be represented on our Advisory Committee.

In a more global perspective, the new European Wind Atlas will also benefit from and supplement the development of the global wind energy atlas – coordinated and supervised by the International Renewable Energy Agency (IRENA), with DTU and the external NEWA partner DLR as participants. This work is conducted by a working group under the Clean Energy Ministerial.

Training/capacity building and outreach activities: A proposal for a Marie Skłodowska-Curie Innovative Training Network ("OpenWATT" - Open Wind Assessment Tools and Training) was applied on the 2014 call for proposals to support the NEWA project, with 15 Ph.D fellows working on the development of wind assessment models and applications. This network, coordinated by CENER and with participation of 6 other partners from NEWA, will extensively use NEWA databases and complement the modeling effort. It will elaborate a training programme on the use and development of open-source mesoscale and microscale models, an important asset for the future improvement of the model-chain and for the exploitation of NEWA databases in general.

An extensive description of the main communication and outreach activities is provided in WP5.

3.3. S/T Methodology and associated Work plan

3.3.1 Work-plan overview and role of participants

NEWA is structured as a highly collaborative and integrative project – all technical work packages engage partners from a variety of disciplines, from both industry and academia and from different EU Member States and one Associated Country. This is critical for the development of a Wind Atlas covering all EU Member States and some Associated Countries and also to achieve the synergy between the leading experts within wind assessment, meteorology, computational fluid dynamics, interactive mapping and surface characterization that composed the consortium. Available data and preliminary studies that will be used as basis for NEWA activities are described in sections 3.3.3 and 3.3.4.

From a scientific perspective NEWA is organized to mitigate the resulting risks by multiple parallel and interacting research tracks. The work plan includes 5 work packages (WPs), schematically presented in Figure 4.1 which have been designed to ensure a broad involvement among the partners and to promote the integration of national research efforts and identification of synergies. The overall scope of the project activities cover a 60-month period.

Research, Technological Development and Innovation Activities (WP2 – WP4)

WP2 addresses wind measurement campaigns and collection and processing of data, whereas **WP3** focus on the development, improvement and implementation of models and downscaling methodologies. Finally, **WP4** aims to validate the developed approaches and estimate the uncertainty, as well as, to develop the NEWA database and its interface.

WP2, led by DTU, is focused on the full scale experiments and data collection. TUBITAK MRC, IZTECH, CENER, UCM, IPE, ERI VIRAC and DTU will be responsible for developing the experimental database, which will consist of collecting data from existing experiments, offshore satellite and surface characterization. 3E and Nazka Mapps will have a central role in providing high quality data on surface characterization for meso and micro scale modelling and for the final wind database. The full scale experiments will cover different locations in Europe. The campaign measurements in Northern Europe will integrate efforts in Germany, Denmark, Latvia and Sweden, where DTU, IWES, UU, WeatherTech, IPE, ERI VIRAC, DNV-GL and LEGMC will have key roles. IWES will be responsible for a forested hill experiment in Kassel. In Portugal, UPORTO will be responsible for a double hill experiment, with the support of ForWind, and other Portuguese partners (LNEG, INEGI and IPMA). In this task, the participants will collaborate with NCAR (US) research groups. A complex terrain experiment with a strong mesoscale component will be performed on the Alaiz Mountain where CENER's Test site is based. CENER and other academic and industrial partners form Spain will perform this task. Finally, the high altitude experiment in Turkey will have input from other full-scale experiments and will be led by TUBITAK MRC with the support of IZTECH and Borusan. Finally, Forwind, DTU, UPORTO and KULeuven will focus on large-eddy simulations for additionally idealized test cases and experimental sites.

WP3 addresses the scientific and technological challenges associated with the development of the model chain. This work will interact substantially with the work on measurement campaigns that integrates multiple inputs in WP2. DTU, CIEMAT, ATM-PRO, ITU, ForWind, UU, WeatherTech and UL – mesoscale modellers – will work in close collaboration to develop a probabilistic and unified wind atlas methodology. In order to complement the probabilistic mesoscale model chain, IC3 and CENER will develop forecasting models in the intermediate subseasonal range from few days to months. In this WP, the development of dynamical and statistical downscaling methods will be performed by varied partners namely IWES, CENER, Cenaero, ITU, UPORTO, LNEG, METUWIND, Vestas, DNV-GL, UU, WeatherTech and ERI VIRAC. The model chain methodology will be implemented by DTU in cooperation with BSC, CENER, 3E and UPORTO. IWES, CENER, UCM, ForWind, ATM-PRO, Cenaero, Vestas and ERI VIRAC will manage the blind test and benchmarking workshops.

Finally, **WP4** aims at developing the new European wind atlas database. This WP will interact substantially with WP2 and WP3. In WP4, CIEMAT, CENER, IC3, ForWind and DTU will be responsible for carrying out the beta and the final production runs of the model chain (UPORTO and BSC will participate in the beta production run and DNV-GL in the final production run). DTU, IWES, UPORTO, UCM, DNV-GL and ForWind will focus on the assessment of the uncertainty propagation through the new model chain. ForWind will generate uncertainty information for the wind atlas data base and provide computing resources on both its own HPC cluster and the HLRN cluster. The tasks related to development of the interface to NEWA and to the development of the NEWA database will be led by Nazka Mapps. 3E and ERI VIRAC will participate in the development of the interface whereas UU, WeatherTech, IPE and ERI VIRAC will contribute to the development of the NEWA Database. DTU will have a key role on the link to the Global Wind Atlas & National Wind Atlases and also on the final database since it will be hosted by DTU.

Management and dissemination activities (WP1, WP5)

Throughout the project, **WP1** will deal with coordinating work between the consortium members whereas **WP5** will be focused on dissemination, communication, outreach and exploitation activities.

A summary of partners' staff effort per work package is presented in the following table. The timing of the work packages is shown in the Gantt chart.

Table 3.2: Summary of staff effort (bold WP leader).

Participant short name	WP1	WP2	WP3	WP4	WP5	Total person months
DTU	**28**	**100**	82	22	4	236
DNV-GL	1.5	1.5	3.8	0.8		7.6
Vestas		1	3			4
3E	4	4	58	0.8		66.8
KULeuven		12				12
Nazka Mapps		6		19		25
ATM-PRO		12	18	7		37
Cenaero			22		4	26
IWES	3	36	22.5	**23**	1	85.5
ForWind		41	21	21		83
IPE	10	51.7		5		66.7
ERI VIRAC	5	29.5	33.1	17.1		84.7
UL			45.4			45.4
LEGMC		26.4				26.4
UPORTO		10	20	4	2	36
INEGI		42.6			1	43.6
IPMA		11			1	12
LNEG		28	4		4	36
CENER	4	47	**72**	24	**6**	153
CIEMAT			33	33		66
UCM		24	4	52		80
UIB		36				36
IC3	2		30	10		42
BSC	2		40	12		54
UU	2	28.2	22.2	24	1	77.4
WeatherTech	1	4.2	20.8	1		27
TÜBITAK MRC	7.8	29.4		25.2		62.4
IZTECH		26.5				26.5
METUWIND			108			108
ITU			207.2			207.2
Borusan	4.8	73.2				78
Total	75.1	681.2	870	300.9	24	1951.2

3.3.2 Description of the methodology and statistical analysis

The basic method to improve the wind atlas predictions is the cyclic interaction between experiments and modelling. Based on the first experiment a blind test will be organized inviting not only the partners of NEWA but also external research groups to provide predictions of winds, wind energy resource, turbulence and other parameters relevant for NEWA. The results of the blind comparison will then be presented at a workshop and the modellers can study the deficiencies of their implementation and expectedly improve the predicting power for the next round of blind comparisons based on the next experiment. This systematic approach will produce the best possible model chain by the end of the last blind test workshop and spread in model results compared with the measurements will estimate the uncertainty in the predicted parameters.

As explained in section 3.3.4 multi-model, multi-ensemble techniques have proven efficient in estimating and reducing the uncertainty in weather predictions. We envisage that a number of the best model chains will be run by different partners for the entire domain of NEWA and that the final atlas will be statistically weighted average of the different runs. The weights will be chosen based on the performance of the different models in the blind comparisons and in other comparisons described below. The performance of the various model chains might be different for different parameters (wind resource, turbulence, extreme wind, etc.) so the weights used for the final atlas might also be different. As a result a probabilistic wind atlas methodology will be formulated to produce the best possible estimate of the relevant parameters and their associated uncertainties.

In addition to testing against the NEWA experiments, the model chain will also be tested against other sources of data:

- Surface stations from national and European met offices
- Existing historical wind data from tall masts collected in the project
- Masts data from industrial partners (approximately 100 masts located at wind turbine sites provided by Vestas are already allocated to the project)
- Wind energy production data from industrial partners (25 Vestas sites used for Vestas' internal quality assurance are already allocated).

The multi-model platform will have a baseline model-chain based on open-source. The basic open-source meso-scale model will be WRF, the Weather Research and Forecast Model (http://www.wrf-model.org/index.php). Three model types will be used for the micro-scale:

- Linearized models.
- Reynolds-Averaged Navier Stokes (RANS) models
- Large-eddy simulation (LES)

The first is computationally the fastest and an open source model[29] will be provided by DTU. However, it is known not to perform very well in very complex terrain, so the next level, the RANS model, is needed. The open-source RANS model will be based on OpenFoam (http://www.openfoam.org). Both these models will be used to calculate the wind atlas over Europe while the last model type LES will primarily be used to calculate the flow at the NEWA experimental sites. It will be used to investigate the built in deficiencies of the RANS models and thereby help pointing to possible improvements of the models.

Several proprietary models – as described in table 3.3 - will also be run by the partners and they will, based on their performance, be allowed to enter into the probabilistic wind atlas of Europe.

Table 3.3: Models that will be used/developed to test the model chain.

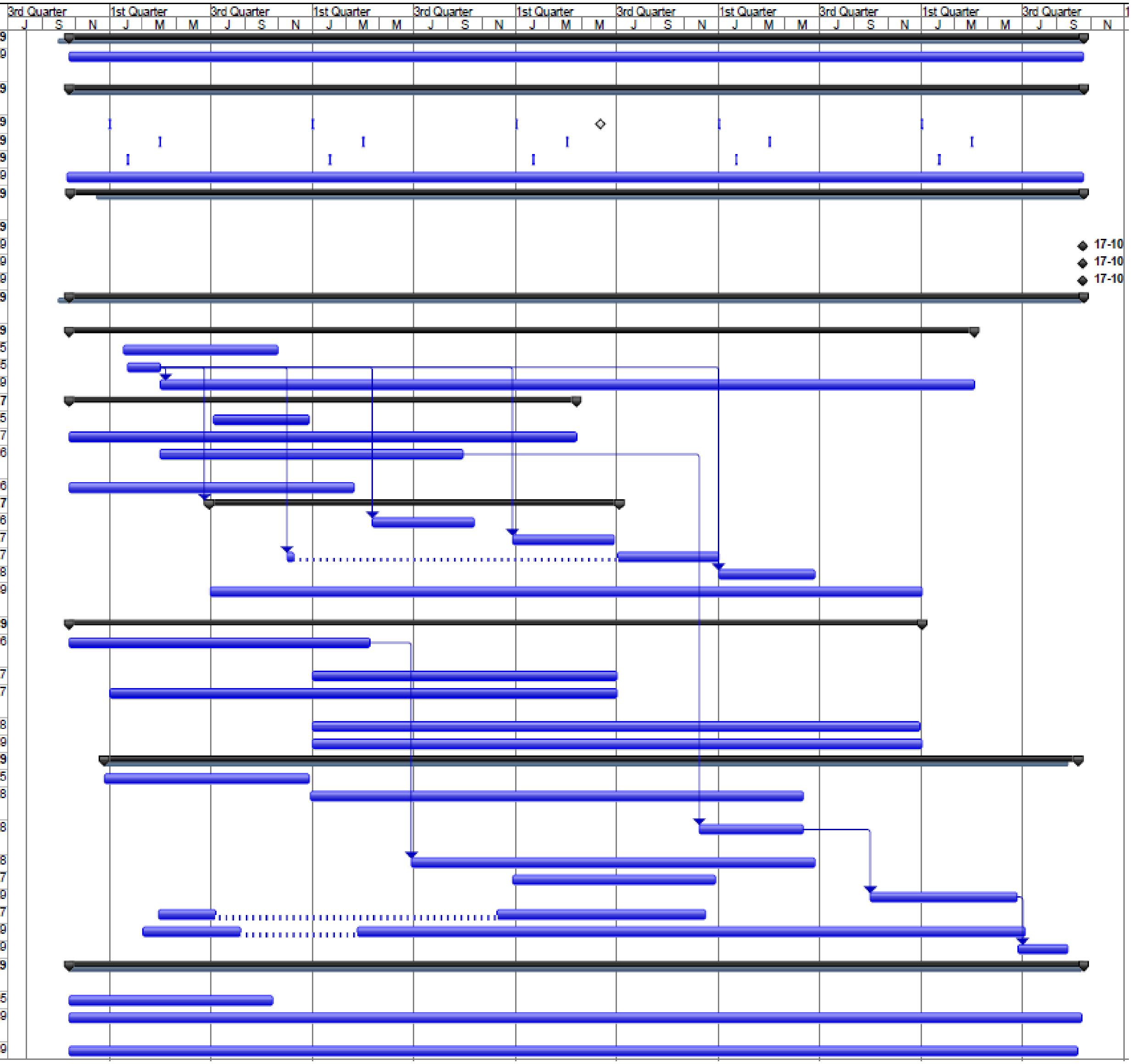
Partner	Model name	Code	Range (horizontal resolution)	Main applications/ capabilities	Licensing
CENER	LocalPred	Skiron + MOS	Mesoscale (4 km)	Regional wind mapping, forecasting	Licensed by University of Athens (NKUA)
CENER	MMC (mesoscale model-chain)	Skiron + WRF	Mesoscale (0.5 km)	Regional wind mapping	Skiron licensed by NKUA
CENER	CFDWind (RANS)	OpenFoam	Microscale	ABL model including atmospheric stability, complex terrain, forest canopy, wakes	in-house research code to open-source
CENER	MMC + CFDWind/WAsP	Matlab	Dynamical-statistical downscaling (100 m)	Virtual met-mast, high-res wind mapping, predictability	in-house research code
ATM-PRO	MAESTRO Wind	MAESTRO Wind	Meso-gamma scale (~0.1–10 km)	Local meteorology, 3D high resolution time.	Proprietary code
Cenaero	RANS	OpenFoam	Microscale	Complex terrains, forest canopy	Opensource
Cenaero	LES	ArgoDG	Mircoscale	Complex terrains	In-house research code
CIEMAT	WRF	WRF	Mesoscale (2 km)	Regional wind and forecasting. Wind variability over complex terrain.	open-source

[29] LINCOM, http://www.risoe.dk/rispubl/VEA/veapdf/ris-r-900.pdf

BSC	WRF + CFDWind	WRF + Alya	Dynamical downscaling		in-house research code
UPORTO	Ventos®	Ventos®/2	Microscale	Wind farm layout design and flow in Complex Terrain	IPR owned by FEUP, RES and NP
UPORTO	Ventos®	Ventos®/LES	Microscale	LES version of Ventos	In-house research code
UPORTO	Ventos®	Ventos®/M	Dynamical downscaling	Resource assessment	IPR owned by FEUP, RES and NP
LNEG			Downscaling		
ForWind	WRF multi-physics ensemble	WRF	Mesoscale	Regional wind mapping + uncertainties	
ForWind	PALM		Large-Eddy Simulation	Wind field modelling in wind farms and in complex terrain, turbulent ABL flow for wide range of atmospheric stabilities	University of Hannover, Germany
IWES	PANS		Microscale		
IWES	WRF + OpenFoam	WRF + OpenFoam	Dynamic downscaling		
KU Leuven	SP-Wind	Pseudo-spectral LES code	Microscale	ABL model including atmospheric stability, complex terrain, and wind-farm boundary-layer interaction	in-house research code
IC3	EC-Earth	IFS, NEMO, OASIS	Global (125 km, 80 km and 25 km)	Seasonal and decadal forecasting/ predictability	Open-source
DTU	EllipSys3D		Microscale	Used in WAsP-CFD	In-house research code+commercial
DTU	LINCOM	Linearized flowmodel	Microscale	Orography, roughness, watersurf.	Will become open source
UU	EllipSys3D (+OpenFoam)		Microscale	Coupling with mesoscale simulations	
WeatherTech	WRF		Mesoscale	Coupling with microscale simulations	open-source
ITU	WRF+ OpenFoam	WRF+ OpenFoam	Mesoscale (up to 1km) downscaling (up tp 100 m)	Validation of WRF and WRF/CFD model + Regional Wind Mapping	
ITU	WRF, RCM	WRF	Mesoscale	Regional Extreme Winds Mapping, Climate Change,	
UL	WRF	WRF	Mesoscale	Regional wind mapping	open source

Gantt Chart

ID	Task Name	Start	Finish
1	**Wp1 Project management (DTU,DK)**	**Mon 20-10-14**	**Sat 19-10-19**
2	1.1 Overall management of the project and risk contingency planning (DTU and all other partners)	Mon 20-10-14	Fri 18-10-19
3	**1.2 Formal responsibilities of the Coordinator within the project (DTU and all other partners)**	**Mon 20-10-14**	**Sat 19-10-19**
4	**Steering Committee**	**Thu 01-01-15**	**Mon 24-06-19**
12	**Advisory Committee meetings**	**Wed 01-04-15**	**Mon 01-04-19**
18	**Management board meetings**	**Mon 02-02-15**	**Fri 01-02-19**
24	Financial management (DTU/ALL)	Thu 16-10-14	Fri 18-10-19
25	**1.3 Admnistrative responsibilities of the Coordinator within the project (DTU and all other partners)**	**Wed 22-10-14**	**Sat 19-10-19**
26	**management deliverables**	**Thu 01-01-15**	**Sat 19-10-19**
27	Public final report	Thu 17-10-19	Thu 17-10-19
28	Confidential final report	Thu 17-10-19	Thu 17-10-19
29	Abstract of main results for joint call brochure	Tue 09-12-14	Thu 17-10-19
30	**1.4 General tasks through the project for the Coordinator (DTU and all other partners)**	**Mon 20-10-14**	**Sat 19-10-19**
35	**Wp2 Full scale experiments & data collection (DTU)**	**Mon 20-10-14**	**Fri 05-04-19**
36	2.2 Development of guidelines for experiments (CENER)	Mon 26-01-15	Fri 30-10-15
37	2.1 Site selection(DTU)	Mon 02-02-15	Wed 01-04-15
38	2.3 Long term measurements at the campaign sites (UPORTO)	Thu 02-04-15	Fri 05-04-19
39	**2.4 Development of experimental database (TUBITAK)**	**Mon 20-10-14**	**Wed 19-04-17**
40	2.5 Existing experiments in database (TUBITAK)	Mon 06-07-15	Fri 25-12-15
41	2.6 Collection of existing tower measurements (CENER)	Mon 20-10-14	Wed 19-04-17
42	2.7 Provision of surface characterization for Meso and Micro scale modeling (3E)	Wed 01-04-15	Tue 27-09-16
43	2.8 Offshore satellite data (DTU)	Mon 20-10-14	Tue 15-03-16
44	**2.9 Northern European combined mesoscale experiment (DTU)**	**Mon 29-06-15**	**Wed 05-07-17**
49	2.10 Forest experiment in Kassel, Germany (IWES)	Mon 18-04-16	Mon 17-10-16
50	2.11 Double Hill experiment at Perdigao (UPORTO)	Mon 26-12-16	Mon 26-06-17
51	2.12 Complex terrain experiment -meso scale (Alaiz) (CENER)	Mon 16-11-15	Sun 31-12-17
52	2.13 Complex high altitude experiment (Turkey) (TUBITAK)	Mon 01-01-18	Fri 22-06-18
53	2.14 Simulations for additional idealized test cases and experimental sites (ForWInd, 3E, DTU)	Wed 01-07-15	Tue 01-01-19
54	**Wp3 Model Chain (CENER)**	**Mon 20-10-14**	**Tue 01-01-19**
55	3.1 Design of a probabilistic wind atlas methodology (DTU, CIEMAT, ATM-PRO, ITU, ForWind)	Mon 20-10-14	Tue 12-04-16
56	3.2 From day-ahead to decadal wind power (IC3, CENER)	Fri 01-01-16	Sat 01-07-17
57	3.3 Downscaling to microscale for site assessment and high-resoulution predictability (IWES and all other partners)	Thu 01-01-15	Sat 01-07-17
58	3.4 Implementation of the Model chain (DTU, BSC, CENER, 3E, UPORTO)	Fri 01-01-16	Fri 28-12-18
59	3.5 Model benchmarking (IWES, CENER, ForWind)	Fri 01-01-16	Tue 01-01-19
60	**Wp 4 New European Wind Atlas database (IWES)**	**Mon 22-12-14**	**Wed 09-10-19**
61	4.1 Defintion of wind atlas output parameters (FORWIND)	Mon 22-12-14	Fri 25-12-15
62	4.2 Models for siting parameters, extremes , turbulences, predictability etc (IWES)	Mon 28-12-15	Fri 01-06-18
63	4.3 Beta production run of the model chain (ForWind/IWES/DTU/CENER/UPORTO)	Mon 27-11-17	Fri 01-06-18
64	4.4 Uncertainty quantification of model chain (DTU)	Mon 27-06-16	Fri 22-06-18
65	4.5 Development of the NEWA database (UU)	Mon 26-12-16	Mon 25-12-17
66	4.6 Final production run of the model chain (CIEMAT/ForWind/DTU)	Mon 01-10-18	Fri 21-06-19
67	4.7 Link to the Global Wind Atlas & National wind atlases (DTU, TUBITAK)	Mon 30-03-15	Thu 07-12-17
68	4.8 Development of interface to NEWA (3E, Nazka mapps)	Mon 02-03-15	Fri 05-07-19
69	4.9 Final database (DTU)	Mon 24-06-19	Fri 20-09-19
70	**Wp 5 Communication, dissemination, outreach and exploitation (CENER)**	**Mon 20-10-14**	**Sat 19-10-19**
71	5.1 Protection of project results (CENER and all other partners)	Mon 20-10-14	Tue 20-10-15
72	5.2 Communication, Dissemination and Outreach – spreading results (DTU and all other partners)	Mon 20-10-14	Tue 15-10-19
73	5.3 Exploitation (CENER and all other partners)	Mon 20-10-14	Tue 08-10-19



Project: test-haej
Date: Mon 04-08-14

Task, Split, Milestone, Summary, Project Summary, External Tasks, External Milestone, Inaktiv opgave, Inaktiv milepæl, Inaktiv oversigt, Manuel opgave, Kun varighed, Manuel oversigtsopløftning, Manuel oversigt, kun start, Kun slutdato, Progress, Deadline

3.3.3 Availability and quality of preliminary data

In the NEWA project, basically **four sets of meteorological data will be used for the making of the Wind Atlas**: 1) Existing climatological wind information from e.g. the Earth Global Observation System (GOS); 2) data from high meteorological observation towers; 3) data from the experimental campaigns and 4) relevant data extracted from the reanalysis data. The reanalysis data is used in the mesoscale analysis; the experimental data is used to improve and verify the model chain and the GOS data is used for regional verification of the wind atlas database.

With respect to the mesoscale modelling the data sources required for wind climate analysis can be broken into two parts, data about the atmospheric state and flow (known as **reanalysis datasets**), and data about **Earth's surface topography**. These two parts are shown below in tables 3.4 and 3.5.

The reanalysis datasets – time series of the large-scale meteorological situation covering decades – have been created by assimilating measurement data from around the globe in a dynamical consistent fashion using large scale numerical models. The primary purpose for the generation of the dataset is to provide a reference for the state of the atmosphere and to identify any features of climate change. For wind energy the application of the dataset is as a long term record of large scale wind conditions.

Table 3.4: Reanalysis Datasets.

Product	Model system	Horizontal resolution	Period covered	Temporal resolution
ERA Interim reanalysis	T255, 60 vertical levels, 4DVar	~0.7° × 0.7°	1989-present	6-hourly
NASA – GAO/MERRA	GEOS5 data assimilation system (Incremental Analysis Updates), 72 levels	0.5° × 0.67°	1979-present	hourly
NCAR CFDDA[30]	MM5 (regional model)+ FDDA	~40 km	1985-2005	3-hourly
CFSR	NCEP GFS (global forecast system)	~38 km	1979-2010 (CFSR) 2011-present (CFSR2)	6-hourly

Modelling of the wind resource requires detailed information on the terrain elevation, water body distribution and land cover of the terrain. Several global or near-global topographical data sets are available that are used in this project for the purpose of NEWA. These are described in the following table.

Table 3.5: Topographical and land cover datasets.

Product	Product description
Elevation – Shuttle Radar Topography Mission (SRTM), version 2.1, released 2009	SRTM data are available as grid point spot heights with a resolution of 1 arc-second (continental USA) and 3 arc-seconds (from 56°S to 60°N, 80% of the Earth's land surface). Derivative data sets exist, where data voids have been filled. The SRTM data sets are used extensively for wind resource assessment already and they are easy to download, process and transform.
Elevation – ASTER Global Digital Elevation Model (ASTER GDEM), version 2 released 2011	ASTER data are available as grid point spot heights with a resolution of 1 arc-second from 83°S to 83°N (99% of the Earths land surface). Less experience exists using ASTER data for wind resource assessment but they are in principle easy to download, process and transform
Coastline contours – SRTM Water Body Data (SWBD**)**	Version 2 of SRTM contains the vector coastline mask derived by NGA during the editing, called the SRTM Water Body Data, in ESRI Shapefile format. These data covers the Earth's surface between 56°S and 60°N.
WorldDEMTM	Newly (commercially) available DEM since 2014 based on TANDEM-X SAR data (still in pre-production phase for Europe). Pole-to-Pole coverage. High accuracy: 2m (relative) / 4m (absolute) vertical accuracy in a 12m x 12m raster. Available through Airbus DS and DLR (German Aerospace Centre).
Land cover – regional databases	Several regional and national land cover data sets exist which may be more detailed and sometimes more readily applicable to microscale flow modelling. As an

[30] The Global Wind Atlas got a lincense for this data product. NEWA would have to obtain the same.

	example, the European Environmental Agency (EEA) has produced vector and raster land cover databases – CORINE – for EC Member States and other European countries.

3.3.4 Feasibility of the project

The feasibility of the NEWA Project is ensured by the composition, structure, experience and capability of the Consortium and the approach to the scientific/technical challenges facing the Project.

As is evident from Section 6: "Description of past and ongoing research projects of each participating group related to the present topic indicating funding sources", all the members of the Consortium have considerable experience with executing scientific/technical projects funded by national programmes and/or EU programmes. Further there is also considerable experience working together with industry and national agencies. Most of the partners have worked together for many years, reaching back to the beginning of European wind energy research in the mid 1970ties. In fact the first European Wind Atlas was initiated by the first EU wind energy research programme in 1981.

The project has three main scientific/technical challenges: Acquiring the necessary experimental data; establishing the necessary model chain and establishing the necessary Wind Atlas data base. The feasibility for each of the three challenges is ensured through the collective competences of the Consortium as described above. It can further be argued through some selected examples, given below.

The experiments rely heavily on the use of remote sensing, especially the use of Lidars. At the moment of writing an intensive measurement campaign of 1 to 2 month duration is taking place for observing the flow over the forest. This campaign takes place in cooperation with the European partners using six long-range windscanners (3 from DTU Wind Energy and 3 from ForWind). This approach makes the airflow over the hill visible and traceable and generates a detailed data set for model evaluation.

The experiments are occurring in succession and a blind test will be arranged in connection with each experiment. The feasibility of this approach has been demonstrated by DTU who has previously arranged a blind comparison with the participation of 57 modellers concerning the Bolund experiment, an experiment in complex terrain with masts only reaching 12 meters.

The Model Chain work is made feasible by the huge experience inside the Consortium with the use of a multitude of mesoscale and microscale models as well as experience in applying the reanalysis data for model runs. However, the many different models available are also a challenge. Therefore the approach will be to use the multi-model, multi-ensemble technique. Several of the partners have already experience with this technique; for example DNV GL has developed a proprietary calibration methodology to allow the variance among the ensemble of simulations to be used as an input to provide an objective estimate of the meteorological uncertainty.

The technique is subject for international research on seasonal weather predictions and in a report from the US National Academies "Assessment of Intraseasonal to Interannual Climate Prediction and Predictability" it is stated "The multi-model ensemble approach has proven extremely effective at quantifying prediction uncertainty due to uncertainty in model formulation, and has proven to produce better prediction quality (on average) than any single model ensemble. This multi-model approach is the basis for several international collaborative prediction research efforts, including an operational European system. There are numerous examples of how this multi-model ensemble approach yields superior forecasts compared to any single model".

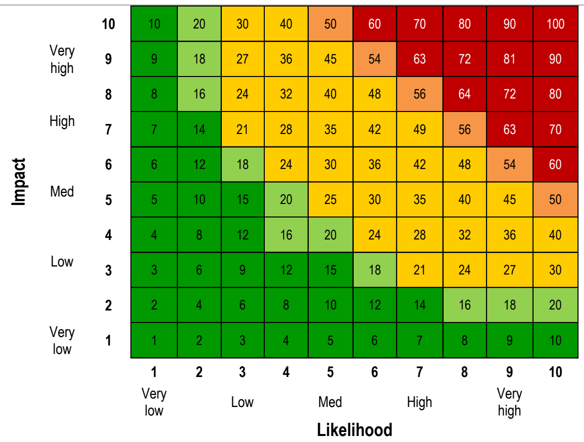
The Wind Atlas Data Base. The establishment of the experimental and the wind climatological databases will follow well known techniques available today – but will develop as the Project develops during the five years and take advantage of the newest database techniques available.

3.3.5 Risk management and contingency planning

The excellence gathered in NEWA by both research and industry partners in each of their areas of expertise, coupled with the integrated work plan and a tailored project organisation, means that an effective structure is in place in NEWA for the mitigation of risk. The project therefore maximises the probability of reaching its objectives.

The consortium has identified potential risks associated with each work package and made a corresponding contingency plan.

For a better visualization, the risk rating is depicted below in a matrix with colour codes indicating severity: Medium-High and High (50-100); Medium (21-49); Medium-Low and Low (1-20).



The Coordinator, together with the Management Board, will use the Risk Mitigation, Monitoring and Management (RMMM) method described in 3.4.2 to identify risks which require special attention. This method aims at targeting and solving any potential risk before it becomes a problem. The Coordinator will then take actions according to the contingency plan. A summary of the main risks identified, their likelihood and impact, and correspondent contingency plan is presented in the Table below.

Table 3.6: NEWA potential risks and respective mitigation / contingency plans.

WP	Risks	Likelihood (L)	Impact (I)	Risk level (R=LxI)	Mitigation / Contingency plans
1	Complications in overall and partner financial management cause project delays.	4	5	Medium-Low 20	The project SC will closely follow these issues to guarantee that activities are not delayed for more than 3 months. Still, even in this scenario, there is not a high risk that a project task is not implemented since competencies, facilities, and tools needed are distributed among several partners and potentially can be redistributed.
2	Experiments will be delayed reducing the impact on the model chain validation.	9	5	Medium 45	Immediately after project start all permissions to erect masts, which often delay experiments, will be applied for. If delays occur, the intensive campaigns might be shortened to reduce the delay of the next campaign.
2	Experiments will not contain sufficient data to pinpoint flaws or weaknesses in the models.	4	6	Medium 24	Extensive modelling with RANS and possibly also with LES of every measurement campaign site will be performed in order to be sure to identify all necessary parameters to measure.
2	Experiments require more funds than estimated, and will therefore not be able to afford to reach the relevant heights and spatial coverage.	3	9	Medium 27	Three out of five experiments will expand already existing infrastructure, which drastically reduces the costs. Two experiments lack this infrastructure, but in these relevant heights will be reached with remote sensing Doppler lidars, whereas the spatial resolution will be obtained by scanning lidars, avoiding costly meteorological towers.
3	There are not sufficient computational resources to run the required multi-model ensemble for the whole	3	8	Medium 24	Each country will secure national computing resources at the beginning of the project to support the design phase of the model-chain. The model-chain will be parallelized in

	of Europe.				the MareNostrum supercomputer of BSC.
3	The grid of meteorological towers across Europe is not of sufficient quality and spatio-temporal coverage to produce a seamless quantification of wind atlas uncertainties.	6	8	Medium 48	A collection of publically available surface stations will be made to cover the whole EU area and provide a minimum level of spatio-temporal coverage. A call for met-mast data addressing wind energy developers will be launched to collect a high-quality database to supplement the NEWA experiments with long-term wind data at realistic wind energy sites.
3	Downscaling models will not be accurate enough to guarantee the general applicability of the model-chain in connection with wind farm design tools.	3	8	Medium 24	The production of benchmarks based on the experiments will allow a systematic quantification of model performance which can be tracked with time as the state-of-the art develops. The establishment of a reference model-chain based on open-source helps mitigating user-dependency problems and therefore improves model development traceability.
3, 4	Not all a-priori considered models provide reasonable results.	4	4	Medium-Low 16	Only results from validated models (cf. WP3) are taken.
4	Some of the design parameters cannot be derived from the model output in reasonable accuracy.	7	3	Medium-Low 21	The work on the methods for the derivation of design parameters is starting already with the first model output data; if deficiencies are detected, research in this issue will be intensified.
4	Mesoscale models are delayed in completing the production run	3	6	Medium-Low 18	The modelling domain can be reduced to most important European areas for wind energy to save computation time.
4	Mesoscale model results in the final run of different partners do not match well at sites/areas that had not been investigated (due to a lack of measurements)	4	5	Medium-Low 20	The harmonization of configuration of the mesoscale models (e.g. domain, grid, nests) ease the comparison of model results and enable that differences are discovered at an early stage to repeat simulation and pin down the problem. The exchange of atmospheric forcing data (Reanalysis) should be prepared and tested to increase the flexibility when repeating simulations.
4	User interface is not capable to handle volume sizes of NEWA, i.e. responses of requests is too low	4	6	Medium 24	Conservative load estimation on the data server; technological improvement of the user interface and data server.
5	Difficulties to run an effective Outreach activity	5	5	Medium 25	Besides the Exploitation and Dissemination Manager, the Executive Management Board will be involved, following this activity closely to ensure its implementation and impact.

3.4. Implementation

3.4.1 Quality of the consortium (relevant resources and infrastructures)

The NEWA project consortium has been composed to gather all the scientific and technological skills and competencies needed to develop a new European Wind Atlas. **Partners were chosen based primarily on their scientific excellence and technological credentials and competencies** necessary to achieve the project's objectives. However, in addition to clear scientific credentials, other parameters, including commitment to contribute to the attainment of the project objectives; availability for the project; and previous experience in collaborative projects, were considered. Based on this process, a strong and determined team of 31 partners from 8 different European countries (9 regions) has been assembled (Figure 3.2), that jointly possess excellence in skills and requirements needed to see this ambitious project to a successful result.

Figure 3.2: NEWA consortium.

Excellence of individual participants - Team expertise and contribution to the project

Denmark

DTU: The team is a world leader in meteorological experiments for wind energy purposes, both on- and off-shore, and has been so for several decades. The group has pioneered the introduction of wind lidar techniques in wind energy research and is world leading in this "wind scanning" technology, which is very useful for NEWA. The group has made the industry standard in wind resource estimation software (WAsP), and is actively engaged in meso-scale modelling (weather forecast models), wind resource estimation offshore with satellite data, and in investigations of extreme winds, turbulence and other atmospheric phenomena responsible for loads on wind turbines.

DNV-GL Energy: DNV GL has a strong international track record in the design, procurement, installation, commissioning and validation of measurements campaigns. DNV GL has successfully installed over 1000 met masts globally on behalf of its clients, including tubular and lattice masts in sites ranging from simple, to remote and complex. The DNV GL Wind Mapping System (WMS) represents the culmination of two decades of research and development. The DNV GL WMS utilises a technique which is known within the numerical weather prediction community as an "ensemble method" and is using the latest developments, called the "multi-physics ensemble", allowing us to place a statistically defined error bar on the resource estimate for any point within the numerical wind map/atlas.

VESTAS: The research team is highly experienced within the field of wind energy, and specifically on the parallelization of the micro-scale flow models based on OpenFoam. Vestas will provide high quality time series of wind speed and direction from approximately 100 meteorological masts at wind turbine sites distributed over the EU. These will be compared anonymously to assess the uncertainty and quality of the predictions. Vestas will under the same conditions as above provide wind energy production time series from approximately 25 sites in Europe for benchmarking.

Belgium – Flanders

3E: The main focus of 3E is in the investigation and modelling of wind resources, LT extrapolation and data processing techniques and tools. Additionally, as a software-as-a-service provider, 3E has significant experience in the definition and delivery of IT related services, including experienced personnel and hardware. 3E provides state of the art data collection, analysis and visualisation tools for wind farms.

KULeuven: KULeuven has extensive expertise in the Large-Eddy Simulation (LES) of atmospheric boundary layer flows. To this end, it has developed over the last years the LES code SP-Wind that allows the simulation of ABLs for different atmospheric conditions. Moreover, this code is currently extensively used for the simulation of large wind farms on flat terrain in the context of ongoing research projects on wind energy.

Nazka Mapps: The team members have in-depth knowledge in Geographic Information Systems (GIS), remote sensing, (geo-)spatial analysis, mapping applications and visualization. They combine their expertise with state-of-the-art web and mobile technologies. The research team have built up relevant experience on the use of Earth Observation (EO) data for land cover/land use mapping, roughness calculation and height modelling and the creation of interactive maps in several Local, National, European and global (research) projects.

Belgium – Wallonia

ATM-PRO: Based on 3D Meteorological models at the meso-gamma scale, the software designed by ATM-PRO - MAESTRO Wind - is specialized on atmospheric flows scales from few hundred meters to few tens of km. Being a 3D meso-gamma scale meteorological model, MAESTRO Wind can provide input data to CFD/microscale models, e.g. developed/used by CENAERO, in order to better understand constraints of CFD use and links between atmospheric scales. ATM-PRO will contribute to the design of experiments, simulation setup, simulation results and analysis.

Cenaero: With a team of more than 50 highly skilled engineers and PhD's specialized in numerical methods, structures, computational fluid dynamics (CFD) and applied mathematics, Cenaero holds an impressive know-how and technological background in Computer Aided Engineering (CAE). Furthermore, Cenaero has a strong expertise in High Performance Computation. It is currently participating/leading three HPC projects: Cobault (DEISA), noFUDGE(PRACE) and PADDLES (PRACE).

Germany

IWES: Fraunhofer IWES has more the twenty-five years of experience in wind measurements. Since 2008, Fraunhofer IWES works with ground based remote sensing and has up to day worked with all kind of wind lidars. Currently more than 10 Person (scientists and technicians) work in the field of wind measurements. Fraunhofer IWES has also several years of experience within the field of offshore site assessment, the application of lidar technology offshore in particular, as well as offshore meteorology. With respect to measurement technology the team developed two different kinds of a floating-lidar system: a lidar buoy and a ship-based lidar system. Fraunhofer IWES has been using the open source field calculation tool OpenFOAM for CFD simulations. It has developed additional tools for micrositing of wind turbines for this tool, which will be contributed to the project such as a structured terrain mesher or the PANS-turbulence approach. Also a method for coupling mesoscale simulations using WRF to the microscale simulations will be contributed to the project.

ForWind: ForWind has a 30 year-experience in wind power research, e.g. in micro- and meso-scale modelling of atmospheric flow, wind power forecasting and marine boundary layer meteorology and extensive LiDAR measurement capabilities. ForWind has several years of experience in LIDAR measurements on- and offshore, including the development of multidimensional scanning long-range LiDAR system. The ForWind competences to be exploited within NEWA will be: LES modelling of atmospheric flow (LES code 'PALM'); meso-scale modelling meso-scale models WRF and COSMO); estimation of uncertainty, use of HPC clusters for atmospheric wind flow modelling, and Lidar measurements at two experimental sites.

Latvia

IPE: IPE team has more than 20 years' experience in the wind measures with metrological masts and lidars, measurement data processing and wind shear modelling. These skills will be used in Latvian and international experiments. The existing cooperation with mobile operators and Latvian Ministry of Defence on using tall masts (70 – 100 m) distributed in Latvia and on the Latvian cost for wind measurements will be used in NEWA. Furthermore, IPE has experience with wind database development and management.

ERI VIRAC: The team has more than 10 years' experience in the wind measures with metrological masts and lidars, measurement data processing and wind shear modelling. These skills will be used in Latvian and international experiments. ERI has experience in OpenFoam model development,downscaling mesoscale models and linking them with measurement data. Existing skills with satellite images and remote sensing data processing pipelines will be used for explore the latest land-use databases from ESA/NASA and use ESA satellite data to validate the offshore wind resources.

UL: The research team has considerable experience in modelling problems in numerous areas of geosciences – groundwater, hydrology and oceanography. UL has both the resources and skills to carry out modelling experiments with WRF, analyse the results and compare with experimental data. The research team has considerable insight in Latvian climate due to numerous finished research projects. UL has experience in working with reanalysis data (ERA - Interim, BaltAn65).

LEGMC: They collect and process meteorological and climatological information since they are the official national meteorological service. The research team has many years of experience and knowledge of methods and standards of wind meteorology and climatology in Latvia and consists of two senior specialists of LEGMC Air and Climate department.

Portugal

UPORTO: The UPORTO experience on wind energy goes back to the early 1990's, via the participation in the European Wind Atlas and the first wind resource campaigns in Portugal. The activity has evolved along two main interests: field studies and computer simulation of wind flow over mountainous regions. The team has pioneered the use of CFD in wind energy resource characterization, site evaluation, and wind and electricity production forecasting. One of the main research products is the software Ventos®.

INEGI: INEGI has expertise in the deployment, operation and maintenance and data monitoring of meteorological stations. They have been involved in about 900 meteorological stations internationally until today from which 230 are currently active. The most significant contribution of INEGI will be the support on the development of the experimental apparatus at Perdigão –double hill experiment.

IPMA: IPMA - the national authority for meteorology and climate - is responsible for monitoring meteorological parameters on the Portuguese territory, using surface stations, upper-air balloons, remote observations from global meteorological satellite networks, including from Europe (EUMETSAT), the Portuguese radar network and the Portuguese lightning network. The contributions will include customized forecast service for the Perdigão site.

LNEG

LNEG has worked for many years in the area of the wind resource. In the last years LNEG has developed wind atlases based on mesoscale numerical modelling for Portugal (onshore and offshore), and other countries (around 18 different countries). LNEG has developed methodologies for wind resource assessment in complex terrains (e.g. ToolComplex methodology) based on the use of data from several met masts. LNEG has a large experience in measurements campaigns with standard measurements equipment and Lidars. LNEG has experience in mesoscale validation methodologies, GIS application and development of RES planning tools and characterization of terrain and roughness elements.

Spain

CENER: The Wind Resource Assessment and Forecasting unit of the Wind Energy department of CENER has 12 researchers working on the following areas: meteorology, wind resource assessment (microscale modeling with WAsP and in-house CFDWind model based on OpenFOAM), forecasting and boundary layer meteorology (analysis of experimental data and development of remote-sensing LIDAR in complex terrain). The development of open-source CFD models is a very active field of research both for the atmospheric boundary layer and for array effects and wake aerodynamics. The development includes activities related to the standardization and evaluation of wind resource assessment methodologies. Another important area of research is the development of high-resolution wind atlas methods based on downscaling from mesoscale outputs using linearized microscale models.

CIEMAT: The research team has extensive experience in: i) developing and applying quality control techniques to observational wind datasets; ii) developing and applying strategies to validate the reliability of mesoscale models in simulating the observed data; iii) the analysis of wind field variability and climatology in both on-shore and off-shore contexts; iv) mesoscale modelling and developing new parameterizations for WRF model; v) conducting and analysing WRF model sensitivity experiments, vi) data acquisition and parallel processing of high amount of data and simulation of the wind field over Europe.

UCM: UCM is active in meteorology and climate research since 1991. The group has worked in several projects related to Development and Application of Ensemble Prediction Systems for the Iberian Peninsula to exhaustively study the atmospheric predictability for weather-related variables in the Atlantic region. Several validation techniques will be developed in order to evaluate the spread of the Ensemble Prediction Systems (EPS). The Research group PalMA (Paleoclimatic Modeling and Analysis) has experience in the use of global models of varying complexity for the simulation of the past and future climate, as well as using regionalization techniques (statistical and dynamical downscaling) in combination with observations in order to study climatic variables, such as the wind, at more local scales.

UIB: The Group of Meteorology of the Department of Physics has five permanent Professors and several support scientists and technicians. The group has large experience in modelling at meso and microscale for real cases in severe weather and for atmospheric boundary-layer circulations, exploring flows in complex terrain also through experimental fieldwork. The team devoted to study the atmospheric boundary-layer, led by J. Cuxart, has organized and participated in several field experiments. Another complementary line of research has been the observational study of the turbulence processes and the development of turbulent schemes for models and, lately, the analysis of the surface energy budget.

IC3: The Climate Forecasting Unit of IC3 undertakes research on the development and assessment of dynamical and statistical methods for the prediction of global and regional climate on time scales ranging from a few weeks to several years. IC3 proposes the development of a climate atlas decision support tool, based on state-of-the-art probabilistic climate predictions relevant to wind power.

BSC: The research team is relatively new in the wind energy field (experience starts only back to 2011) but it has a strong background and tradition on environmental and computing sciences. The team is developing a code for RANS atmospheric flow simulations based on the in-house codes that are suitable for wind farm optimization and design. They are also developing a LES turbulence module for the Planetary Surface Layer with thermal coupling and carrying out transient micro-scale meteorological simulations driven by WRF and wind turbine modelling to simulate the downwind effects of rotors.

Sweden

UU: Uppsala University has long experience working with microscale simulations focusing on wake interaction and farm optimization. The simulations mainly use the EllisSys3D code (CFD LES) in combination with actuator disc and line methods. These methods have been used in mesoscale models and therefore, coupled micro/mesoscale models will be considered. UU also has a long experience in performing measurements. The group led by the PI includes 15 persons in the wind energy field.

WeatherTech: The WeatherTech research team has a long experience in running mesoscale models. They have produced wind resource maps of Sweden with 1 km^2 model grid resolution which relatively recently was updated to 0.25 km^2 model grid resolution. Wind resource maps covering Finland, Estonia, parts of Poland and Germany, and Romania/Bulgaria have also been produced using mesoscale models. WeatherTech also has knowledge and unique experience in estimating production losses due to icing using mesoscale model output both as forecasts and in site assessments.

Turkey

TÜBİTAK–MRC: The research team has a great expertise in development of data acquisition and management systems in energy sector for widespread applications. Moreover, the team has an expertise of preparing and managing experiment campaigns, collecting remote data, data acquisition from fields, meso and micro scale modelling. The team has also completed a wind mapping study in 2014 for Turkey using meso scale models for grid extension planning.

IZTECH: IZTECH has expertise on field experiments, offshore satellite wind data analysis and lidars. The team consists of 2 researchers and 2 MSc. Students working on wind measurements and wind data analysis. The team will also get external support from 2 senior scientists from Greece who have relevant background on tall tower design, installation and operation.

METUWIND: The research team has experience in the computation of turbulent atmospheric flows coupled with a mesoscale weather prediction model (MM5, WRF). The turbulent flows are computed with an in-house, finite-volume based, parallel Navier-Stokes solver on unstructured, hybrid grids. The coupling is achieved by providing the unsteady boundary conditions extracted from the mesoscale model solutions.

ITU: ITU has worked with wind energy since the beginning of 1990th. ITU has recently developed a system for short term wind energy prediction by using coupled WRF Model and physical/CFD model. One of group member was the consultant of Wind Atlas of Turkey. ITU has experience with mesoscale atmospheric models. Additionally they have applications about downscaling, climate change and extreme winds modelling. The team has also an expertise on using variational data assimilation techniques to improve model results. ITU has experience in WRF parameterizations used to improve the accuracy of the WRF Model's wind predictions.

Borusan: The research team has experience in wind farm development and operation. In addition to carrying out wind measurement campaigns, Borusan has in house wind resource assessment expertise using WAsP, WindPRO, as well as Computational Fluid Dynamics methodology. The team has also experience in processing the measurement data from meteorological masts and determining the uncertainty levels associated with the measurement. Borusan currently operates 22 meteorological masts in 6 different projects in various regions of Turkey. Borusan will provide the Turkish experimental site and take part in the related measurement and calculations.

The consortium is firmly committed to attaining the project objectives. This is evident not only from their commitment of resources to the NEWA project itself, but also from their previous and existing activities and projects in related areas (more details in section 6). The commitment of partners is given in their dedication of best available human resources for the project, including a number of internationally acclaimed professors and researchers in wind assessment, meteorology and numerical modelling, and also by providing the necessary infrastructures (Table 3.6). Some of the partners will acquire material and equipment during the project to expand their capacity (more details in section 9).

Table 3.6: Relevant infrastructures and resources of each participant to be used in the project.

Relevant infrastructures and resources		
Denmark	**DTU**	- Meteorological masts: Two 250 m meter masts in Northern Denmark, several masts in Western Denmark between 100 and 160 m. A 125 m mast on campus. - Computer cluster: Second largest computer cluster in Denmark located at the DTU Risø campus with 144 TFlops and 6400 CPUs - Meteorological instruments: Approx 30 sonic anemometers, cups, temperature sensors, data acquisition software, etc.
	DNV -GL	- Linux computer cluster, Hornet, currently equipped with over 500 cores.
	Vestas	- supercomputing resources: 14664 core IBM linux cluster, 25 TB RAM, 2.6 PB HD, 172 TFlop/s peak performance, parallel FS with 1 GB/s transfer speed; - Model data storage, retrieval, and analysis is based on IBM InfoSphere BigInsights.
Belgium- Flanders	**3E**	- close collaboration with UGent HPC centre, where intensive calculations can be performed. - As a software as a service provider, 3E has all hard- and software required to develop a robust model chain for the NEWA project - Experience in model chain development as lead and toolbox developer partner in the ClusterDesign project.
	KU Leuven	- An existing accurate and efficient large-eddy simulation code, i.e. SP-Wind is used for the simulation of micro-scale wind conditions in different atmospheric regimes. SP-Wind consists of a fully parallelized flow solver developed since 2006 at KU Leuven.
	Nazka Mapps	- Software: QGIS, GRASS, ArcGIS - Open source libraries: Leaflet - Web frameworks: Django - Other tools: PostGIS, GeoServer, SpatialHadoop
Belgium- W.	**ATM -PRO**	- In order to implement their numerical modelling contributions, ATM-PRO will use its computer cluster (~ 300 CPUs) & mass storage system (~ 400TB).
	Cenaero	- Top supercomputing infrastructure among the world 500 most powerful systems with more than 10000 cores.
Germany	**IWES**	- 200-m-met. mast and related infrastructure (site for Forest experiment), 2 VAD lidar - developed offshore-lidar systems - ship-lidar system; - FINO data expertise (Fraunhofer IWES is partner in the national project 'FINO-wind' that has the aim of standardising and evaluating the data of the three FINO met. masts according to a clear, jointly developed, strategy.)
	ForWind	- Synchronized long-range 3D LiDAR-Windscanners (3 units Leosphere Windcube 200S) - HPC cluster 'FLOW' (IBM) with > 2000 CPUs
Latvia	**IPE**	- wind measurements database compiled since 2007, which include 3 sites in Latvia. - 10 wind measurement complexes NRG LOGGER Symphonie9200 with certified cap anemometers and other sensors. - lidar Pentalum Spidar for wind measurements, which will be used in Latvian and international experiments.
	ERI VIRAC	- Existing site for wind measurements, where 60m metrological mast and lidar are already installed. - High performance computing power, for grid and cloud computing, with dedicated 1 Gbps optical fibre connect to the GEANT pan-European network. HPC Server I, IBM Power 8 architecture has 32 RISC architecture cores. HPC Server II –28 processors with two x86 architecture processors with minimum 8 cores for each.
	UL	- High Performance Computing unit that is currently being partially used for running calculations of Numerical Weather Prediction models - Additional workstations (including hardware and software) that are currently used for post-processing and analysing NWP data

	LEGMC	- Long-term meteorological observation data. Observation series of meteorological stations cover more than 50 years. 50% of all observation series cover at least 80 years. - Centre operates one upper air station which makes sounding every other day. The observations of upper air in territory of Latvia cover 68 years.
Portugal	**UPORTO**	- Computer cluster: 58 Intel Xeon CPUs with 448 cores and 8847.8 GFlops computing performance; 1.8 TB memory, 28 TB storage capacity and 40 Gbps InfiniBand connection
	INEGI	- Infrastructure for the conduction of measuring campaigns, in particular regarding the Perdigão experiment: all-terrain vehicles, workshop and tools, hardware and software.
	IPMA	- Observations data in mainland Portugal: IPMA operates ca. 100 automatic meteorological stations, measuring near surface temperature and humidity, wind speed and direction, and sampling the atmosphere every 10 min. IPMA operates 2 C-band radars operating continuously. A 3rd C-band radar, dual pol ,is to be ready by the end of September 2014. - Modelling: IPMA runs twice a day the NWP AROME model, at 2.5 km horizontal mesh..
	LNEG	- Numerical cluster with 184 cores (320 GB RAM) for mesoscale modelling. - Software ArcGIS
Spain	**CENER**	- computer cluster to run simulations during the model design phase - access to the BSC MareNostrum HPC facility to run the model-chain during the production and intensive validation phase of the wind atlas. - existing infrastructure of the Alaiz Test Site to base one of the experiments of NEWA in complex terrain. The site has 5 118-m met masts equipped with conventional instruments. A reference mast is also equipped with three sonic anemometers to be used as long-term station for wind climatologies and turbulence characteristics on the site.
	CIEMAT	- 200 TB of a high performance storage solution based in a file system using Lustre. - High performance computers with more than 117 TFLOPs of computing power - High speed interconnection network for the HPC environment and the storage system. - Backup system with more than 580TB storage.
	UCM	- Server with 4 CPU, 32 Gb and 16 Tb; - Access to the Supercomputation Centre of the Complutense University of Madrid, Supercomputation Centre of the Spanish Meteorological Agency, HPC resources both at the local Campus of Excelence of Moncloa.
	UIB	- A number of simplified Surface Energy Budget stations will be built and distributed around the Alaiz experimental site to provide the necessary surface boundary conditions. - WindRass and the corresponding database that will provide profiles of wind, virtual temperature and estimations of turbulence for the lowest 500 m of the atmosphere.
	IC3	- competitive computing resources that are worth 0.5 million euros per year. - access to major operational databases of monthly and seasonal forecasts via collaboration with major European meteorological centers and initiatives. - own global prediction model, EC-Earth, to create open source predictions of wind on timescales ranging from two weeks to several months in the future.
	BSC	- access to MareNostrum, the most powerful supercomputer in Spain (48.896 Intel Sandy Bridge processors, peak performance of 1.1 Petaflops, 29th in the Top500 list). - BSC-CNS is a tier-0 member of the PRACE pan-European infrastructure
Sweden	**UU**	- Access to computer clusters trough national computer centres.
	Weather Tech	- A cluster with 12 nodes with dual Intel Xeon processors with in total 144 cores and 288 GB RAM will be available for mesoscale modelling.
Turkey	**TUBITAK - MRC**	- a small scale cluster for hosting databases and running models with coarse resolutions. - a set of sensors and data collecting unit for experiments in Turkey.
	IZTECH	- A tall tower between 150m and 180m will be erected. - IZTECH is also installing a medium size wind turbine (250kW) funded by the Izmir Development Agency for academic studies.
	METU WIND	- High Performance Computing Cluster- **Total:** 512 cores, 2 TB memory, 20 TB storage capacity, Centos/Scientific Linux OS

	ITU	Access to two main computational sources: - Meteorological and climatological computing and analysis lab in the department of Meteorological Engineering at ITU. - National Computing Center at Istanbul Technical University.
	Borusan	- Access to a vast amount of wind turbine operational data: 109 wind turbines (337 MW by the end of 2015) - Three workstations for running the WAsP, WindPRO, and CFD softwares. - Data of 22 operational meteorological masts.

Potential external contributions to NEWA

Several individuals, institutions and universities having a particular interest in the project will participate in the project as external partners. They will contribute to the project by providing, for instance, access to data or infrastructures. The NEWA consortium will collaborate with a group of external partners and some of them have already shown their commitment, such as DLR-Institute of Atmospheric Physics, IRENA, SIA "Energo Wind, NCAR and ECOGEN (c.f. Letters of support at the end of the proposal, together with their specific contribution to the project). Other important external contributions are briefly described below.

The Norwegian wind energy research center NORCOWE has meteorological/oceanic conditions as one of their main research areas. They have measurement equipment like lidars, data buoys and other met/ocean equipment. Despite the fact that Norway is not a part of NEWA, then in the words of the director of the center Kirstin G. Frøysa "NORCOWE would anyway like to consider collaboration and support to the work with the EU wind atlas."

Several American institutions and universities have expressed interest in NEWA. First and foremost is National Center for Atmospheric Research (NCAR). Together with Notre Dame University (Prof. H. J. Fernando) and University of Colorado they are applying US National Science Foundation (NSF) to participate with a massive amount of instruments in the Perdigão experiment.

Many European meteorological institutes beyond those already in NEWA are also expected to exchange data with NEWA.

3.4.2 Description of Management structure and procedures

To implement the ambitious NEWA project an efficient management structure is required, which can handle the complexity of the planned activities.

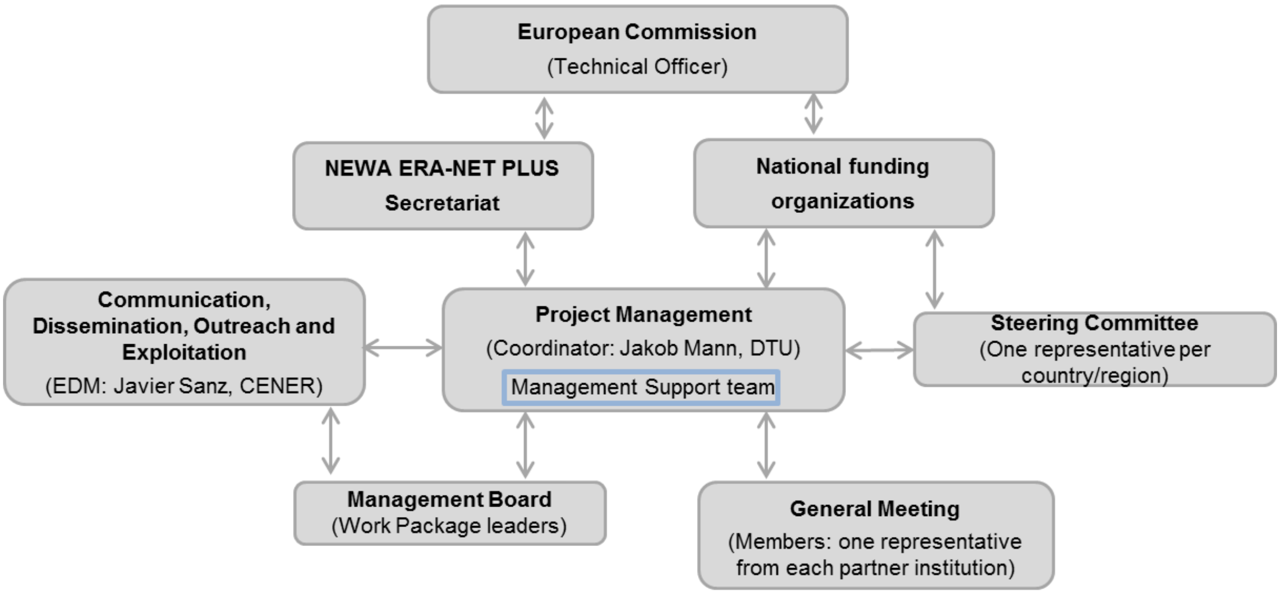


Figure 3.3: NEWA organisational structure.

Organisation of NEWA – roles and responsibilities

The NEWA organisational structure is comprised of the following Consortium Bodies to ensure a clear and balanced distribution of power and responsibilities (see Figure 3.3).

Decision making body

- A **Steering Committee (SC)** as the ultimate decision-making body of the consortium for strategic decisions impacting on the project and its external relationship. The SC is composed by one representative from each country (i.e. 9 national/regional consortium leaders).

Management bodies

- A **Coordinator** – Jakob Mann, DTU – as an intermediary between the NEWA ERA-NET PLUS Joint Call Programme and the consortium, and overseeing day-to-day management of the project.
- A **General Meeting (GM)** as a non-decisive formal body for the consortium. All partners in NEWA will be members of the GM, which is chaired by Hans Ejsing Jørgensen, from DTU.
- A **Management Board (MB)** comprised of the 3 WP leaders, responsible for the-day-to-day planning of the project and to oversee the execution of the R&D work packages (WP2-WP4).
- An **Exploitation and Dissemination Manager (EDM)**, J. Sanz (CENER), to formulate and execute an exploitation and dissemination strategy for NEWA, reporting to the Coordinator.
- A **Management Support Team (MST)**, referring to the Coordinator and providing legal, contractual, financial, ICT and administrative support.

External Bodies

- An **Advisory Committee (AC)** to serve as external advisors to the project and to promote dissemination of project results and further S & T developments in a post-project period.

Steering Committee (SC)

NEWA will be controlled by the SC chaired by the project Coordinator **Jakob Mann**. Each of the nine partners in the SC has one vote. The SC members shall be duly authorised to deliberate, negotiate and decide on all matters, and all partners must abide to all decisions taken by the SC. The SC will consider and decide upon all proposals put forward by the Coordinator, GM and MB in accordance with decision-making procedures set out below. Furthermore, the SC is free to formulate their own proposals to be carried out by the managers. Final decisions on actions ahead will be taken by the SC.

The SC will meet according to need – but at least every six months – to define and review strategic priorities, monitor and review progress made and agree on actions for the coming period. Meetings will be convened by the Coordinator. Extraordinary meetings may be organized upon request of the partners. All SC members will be informed of an official agenda two weeks before it is held. Written minutes will be transmitted to all SC members within two weeks.

The members of the SC will be responsible for managing the communication and reporting to the respective national funding organizations. Furthermore, the responsibility of the SC is:

- to decide if part of or the whole of the project should be terminated
- to agree on managers and members of the Management Support Team
- to support the Coordinator in preparing for meetings with the NEWA ERA-NET PLUS Secretariat or National funding agencies
- to prepare the content and timing of press releases and joint publications by the Consortium.

Coordinator

The Coordinator of the NEWA project shall be the intermediary between the partners and the NEWA ERA-NET PLUS Secretariat. As a guiding principle, the Coordinator's responsibilities are restricted to activity coordination and he shall not be entitled to act or to make legally binding declarations on behalf of the consortium or any other partner.

The tasks of the Coordinator include: scientific management, reviewing project progress, ensure work flow scheduling and provide work plan change control procedures, ensure that the project is on track in accordance with objectives and milestones, and report deviations from the project plan to the SC, reporting and contact with the Call Secretariat.

NEWA has appointed DTU to fulfil the task as Coordinator. DTU has extensive experience from a large number of R&D projects and has a strong support team to assist the Coordinator in his management task. The consortium has appointed **Jakob Mann** as project Coordinator. Jakob has a vast experience with wind energy research attained through more than 20 years as a Scientist and Professor at Risø National Laboratory, Technical University of Denmark (DTU), where he has been managing the development of the computer program WAsP Engineering used by the wind energy industry. Jakob is also the Vice-president of the European Academy of Wind Energy (EAWE) – an organization that promotes European coordination within wind energy research and education, – and the Organizer of The Science of Making Torque from Wind 2014 – which is the largest scientific conference about wind turbine aerodynamics and wind turbine siting. Moreover, he has recently enhanced his management skills by completing DTU Management course. In 2013, Jakob has won the EAWE Science Award which is given each year to one person who has contributed significantly to wind energy research.

General Meeting (GM)

The General Meeting is mainly responsible for the proper execution and implementation of the final decisions of the SC. Only principle decisions are made by the GM. Moreover, the GM will support the Coordinator in the preparation of meetings and deliverables. The GM convenes at least once every twelve months and is chaired by the Coordinator partner – DTU – and, specifically, by **Hans Ejsing Jørgensen** (Section Head). Each partner will designate its representative to the GM prior to the kick-off meeting.

Management Board (MB)

The Coordinator will be responsible for the implementation of the objectives of the NEWA in time and under the available funding. To ensure an efficient day-to-day management and monitoring of the project activities and contractual obligations, the Coordinator will be assisted by the Management Board composed of all WP Leaders. The Coordinator is chairing the Management Board. The Management Board will monitor and analyse the project progress and propose actions/decisions to the SC necessary for the implementation of the work-program and in accordance with the Consortium Agreement. Regular Management Board meetings are scheduled twice a year. Additional meetings will be held as necessary.

Exploitation and Dissemination Manager (EDM)

The partners have decided to appoint an Exploitation and Dissemination Manager who will assist the Coordinator in coordinating the dissemination, exploitation and communication of project results.

The EDM will draft and keep updated an Exploitation and Dissemination plan to be approved by the SC. A detailed description of foreseen dissemination and outreach activities is provided in WP5. **Javier Sanz Rodrigo** from CENER will take the role as EDM. Javier is a Senior Researcher at CENER, having more than 10 years of experience in the wind energy field with specialization in wind resource assessment and forecasting. Javier has a wide experience in collaborative European projects, being the Coordinator of the FP7-WAUDIT project. Moreover, he has been Work Package Leader in FP6-ANEMOS.Plus, FP7-SAFEWIND and will also lead a WP in the FP7-IRPWIND project. He has co-authored more than 50 publications in wind energy.

The Management Support Team (MST)

The Management Support Team consists of DTU staff and will assist the Coordinator and other management bodies in the day-to-day administration of the project, legal and financial matters and ICT support. Also, it will manage all cost statements and provide support on setting up meetings, conferences, etc. **Christian Orup Damgaard**, Project Manager at DTU, will be responsible for setting up a wellfunctioning MST, which will include a DTU administrative person dedicated to financial management.

Advisory Committee (AC)

In addition, an Advisory Committee will be established with representatives of relevant stakeholders and scientific experts, with particular interest in the project. The main objective of this Committee is to follow the project, and to advise on the different activities. **Bernhard Lange**, IWES, will chair the AC, which will meet once a year. At this stage, the AC comprises the following members: **Lars Landberg,** (DNV-GL) Representative for TPWind; **Patrick Moriarty** (NREL), co-Operating Agent of Wakebench; **Branko Kosovic** (NCAR), multi-scale modeling with WRF; **Gregory Oxley** (Vestas), lead developer of VestasFOAM**; Ulrich Schumann**, (Institute of Atmospheric Physics, DLR);**Nicolas Fichaux** (International Renewable Energy Agency, IRENA) Leader of Global Ren. Wind Atlas;**Thomas Foken** (Dept. of Micrometeorology, Univ. of Bayreuth) Specialist in micrometeorology.; **Peter Hauge Madsen**, (DTU Wind Energy) Manager of Joint EERA Programme on Wind Energy,

Communication and monitoring

Communication within the project will take place at several levels ensuring an adequate monitoring and coordination of activities. At the consortium management level, every year a progress report on the active work packages and the actions needed for the following period will be presented to the SC. At task level, monthly teleconferences will take place between research groups, and brief status updates will be reported by the respective WP leader. In addition, the Coordinator, on behalf of all NEWA partners, will prepare and provide to the NEWA ERA-NET PLUS Secretariat a midterm project report and a comprehensive final report.

Quality assurance plan

The Coordinator will prepare a quality assurance plan in WP1, which will be presented at the kick-off meeting. The plan lists the activities and procedures that are planned for the implementation of the project, and can be supplemented with the changes and additions to be agreed with the NEWA ERA-NET PLUS Secretariat. It works as an internal management tool for the Coordinator and the SC. The plan ensures a high level of competence on individual assignments and project management, execution in accordance with the schedule and specific procedures for:

- Timetable and continuous assessment: The schedule is monitored continuously and reviewed annually in the context of the status reports;
- Resource Management: The Coordinator will meet the agreed financial framework and time records will be maintained for each person of the project;
- Conflict management: Specific procedure for resolution of conflicts and deviations;
- Document Management: All documents are prepared and stored digitally. Text documents such as letters, e-mails, memos, reports, schedules, etc. draw on standard project templates;
- Approvals: The SC approves and performs QA of deliverables and material for publication;
- Meetings: Meetings during the project follow a set agenda. A written record of all meetings, containing information about the participants, agenda and substance will be maintained.

Decision making and conflict resolution

Each member of the SC present or represented in the meeting shall have one vote. The Body shall not deliberate and decide validly unless a quorum of 2/3 of its members is represented. Decisions shall be taken by simple majority, with the Coordinator casting the deciding vote in case of a tie. Partners have a right to veto decisions, if they can show that their own work, time for performance, costs, liabilities, IPR or other legitimate interests will be severely affected by a given decision. Defaulting partners may neither vote, nor veto. A **conflict resolution mechanism** will be put in place, whereby all emerging conflicts or decision making divergence will be submitted to the Coordinator for mediation and resolution.

Contingency planning and risk management

In general, we will apply the Risk Mitigation, Monitoring and Management (RMMM) method, which attempts to anticipate risks before they become an actual problem. The probability and impact of each risk is prioritised according to importance followed by a plan for the management of potential risks. The Coordinator together with the MB is responsible for carrying out risk management.

Confidentiality issues

The partners agree to follow guidelines on confidentiality issues as these will be agreed in the CA. Should any confidentiality issues arise they will be submitted to the EDM and the Coordinator for mediation and resolution. If needed, such issues will be presented to the SC for resolution among all partners.

In conclusion, the project management structure and procedures are designed to ensure an effective attainment of the project objectives, making sure that corrective action is taken in case of errors or misconduct, while also allowing for a simple, flexible and efficient implementation.

4. Diagram which compiles the work plan, the contribution of the partners to each work package and their interactions (Pert diagram)

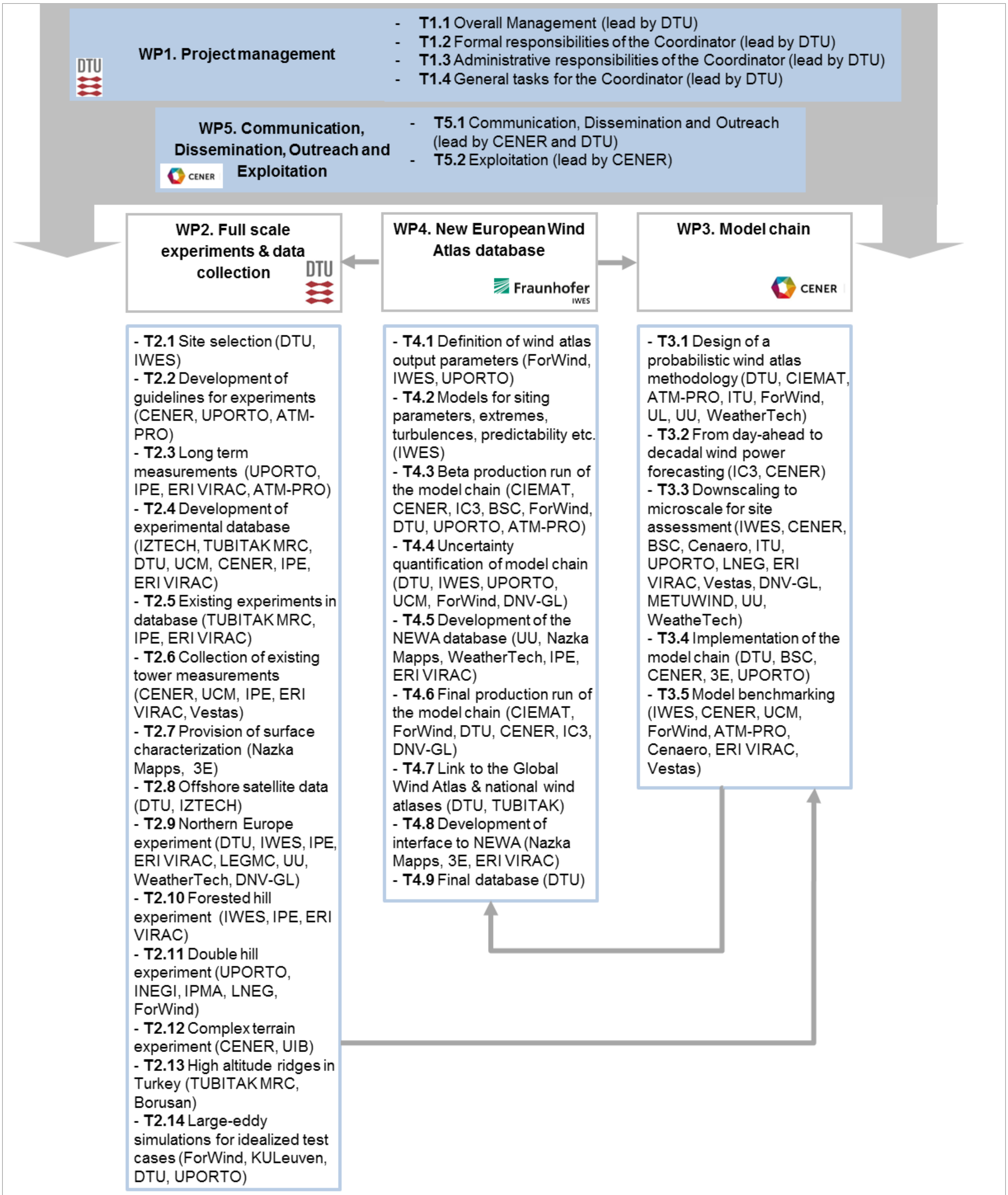


Figure 4.1: NEWA PERT Diagram

5. Added value of the collaboration in the proposed transnational project

5.1 Excellence of individual partners

NEWA deals with several interdisciplinary concepts requiring a wide range of specific competencies, skills, and knowledge as well as project management. The team behind NEWA consists of 31 partners from 8 different European countries. DTU, CENER and IWES are the work packages' leaders and national representatives of Denmark, Spain and Germany, respectively. DTU, the coordinator, is a world leading centre in meteorological experiments for wind energy purposes. The group has produced more than 100 journal publications relevant to NEWA and they have one patent that will be used freely in NEWA experiments. Moreover, the team is highly experienced in leading and coordinating several large EU projects. CENER – Wind energy department – has a cutting-edge technological infrastructure, with the most modern laboratories and facilities in Europe – the unique Wind Turbine Test Laboratory and a field test facility in the complex terrain of the Alaiz Mountain which supports testing in real conditions of up to 5 prototype multimegawatt turbines. Fraunhofer IWES is highly experienced in wind measurements and offshore meteorology. The group is active in several relevant committees and expert groups on national and international level; including EERA, TPWind, IEC, IEA.

Similarly, the other 28 partners play a crucial role in the project and they each bring different areas of excellence into the consortium (cf. section 3 – 3.3.1; 3.4.1). The quality of each group is also demonstrated by the track record of the principal investigator (more details are provided in section 11).

5.2. Consortium as a whole

NEWA is founded in a strong European consortium which forms a strategic research alliance of carefully selected world leading partners from European universities, institutions and industry. The project is based on a true cooperation, through which all partners contribute to and benefit from the project results. The consortium mobilises a broad group of partners around the core challenges, and benefits from complementarities, synergies and capabilities. NEWA consortium synergies are provided by previous joint participation in international projects, and research capacity has already been proved by the outputs and products generated by already collaborative activities between partners:

- Research projects: **IRENA** (DTU, DLR (external partner), CENER); **Windscanner** (DTU, IWES, UPORTO, LNEG, CENER, ForWind); **NORSEWInD** (DTU, IWES, ERI VIRAC, IPE, LNEG, 3E, DNV-GL); **ClusterDesig**n (3E, ForWind); I**RPWIND** (DTU, CENER, IWES, ForWind, UPORTO, LNEG, IC3, CIEMAT), **EERA DTOC** (IWES, DTU, CENER, ForWind, UPORTO, Iberdrola (external partner)); **IceWind** (DTU, VESTAS, UU, WeatherTech) **ANEMOS-ANEMOS.Plus-SAFEWIND** (DTU, CENER, ForWind), **WAUDIT** (CENER, DTU, ForWind, UCM, DNV-GL)
- **IEA Wind Task 31 Wakebench** (CENER, DTU, ForWind, Fraunhofer, Vestas, BSC)
- Several co-authorships on scientific publications;
- Training programs and shared students' supervision. Erasmus Mundus Wind Energy Master (DTU, ForWind). Several PhD networks and PhD summer schools through the European Academy of Wind Energy (almost all academic partners)

Through the sum of national competences and existing infrastructures, the consortium exhaustively covers the core aspects of the envisioned research for the future wind energy Atlas. Access to and sharing of research infrastructure and IPR will be an essential part of this project. In conclusion, NEWA will create an improved network within Europe's wind energy communities to facilitate open access to knowledge, skills and best practices, and to create a close community of actors and institutions involved in wind energy. The continuation of the database after the end of the project will be secured through IRENA, and we envisage that commercial partners could make a business out of updating the database at that time. The academic continuation of the activities in NEWA will be facilitated by the European Academy of Wind Energy (EAWE), where research projects and applications will be coordinated.

6. Description of past and ongoing research projects of each participating group related to the present topic indicating funding sources and possible overlaps with the proposal

NEWA will be entirely complementary to and not conflict with national or international research activities. In fact, NEWA has positive synergies with the following projects: WindScanner.eu, NORSEWInD, RUNE, The Global Wind Atlas, FlowCenter, IEA Task 31 Wakebench, ITN-OpenWATT (under review), and others presented below.

Denmark

DTU

FlowCenter, Center for Computational Wind Turbine Aerodynamics and Atmospheric Turbulence
The objective of the project is to develop computational methodologies and physical models capable of coping with multiple scales and apply them to combined wind turbine aerodynamics and atmospheric physics problems. Part of the project is about micro-scale modeling in complex terrain. Duration: 2010 - 2015; Funding source: Danish Council for Strategic Research; ID nr: 09-067216; Total budget: 11 M€.

WindScanner.eu - The European WindScanner Facility
A preparatory project to make an European infrastructure with wind lidars. Duration: 2012-10-01 to 2015-09-30; Funding source: EC FP7; ID nr: 312372; Total budget: €6 197 572

RUNE - Reducing uncertainty of near-shore wind resource estimates using onshore Lidars
Methods of scanning winds over sea for resource estimation. Duration: 14 months starting fall 2014; Funding source: ForskEL; ID number: appl. No 12263; Total budget: 0.5 M€

WAsP Engineering
The project produced a software program that helps wind energy developers assessment flow statistics relevant for loads on wind turbines. It supports NEWA's interaction with the industry. Duration: 1997-2000; Funding source: Danish Energy Agency; ID nr: EFP-97 1363/97-0004; Total budget: 0.5 MEuro

NORSEWInD- Northern seas wind index database
It is a programme designed to provide a wind resource map covering the Baltic, Irish and North Sea areas that will enter in NEWA. The project consisted on acquiring physical data using a combination of traditional Meteorological masts, ground based remote sensing instruments and Satellite acquired SAR winds. Duration: 2008-2012; Funding source: EC FP7; ID nr: 219048 ; Total budget: €6 736 681

Wind atlas of South Africa (WASA)
Development of a wind atlas for South Africa (www.wasaproject.info) Duration: 2009 to 2014 Funding source: Royal Danish Embassy and the Global Environment Facility. Total budget 20 mio kr

Global Wind Atlas : Danish Energy Agency and funded by grant EUDP 11-II, Globalt Vind Atlas, 64011-0347 Total amount 8 mio Dkkr

DNV-GL Energy

Renewable Energy Resource Mapping, Zambia
Mapping of the national wind energy resource in Zambia. Duration: 3 years; Funding source: World Bank; ID number: Job # 702833. The models, or methods based on these, will be used in NEWA

Vestas

DSF Flowcenter
Duration: 1/1 2010-31/12 2016; Funding source: Danish strategy research council; ID number: 09-067216); Total budget: 48 MDKK.

DSF Tallwind project
Duration: 1/3 2009 – 1/9 2014; Funding source: Danish strategy research council; ID number: 2104-08-0025; Total budget 13.5 MDKK

IceWind
Duration: 9/2010-8/2014; Funding source: Norden, Top-Level research initiative; ID number: ; Total

budget: 20.8 MNOK

Belgium- Flanders

3E
Sopcawind: Software for the Optimal Place CAlculation for WIND-farms Development of a software tool to screen areas in Europe for suitable locations for the development of wind farms and to calculate optimal wind farm layouts. Duration: 2012-2014 (24 months); Funding source: EC FP7; ID number: 296164; Total budget: EUR 2 468 785 **ClusterDesign - A Toolbox for Offshore Wind Farm Cluster Design** Research, analysis and development of design toolbox for optimised offshore wind farm clusters. Integrated toolbox enabling combined approach focused on improved wind modelling, grid connection and power system support, intelligent control strategies and cost optimisation. Duration: 01-12-2011 - 31-05-2016; Funding source: EC FP7; ID number: 283145; Total budget: 5 207 452 € **Endorse (ENergy DOwnstReam SErvices) - Providing energy components for GMES** This project aims at developing tools for the energy industry based on earth monitoring data. As part of the project, the 3E wind team set up a web app for preliminary wind farm energy production calculations in Belgium (both onshore and offshore). Duration: 2011-2014 (36 months); Funding source: EC FP7; ID number: 262892 ; Total budget: EUR 3 176 340 **SWIFT** This project aims to maximize the integration of wind turbines in the distribution grid while minimizing the amount of lost wind energy at the lowest possible overall cost. Duration: 2 years; Funding source: IWT (Flanders); ID number: 120454; Total budget: € 182,589 (3E funded amount)

KULeuven
Active Wind Farms: Optimization and control of atmospheric energy extraction in gigawatt wind farms Duration: 1/10/2012 – 30/09/2017; Funding source: ERC – FP7 Ideas (EC); ID number: grant no: 306471; Total budget: 1 499 243 € **From atmospheric circulation to electrons: an integrated approach for optimization and control of large-scale wind farms** Duration: 1/01/2012 – 30/12/2015; Funding source: KU Leuven research council; ID number: grant no: IDO /11/012; Total budget: 500 000 € **Improving wind-farm performance by active control of the atmospheric boundary layer using individual turbines as actuators** Duration: 1/10/2012 – 30/09/2016; Funding source: Science Foundation Flanders (FWO); ID number: grant no: G.0376.12; Total budget: 423 576 € **Improved modeling and experimental validation of near-range atmospheric dispersion** Duration: 1/10/2010 – 30/09/2014; Funding source: SCK.CEN (Belgian Nuclear Research Center), bilateral agreement; ID number: PO 4500011763; Total budget: 200 102 €

Nazka Mapps
B-Life - Biologically Light Fieldable Laboratory for Emergencies: Using EO data and interactive maps for site selection, monitoring and precise geolocation of sampling and field teams. Duration:1/11/2014 – 31/10/2017; Funding source: ESA (IAP ARTES 20 programme); ID number: *not yet available at time of printing;* Total budget: 270.050 € **Earth Observation Information Products/Services for World Bank Projects' VæSSA, VAE for Sri Lanka: a Satellite-based flood Analysis**

Duration: 15/06/2014 – 15/04/2015; Funding source: ESA (VAE programme); ID number: 4000110900/14/I-AM; Total budget: 108.348 €

IWT feasibility study: nostalgeo
Duration: 01/04/2014 – 31/08/2014; Funding source: IWT; ID number: 140403; Total budget: 50.500 €

CityZEN: development of a prototype of this "city platform for climate adaptation" [City of Antwerp]
Duration: 12/11/2013 – 30/09/2014; Funding source: iMinds; ID number: 2013KMO096017 ; Total budget: 13.333 €

Nazka mapps is a young company (started October 2012). The founders of Nazka Mapps have built their experience in remote sensing applications during their time at the company Eurosense where they managed varied research projects (funded by ESA and EC -FP7) such as MALAREO, GEOLAND2, GMES SAFER, and REDDINESS.

Belgium- Wallonia

ATM-PRO
MW-Forecast - Development and validation of a tool for short-term prediction of local wind and wind generation Duration: 16 months ; Funding source: SPW/DGO4 – Département de l'Énergie et du Bâtiment durable.; ID number: #550097; Total budget : 118 k€ **SPIn-Off - *L'Analyse des Spécificités et Paramètres pertinents à Intégrer dans la modélisation météorologique à des fins de développement de projets éoliens « OFF-SHORE» - MAESTRO Wind – Climatology*** Duration: 9 months ; Funding source: SPW/DGO4 – Département de l'Énergie et du Bâtiment durable; ID number: #1050435; Total budget:72 k€ **POWER - Production Optimization through Wind Energy Reliability** Duration: 48 months; Funding source: SPW/DGO4&DGO6; ID number: #6718; Total budget: 291 k€

CENAERO
Cenaero has participated and lead a large number of research projects in the Walloon Region projects as well as European projects (e.g. PROMUVAL, FAR-Wake, VITAL, CESAR, NEWAC, TATMo, DREAM, NICE-TRIP, LAPCAT II, H2-IGCC, ERICKA, ELUBSYS, ADIGMA, IDIHOM). Related to the coupling of multiscale and multifidelity tools to the CFD, Cenaero is currently working on 4 projects: **SIMBA: Multiphysic advanced simulations for the building industry** Duration: 66 months; Funding source: ERDF; ID number: ECV12020022211F – 930522 et ECV12020042210F – 930523; Total budget: 1.610.726€. **APPLES: Implementation of wall models in Large Eddy Simulation for different wall roughness. Application to wind and civil engineering**. Duration: 2 years; Funding source: DGO6 Walloon Region; ID number: First DoCA 1217882; Total budget: 176.000€. **SmartSIG3D: Information exchange methodology development and implementation for integrated 3D city coordination** Duration: 2 years; Funding source: DGO6 Walloon Region; ID number: CWALity 1117310; Total budget: 505.621,62€.

Germany

Fraunhofer - IWES
Utilisation of inland wind power Duration: 2009-ongoing; Federal Ministry for Economic Affairs and Energy Germany: German Federal Environment Ministry; ID numbers: phase 1: 0325171 (budget: €1 498 682), phase 2: 0325171A (budget: €1 931 598); Total budget: €3 430 280
NORSEWInD- Northern seas wind index database Duration: 2008-08-01 - 2012-07-31; Funding source: EC FP7; ID nr: 219048 ; Total budget: €6 736 681
EERA DTOC - EERA Design Tools for Offshore Wind Farm Cluster The European Energy Research Alliance (EERA) together with some high-impact industry partners addresses the call proposing an integrated and validated design tool combining the state-of-the-art wake, yield and electrical models available in the consortium, as a plug-in architecture with possibility for third party models. Duration: 2012-01-01 - 2015-06-30; Funding source: EC FP7; ID number: 282797 ; Total budget: €3 997 733
WindScanner.eu - The European WindScanner Facility Duration: 2012-10 to 2015-09; Funding source: EC FP7; ID number: 312372; Total budget: €6 197 572
InnWind.eu - Innovative Wind Conversion Systems (10-20MW) for Offshore Applications Duration: 2012-11-01 to 2017-10-31; Funding source: EC FP7; ID number: 308974; Total budget: €19 526 767
Offshore Messboje Duration: 2011-13; Funding source: BMU (Ministry for the Environment, Nature Conservation, and Nuclear Safety of Germany); ID number: 0325387; Total budget: € 838 969
FINO-WIND Duration: 2013-15; Funding source: BMU (Ministry for the Environment, Nature Conservation, and Nuclear Safety of Germany); ID number: 0325508 ; Total budget: € 1 200 839

ForWind
WindScanner.eu - The European WindScanner Facility A preparatory project to make an European infrastructure with wind lidars. Duration: 2012-10-01 to 2015-09-30; Funding source: EC FP7; ID number: 312372; Total budget: 6 197 572 €
IRPWind - Integrated Research Programme on Wind Energy Duration: 2014-03-01 to 2018-02-28; Funding source: EC FP7; ID number: 609795; Total budget: 12 417 460 €
SAFEWIND - Multi-scale data assimilation, advanced wind modelling and forecasting with emphasis to extreme weather situations for a safe large-scale wind power integration Duration: 2007-2012; Funding source: EU FP7, ID number: 213740; Total budget: 5 617 760 €
InnWind.eu - Innovative Wind Conversion Systems (10-20MW) for Offshore Applications Duration: 2012-11-01 to 2017-10-31; Funding source: EC FP7; ID number: 308974; Total budget: €19 526 767
ClusterDesign - A Toolbox for Offshore Wind Farm Cluster Design Research, analysis and development of design toolbox for optimised offshore wind farm clusters. Integrated toolbox enabling combined approach focused on improved wind modelling, grid connection and power system support, intelligent control strategies and cost optimisation. Duration: 01-12-2011 - 31-05-2016; Funding source: EC FP7; ID number: 283145; Total budget: 5 207 452 €
OffshoreGrid ('Regulatory Framework for Offshore Grids and Power Markets in Europe: Techno-economic Assessment of Different Design Options ')

Duration: 2009-2012; Funding source: IEE; ID number: 08/780/SI2.528573; Total budget: 1 386 368 ,-€

OWEA (‘Verifikation von Offshore-Windenergieanlagen‘)
Duration: 2007-2011; Funding source: BMU; ID number: 0327696B; Total budget: 894.474€

Latvia

IPE

NORSEWInD project - Northern Seas Wind Index database
Duration: 2008-08-01 - 2012-07-31; Funding source: EC FP7 50% and Ministry of Science and Education of Latvia 50%; ID number: 219048; Total budget: €6 736 681
In this project, wind measurements using lidar ZephIR were conducted in Ventspils, (located on the western coast of Latvia).

Assessment of the wind energy potential in Latvia and the effect of the wind power generation on the environment
In this project 10 wind measurements complexes NRG LOGGER Symphonie and lidar Pentalum were acquired, which will be used in NEWA for wind measurements in Latvia. Duration: 2013-2015; Funding source: European Social Funds (ESF); ID number: 1DP/1.1.1.2.0/13/APIA/VIAA/033; Total budget: ~1.3M€.

Collaboration agreement between IPE and Encom LTD
Duration: April 2009 – open; Funding source: ENCOM LTD; ID number: PKL 02/2009; Total budget: ~€42.700
Installation of a 60 m metrological mast instrument with NRG LOGGER Symphonie9200 complex.

National Research programme “Technologies for Innovative Production and Use of Energy Resources and Provision of Low Carbon Emissions by Means of Renewable Energy Resources, Support Measures for the Mitigation of Environmental and Climate Degradation - LATENERGI”
Duration: 2010 – 2013; Funding agency/source: Ministry of Science and Education of Latvia; ID number: LATENERGI 2010-2013; Total budget: ~2.1M€

Ventspils University College (ERI VIRAC)

NORSEWInD project - Northern Seas Wind Index database
Duration: 2008-08-01 - 2012-07-31; Funding source: EC FP7; ID number: 219048; Total budget: €6 736 681

Assessment of the wind energy potential in Latvia and the effect of the wind power generation on the environment
Duration: 2013-2015; Funding source: ESF; ID number: 1DP/1.1.1.2.0/13/APIA/VIAA/033; Total budget: ~1.3M€

Estimation of forest inventory parameters in non inventoried and overgrowing agricultural lands using remote sensing data processing
Duration: 07.04.2014. - 31.05.2015; Funding source: European Regional Development Fund and JSC "Meža nozares kompetences centrs"; ID number: P10; Total budget: EUR 185 369
This project overlaps with NEWA since it includes development of thematic maps based on input data from satellite images and field measurements. During the project GIS tools (plug-ins for QGIS) for data processing, visualisation and preparation of the reports will be developed as well. Project results will enable end users to employ prepared thematic maps in any GIS system or to develop thematic maps themselves using plug-ins.

Receiving, transmitting and processing technologies of signals related to artificial Earth satellites
Duration: 01.12.2009.-30.11.2012; Funding source: European Social Funds, supervised by Investment and Development Agency of Latvia; National funding; ID: Nr. 2009/0231/1DP/1.1.1.2.0/09/APIA/VIAA/151; Total budget: ~€1.3M

Hydrodynamics modeling of vertical axis wind turbine with wind shields

Duration: 2009-2010; Funding source: SIA Electric Rhino Run; ID: PKL 12/2009;Total budget:~€3500

Mechanical model of vertical axis turbine of Darius type
Duration: 2011-2012; Funding source: SIA Salons AIS; ID: PKL 09/2011; Total budget: ~€4000

University of Latvia (UL), Faculty of Physics and Mathematics

PROMESYS
Statistical post-processing of the results of Numerical Weather Prediction models and their applications. Duration: 01.01.2014 - 31.08.2015; Funding source: European Regional Development Fund, supervised by State Education; ID number: 2013/0058/2DP/2.1.1.1.0/13/APIA/VIAA/008; Total budget: 231 081 EUR

GorWIND - Gulf of Riga as a resource for WIND energy
The aim of the project was to create a tool for spatial planning for the Gulf of Riga that contained all information relevant to wind energy. UL task was to create a wind map for the Gulf of Riga, using a combination of Regional Climate Model and Numerical Weather Prediction model data.
Duration: 01.11.2010 - 31.10.2012; Funding source: Estonia-Latvia Programme and Environmental Investment Centre (KIK), 85% of total amount is funded by European Regional Development Fund, supervised by State Regional Development Agency (VRAA); ID number: ETS2010/6; Total budget: 1 444 612 EUR

PUMA - Establishment of interdisciplinary scientist group and modelling system for groundwater research
Statistical downscaling of Regional Climate Models, data application to hydro-geological research.
Duration: 01.12.2009 – 01.12.2012; Funding source: European Social Fund, supervised by supervised by State Education Development Agency (VIAA); ID number: 2009/0212/1DP/1.1.1.2.0/09/APIA/VIAA/060; Total budget: 2 000 000 €.

KALME – National Research Program "Climate Change Impact on the Water Environment of Latvia"
LMMETP carried out the statistical downscaling of Regional Climate Model (RCM) data. Duration: 2006 – 2009; Funding source: Latvian Council of Science; ID number: N/A; Total budget: N/A

Latvian Environment, Geology and Meteorology Centre (LEGMC)

Impacts of climate change on renewable Energy Sources and their role in the Nordic Energy system
Duration: 27.05.2005.-27.05.2007; Funding source: Nordic Energy Research financed the projects with a total of NOK 11,800,000 for the Nordic activity and NOK 1,000,000 for Baltic involvement. There was also support from the national energy sectors and individual participants; ID number: Nordisk Energiforskning: No. 10-02; Total budget: 12 800 000 NOK

Climate and Energy Systems: Risks, Potential and Adaptation
Duration: 03.12.2007-31.12.2010; Funding source: With a contribution of 10 million NOK, Nordic Energy Research contributed more than 50% of the funding. Nordic energy companies, i.e. the National Power Company in Iceland, Statkraft in Norway, DONG Energy in Denmark, Elforsk in Sweden and the Finnish Energy Industries provided funds amounting to 5,800,000 NOK. The participatingresearch institutes financed the remaining part of the budget.; ID number: Clim-12; Total budget: 18,235,000 NOK

Portugal

UPORTO

Title EERA Design Tools for Offshore Wind Farm Cluster (EERA-DTOC)
Duration: 2012-01-01 to 2015-06-30; Funding source: EC- FP7; ID nr. 282797; Total budget: 3 994 731 €.

WindScanner.eu - The European WindScanner Facility
Duration: 2012-10-01 to 2015-09-30; Funding source: EC-FP7; ID nr. 312372; Total budget: €6 197 572

ADWIND - Remote sensing in non-conventional environments: advanced methods and techniques for wind characterization
Duration: 2014-01-01 to 2015-06-30; Funding Source/ ID nr. Integrated program RES2IN From Research to Innovation. SAESCTN-PIIC&DT/1/2011, Norte 07-0124-FEDER-000043, QREN; Total budget: 108 255 €.

COMPWIND - High Performance Computing of Wind over Complex Terrain
Duration: 2007-12-30 to 2011-06-30; Funding Source: Portuguese Foundation for Science and Technology (FCT); ID nr. PTDC/ENR/71216/2006; Total budget: Budget: 30 000€

INEGI
ADWIND – Remote sensing in non-convention environments: advanced methods and techniques for wind characterization. This project is focused on the development of technics and use of remote sensing equipment to characterize the atmospheric flow. Duration 01-12-2013 to 30-06-2015; Funding Source/ ID nr. Integrated program RES2IN From Research to Innovation. SAESCTN-PIIC&DT/1/2011, Norte 07-0124-FEDER-000043, QREN; Total budget: 252 k€. **SAIECT – Investment on technological infrastructure.** The project consisted in the acquisition of scientific equipment for INEGI's activities, in which Wind energy is included. Duration: 2009-01-01 to 2013-12-31; Funding source: European Union (EU) FP7; ID nr: Norte-07-0162-FEDER-00001; Total budget 2.8 M€. **AMIC – Assessing the mid-Century Climate transition**. This project was focused on contributing to the IPCC (Intergovernmental panel on climate change). Based on regional simulations, assess impacts in the renewable energy sector, a crucial element in Iberian economy. Duration 30-11-2009 to 30-06-2013; Funding source: FCT / Fundação para a Ciência e Tecnologia; ID nr. PTDC/AAC-CLI/109030/2008; Total budget: 171 k€.

IPMA
EUPORIAS - EUropean Provision Of Regional Impact Assessment on a Seasonal-to-decadal timescale Development of climate services associated to seasonal and decadal forecasts; Duration: 2012-11-01 to 2017-01-31; Funding source: EC-FP7; ID nr. 308291; Total budget: 13 048 572 € **GEOLAND-2 towards an operational GMES land monitoring core service** Duration: 2008-09-01 to 2012-12-31; Funding source: EC-FP7; ID nr. 218795; Total budget: 32 558 056 € **MACC-II - Monitoring Atmospheric Composition and Climate Interim Implementation** Duration: 2011-11-01 to 2014-07-31; Funding source: EC-FP7; ID nr. 283576; Total budget: 27 726 624 € **GEOLAND - GMES products & services, integrating EO monitoring capacities, to support the implementation of European directives and policies related to "land cover and vegetation"** Duration: 2004-01-01 to 2007-03-31; Funding source: EC-FP6; ID nr. 502871; Total budget: 17 010 078€

LNEG
NORSEWInD- Northern seas wind index database Duration: 2008-08-01 - 2012-07-31; Funding source: EC FP7; ID nr. 219048 ; Total budget: €6 736 681

WindScanner.eu - The European WindScanner Facility
Duration: 2012-10-01 - 2015-09-30; Funding source: EC- FP7; ID nr. 312372; Total budget: €6 197 572

Roadmap WW
Development of planning tools for marine renewable energies were developed based on a GIS platform and can be applied for any geographic location. In the development of this tool a large set of information was mapped – environmental restrictions, sea bottom description, bathymetry, sea use, navigation channels, wind and wave resource, economic parameters – which can be used for the NEWA Portuguese part. Duration: 2010-2012; Funding Source: FCT; ID nr. PTDC/SEM-ENR/105403/2008; Total budget: 200 K€

DemoWFloat – Demonstration of the WindFloat Technology
This project is referred to the testing of the WindFloat offshore wind turbine and can be used has an example for the development of guidelines for experiments making use of lessons learned from the project. Duration: 2011-07-15 - 2014-07-14; Funding Source: EC-FP7; ID nr. 296050; Total budget: 5 982 249 €

Spain

CENER

IRPWind - Integrated Research Programme on Wind Energy
CENER leads WP3 Infrastructures and WP6.2 "Benchmarking of design models for offshore wind farms"; Duration: 2014-03-01 to 2018-02-28; Funding source: EC-FP7; ID nr: 609795; Total budget: 12 417 460€

EERA DTOC - EERA Design Tools for Offshore Wind Farm Cluster
CENER leads WP3 "Energy yield prediction of wind farm clusters" and participates with the development of wake models at microscale and mesoscale as well as the characterization of uncertainties on annual energy yield assessments. Duration: 2012-01-01 - 2015-06-30; Funding source: EC FP7; ID nr. 282797 ; Total budget: €3 997 733

WAUDIT Wind resource assessment audit and standardization
European project coordinated by CENER on "Wind resource assessment audit and standardization". CENER coordinated this Marie Curie initial training network composed of 23 fellows, 15 of them to obtain a PhD degree. Duration: 2009-10-01 to 2013-09-30, Funding Source: EC- FP7; ID nr. 238576; Total budget: 3 984 000€

ISSWIND - Supporting services for the wind industry
Feasibility study. CENER participates as associate partner in the proof-of-concept of the meteorological engine that will support new resource assessment and forecasting services that make extensive use of databases from the European Space Agency. Duration: 2012-2013; Funding Source: ESA-ARTES20; ID nr. ; Total budget: 300 000€.

IEA-Wind Task 31 WAKEBENCH: Benchmarking Wind Farm Flow Models
International project coordinated by CENER on "Benchmarking on wind farm flow models". CENER coordinates together with NREL the Task with 13 participating IEA countries. The project involves the elaboration of a model evaluation protocol and best practice guidelines for the use of wind farm models in all site conditions. Duration: 2011-2014; Funding source: 13 IEA country representatives; ID nr. Task 31 ; Total Budget: 300 000€

CIEMAT

Fomento de la tecnología eólica de pequeña potencia (Minieólica)
Duration: 2008-2009; Funding source: MCI; ID nr. PSE 120000-2008-9; Total budget: € 6 329 125

AVAVIP - Análisis de la variabilidad/predictibilidad climática regional del viento y la potencia eólica
Duration: 2008-2011; Funding source: MINECO; ID nr. CGL2008-05093/CLI; Total budget: €48 400

Variabilidad regional del viento y la potencia eolica: incertidumbres, escenarios y extremos.
Duration: 2012-2013; Funding source: Acciones Integradas MINECO; ID nr. PRI-AIBDE-2011-1304; Total budget:€ 8 000

AVAVIP-Plus - Análisis de la variabilidad y predictibilidad climatica regional del viento y la potencia eólica: Downscaling dinámico
Duration: 2012-14; Funding source: MINECO; ID nr. CGL2011-29677-C02-01; Total budget: €80 000

NEPTUNE
The KIC-InnoEnergy project develops a floating Lidar buoy and a hindcast- and forecast model for wind- wave- and current measurements of offshore wind farms.
Duration: 2013 - 2014; Funding source: European Institute of Technology, EIT; Total budget:€154 000

EERA DTOC - EERA Design Tools for Offshore Wind Farm Cluster
Duration: 2012-01-01 - 2015-06-30; Funding source: EC FP7; ID nr. 282797 ; Total budget: €3 997 733

UCM

PAPPI - Análisis de la predecibilidad de las anomalías de precipitación en zonas autosimilares de la Península Ibérica
Duration: 2004-2007; Funding source: Ministerio de Educación y Ciencia (MEC); ID nr. CGL2004-01584; Total budget: 50000€

Integración de un modelo de superficie en el reanálisis meteorológico de mesoescala de la Península Ibérica
Duration: 2005-2008; Funding source: MEC; ID nr. CGL2005-06966-C07-04; Total budget: 48790 €

SIPCO - Desarrollo y Aplicación de un Sistema de Predicción por Conjuntos para la Península Ibérica.
Duration: 2007-2010; Funding source: MEC; ID nr. CGL2007-61328; Total budget: 47190 €

SAFEWIND - Multi-scale data assimilation, advanced wind modelling and forecasting with emphasis to extreme weather situations for a safe large-scale wind power integration
Duration: 2007-2012; Funding source: UE VII Programa Marco; ID nr. 213740; ENERGY-2007-2.3.2; Total budget: 210000 €

PRECOMEX - Desarrollo y evaluación de técnicas de predicción por conjuntos de eventos meteorológicos extremos
Duration: 2012-2014; Funding source: MEC; ID nr. CGL2011-25327; Total budget: 189970€.

UIB

Projects related to the **Atmospheric Boundary Layer over complex terrain** since 2002 to the present, funded by the Spanish Ministry related to Research (REN2002-00486, REN2003-09435, CGL2006-12474-C03-01, CGL2009-12797-C03-01, CGL2012-37416-C04-01). Current project funded with 130000 euros. Project with computing time in the ECMWF since 2002.

IC3

SPECS: Seasonal-to-decadal climate Prediction for the improvement of European Climate Services

European project coordinated by IC3. Research and dissemination activities to deliver a new generation of European climate forecast systems, with improved forecast quality and efficient regionalisation tools. Duration: 2012-11-01-2017-01-31; Funding source: EC-FP7; ID nr. 308378; Total budget: 11 989 174€.

EUPORIAS: EUropean Provision Of Regional Impact Assessment on a Seasonal-to-decadal timescale
IC3 leads WP41: Climate Information for Decision Making. Research and dissemination to improve our ability to maximise the societal benefit of climate technology to predict future environmental conditions. A few, fully working prototypes of climate services over a time horizon of a month and a year ahead. Duration: 2012-11-01 – 2017-01-3; Funding source: EC-FP7; ID nr. 308291; Total budget: 12 962 917€.

CLIM-RUN: Climate Local Information in the Mediterranean region: Responding to User NeedsIC3 leads WP7: Renewable Energy Case Studies. Research and dissemination activities to develop a protocol for applying new methodologies and improved modelling and downscaling tools for the provision of adequate climate information at regional to local scale. Duration: 2011-03-01 – 2014-02-29; Funding source: EC-FP7; ID nr. 265192; Total budget: 4 731 318€.

RESILIENCE: Strengthening the European Energy Network using Climate Services
National project coordinated by IC3. Research and dissemination to strengthen the efficiency and security of the European energy network using the best information from subseasonal-to-seasonal operational climate predictions developed in a co-production with end users. Duration: 2015 – 2018; Funding source: MINECO; Total budget: 224 000€.

BSC

OPENFOAM INNPACTO- Modelling of wind and wind farms based on OpenFOAM
Duration: 01/05/2011 - 30/06/2015; Funding source: Spanish Ministry of Industry, Energy and Tourism (MINETUR); ID nr. IPT-2011-1693-920000 ; Total budget: 873 480€

S4E - Supercomputing for Energy
Duration: 01/01/2013 to 31/12/2015; Funding source: Spanish Ministry of Economy; ID nr. TIN2012-36098; Total budget: 116 716€

Micro-scale meteorological forecast using CFD
Duration: 01/01/2013 to 31/12/2015; Funding source: Catalan Government (AGAUR) and Catalan meteorological service; Total budget: 134.144€

Sweden

UU

Wind power in forests II.
Duration: 2014-04-01 – 2017-12-31; Funding source: Swedish Energy Agency + industry ; ID number: Vindforsk IV; Total budget: 10.75 MSEK

Nordic Consortium, Optimization of large wind farms
Fundamental understanding of wind turbine wakes and farm optimization.
Duration: 2014-04-01 – 2017-12-31; Funding source: Swedish Energy Agency + industry; ID number: Vindforsk IV ; Total budget: 5.2 MSEK

Wind power in forests – Winds and effects on loads.
Duration: 2009-09-01 – 2012-12-31; Funding source: Swedish Energy Agency + industry; ID number: Vindforsk III,V-312; Total budget: 13.5 MSEK

Wind power in cold climates – Ice mapping methods
Duration: 2009-09-01 – 2012-12-31 ; Funding source: Swedish Energy Agency + industry; ID number:

Vindforsk III, V-313 ; Total budget: 11 MSEK

ICEWIND
Duration: 9/2010-4/2015; Funding source: Norden, Top-Level research initiative; ID number:n/a ; Total budget: 1,2 MNOK"

WeatherTech Scandinavia AB

Wind power in forests II.
Duration: 2014-04-01 – 2017-12-31; Funding source: Swedish Energy Agency + industry ; ID number: Vindforsk IV; Total budget: 10.75 MSEK

Wind power in forests – Winds and effects on loads.
Duration: 2009-09-01 – 2012-12-31; Funding source: Swedish Energy Agency + industry; ID number: Vindforsk III,V-312; Total budget: 13.5 MSEK

Wind power in cold climates – Ice mapping methods
Duration: 2009-09-01 – 2012-12-31 ; Funding source: Swedish Energy Agency + industry; ID number: Vindforsk III, V-313 ; Total budget: 11 MSEK

Nordic Consortium, Optimization of large wind farms
Duration: 2009-09-01 - 2012-12-31; Funding source: Swedish Energy Agency and Vindforsk III; ID number: Vindforsk III, V-333, V355, V-370; Total budget: 14 MSEK

Turkey

TÜBİTAK Marmara Research Center Energy Institute

Monitoring and Forecasting System Development for Wind Generated Electrical Power in Turkey
Duration: 3 years (started on July 2010); Funding source: Republic of Turkey Ministry of Energy and Natural Sources General Directorate of Renewable Energy; ID number: internal ID number 7D100820; Total budget: aprox. 2 million €

Renewable Energy Grid Connection and Ancillary Services Technical Assistance Project
Duration: 3 years (started on March 2014); Funding source: Turkish Electricity Transmission Company; 5142802; Total budget: aprox. 1.5 million €.

IZTECH - İzmir Institute of Technology

Adaptation of Uniform Wind Atlases: Case Study of Turkey
The project has the goal to create best practise methodology of use of large scale numerical wind atlases (e.g. Global Wind Atlas - GWA) for the case study of Turkey. It does not have a conflict with the New European Wind Atlas Project (NEWA) because it only uses results of numerical wind atlas projects and do not try to alter their model chain. Although the project was developed in aim to use the GWA as input, it can also be used to disseminate NEWA results more efficiently in certain regions by the end user (e.g. engineers).
Duration: 05-2014 – 05-2016; Funding source: Scientific and Technological Research Council of Turkey (TÜBİTAK) under the Programme of the CO-FUNDED Brain Circulation Scheme (Co-Circulation Scheme). The co funder is the Marie Curie Action COFUND, of the 7th. Framework Programme (FP7) of the European Commission.; ID number: 114DC016 ; Total budget: €115000

METUWIND - Middle East Technical University - Center for Wind Energy

Development of a Navier-Stokes Flow Solver Topographic Unstructred Grids For Micro Site Selection of Wind Turbines

Funding source: TUBITAK; ID number: 112M104.

Application and development of data assimilation models in parallel computing environments for MM5 program used in meteorological forecasting
Funding source: TUBITAK; ID number: 112M104.

ITU

Developing National Wind Power System and Producing Wind Turbine Prototype (MILRES).
This project is one of the biggest projects in Turkey funded by TUBITAK. In this project our responsibilities are wind resources, measurements, modeling and design wind turbine tower. In this Project Professor Dr. Ahmet Duran SAHIN is the project leader of Istanbul Technical University (Ongoing).
Duration: (Started on July 2012); Funding source: TUBITAK; ID number: 110G110; Total budget: Approximately € 3.000.000

Evaluation spatio-temporal and exergy models for a wind-solar hybrid system under climatic conditions of Turkey.
Duration: 2010-2012 ; Funding source: TUBITAK; ID number: 107M331; Total budget: Approximately € 54.000

Wind Atlas of Turkey (WAT), 1998.
This wind atlas was based on Numerical Weather Prediction.
Duration: finished 2006; Funding source: Energy Ministry; ID number: n/a; Total budget: Approximately € 345.000.

Short Term Wind Energy Prediction System (SWEPS)
Led by Professor Mentes and her research team. The main goal of the project was to developed an operational method for wind energy prediction up to 72 hours, for western part of Turkey for different wind farm locations, so that a high accuracy database is used in the decision making process of the energy authority in Turkey. The modelling approach consists of a numerical weather prediction model, the WRF model, micro/CFD model and model output statistics, Artificial Neural Network (ANN) technique. The experienced that is developed during this project is going to be shared with NEWA for the improvement of the WRF/CFD coupling results.
Duration: 2010-2013; Funding source: TUBITAK; ID Number: 110Y050; Total budget: Approximately €146.000.

Lagrangian model forecast of the transport and dispersion of toxic gases/particles over Istanbul by assimilating radar observed radial winds in a regional model
Duration: 2010-2013; Funding source: TUBITAK; ID Number: 110Y155; Total budget: Approximately €109.000.

8. Description of existing or potential patents (own or third party) and present/future position with regard to intellectual property rights, both within and outside the consortium (i.e. freedom to operate, barriers to sharing materials or results), if applicable

Management of Background

The partners have discussed the issue of Background management and the following table (Table 8.1) lists the Background brought to the NEWA project by participant and type. Access to Background owned by members of the consortium during the duration of the project will be defined in the CA. Nevertheless, by principle, Background will be brought to the project on a royalty-free, full-access basis, for the purpose of implementing the project.

Table 8.1: Background brought to the NEWA project.

Partner Short Name	Background IP Title	Usage conditions in NEWA and post-project
DTU	Rotating prism scanning device and method for scanning	Can be used freely in NEWA experiments
CENER	CFDWind in-house research model based on OpenFoam	To contribute to the open-source model-chain
CIEMAT	Development of new parametrizations in the WRF model.	To contribute to the open-source model-chain

In order to promote data sharing and trust, and to facilitate the access to data while preserving the particular interests of both research and industrial communities – i.e. to remove barriers to sharing of data and results – a set of Guidelines have been proposed as part of the Wakebench IEA Task 31[31]. In NEWA similar accessibility Guidelines will be adopted.

Management of Foreground: The consortium behind this project wish to promote the most efficient and effective use of the project results, in order to maximise benefits for European wind industry. Therefore, the NEWA consortium is highly committed in ensuring wide dissemination regarding the data-set related to of European wind energy resources and the models to be developed, guaranteeing transparency and facilitating scientific and technical progress and cooperation. These results should be completely documented and made generally available (free and open) (e.g. the results will be available in the Commission's Strategic Energy Technologies Information System (SETIS), through the web-based Energy Research Knowledge Centre). These general principles will be laid down in the CA.

[31] **Sanz Rodrigo J**, Moriarty P, et al. (2014) Model Evaluation Protocol for Wind Farm Flow Models. IEA Task 31 Wakebench (under preparation).

9. Justification of requested budget

Intended use of the EU contribution for the common good of the NEWA-consortium

The total amount to be used for the common good of the NEWA consortium is 1.083.582€, which corresponds to 25 % of the EU top-up funding from all partners. The rules for managing this are described below. National rules apply for all countries. The EU contribution for the common good of the NEWA-consortium is intended to be used for the following:

1. Overall administration and coordination of the project mainly by DTU, including support to travel costs of the advisory board and other invited persons: 150.000€.
2. Dissemination and workshops (including logistics in connection with conferences): 130.000€, administered by CENER and DTU. A limited amount of subcontracting is foreseen.
3. Leasing of instruments from National Center for Atmospheric Research (NCAR) USA, to be used primarily in the Perdigão experiment, but possibly also in other NEWA experiments: 371.045€. The condition for this to happen is that NCAR will successfully apply the National Science Foundation (NSF) for a deployable network of 100 micro-meteorological surface stations. The NEWA leasing amount will be used to leverage a NSF application, where it will constitute 30% of the total budget.
4. Purchasing a wind scanner system (i.e. a coordinated system of 3 long range lidars) including various necessary updates: 382.537€. The system will be used in all experiments. At the end of the project the system is expected to be transferred to the WindScanner.eu research infrastructure, which will establish rules for how the partners can use the system after the NEWA project has ended. If WindScanner.eu is discontinued before the end of NEWA, the ownership will remain with the German and Swedish partners, who will maintain the systems and make them available for rent for the NEWA partners under favourable conditions.
5. Interaction with European Space Agency (ESA), which provides satellite information for offshore winds, and European Centre for Medium-range Weather Forecast (ECMWF) for testing parts of the model chain: 50.000€.

DTU

In WP2 the plan is to use 180 k€ to buy measurement equipment to be used in *all five* campaigns in the project. These instruments will be sonic anemometers (approximately 50), cup anemometers, temperature sensors, humidity sensors, various components to the data acquisition system of DTU, and cables, boom, etc.

Furthermore, 60 k€ in WP2 are reserved for spare parts for and transportation of the DTU windscanner systems which will be used in *all five* experiments in NEWA.

DTU wind has both a short range and long range wind scanner system, several lidar profiler systems, and many ordinary sensors, including approximately 35 sonic anemometers and 20 cup anemometers, and in addition data acquisition systems. All this equipment correspond to an investment of approximately 3.000 k€ and the rental of this will be included as in kind in the project.

In WP 4 DTU wind will contribute with the following in kind contribution to the project: A new storage system of approximately 200 -500 TB at an estimated cost of approximately 270 k€ for storage of the raw model chain data and experimental data. Furthermore, an estimated 4-5 Mio cpu hours are donated to the project through the calculations done by DTU's supercomputer which is currently number 80 in the world with respect green cpu time, and in the top 500 on largest facilities in the world. The in kind contribution is here estimated to approximately 150 k€.

In total the in-kind contribution to the project is around 3.500 k€ including instruments, computational time, and data storage.

Danish rules state that all costs will have an overhead of 44%, but DTU will not charge overhead of equipment bought in this project. This is an own contribution of app. 80 k€. Danish rules also state that we can obtain a max. contribution of 90% of the total budget. This corresponds to an own contribution of 250 k€.

DNV-GL

DNV GL will spend 70% of the budget for personnel. DNV-GL will contribute to all work packages with man-power according to the following approximate distribution: WP1 20%; WP2 20%; WP3 50%; WP4 10%. The funding rate for DNV-GL will be 40%.

Computing costs amounts to 22% (75 k€, 30k€ financed through the NEWA budget) and DNV-GL will contribute with an extra 50 k€ of computing for free on their DNV-GL Hornet cluster.

Lars Landberg will spend some funds for travelling, as TP Wind representative, and DNV-GL will also attend project meetings in all work packages, estimated at 5 trips per year at 1000 EUR per trip.

Vestas

Vestas provides in-kind contributions in the form of data and supercomputer resources. The data comprise wind measurements from approximately 100 meteorological masts, provided to DTU under a NDA. The computations will be performed on the Vestas IBM Firestorm.

The funding rate for Vestas will be 40%. 60% of the total budget will go to personnel costs in connection with work on WP2 and WP3. The rest will to attendance for project meetings at an estimated 5 trips per year at 1000 € per trip.

3E

The total 3E budget is 739 169 €. Approximately 408 k€ of the 3E budget goes to personnel costs in model chain development (41 MM) and model verification (21 MM) - work packages 2 and 3. A small contribution to Project Management (4 MM) and interactive mapping (0.8 MM) is foreseen.
Other costs are divided in equipment, travel, other direct costs and overhead costs.
8.000 € are foreseen as travel costs. This budget covers 1 - 2 workshops, seminar, etc. per year for 3 years (3000 €), plus travel budget for project meetings for 2 person for 3 years (5000 €).

Depreciation of a lidar over a 6 month campaign is included at 13.500€. 25k€ have been included as contribution to be used for the common good of the NEWA consortium.
30k€ have been budgeted for HPC costs for selected WRF simulations.
10k€ has been budgeted under consumables for proprietary software licences and other incidentals.
3E is investing 268k€ of its own money in this project, including costs to be used for the common good of NEWA (financed at less than 70%).

KULeuven

12 man-months of a PhD student are to be used to investigate meso-micro coupling using the LES model SPWind. Additional costs of €10,000 are allocated to HPC time.

Nazka Mapps

The total Nazka budget is 194,263 €. Approximately 70% (136,763 €) of the Nazka budget goes to personnel costs in WP2 and WP4. Other costs are divided in equipment, travel, other direct costs and overhead costs.
In WP2 and WP4, 2.500 € is foreseen for equipment i.e. the rental of a VPS server to test web interface developments, plus + the specialized software cost for advanced image processing (ArcGIS, eCognition, etc.).

In WP2, 5.000 € are declared as other direct costs, i.e. budget reserved for the acquisition of EO data for developing new land cover/use and roughness layers. €5000 are also included to be used for the project common good.

3.000 € are foreseen as travel costs. This budget covers 1 workshop, seminar, etc. – 1 per year for 3 years (1.500 €), plus travel budget for project meetings for 1 person for 3 years (1.500 €).

The total overhead cost is budgeted at 42.000 €. This figure is calculated according to IWT regulations, saying that indirect other costs (overhead) can be calculated a ratio of 20.000 €/ man year. (25 man-months/12 * 20.000).

The total funded amount is 155.410 € (80%). Nazka is investing 38.8 k€ from its own resources in the project and 4k € in the research partner (KU Leuven).

ATM-PRO

Mainly, the requested budget will cover the personnel involved in the project and the computer power to be put in place and maintained throughout the project. Travel expenses to take part to the regularly organized meetings are also foreseen.

The planning ATM-PRO would like to follow, in accordance with the general time frame of the project, is as follow :

YEAR 1 : run “a priori” on the sites of experiments (PT, ES, DE, DK at least) to provide
(1) insights on the climatology in the area, specific circulation of interests and
(2) analysis on which situation to be run with CFD code of CENAERO.
(3) sensitivity analysis on various settings, scales & parameters.
YEAR 2 & 3: run on the sites of experiments (PT, ES, DE, DK at least) for as long as possible time period (35 years available in ECMWF Re-Analysis) to build an explicit LT Database at various resolution and enable multiple sensitivity analysis to be performed.
YEAR 4: Validation methodology to be implemented in collaboration with other teams. Validation against available data resulting from experiments requiring to run the models on the same period of time (PT, ES, DE, DK sites). Results analysis. With CENAERO, multi scale validation and methodology proposal for improvements and implementation in the model chain.

YEAR 5: Runs to be performed as for the new atlas requirements. Finalisation of sensitivity experiments analysis, finalisation of validation exercises, reporting.

As a SME, ATM-PRO is subject to a 70 % funding ratio.

Cenaero

As Cenaero is working on CFD computation, the needed budget is mostly only the man hours. The different tasks and corresponding human cost are given hereafter:

- Year 1: WP3.3 Downscaling to microscale for site assessment (6PM)
- Year 2: WP3.3 Downscaling to microscale for site assessment (6PM)
- Year 3: WP3.3 Downscaling to microscale for site assessment (2PM) and 3.5: Model benchmarking (3PM)
- Year 4: WP3.5: Model benchmarking (5PM)
- Year 5: WP5.2: Article writing and dissemination (4PM)

Some additional costs for travelling and computational cost (electricity, memory storage) are added to this budget and are as following:

- Travelling for NEWA meetings, conferences (4.000€/year) → 20.000€
- CPU hours: CFD RANS calculation over very large domains and in multiple wind direction will be required. High parallelisation and long running time will be needed 625.000hCPU → 25.000€
- Scientifics papers, books (500€)
- Licence for CFD benchmarking (40.000€) (Although the project tends to develop an opensource

platform, it is important to compare the opensource code to at least one commercial code accepted and validated by the industry.)

IWES

Personnel (plus overheads) and travel costs in WP 1 are assigned to the national coordination task and the management of WP 4.
In WP 2 costs are distributed for the preparation, execution and evaluation of two (out of the five) experiments – the forested hill experiment near Kassel and the Northern Europe combined mesoscale experiment. In addition to the personnel costs (plus overheads) equipment and other direct costs are assigned e.g. for the preparation of the measurement sites, the purchase and erection of an additional met mast for the forested hill experiment, the maintenance of mast and measurement systems, the calibration of wind sensors, the purchase of minor instrumentation, spare parts and other necessary material. Not included are the 200-m-met-mast infrastructure and the ship-lidar system – except for O&M costs – that IWES provides as (already existing) contribution to the project. Travel costs are budgeted for the travels in connection with the experiments in addition to the travels to project meetings and conferences or workshops – the second category applies also to the other WPs.
In WP3 / WP4 apart from the mentioned travel costs, there will be expenses due to the geometry-data for the terrain, which are for certain countries fee-based. Further costs for the organization of workshops related to blind tests and validation are budgeted. On the simulation side a very large amount of data are to be stored safely. Thus, the purchase of a NAS-storage system to secure the data from the simulation cases is also part of the budget.
An overhead of approx. 85% is added to all IWES personnel costs. The exact percentage number is dependent on the calendar year and will be re-calculated after each completed year.

ForWind

In WP 2 costs are claimed for two specific tasks: The LiDAR measurements at two of the five experiments require personnel resources for preparing, performing, and evaluation of the experiments. In addition, costs for the logistics of the experiments (transport of the LiDARs, accommodation during the measurements) and for maintenance of the instruments need to be assigned. For the Large Eddy Simulations in WP2 personnel costs are specified as well as traveling costs for one person to project meetings and to one conference per year.
For the contribution to WP3 (Mesoscale model improvement) personnel costs are by far the major cost item. In addition, traveling costs for one person to project meetings and to one conference per year are specified.
WP4 (NEWA database) requires – besides the personnel costs – additional investments in a moderate extension of the locally available computer system. This comprises six additional nodes (IBM nx360 M4) to enable the existing system to participate in the generation of the wind atlas data base.
For all WPs a minor amount of consumables is requested.
No overhead costs are claimed.
No dedicated coordination and management costs are claimed.

IPE

Senior researcher - Principal investigator will coordinate Latvian tasks and measurement campaigns, WP1 and WP2. Hourly rate 18.3 Euro/hour total 33.9 PM. Senior researcher - WP2 (measurements and data processing), hourly rate 14 Euro/hour, 10.9 PM. Researcher - wind measurements and database maintenance, hourly rate 14 euro/hour, 10.9 PM. NEWA project Latvian local administration, hourly rate 14 Euro/hour, 10.9 PM. Requested funding will be used for: project administration (WP1); wind measurements in Latvia using up to 10 wind measurement complexes mounted on the masts and lidar measurements; development and maintenance of wind data base. Travel budget will be used for WP meetings; conferences and for experiments. IPE contribute to the project with 10 sets of NRG loggers with cup anemometers and wind lidar Pentalum Spidar with approximate value of 150 K€.

ERI VIRAC

One Researcher for tasks from WP1 and WP2 with 34.5 PM, hourly rate 14 Euro/h, will participate and coordinate all measurement campaigns for Latvian measurements; 1 Senior researcher with 16 PM and hourly rate 14Euro/hour will lead WP3 in VUC. 1 Researcher, 17.1 PM with hourly rate 11 Euro/hour for WP3 and 1 researcher, 17.1 PM with hourly rate 11 Euro/hour for WP4. Requested funding will be used for: project administration (WP1); wind measurements in Latvia using up to 10 wind measurement complexes mounted on the masts and lidar measurements. Site CFD models development and measurement validation. Travel budget will be used for WP meetings; conferences and for experiments.

UL

The requested funds are planned to be used to carry out meso-scale modelling (WP3) activities in UL.

Most of the budget consists of the costs with personnel that are needed to perform model runs and analyze the results.

The projected personal costs are calculated as follows:

Principal Investigator (Senior Research Scientist) – 2.5 PM or 400 hours for 14.8308 EUR/h (gross wage, net wage -12 EUR/h). Net wage limited by national regulations, limit - 14.23 EUR/h.

PhD student – 43 PM or 7224 hours total for 12.359 EUR/h (gross wage, net wage - 10 EUR/h). Net wage limited by national regulations, limit - 11.38 EUR/h.

Due to the international scope of the project, funding for several international meetings a year are included in the budget. The amount of data generated during the project can be expected to reach the terabyte scale and additional data storage is needed.

LEGMC

The professionals with experience in meteorological measurements according to international standards in meteorology as well as experience in long-term data analyses are essential to the project and comprise the majority of the requested funding. 2 researchers will be involved in wind measurement site selection, wind measurement campaigns, assessment of wind data and site evaluation, evaluation and analyses of short-term and long-term wind data, WP2. Staff categories: 1 principle investigator and 1 researcher. The requested funding is calculated using the scale on: principle investigator - 2455 person hours, hourly rate 14 EUR including employer's national social security contributions; researcher 2455 person hours, hourly rate 11 EUR including employer's national social security contributions. 1-2 international conferences and/or meeting per year to share work in the scientific community and get feedback before a study is finished. 2 trips per year at 1000 EUR per trip.

UPORTO

UPORTO as the coordinator of the Portuguese consortium will be the representative of the Portuguese partners at the Steering Committee. All activities of the Portuguese partners, and therefore their budget, are channelled towards the double-hill experiment in Perdigão.

This is a site with a particularly suited orography and excellent access; however, the local infrastructures such as meteorological masts are scarce. A great effort is needed, both in financing and human resources, with implications not only in UPORTO's budget but also in the budget of the remaining Portuguese partners and even the European consortium.

The most significant item in UPORTO's budget is the Personnel (91 k€), all involved firstly in the design of Perdigão's experiments and later, contributing to the model-chain and uncertainty determination based on Perdigão field measurements. These must all be well-experienced researchers: one at a senior research level and two Post-Docs.

The equipment costs (53,8 k€) include a modest contribution of 13,8 k€ to the UPORTO cluster (https://www.grid.fe.up.pt/web/guest/clusters) and the remaining 40 k€ are part of the costs of the NCAR instruments, to which an additional 21,6 k€ were foreseen and classified as Direct Costs, since some of this equipment might be actually leased. A total of 61,6 k€, although included in UPORTO budget is the contribution of UPORTO to be used for the common good of the NEWA consortium.

Travel (12 k€) and consumable (~5 k€) costs are the strictly necessary for participation in the project meetings, and small expenses (e.g., small repairs of computing equipment, printer toner, express mail, upgrade of a software license, copies of a poster for a conference, etc.) that will certainly occur during the course of the project. Travel costs are split in costs of project board meetings (8 k€) and the participation (4 k€).at the EWEA conference, the annual event in Europe gathering all sectors related to wind energy.

INEGI

INEGI will be the main responsible for installation and maintenance of the scientific field infrastructure in Perdigão. Personnel, equipment and travel are the most significant items in its budget.

Personnel includes 43,6 PM of field technicians and engineers directly involved in erecting the meteorological masts and installing the scientific equipment provided by other European partners and USA (NCAR and NREL) participants. INEGI is the only institution in Portugal with a staff of experienced people, licensed to perform this type of work.

The costs of personnel (78,7 k€) include 0.5 PM in the preparation of the experimental setup at workshop; 1.0 PM working at the database setup synchronization; 2.5 PM in the reception and preparation of equipment from partners at INEGI facilities; 11.0 PM for instrumentation of 10 meteorological stations; 10,0 PM performing O&M visits and assisting partners in the installation of their own equipment (contribution to the Perdigão experiment); 8.0 PM performing data monitoring, data cross-check and validation; 7.0 PM working at the dismantling of experiment; 3.6 PM of global coordination.

Consumable costs (10 k€) concern mainly the experimental apparatus support equipment, as auxiliary energy supply equipment (solar panels and controllers, batteries), communication equipment (modems, antennas), cabling and other ancillary as booms.

Equipment (136,7 k€) includes supply and installation of 3 lattice meteorological masts with 100 m height, plus electrical supply and accesses construction. Most of the scientific equipment to be installed at these masts will be made available by other partners, namely DTU and NCAR.

90% of the budget for travel (69,7 k€) is meant to cover travelling and overnights during the instrumentation of the meteorological stations, the operation and maintenance of all experimental apparatus and its dismantling. The remaining 10% concerns the participation in work meetings.

Other direct costs (34 k€) include the transportation and storage of equipment onsite; rental of local space for workshop and land lease for the masts, administrative licenses and insurance for legal responsibilities.

Overheads (65,8 k€) were estimated as established by Portuguese regulations.

IPMA

The human resources (19,9 k€) are for 1 Post-doc (1 year, 12PMs) for performing mesoscale operational modelling during the double-hill experiment in Perdigão.

Under consumables (10,4 k€) and direct costs (9 k€) we include the costs of non-reusable equipment (spare parts) to be used during the course of the experiments. IPMA will be responsible for launching radiosonds twice a day, as part of the short-duration (two-week) intensive (staff and foreign teams in Perdigão) campaigns.

Travel costs (5 k€) will cover the expenses of the annual meetings, once over the 5 years project.

IPMA will make available to the project all other information, which is a consequence of its daily activity, including the expertise of experienced meteorologists with a high knowledge on the micro-clima in Perdigão.

LNEG

LNEG costs in personnel (~35k€) will cover 2 MSc grants.

The first MSc grantee responsibility will be data processing and quality control. The main activity and contribution to Perdigão's experiment will encompass the terrain description and map processing, and terrain and roughness refinements in Perdigão area using ENVI or other similar model.

The activities of the second MSc grant will evolve around the processing of roughness maps and terrain conversion, terrain and roughness descriptions processing with GIS and formatting of the mapped information for dissemination among other partners.

The costs for equipment (24k€) include the update of GIS software, e.g., ArcGIS and ArcGIS/ArcInfo, for maps (terrain and roughness) conversion and classification (6 k€), image processing and analyzing software (ENVI) and spatial data processing and image conversion and ortorectification (terrain and roughness refinements) (15,5 k€). All this software will be installed in a dedicated Workstation (2,5 k€).

Travel costs are just enough to ensure the participation of one researcher at the project annual meetings abroad (3 k€) and travel and meetings in Portugal for work discussion and strategies definition and visits to Perdigão site. (2 k€).

Overhead costs are based on the national rules of 20% over all costs.

CENER

CENER will lead WP3 and WP5, will represent Spain in the Steering Committee, member of the Management Board and will take the role of Exploitation and Dissemination Manager (100k€ associated to management aspects).

CENER will manage the Alaiz measurement campaigns, subcontract the engineering works for the installation and maintenance of the mast campaign (220k€) and provide support during the setting-up, monitoring and maintenance of the campaign in general as well as the data quality-check and processing to generate the database of the experiment. 30k€ are allocated CENER lead the *call for wind data* that will address potential contributions of data mainly from industrial partners. CENER will make use of the existing infrastructure and databases of the Alaiz Test Site to assist the experiment and facilitate the administrative permitting process (195k€ of personnel cost associated to WP2). CENER will make available eight 80-m met masts donated by Iberdrola Renobables equipped with conventional instruments. Together with Alaiz test site instrumentation, data and support infrastructure (4 x 118 m masts) this corresponds to an investment of 6M€ whose amortization is provided in-kind to the project.

CENER will develop models for downscaling from mesoscale to microscale using CFDWind in-house CFD model build on OpenFoam code. CFDWind will contribute to the open-source platform of NEWA. In collaboration with IC3, CENER will develop models for sub-seasonal wind power predictability. CENER will lead benchmarking activities in WP3 and extend participation to the IEA-Wind Task 31 Wakebench. Benchmarks will be managed through windbench.net to produce a repository of open-access strong-sense benchmarks. Model evaluation protocols will be reviewed and integrated in windbench.net following NEWA feedback. In total 310k€ will be allocated to WP3 and 125k€ to WP4.

If approved, CENER will coordinate the OpenWATT Marie Skłodowska-Curie Innovative Training Network on "Open Wind Assessment Training and Tools" (3.8M€, 15 PhDs). This project will constitute the training dimension of NEWA with important support on the development of models and applications interfacing with NEWA databases. CENER will lead the elaboration of an exploitation plan that will explore the research and commercial opportunities generated by NEWA. The total in-kind contribution of CENER is estimated at 3M€ (test site infrastructure, instrumentation, open-source CFDWind code, computing time, databases).

CIEMAT

In WP3 and WP4, CIEMAT will be focused in two main tasks: Simulation, and environments set up, parallelization and computation. CETA-CIEMAT, a CIEMAT centre in Extremadura, will contribute with its infrastructure to help parallelizing and accelerating the simulation of the wind field over Europe. CETA-CIEMAT is also one of the less than 80 CUDA Research Centres in the world, due to its impact in high performance computing technologies, and especially in GPU Computing. In total ~239k€ for recruitment of personnel will be allocated to WP3 and WP4 for the developing of such task.

The main focus of the experts will be in achieve an efficient (and desirable real-time or near real-time) simulation of all the wind field over Europe. To achieve this, a previous investment and set up will be done to configure and test the simulation before reaching the time and results expected. For this purpose several nodes of the different clusters in CETA-CIEMAT will be used.

In total the in-kind contribution of CIEMAT to the project is over 500k€, including high performance computing clusters, computational time, storage and backup from CETA-CIEMAT.

UCM

UCM will participate in Task 4.4. 167,600 € will be invested in recruitment of personnel. The hired post-doc will be in charge of developing the Research Task “Development of validation techniques for spatial and temporal spread and uncertainties from probabilistic modelling”. This work is proposed as a midrange task where diverse techniques will be developed in order to assess the ensemble spreading over Europe. The evaluation should be realized taking into account the geographic variability of the whole domain; therefore, new statistical techniques should be developed allowing the geographic visualization of model spread. Since the task is based on development of new statistical methodologies, previous to be applied to the probabilistic wind atlas, they should be developed and validated over other state of the art models such as the ECMWF-EPS.

UCM will be in charge of applying the quality control procedures to the European database to produce a homogeneous validation dataset for the wind atlas. In total 97k€ for recruitment of personnel will be allocated to WP2 and WP3 for the development of such task.

UCM will carry out the validation of the European Wind Atlas in order to test the ability of the simulation in reproducing the wind observations. This procedure will allow for inferring the areas and the timescales where the model provides a more credible representation of the wind in Europe. 42K€ for recruitment of personnel will be allocated to WP4.
4k€ are required to purchase computer equipment to be used in the development of previous tasks.

Furthermore, ~15k€ are needed to support travel expenses related with progress meetings and dissemination of results in congresses.

UIB

UIB will assembly and manage the surface layer stations in the Alaiz site as well as the WindRass for the monitoring of the thermal structure in the first 500 m above the ground. It will calibrate the instrumentation, perform supplementary measurements during the short term intensive measurement periods with tethered balloons and drones, and proceed to analyse the obtained data and made the data set available to the consortium.

Personnel: 1) Technician for DAS, assembling and installing the material in the field; 2) Scientist: for the management of the equipment and data during and after the field campaign, including short term actions and WindRass data.
Equipment: material for building the SEB stations, including air and soil parts.
Travelling: to participate in the Alaiz campaign and in the general meetings.
Hiring Windrass: use of the equipment belonging to the Catalan Meteorological Service.

IC3

IC3 proposes the development of a climate atlas decision support tool, based on state-of-the-art probabilistic climate predictions relevant to wind power in WP3 and WP4. The climate atlas tool will be developed as a modular computing platform based on different coupled models, in collaboration with CENER to include weather forecast.

o Short term forecast: hours to days (CENER)
o Medium-range weather forecast: days (CENER) to weeks (IC3)
o Climate predictions: sub-seasonal and seasonal (IC3)
o Cost models of the logistics involved in operations.

Climate prediction of wind speed/power will be evaluated, over time horizons that cover the complete life cycle of a wind farm.

BSC

BSC will participate in WP3 implementing the CFDWind model with thermal coupling in the in-house finite-element-based solver Alya and in developing strategies for downscaling models from mesoscale to microscale in collaboration with other partners. In the implementation of the model chain (WP3.4), BSC will assist on the parallelization and installation of the open-source platform in the MareNostrum supercomputer (1 Pflop of peak capacity) during the duration of the project. In addition, BSC will support NEWA members on the elaboration of competitive proposals to gain access to the PRACE HPC resources in order to enhance the production of the NEWA wind atlas simulations (proposals are competitive but, if accepted, would imply no additional cost to the Consortium for using any tier-0 European infrastructure). Finally, in WP4.3, BSC will participate in the beta production runs.

If approved, BSC will also be a member of the OpenWATT Marie Skłodowska-Curie Innovative Training Network on "Open Wind Assessment Training and Tools" (3.8M€, 15 PhDs). The PhD involved in this project would also support the development of model chain strategies at BSC.

It is estimated that the BSC contribution requires of 54 person month.

UU

In WP1 the plan is to use 42 000€ for administrative costs. (2 PM) The “other direct cost” budget is planned to be used here. 20% of the traveling budget is planned here for meetings etc.

In WP2 the plan is to use 766 000 for experimental work and equipment of an existing Swedish met mast. (28,2 PM) 95 % of the equipment budget is used here.

In WP 3 the plan is to use 445 000 for development of meso- and micro-scale models. (46,2 PM). 5 % of the equipment budget will be used here.

In WP 4 the plan is to use 12 000€ for development of the project database. (1 PM)

The traveling budget (included in the 4 WPs) is in total 60 000€ for meetings and experimental setup.

WeatherTech

In WP1 the plan is to use 12 000€ for administrative costs. (1 PM)

In WP2 the plan is to use 40 000€ for experimental work and equipment of an existing Swedish met mast. (4,2 PM)

In WP 3 the plan is to use 168 000€ for development of meso- and micro-scale models. (20,8 PM)

In WP 4 the plan is to use 8 000€ for development of the project database. (1 PM)

The traveling budget is in total ~27 000€ for meetings and experimental setup.

TUBITAK MRC

In WP2, TUBİTAK MRC will host the experimental database and need some additional storage units and/or servers. The capacity of the units will be determined according to the requirements determined at the first stages (appr. 100 TB) and the cost is expected to be 47.667 € or more.

The total travel expenses for meetings and site studies are around 16.667 €.

The total personnel cost for database design, service codes for data acquisition and interface applications is 64.000 €.

Overhead for the 1001 programs are calculated after full application which is later than 4th of August and it is not included into the total budget. The total contribution is 100% of the budget.

IZTECH

In WP2 the plan is to use 120.000 € to design for a tall met.mast, installation and equip it with necessary anemometers (cup anemometers, temperature sensors, humidity sensors, various components to the data acquisition systems, and cables, boom etc.) Nearly, 69% of the total budget will be spent for the equipment.

Such tall tower for academic use will be the first in Turkey and at the region, therefore it will provide important insight for the wind conditions of the region where there are no other sources available at the planned quality. Thus, we would like to get international experts support during the planning, installation and first year of data collection that had planned and installed similar size turbine for similar purpose. We have spared €16600 for such service to subcontract experts. This will keep the project on track and keep the 1-year deadline of installing the mast on schedule.

We also would like 2 students to get involved with the project in their MSc thesis studies and in PhD studies; and we had requested a budget for their support. This will help us to keep necessary manpower on the project.

IZTECH will not charge overhead in this project.

METUWIND

METUWIND has a High Performance Computing Cluster for academic research and educational purposes. It consists of a server and 8 compute nodes with 8 AMD CPUs installed in 2012. In WP3, the cluster will be upgraded with 4 more nodes with Intel CPUs.

For a PhD. Student and 2 Ms. Students, 57.600 € is requested as a scholarship. Also, 3.333 € paper-work expenditure is expected during the project. This expenditure will include office materials such as paper, printer cartridges, storage devices, etc.

Lastly, for the travel costs of the meetings (expected number 8) 8.333 € budged is requested in the project.

ITU

One of the main budget parts for our proposal is PMs, which include PhD, and MSc. student costs. Budget of the PMs item is ~104.6k€. Researcher personnel cost is not included to this amount according to the regulations of TUBITAK.

Hardware: computer, servers and services, laptops and storage facilities ~105k€. The systems will include two separate storage systems of 96TB and 12 TB, a workstation to work with micro- and meso-scale coupling. We also plan to buy 625.000 cpu hours at ITU High Computing Center (17 k€)

Travels, meetings and dissemination: 30 k€. Apart from travels to projects meetings (17 k€) we also plan to host a couple of workshops (13 k€).

Borusan

BORUSAN will host a site experiment in Turkey for a high altitude site and need additional measurement equipment for this task, such as meteorological mast with anemometers, temperature sensors, humidity sensors and data acquisition system and LIDAR. Moreover, BORUSAN will procure some 3rd party micro modelling software for modelling site before experiments and using at the validation stage. The total budget of these instruments and software is 266.800€.

The total travel expenses for meetings and site studies are around 10.000 €.

The total personnel cost for high altitude experiment is 294.840 €.

There is not any overhead for the 1509 program in Turkey. The total contribution is %60 of the budget.

10. Ethical and legal issues

The NEWA consortium foresees no ethical issues stemming from the developments proposed in the project. All the envisioned activities respect fundamental ethical principles, including those reflected in the Charter of Fundamental Rights of the European Union. This project does not involve the use of humans in any way and thus the issue of informed consent is not relevant in this case. Also, NEWA does not involve the use of animal species or methods.

No specific legal requirements are applied to the study. Permitting processes to run the experiments will be carried out at a Regional or National level.

11. Brief CVs for each research partner

Jakob Mann
DTU (Technical University of Denmark) - DENMARK

Brief description of the main domain of research

The main research interests of Jakob Mann (JM) are atmospheric flow for wind energy applications including wind resources, turbulence and gusts. Both experimental and theoretical approached have been used. JM created a turbulence model, which is now implemented and used by all major wind turbine manufacturers to calculate loads on wind turbines. The model is incorporated in the International Energy Commission (IEC) standard on wind turbine design. JM has over the last ten years been strongly involved with wind field measurements with scanning laser (wind lidars). JM is also contributing to basic fluid mechanics.

Relevant professional experience

2007-	Professor, Dept. Wind Energy, Technical University of Denmark
2003-2007	Professor, Risø National Laboratory
1990-2003	Ass. Scientist, Scientist, and Senior Scientist, Risø National Laboratory

Other relevant professional experience:

- Manager of the development of the computer program WAsP Engineering used by the wind energy industry with a first release in 2002. The software calculates flow properties in complex terrain relevant for loads on wind turbines.
- Vice-president of the European Academy of Wind Energy (EAWE) 2013-. An organization that promotes European coordination within wind energy research and education.
- Organizer of The Science of Making Torque from Wind 2014. The largest scientific conference about wind turbine aerodynamics and wind turbine siting.
- Winner of the EAWE Science Award 2013 which is given each year to one person who has contributed significantly to wind energy research.
- JM has been on the executive editorial board of Environmental Research Letters since 2007.
-

Relevant degrees

2013	DTU management course completed
1994	PhD in micro-meteorology from Risø/Aalborg University Centre, Denmark.
1990	MSc in astronomy, from Aarhus University, Denmark.
1987	BSc in mathematics and physics,

List of the five most relevant publications within the last five years

Bingol, F; **Mann, J**; Larsen, G C. Light detection and ranging measurements of wake dynamics Part I: One-dimensional Scanning Wind Energy 13(1) 51—61, 2010

Mann J, Pena A, Bingol F, Wagner R Scanning of Momentum Flux in and above the Atmospheric Surface Layer Journal of Atmospheric and Oceanic Technology 27(6) 959—976, 2010

Bechmann A, Sørensen NN, Berg J, **Mann J**, Rethore P-E The Bolund Experiment, Part II: Blind Comparison of Microscale Flow Models, Boundary-Layer Meteorology 141(2) 245—271, 2011

Petersen E L, Troen I, Jørgensen H E, **Mann J** Are local wind power resources well estimated? Environmental Research Letters 8(1) 011005, 2013

Dellwik E, Bingol F, **Mann J** Flow distortion at a dense forest edge Quarterly Journal of the Royal Meteorological Society 140(679) 676—686, 2014

Lars Landberg DNV-GL Energy - DENMARK
Brief description of the main domain of research
The principal investigator from DNV GL RA will be Lars Landberg (LL).The main domains of research of LL and of his research team are: - wind resource estimation; - development of micro-scale and mesoscale models - estimation and reduction of uncertainties - design, procurement, installation, commissioning and validation of measurements campaigns to support regional mapping activities -
Relevant professional experience
LL has worked in wind energy for 25 years. When working at the Risø National Laboratory (now DTU Wind) he was responsible for the WAsP programme for many years, the sale and marketing of the original EWA, the development of many regional and national wind atlases, and the development to the KAMM/WAsP method. Within Garrad Hassan (now DNG GL RA) he has been involved with meso-scale and CFD modelling, and supported several national atlases.
Relevant degrees
PhD in Physics/Geophysics (Boundary-layer meteorology) from University of Copenhagen (DK) MBA from Warwick University (UK)
List of the five most relevant publications within the last five years
Rife, D., et al., 2013b, “Toward Computationally Efficient Virtual Time Series with an Analog Ensemble”, WindPower 2013 Conference, Chicago, IL. Delle Monache, L., et al., 2013. “Probabilistic weather predictions with analog ensembles”. Mon. Wea. Rev., 141, 3498-3516. Bleeg, J., Digraskar, D., Woodcock, J., Corbett, J.F., 2014. “Modeling stable thermal stratification and its impact on wind flow over topography”, Wind Energy. DOI:10.1002/we.1692. (print publication pending) Corbett, J.F., Horn, U., Bleeg, J., Whiting, R., Digraskar, D., “A systematic validation of CFD modelling for commercial wind farm sites.” EWEA 2014. J-F. Corbett, R. Whiting, J. Bleeg, J. Woodcock, U. Horn, L. **Landberg, A.** Tindal: “CFD can Consistently Improve Wind Speed Predictions”. EWEA 2012

Mark Žagar VESTAS - DENMARK	
Brief description of the main domain of research	
The main research interests of Mark Žagar are: - applied meteorology research, - atmospheric model development, - mesoscale and microscale climate research, - boundary layer meteorology.	
Relevant professional experience	
2/2009 -	Vestas, Specialist Design, implementation, and maintenance of global mesoscale climatology with focus on wind energy and boundary layer research.
10/2005 -12/2009	Part-time employed as a researcher and assistant professor, University in Ljubljana
7/2004 - 1/2009	Environmental Agency of Slovenia Full-time Consultant for NWP, EARS Project Wind climatology by dynamical downscaling of the ERA40 Head of the Meteorological modeling section, EARS Project Numerical high-resolution climate modelling for climate change scenario development for Slovenia in the 21st Century
10/2000 - 6/2004	Post-doctoral fellow at the Department of Meteorology, Stockholm University MEAD project; research for evaluating the impact of small-scale meteorological features to pollution of marine surface, and improving prediction of pollution events; MISU Mesoscale modelling of the Arctics; ARCMIP project; MISU
08/1993 - 10/2000	Hydrometeorological Institute of Slovenia (HMIS) Development of the ALADIN spectral limited area meteorological prediction model; Partially working as a forecaster in the meteorological forecasts department, Setting up operational activity of the ALADIN model at the HMIS Research for improving small-scale predictions of wind and precipitation ; HMIS, Météo France Scientific officer in charge at the ALATNET local centre, HMIS
Relevant degrees	
Ph.D. in meteorology, 2000; University in Ljubljana, Slovenia, Universite Paul Sabatier Toulouse III, France	
List of the five most relevant publications within the last five years	
Davis, N., A. Hahmann, N.-E. Clausen, **M. Žagar,** 2014: Forecast of Icing Events at a Wind Farm in Sweden, *J. Appl. Met. Clim.*, **53**, 262-281	

Rory Donnelly
3E – BELGIUM - FLANDRES

Brief description of the main domain of research

In the wind energy sector, Rory Donnelly (RD) has experience in a wide range of topics, from mathematical tool development and atmospheric model development and validation, to wind resource assessments.
The main research interests of RD are:

- Atmospheric dispersion modelling: urban dispersion, emergency response modelling, particulate and pollutant modelling.
- Wind farm simulations: modelling all aspects of wind farms from resource assessment to power production estimation.

Relevant professional experience

2011 – Present – R&D programme manager Wind at 3E Belgium.
2010 – 2011 – Meso-scale model development and validation at MetoFrance
2004 – 2010 – Air quality Scientist at SKM Australia

Other relevant professional experience:

- Consortium coordinator for ClusterDesign project.
- Project coordinator for several IWT funded research projects in wind energy sector.
- Project Advisory Board member EERA-DTOC
- TPWind member

Relevant degrees

08/2010 PhD in atmospheric modelling from Murdoch University; “Urban Dispersion Modelling in an Emergency Response Context”

06/2005 - Hons Env. Sc (Atmos. Modelling)

06/2004 – B.Sc. Env. Sc.

List of the five most relevant publications within the last five years

R.P. Donnelly, T.J. Lyons, T. Flassak (2009): Evaluation of results of a numerical simulation of dispersion in an idealised urban area for emergency response modelling. Atmospheric Environment Volume 43, Issue 29, September 2009, Pages 4416-4423.

C. Lac, **R. P. Donnelly**, V. Masson, S. Pal, S. Donier, S. Queguiner, G. Tanguy, L. Ammoura, I. Xueref-Remy, (2013) CO2 Dispersion Modelling Over Paris Region Within The CO2-megaparis Project. Atmos. Chem. Phys. Discuss., Issue 12, May 2013, Pages 28155-28193.

E. Alexakis, **R. Donnelly**, C. Hofemann, P. Hoebeke, (2012) IMPROVED WAKE MODEL PERFORMANCE USING INDUSTRY STANDARD TOOLS, Session 20 (Lidar), DEWEK 2012, 7th to 8th November 2012 in the Congress Centrum Bremen.

R. Donnelly, A. Kyriazis, G. Leroy (2013), RESOURCE ASSESSMENT WITH LIMITED DATA AVAILABILITY - Determination of a representative meteorological year. P.233, EWEA 2013, 4 – 7 Feb. 2013, Vienna, Austria.

E. Lemmens, **R. Donnelly**, T. Kyriazis (2014). Determining uncertainty in wind resource assessments using long term tall mast datasets Po. 319, EWEA 2014, Barcelona.

Johan Meyers
KULeuven – BELGIUM - FLANDRES

Brief description of the main domain of research

The TFSO-research group (http://www.mech.kuleuven.be/en/tme/research/tfso) of J. Meyers focuses on the simulation, optimization, and optimal control of turbulent flows using high-performance computing. Application areas are wind energy, and atmospheric and indoor dispersion of pollutants. The group consists of 9 PhD and 1 postdoctoral researcher. In recent years, research has focused on adjoint-based optimal control of turbulent flows. In this context, J.M. obtained an ERC grant on wind-farm control (Active Wind farms: http://www.kuleuven.be/eu/projects/fp7/erc/2012/meyers.html).

Relevant professional experience

10/2009 – now	Assistant Professor, Mechanical Engineering Department, K.U.Leuven, Belgium
10/2007 – 09/2009	Postdoctoral fellow of the Science Foundation Flanders (FWO-Vlaanderen)
10/2006 – 09/2007	Postdoctoral researcher, Mechanical Engineering Department, K.U.Leuven, Belgium
10/2005 – 09/2006	Postdoctoral researcher, Laboratoire de Modélisation en Mécanique, Université Pierre et Marie Curie (Paris 6), France
03/2004 – 09/2005	Postdoctoral researcher, Mechanical Engineering Department, K.U.Leuven, Belgium

Relevant degrees

10/1997 – 02/2004	Ph.D. in Mechanical Engineering on “Accuracy of large-eddy simulation strategies”
10/1991 – 06/1996	Bachelor and Master of Science in Mechanical Engineering, University of Leuven; 4th year (1994–1995) at T.U.Graz (Austria) in the framework of ECTS-exchange

List of the five most relevant publications within the last five years

D Allaerts, **J Meyers**, 2014. Wind farm performance in conventionally neutral atmospheric boundary layers with varying inversion strengths. J. Phys.: Conf. Ser., 524, art no 012114.

J Meyers, C Meneveau, 2013. Flow visualization using momentum and energy transport tubes and applications to turbulent flow in wind farms. Journal of Fluid Mechanics, 715, 335-358.

Vervecken, L., Camps, J., **Meyers, J.** (2013). Accounting for wind-direction fluctuations in Reynolds-averaged simulation of near-range atmospheric dispersion. Atmospheric Environment, 72, 142-150.

J Meyers, C Meneveau, 2012. Optimal turbine spacing in fully developed wind-farm boundary layers. Wind Energy, 15 (2), 305-317

M Calaf, C Meneveau, **Meyers**, 2010. Large eddy simulation study of fully developed wind-turbine array boundary layers. Physics of Fluids, 22 (1), art no 015110

Ides Bauwens Nazka Mapps – BELGIUM - FLANDRES
Brief description of the main domain of research
The main research interests of Ides Bauwens are: - Spatial analysis based on remote sensing and GIS - Development of advanced interactive mapping applications He has expertise on: - Processing, georeferencing, segmentation, classification and modelling of raw spatial data (satellite imagery, vector data, aerial imagery). Specific research expertise in interpretation and analysis of these data followed by the creation of added value for study and advice. - Combination of the processed data (open data, remote sensing, statistical data, crowd-sourced) & GIS with web & mobile applications. - Making the bridge between engineering and ict. Research on the whole traject: processing and analyis of data, interpretation, visualisation and communication of spatial data.
Relevant professional experience
October 2012 – Present Managing Partner Nazka mapps January 2006 – September 2012 - Project Manager/Engineer Eurosense, Remote Sensing Applications (RSA) department June 2004 – November 2005 - Researcher at VITO (Flemish Institute for Technological Research) and KULeuven **Active role as project manager/engineer for several Earth Observation related European research projects (described in section 6)**
Relevant degrees
1996 – 2002 MSc in Bio-Engineering, Land Management and Forestry, with honours from the Catholic University of Leuven (BE)
List of the five most relevant publications within the last five years
Bauwens, I., Franke, J., Gebreslasie, M., Dlamini, S., Ahmed, F., & Vounatsou, P. (2011). MALAREO - Earth Observation in Malaria Vector Control and Management FP7 space conference “Let’s embrace space.” **Bauwens, I**., Franke, J., & Gebreslasie, M. (2011). (pp. 3–6). Earth Observation to support malaria control in southern Africa IEEE International Geoscience and Remote Sensing Symposium. Stephenne N, **I Bauwens**, M Rahm & N Dosselaere, (2011). Monitoring the reopening of roads in the Democratic Republic of Congo with Earth Observation data. EARSeL eProceedings, 10(2): 131-148. Stephenne N., Tambuyzer H., **Bauwens I.** (2010) Supporting authorities in multi-risk prevention: assessing damages and potential affected people. Abstract accepted for the proceedings of the TIEMS 18th Annual Conference 2011, Bucharest, Romania from 7th-10th June 2011. Stephenne N., Tambuyzer H., **Bauwens I.,** Dosselaere N., Rusu L. (2011). Monitoring European human security: quantitative and qualitative multi-risk assessment on affected people, damages and impact. Proceedings of the TIEMS 18th Annual Conference 2011, Bucharest, 7th-10th June 2011.

Alexis DUTRIEUX
ATM-PRO – BELGIUM - WALLONIA

Brief description of the main domain of research

The main research interests of Alexis DUTRIEUX are related to the development of software & decision maker tools in varied fields such as, atmospheric processes, air pollution and wind energy assessment. The main focus in Atmospheric Modelling is on the meso-gamma scale.

Relevant professional experience

Since 1995, Dr. Alexis DUTRIEUX is the managing director of ATM-PRO which is an environmental consulting & software development company specialized in ATMospheric PROcesses (www.atmpro.be).

Alexis DUTRIEUX is also invited Professor at Université Catholique de Louvain in its Polytechnic School, in Louvain-la-Neuve, Belgium.

Relevant degrees

Alexis DUTRIEUX has a PhD in physics, orientation climatology, from the Université Catholique de Louvain, Louvain-la-Neuve, in Belgium. He has also a MBA in innovation technology from Hautes Ecoles de Commerce (HEC) Saint-Louis in Brussels Belgium and a MBA in enterprise creation & development from Université Libre de Bruxelles - Solvay Business School, in Brussels, Belgium.

List of the five most relevant publications within the last five years

Together with GDF-Suez, ATM-PRO presented recently a study in the ICEM2013 about “What can we learn from an application of the mesoscale meteorological model “maestro wind” to an existing wind farm?”. This study investigates in particular the question of the time period to be considered while looking at long term estimates of energy yield. This will be a basis for further investigation in the framework of the present project.

Ariane Frère CENAERO – BELGIUM - WALLONIA
Brief description of the main domain of research
Ariane Frère is an aeronautical engineer specialized in Computation Fluid Dynamics. The main fields of research are: - Wind turbine design - CFD modelling - Urban wind modelling - Large eddy simulations
Relevant professional experience
A. Frère has 6 years of experience in the wind sector. 3 years in General Electric Wind in wind turbine blade design and 3 years in Cenaero in CFD modelling of vertical axis wind turbine (VAWT) and on urban wind modelling with commercial tools and with OpenFoam. She is currently working on Large Eddy Simulations (LES) and on the implementation of wall models in the Discontinuous Galerkin method developed in Cenaero, Argo DG. A. Frère is currently working as PhD engineer on WMLES.
Relevant degrees
A. Frère has a master degree in Mechanical Engineering and is currently working on a PhD.
List of the five most relevant publications within the last five years
A. Frère, K. Hillewaert, H. Sarlak, R. F. Mikkelsen, "Cross-Validation of Numerical and Experimental Studies of Transitional Airfoil Performance", 33rd ASME Wind Energy Symposium, 5-9 January 2015, Kissimmee (Florida), USA **A. Frère**, K. Hillewaert, C. Carton, "Large-Eddy Simulations of wind turbine airfoils computed with the Discontinuous Galerkin Method", ETC11: European Turbomachinery Conference, March 23-26 2015, Madrid, Spain **A. Frère**, C. Goffaux, B. Parmentier, "Wind loads on isolated building: comparison of experimental and numerical approaches", CWE2014: 6th International Symposium on Computational Wind Engineering, June 8 - 12 2014, Hamburg, Germany S.Buckingham, C. Goffaux, **A. Frère**, D.Jacquet, L. Geron, "CFD simulation of the three-dimensional effects induced by the NOx photocatalytic degradation around an isolated building", BS2013: 13th International Conference of the International Building Performance Simulation Association., August 25-30 2013, Chambery, France **A. Frère**, K. Hillewaert, C. Goffaux, "Aerodynamic design of a high solidity canted Vertical Axis Wind Turbine with OpenFoam", SOWE2013: First Symposium on OpenFOAM in Wind Energy, March 20-21 2013, Oldenburg, Germany.

Bernhard Lange Fraunhofer IWES – GERMANY
Brief description of the main domain of research
The main research interests of Bernhard Lange are: - Wind measurements – experiments in forested terrain; - Offshore site assessment – including the aspects of offshore experiments (data recording and evaluation), the application of lidar technology offshore in particular, as well as offshore meteorology; - Numerical modelling.
Relevant professional experience
since August 2009 - Head of Department 'Wind farm planning and operation' - Fraunhofer Institute for Wind Energy and Energy System Technology IWE, leading a team of 33 scientists; Project responsible for several national and European research and development projects with public and private funding Lectures at the University of Kassel Member of the steering committee of EERA Wind Member of TP Wind and co-chair of working group 1 'wind conditions' April 05 – July 09 - Head of research group 'Information and Prediction Systems' – Fraunhofer Institute for Wind Energy and Energy System Technology IWES (until 2009 named ISET Institut für Solare Energieversorgungstechnik) Jan 04 – March 05 Head of Research Area 'Offshore Meteorology and Wind Farm Modelling'– University of Oldenburg, Germany Sept. 00 – March 05 Researcher – University of Oldenburg, Germany August 00 - Dec. 04 Freelance Consultant – BL-Consult, Oldenburg, Germany July 98 – July 00 Researcher - Department of Wind Energy and Atmospheric Physics at Risø National Laboratory, Denmark. Nov. 97 – June 98 Project Manager - Wind World af 1997 A/S, Aalborg, Denmark March 97 - Aug. 97 Guest Researcher - Department of Wind Energy and Atmospheric Physics at Risø National Laboratory, Denmark
Relevant degrees
1998 – 2002 - PhD – University of Oldenburg, Germany / Risø National Laboratory, Denmark. Title: "Modelling the Marine Boundary Layer for Offshore Wind Power Utilisation" 1988 – 1996 - MSc in Physics - University of Konstanz, Germany; University of Edinburgh, United Kingdom und University of Oldenburg, Germany
List of the five most relevant publications within the last five years
Gesino, A.J., **B. Lange**, K. Rohrig: Large scale integration of offshore wind power through wind farm clusters. in: WWEA (ed.): Wind Energy International 2010/2011. World Wind Energy Association, Bonn, Germany, 2011 C.A. Quintero, K. Knorr, **B. Lange**, H.-G. Beyer: Characterisation and Modeling of the Variability of the Power Output of Aggregated Wind Farms. in: WWEA (ed.): Wind Energy International 2009/2010. World Wind Energy Association, Bonn, Germany, 2009, 355-361 Kiviluoma, Juha, Meibom, Peter, Tuohy, Aidan, Troy, Niamh. Milligan, Michael, **Lange, Bernhard**, Gibescu, Madeleine, O'Malley, Mark: Short term energy balance with increasing levels of wind energy. IEEE Transactions on Sustainable Energy (accepted for publication) Holttinen, Hannele, Peter Meibom, Antje Orths, **Bernhard Lange**, Mark O'Malley, John Olav Tande, Ana Estanqueiro, Emilio Gomez, Lennart Söder, Goran Strbac, J Charles Smith and Frans van Hulle. Impacts of large amounts of wind power on design and operation of power systems, results of IEA collaboration. Wind Energy, Vol. 14, no. 2 (2011), pp. 179-192 Holttinen, H.; Orths, A.G.; Eriksen, P.B.; Hidalgo, J.; Estanqueiro, A.; Groome, F.; Coughlan, Y.; Neumann, H.; **Lange, B**.; Hulle, F.; Dudurych, I.; , "Currents of change," Power and Energy Magazine, IEEE , vol.9, no.6, pp.47-59, Nov.-Dec. 2011 doi: 10.1109/MPE.2011.942351

Detlev Heinemann
University of Oldenburg – GERMANY

Brief description of the main domain of research

Dr. Heinemann‘s work focuses on Energy Meteorology, i.e. on meteorological aspects of the use of renewable energies. He established this topic in the German research community and today leads a group of 30 researchers dedicated to this subject. His research spectrum encompasses both solar and wind power related work on resource assessment, forecasting and modelling of wind flow and solar irradiance.

Relevant professional experience

Dr. Heinemann is the head of the Energy Meteorology research group at Oldenburg University and has managed numerous national and international research projects related to wind and solar power systems with emphasis on meteorological aspects. He was the co-ordinator of two European research projects.

Dr. Heinemann was the co-founder and first chairman of the Center for Wind Energy Research (ForWind) at the universities Oldenburg, Hannover and Bremen and is currently one of its scientific directors. He represents Oldenburg University in the European Academy of Wind Energy (EAWE) and the European Renewable Energy Centers Agency (EUREC).

Relevant degrees

Diploma, Meteorology, Kiel, 1983
PhD, Physics, Oldenburg, 1990

List of the five most relevant publications within the last five years

von Bremen, L., Saleck, N., and **Heinemann, D**.: Enhanced regional forecasting considering single wind farm distribution for upscaling. Journal of Physics, Conf. Series, 75, 2nd Conf. Science of Making Torque from Wind, Copenhagen, Denmark, 2007.

Sušelj, K., Sood, A., and **Heinemann, D**. Influence of the large scale circulation on the North Sea wind climate e-WINDENG, 1–45, 2007.

Sušelj, K., Sood, A., and **Heinemann, D**.: North Sea Near-Surface Wind Climate and Its Relation to the Large-Scale Circulation Patterns. Theoretical and Applied Climatology, 99, 403– 419, 2010.

Junk, C., von Bremen, L., Kühn, M., Späth, S., and **Heinemann, D**.: Comparison of Postprocessing Methods for the Calibration of 100-m Wind Ensemble Forecasts at Off- and Onshore Sites. J. Appl. Meteor. Climatol., 53, 950–969, 2014.

Shimada, S., Ohsawa, T., Kogaki, T., Steinfeld, G., and **Heinemann, D**.: Effects of Sea Surface Temperature Accuracy on Offshore Wind Resource Assessment using a Mesoscale Model. Wind Energy, in press, 2014.

Valerijs Bezrukovs
Institute of Physical Energetics/Fizikalas energetikas instituts (IPE) – LATVIA

Brief description of the main domain of research

Dr.ing. sc. Valerijs Bezrukovs - is a senior researcher and he has more than 35 years' experience in the field of electric engineering and electric machines design. Last 20 years he has been involved in studies related to the estimation of wind energy potential distribution in Latvia.
The main research areas of Valerijs Bezrukovs and his research team are:

- wind measurement with metrological masts and lidars;
- wind shear modelling.

Relevant professional experience

- Senior Researcher, Latvian Academy of Sciences Institute of Physical Energetics, Div. Electrical Machines
- Senior Researcher and Chief Engineer of the Ventspils International Radio Astronomy Centre

- Expert of Latvian Council of Science in the energetics
- Member of CRAF (Committee on Radio Astronomy Frequencies, an Expert Committee of the European Science Foundation (ESF)),
- Senior Researcher, FP7 project NORSEWIND (Northern seas wind index database) (2009 – 2013).
- Senior Researcher, ESF Project Nr. 1DP/1.1.1.2.0/13/APIA/VIAA/033 (2013-2015) «Assessment of the wind energy potential in Latvia and the effect of the wind power generation on the environment».
- Senior Researcher, National Research programme 2010-2013. Technologies for Innovative Production and Use of Energy Resources and Provision of Low Carbon Emissions by Means of Renewable Energy Resources, Support Measures for the Mitigation of Enviromental and Climate Degradation - LATENERGI
- He is author or co-author of more than 100 scientific papers and patents.

Relevant degrees

Dr.sc.ing. degree in Electrical machine area since 1992

List of the five most relevant publications within the last five years

V.Bezrukovs, Vl.Bezrukovs, N.Levins (2011). Problems in Assessment of Wind Energy Potential and Acoustic Noise Distribution when Designing Wind Power Plants. Scientific Journal of Riga. Technical University, series. 13, Environmental and Climate Technologies, vol.6, 2011, pp. 9-16. doi: 10.2478/v10145-011-0001-7.

Bezrukovs V., Bezrukovs Vl., Lizuma L. (2014): The landscape influence on the wind energy distribution in height on the Latvian coast of the Baltic Sea". Energy Procedia, 2014. DOI 10.1016/j.egypro.2014.07.073.

Peteris Shipkovs, Valery Bezrukov, Vladislav Pugachev, Vladislavs Bezrukovs (2013): Research of the wind energy resource distribution in the Baltic region Original Research Article. Renewable Energy, Volume 49, January 2013, Pages 119-123. DOI:10.1016/j.renene.2012.01.050

Bezrukovs V., Bezrukovs Vl., Shipkovs P., Lizuma L. (2013)"Investigation of wind energy distribution in height in Latvia". In the proceedings of the 2013 ISES Solar World Congress. November 3-7, 2013. Cancun, Mexico. In print. http://www.swc2013.org/isesswc/index.php/en/

V P Bezrukovs, V V Bezrukovs and A J Zacepins. (2014): Comparative efficiency of wind turbines with different heights of rotor hubs: performance evaluation for Latvia. 2014 J. Phys.: Conf. Ser. 524 012113 doi:10.1088/1742-6596/524/1/012113

Vladislavs Bezrukovs Ventspils University College (VUC) – LATVIA
Brief description of the main domain of research
Vladislavs Bezrukovs research is focused on: - onshore wind measurements using different types of measuring systems (meteorological mast and lidars); - modelling of wind shear - long term data corrections.
Relevant professional experience
- Researcher in the Engineering Research Institute "Ventspils International Radio Astronomy Center" of Ventspils University College since 2008. - Expert in the CRAF (Committee on Radio Astronomy Frequencies, an Expert Committee of the European Science Foundation (ESF)) since 2008. - Lecturer in the Ventspils University College, Informational Technology Faculty since 2006. - Researcher and programmer in the “ELMAG” Ltd, since 1999. - Professional experience: wind studies in Latvia since 2005. Wind measurements using NRG sensors and loggers, Lidar ZephIR, lidar Pentalum; metrological mast installation; processing of wind measurement data. - Site assessment and consultancy for wind farms development since 2008, including wind measurements, wind farms acoustic noise assessment, efficiently estimation of wind farms. - Programming C#, Fortran, Visual Basic; Matlab modelling; image processing. - Researcher in the FP7 project NORSEWIND (Northern seas wind index database), 06/2009 – 07/2012.
Relevant degrees
02/2005 – present. PhD in Applied Physics Department, Cork Institute of Technology, Cork, Ireland. 09/2003 –07/2005 Master’s Degree in computer science and computer engineering. Riga Technical University, Riga, Latvia. 09/2000 – 07/2003 Bachelor's Degree in computer science and computer engineering. Riga Technical University, Riga, Latvia.
List of the five most relevant publications within the last five years
V P Bezrukovs, V V Bezrukovs and A J Zacepins. (2014): Comparative efficiency of wind turbines with different heights of rotor hubs: performance evaluation for Latvia. 2014 J. Phys.: Conf. Ser. 524 012113 doi:10.1088/1742-6596/524/1/012113. Bezrukovs V., Bezrukovs Vl., Lizuma L. (2014): The landscape influence on the wind energy distribution in height on the Latvian coast of the Baltic Sea”. Energy Procedia, 2014. DOI 10.1016/j.egypro.2014.07.073. Shipkovs P., Bezrukov V., Pugachev V., Bezrukovs Vl., Silutins, V. „Research of the wind energy resource distribution in the Baltic region”. (2013) Renewable Energy Volume 49, January 2013, Pages 119- 123. DOI: 10.1016/j.renene.2012.01.050. V. Bezrukovs, Vl. Bezrukovs, Wind speed and energy at different heights on the Latvian coast of the Baltic Sea. (2012) Proceedings of World Renewable Energy Forum (WREF) 2012, Denver, Colorado May 13- 17, 2012, 8 pp. P. Shipkovs, V. Bezrukov, V. Pugachev, Vl. Bezrukovs, V. Silutins. “Measurements of the wind energy resource in the Latvia”. (2011) World Renewable Energy Congress 2011 – Sweden 8 – 11 May, 2011, Linkoping, Sweden.

Uldis Bethers University of Latvia (UL), Faculty of Physics and Mathematics – LATVIA
Brief description of the main domain of research
Uldis Bethers has more than 20 years of experience in wide range of environmental modelling fields including oceanography, geological modelling and hydrology, including application of Numerical Weather Prediction and Regional Climate Model Data. He oversaw the implementation of WRF model in LMMETP.
Relevant professional experience
Uldis Bethers has participated in numerous international and local scientific projects in both scientific and administrative capacities. - Scientific Project Lead (2013 - 2015) - ERAF 2013/0054/2DP/2.1.1.1.0/13/APIA/VIAA/007 „Development of methods and design of toolkit for management of heterogenic geologic information”; - Lead scientist (2012 - 2015) - EU 7th Framework Programme “MyOcean2 - Prototype Operational Continuity for the GMES Ocean Monitoring and Forecasting Service”; - Scientific Project Lead (2009 - 2012) - 2009/0212/1DP/1.1.1.2.0/09/APIA/VIAA/060, “Establishment of interdisciplinary scientist group and modelling system for groundwater research”. - Scientific Lead of Work Package Nr.2. (2010 - 2012) - ETS2010/6, “Gulf Of Riga as a resource for WIND energy” (GORWIND); - Lead scientist (2009 - 2012) - EU 7th Framework Programme “MyOcean- Development and pre-operational validation of upgraded GMES Marine Core Services and capabilities”.
Relevant degrees
PhD in physics, University of Latvia (1993)
List of the five most relevant publications within the last five years
J. Seņņikovs, **U. Bethers**. Uncertainty of temperature and precipitation projections for the future climate of Latvia // NORDIC WATER 2010 The XXVI Nordic Hydrological Conference Hydrology: From research to water management 9-11 August 2010 Riga, Latvia, pp.161-162 **U. Bethers**, J. Sennikovs. Ensemble modelling of impact of climate change on runoff regime of Latvian rivers // 18th World IMACS / MODSIM Congress, Cairns, Australia 13-17 July, 2009, pp. 3900-3906 Janis Virbulis, **Uldis Bethers**, Tomas Saks, Juris Sennikovs, Andrejs Timuhins. Hydrogeological model of the Baltic Artesian Basin // Hydrogeology Journal. Official Journal of the International Association of Hydrogeologists. Springer-Verlag Berlin Heidelberg 2013. Received: 8 February 2012 /Accepted: 24 February 2013 D. Cepīte-Frišfelde, **U. Bethers**, J. Seņņikovs, A. Timuhins. Penalty Function for Identification of Regions with Similar Climatic Conditions. Climate Change in Latvia and Adaption to It, 2012, pp. 8 - 16, ISBN 978-9984-45-440-5 P. Bethers, **U. Bethers**, J. Seņņikovs, A. Timuhins. On Driving External Hydrological Models by Regional Climate Models. Climate Change in Latvia and Adaption to It, 2012, pp. 17 - 31, ISBN 978-9984-45-440-5

Lita Lizuma Latvian Environment, Geology and Meteorology Centre (LEGMC) – LATVIA
Brief description of the main domain of research
Principal investigator form LEGMC, Lita Lizuma has got solid academic education in meteorology and climatology in University of Latvia. Lita Lizuma is author and co-author of more than 20 scientific papers and research reports, has active research in the following research domains: climate of Latvia, climate change, renewable energy resources. Lita's team has many years of experience and knowledge of methods and standards of wind meteorology and climatology in Latvia. LEGMC will be involved in wind measurement site selection, wind measurement campaigns, assessment of wind data and site evaluation, evaluation and analyses of short-term and long-term wind data.
Relevant professional experience
Lita Lizuma's professional background includes an extensive experience in meteorological measurements in situ employed as a manager of Meteorological Unit in the University of Latvia (1994-2003) and as senior specialist in LEGMC (2003-today). The main task and responsibility in LEGMC included also expert analysis of meteorological data to provide reliable statistics and consulting support to meet customer demands both in governmental and private sectors. Lita Lizuma was an involved in the European Regional Development Fund Project - Analysis of energy resource production possibilities within Latvian territorial waters and the EEZ. (2011-2013)
Relevant degrees
PhD degree in Geography
List of the five most relevant publications within the last five years
Lizuma L., A.Briede and M.Klavins (2010). Long-term changes of precipitation in Latvia. Hydrology Research, Vol.41.No 3-4, 241-252 Avotniece, Z., Rodinov, V., **Lizuma, L**., Briede, A., Kļaviņš, M. (2010). Trends in the frequency of extreme climate events in Latvia. Baltica, 23 (2), 135-148. Kriauciuniene, J., Meilutyte-Barauskiene, D., Reihan, A., Koltsova, T., **Lizuma, L.** & Sarauskiene, D. (2012) Variability in temperature, precipitation and river discharge in the Baltic States. Boreal Environment Research Vol.17. No 2, 150-162. **Lizuma L**., Avotniece Z., Rupainis S., Teilans A. (2013). Assessment of the Present and Future Offshore Wind Power Potential: A Case Study in a Target Territory of the Baltic Sea Near the Latvian Coast. The Scientific World Journal, Article ID 126428, 10 pages, 2013. doi:10.1155/2013/126428. **Lizuma L.,** Rupainis S., Teilans A. (2013). Mapping of Offshore Wind Climate and Site Conditions for the Baltic Sea within Latvian Territorial Waters. Advances Material Research. Vol. 827, 153-156. Bezrukovs V., Bezrukovs V., **Lizuma L.** (2013). The landscape influence on the wind energy distribution in height on the Latvian coast of the Baltic Sea. 2013 International Conference on Alternative Energy in Developing Countries and Emerging Economies (2013 AEDCEE). Proceeding of Abstracts May 30-31, 2013, Bangkok, Thailand.

José Palma UPORTO – PORTUGAL
Brief description of the main domain of research
His scientific interests are Fluid Mechanics, in general, with emphasis on computer modelling and field measurements of wind flow over mountainous regions, since the early nineties.
Relevant professional experience
José Palma is an Associate Professor, with Aggregation, at University of Porto (Faculty of Engineering). He is the coordinator of Centre for Wind Energy and Atmospheric Flows (CEsA) and a member of EERA JP Wind Energy, heavily involved in the promotion of the New European Wind Atlas. He has participated in more than 40 projects (both R&D and consultancy) at national and international level, in many different roles, from participant to main responsible. His research work is available over more than 30 articles, 100 communications, edited books and consultancy reports. Ten PhD and more than 50 MSc theses were concluded under his supervision.
Relevant degrees
2009 - Aggregation in Mechanical Engineering (Fluid Mechanics), FEUP – University of Porto 1989 - PhD, Imperial College (London) 1983 - MSc in Heat Transfer and Energy Conversion, Instituto Superior Técnico (Lisboa, Portugal), 1981 - Graduation in Mechanical Engineering (Applied Thermodynamics), Instituto Superior Técnico (Lisboa, Portugal)
List of the five most relevant publications within the last five years
A.Silva Lopes, J**. M. L. M. Palma**, J. Viana Lopes, Improving a Two-Equation Turbulence Model for Canopy Flows Using Large-Eddy Simulation Boundary-Layer Meteorology, 2013, 1-27 L.T. Paiva, C. Veiga Rodrigues and **J.M.L.M. Palma**, Determining wind turbine power curves based on operating conditions Wind Energy, 2013, 1-13 C. Abiven, **J.M.L.M. Palma**, O. Brady, High-frequency field measurements and time-dependent computational modelling for wind turbine siting. Journal of Wind Engineering & Industrial Aerodynamics, 2011,Vol. 99, 123-129. C. Veiga Rodrigues and **J.M.L.M. Palma**. WindS@UP: The e-Science Platform for WindScanner.eu (2014). Journal of Physics: Conference Series}, Vol. 524, pp. 012006, N. 1, Jun. C. Veiga Rodrigues and **J.M.L.M. Palma**, Estimation of turbulence intensity and shear factor for diurnal and nocturnal periods with an URANS flow solver coupled with WRF (2014). Journal of Physics: Conference Series, Vol. 524, pp. 012115, N. 1, Jun.

Álvaro Rodrigues
INEGI – PORTUGAL

Brief description of the main domain of research

The main research interests of Álvaro Rodrigues are:

- Wind resource assessment tools and methodologies. Uncertainty reduction;
- Wind farm layout optimization;
- Short term forecasting of wind farms output;
- Wind farm perform verification procedures;
- Simulation of atmospheric flows for wind turbine micro-siting in complex terrain.

Relevant professional experience

Since 2008 - Chief Technical Officer at Novenergia II, an investment fund in projects for renewable energies conversion (PV and wind energy projects in several countries).

Since 1992 - Assistant Professor at Engineering Faculty, Porto University. Fluid Mechanics and Renewable Energies at undergraduate, MSc and Doctoral programs.

Other relevant professional experience:

- Researcher, Wind Energy and Atmospheric Flow Research Centre, CEsA, FEUP.
- Responsible for the establishment of INEGI's Wind Energy Department (1994) and for the planning and running of the pioneer wind measuring campaigns in Portugal (e. g. Project JOUR-0067-C).
- Consultant in the renewables field for utilities, regional energy agencies, municipalities and most of the wind farms promoters and investors in wind energy in Portugal.
- Consultant in the evaluation and development of many wind farm projects in Brazil, Spain, France, Italy, Bulgaria, Hungary and Poland.

Relevant degrees

1992 - PhD in Mechanical Engineering (Wind Energy), University of Porto (UP). Porto.

1998 - Advanced Management Program, AESE, Business and Management School. Porto.

1982 - "Von Karman Institute Diploma Course", Von Karman Institute. Brussels.

1979 - Graduation (5 years course) in Mechanical Engineer. Porto.

List of the five most relevant publications within the last five years

Ribeiro, C., Cardoso, N., Matos, J., **Rodrigues, Á.**, Silva, B., "analysis of the impact of the height of the measurement levels used in wind resource assessment." EWEA 2012.

Matos, J., Marques, M., Silva, B., Ribeiro, C., **Rodrigues, Á.**, "The role of power curtailment on the uncertainty of energy yield estimates." EWEA 2010.

Silva, B., Marques, M., Matos, J., **Rodrigues, Á.,** Pereira, R., Bastos, Á., Cabral, P. Saraiva, F., "Wind power in Portugal - from the potential to the integration in the electric grid." EWEA 2010.

Palma, J.M.L.M., Castro, F. A., Ribeiro, L. F., **Rodrigues Á.**, Pinto, A. P.,"Linear and Nonlinear Models in Wind Resource Assessment and Wind Turbine Micro-Siting in Complex Terrain (2008)". Journal of Wind Engineering and Industrial Aerodynamics, Vol. 96, pp. 2308-2326.

Rodrigues, C.V., Santos, C.M.S., Palma, J.M.L.M., Castro, F.A., Miranda, P.M.A., **Rodrigues, Á.**, "Short Term Forecasting of a Wind Farm Output using CFD". EWEC 2008.

Pedro Viterbo
IPMA – PORTUGAL

Brief description of the main domain of research

His main research activities on IPMA are focused on:

- Earth System modelling,
- Climate modelling,
- climate variability;
- Remote sensing of land surface quantities.

The main research activities carried out when he worked at the ECMWF were:

- Development of parameterization of the Planetary Boundary Layer;
- Development of several versions of the land surface mode;
- Data assimilation of land surface processes.
- Coupling of wind and ocean wave models.

Relevant professional experience

2012/05 - now – IPMA, I.P Head, Department of Meteorology and Geophysics

2005/10 -2012/04 – Instituto de Meteorologia, I.P. Scientific Coordinator

1986/10-2005/09 - European Centre for Medium-Range Weather Forecasts Scientist (1986-1997); Senior Scientist (1998-2000); Principal Scientist (2001-2005)

He has participated in several national and international research projects. He is author or co-author of 79 papers; sum of times cited: 7182; average citations per article: 90.91; h-index 37.

Relevant degrees

1996- PhD in Physics, University of Lisbon, Portugal; Thesis Title: 'The representation of surface processes in general circulation models'.

List of the five most relevant publications within the last five years

Boussetta, S., G. Balsamo, A. Beljaars, A.-A. Panareda, J.-C. Calvet, C. Jacobs, B. van den Hurk, **P. Viterbo**, S. Lafont, E. Dutra, L. Jarlan, M. Balzarolo, D. Papale, G. van der Werf, 2013: Natural land carbon dioxide exchanges in the ECMWF Integrated Forecasting System: Implementation and offline validation. *J. Geophys. Res.*, 118, 5923-5946.

Weedon, G.P., S. Gomes, **P. Viterbo**, J. Shuttleworth, E. Blyth, H. Österle, J.C. Adam, N. Bellouin, O. Boucher, and M. Best, 2011: Creation of the WATCH Forcing Data and its use to assess global and regional reference crop evaporation over land during the twentieth century. *J. Hydrometeor.,* 12, 823-848, doi:10.1175/2011JHM1369.1.

Dutra, E., V.M. Stepanenko, G. Balsamo, **P. Viterbo**, P.M.A. Miranda, D. Mironov, and C. Schaer, 2010: An offline study of the impact of lakes on the performance of the ECMWF surface scheme. *Bor. Env. Res.*, 15, 100-112.

Dutra, E., G. Balsamo, **P. Viterbo**, P.M.A. Miranda, A.C.M. Beljaars, C. Schär, and K. Elder, 2010: An improved snow scheme for the ECMWF land surface model: descrition and offline validation. *J. Hydrometeor.*, 11, 899-916, doi: 10.1175/2010JHM1249.1.

Hazeleger, W., C. Severijns, T. Semmler, S. Ştefănescu, S. Yang, X. Wang, K. Wyser, J.M. Baldasano, R. Bintanja, P. Bougeault, R. Caballero, E. Dutra, A.M.L. Ekman, J.H. Christensen, B. van den Hurk, P. Jimenez, C. Jones, P. Kållberg, T. Koenigk, R. McGrath, P. Miranda, T. van Noije, J.A. Parodi, T. Schmith, F. Selten, T. Storelvmo, A. Sterl, H. Tapamo, M. Vancoppenolle, **P. Viterbo**, U. Willén, 2010: EC-Earth: A Seamless Earth System Prediction Approach in Action. *Bull. Amer. Meteorol. Soc.*, 91, 1377-1388, doi: 10.1175/2010BAMS2877.1.

Ana Estanqueiro LNEG – PORTUGAL
Brief description of the main domain of research
She is an expert in several wind energy sub-areas being some of her research activities in the area of Grid Integration of RES. The experience of the PI together with experiences of LNEGs' team, which includes mesoscale modeling; wind resource assessment in complex terrains, urban environment and offshore; development of national and regional wind potential atlases and development of planning tools for RES deployment; results in a solid contribution for this project.
Relevant professional experience
Ana Estanqueiro is a Senior Researcher at LNEG since 1987 being at this date coordinator of the Energy Analysis and Networks Unit, and invited Professor at the University of Lisbon. She launched the CTE 88 – Turbinas Eólicas (branch of the standard body IEC TC 88) in Portugal in 1995 and was its President since then. Starting in 1996, she organised and led the Wind Energy R&D group, including its scientific orientation, administrative governing and project leading at INETI (now LNEG). Ana organized the Portuguese adhesion to the IEA Wind Implementing Agreement in 1998, being the representative Portuguese Member since then. 24 years' experience in several areas of the wind technology, research and development. Scientific coordinator of LNEGs team in several EU projects.
Relevant degrees
PhD in Mechanical Engineering, MSc in Mechanical engineering and 5 year degree in Electrical and Computer Engineering, all by the Technical University of Lisbon – IST.
List of the five most relevant publications within the last five years
Estanqueiro A., A. Couto, L. Rodrigues and R. Marujo: A wind resource assessment method for floating deep offshore wind turbines. IET Renewable Power Generation, p. 5 (in press, 2014). Marujo R., P. Costa, **A. Estanqueiro** "Validation of an offshore wind atlas using the satellite data available at the coastal regions of Portugal". Wind Engineering, Volume n.4, 2013. Fernandes M., P. Costa, **A. Estanqueiro** "Using a Data Assimilation Scheme to Improve Offshore Wind Resource Assessments". Proceedings of the Offshore Wind and other marine renewable Energy in Mediterranean and European Seas". OWEMES Conference, Rome, September 2012 Marujo R., P. Costa, M. Fernandes, **A. Estanqueiro** "Application of a Statistical spatial model for validation the offshore wind resource". Proceedings of the European Offshore Wind Conference, Amsterdam, November 2011. Simões T., P. Costa, **A. Estanqueiro**: A methodology for the identification of the sustainable wind potential. The Portuguese case study. Power Systems Conference and Exposition, 2009. PSCE '09. IEEE/PES, Seattle, USA; 04/2009

Javier Sanz Rodrigo
CENER – SPAIN

Brief description of the main domain of research

Javier Sanz Rodrigo has more than 10 years experience in the wind engineering field with specialization in wind resource assessment and forecasting. His research interests are: boundary layer meteorology, wind engineering, CFD, wind power forecasting and remote sensing.

Relevant professional experience

2007-Actual: Senior Researcher (CENER)

- He is coordinator of the FP7-WAUDIT project, the IEA Task 31 WAKEBENCH on wind farm modeling benchmarks. He has been Work Package Leader in european projects FP6-ANEMOS. Plus, FP7-SAFEWIND and will also lead a WP in the FP7-EERA-IRP project related to benchmarking of offshore wind turbine design models. He has co-authored more than 50 publications in wind engineering publications and conferences and chaired sessions in the European Wind Energy Conference and International Conference on Wind Engineering.

2004-2007: Research Engineer (von Karman Institute)

- He led the wind tunnel and CFD modeling activites related to the aerodynamic design of the Princess Elizabeth Belgian research station in Antarctica.

2000- 2003: Wind Resource Analyst (GAMESA)

- He has been involved in the development of wind farms in Italy and Greece.

Relevant degrees

2011 PhD on Engineering Sciences (Université Libre de Bruxelles), "On Antarctic Wind Engineering".

2004 MsC on Fluid Dynamics (von Karman Institute)

2000 Industrial (Mechanical) Engineer (U. Carlos III of Madrid)

List of the five most relevant publications within the last five years

Sanz Rodrigo J, Anderson P (2013) Investigation of the Stable Atmospheric Boundary Layer at Halley Antarctica. *Boundary Layer Meteorol*. 148: 517-539

Sanz Rodrigo J, Borbón Guillén F, Gómez Arranz P, Courtney MS, Wagner R, Dupont E. (2013) Multi-Site Testing and Evaluation of Remote Sensing Instruments for Wind Energy Applications. *Renewable Energy* 53: 200-210

Sanz Rodrigo J, Buchlin J-M, van Beeck J, Lanaerts JTM, van den Broeke MR (2013) Evaluation of the Antarctic Surface Wind Climate from ERA Reanalyses and RACMO2/ANT Simulations Based on Automatic Weather Stations, *Climate Dynamics* 40: 353-376

Sanz Rodrigo J, Frias L, Stoffels N, von Bremen L (2013) Wind power predictability assessment from large to local scale. *EWEA-13 proceedings*, Vienna, February 2013

Correia P, Lozano S, Chavez R, Loureiro Y, Cantero E, Benito P, **Sanz Rodrigo J** (2013) Wind Characterization at the Alaiz – Las Balsas Experimental Wind Farm using high-resolution simulations with mesoscale models. Development of a “low cost” methodology that address promoters needs. *EWEA-13 proceedings*, Vienna, February 2013

Jorge Navarro
CIEMAT – SPAIN

Brief description of the main domain of research

The main branches of research are:

- High resolution modelling and model-data comparison, with application to wind field research and energy resources. This line involves state of the art statistical methodologies for the analysis of observations and model outputs, and downscaling approaches, both statistical and dynamical.
- Use of global and regional models focused on climate variability and climate change issues. These activities focus on larger timescales that the ones stated above, from interannual to multi centennial within the last millennium. Approaches to problem solving comprise the analysis of global model simulations, regional model simulations, observations and reconstructions from proxy data.

Relevant professional experience

Research
11/1996 - today Researcher position at CIEMAT
09/1994 - 11/1996 Junior consultant in different companies

Visiting scientist
06 - 08/2011 National Center of Atmospheric Research (Boulder, Colorado-USA).
06 – 08/2012 Giessen University (Hesse, Germany).
Supervisor of 4 PhD.

Relevant degrees

2002: Ph. D. disertation at the Universidad Politécnica de Madrid (UPM). Title: Implicaciones de la Anisotropía de la Turbulencia Atmosférica en la Medida de Velocidad mediante Anemometría Sónica.

1995: Master in Environmental Engineering and Management (Madrid – EOI: http://www.eoi.es/portal/en/master-enviromental-engineering-management-madrid-essentials).

1994: MSc. in Physics at the UCM. (Branch of Atmospheric Physics).

List of the five most relevant publications within the last five years

Jiménez, P. A., J. F. González-Rouco, **J. Navarro**, J. P. Montávez, and E. García-Bustamante. Quality-control and bias correction of high resolution surface wind observations from automated weather stations. J. Atmosph. Ocean. Techn., 27, 1101-1122, 2010.

Jiménez, P. A., J. F. González-Rouco, E. García-Bustamante, **J. Navarro**, J. P. Montávez, J. Vilá-Guerau de Arellano, J. Dudhia and A. Muoz-Roldán. ”Surface Wind Regionalization over Complex Terrain: Evaluation and Analysis of a High-Resolution WRF Simulation”. J. Appl. Meteorol. Climatol., 49, 268-287, 2010.

Garcia-Bustamante, E., J. F. Gonzalez-Rouco, **J. Navarro**, E. Xoplaki, J. Luterbacher, P. A. Jimenez, J. P. Montavez, A. Hidalgo and E. E. Lucio-Eceiza. Relationship between wind power production and North Atlantic atmospheric circulation in the Iberian Peninsula: methods, uncertainties and long-term downscaled variability, Clim. Dynamics, 40, 935-949, 2013.

Garcia-Bustamante, E., J. F. Gonzalez-Rouco, **J. Navarro**, E. Xoplaki, P. A. Jimenez & J. P. Montavez. North Atlantic atmospheric circulation and surface wind in the Northeast of the Iberian Peninsula: uncertainty and long term downscaled variability. *Clim. Dyn.*,38, 141-160, 2012.

Jimenez, P.A., J. Dudhia, J.F. González-Rouco, J.P. Montávez, E. García-Bustamante, **J. Navarro**, J. Vilà-Guerau de Arellano, and A. Muñoz-Roldán. An evaluation of WRF's ability to reproduce the surface wind over complex terrain based on typical circulation patterns. *Journal of Geophysical Research-Atmospheres*, 118, 7651–7669, 2013.

Fidel González Rouco
UCM – SPAIN

Brief description of the main domain of research

His main research interests are high resolution modeling and model-data comparison with application to wind field research and energy resources and use of global and regional models focused on climate variability and climate change issues.

Relevant professional experience

Research
02/2011 - today Profesor Titular at Universidad Complutense de Madrid
11/2008 - 02/2011 Profesor Contratado Doctor at Universidad Complutense de madrid
01/2004 - 10/2008 Ramon y Cajal contract: research associate at Universidad Complutense de Madrid.
01/2002 - 12/2003 Assistant proffesor at Universidad Complutense de Madrid.
07/2001 - 12/2001 Researcher position at Universidad Complutense de Madrid.
10/2000 - 06/2001 Researcher position at GKSS Research Centre.
10/1998 - 09/2000 Postdoc. GKSS Reseach Centre. Founds: Ram´on Areces Foundation.

Teaching
01/2004 - today Statistics and Physics (1st year Physics degree). Phd. courses on Climate Variability .
01/2002 - 12/2003 Assistant proffesor at Universidad Complutense de Madrid
10/1997 - 09/1998 Profesor for Statistics at Colegio Universitario Domingo de Soto (UCM)
1997 to 1998 Associated proffesor T1 P6. UNED.
1996 to 1997 Teacher for Physics at Centro Estudios Unversitarios

Relevant degrees

12/1997: Ph. D. disertation at the Universidad Complutense de Madrid (UCM).Title: Modelo de Predicción de la Precipitación Peninsular en Climas Perturbados.

1993: Diploma thesis at the Universidad Complutense de Madrid (UCM).Title: Detección de señales atmosféricas en series de recorrido del viento de Madrid.

1986 to 1991: Masters degree in Physics at the UCM. (Branch of Atmospheric Physics).

List of the five most relevant publications within the last five years

Jiménez, P. A., **J. F. González-Rouco**, J. Navarro, J. P. Montávez, and E. García-Bustamante. ”Quality-control and bias correction of high resolution surface wind observations from automated weather stations”. J. Atmosph. Ocean. Techn., 27, 1101-1122, doi: 10.1175/2010JTECHA1404.1, 2010.

Jiménez, P. A., **J. F. González-Rouco**, E. García-Bustamante, J. Navarro, J. P. Montávez, J. Vilá-Guerau de Arellano, J. Dudhia and A. Muoz-Roldán. ”Surface Wind Regionalization over Complex Terrain: Evaluation and Analysis of a High-Resolution WRF Simulation”. J. Appl. Meteorol. Climatol., 49, 268-287, doi: doi: 10.1175/2009JAMC2175.1 , 2010.

Garcia-Bustamante, E., **J. F. Gonzalez-Rouco**, J. Navarro, E. Xoplaki, J. Luterbacher, P. A. Jimenez, J. P. Montavez, A. Hidalgo and E. E. Lucio-Eceiza. ”Relationship between wind power production and North Atlantic atmospheric circulation in the Iberian Peninsula: methods, uncertainties and long-term downscaled variability”, Clim. Dynamics, 40, 935-949, DOI: 10.1007/s00382-012- 1451-8, 2013.

Garcia-Bustamante, E., **J. F. Gonzalez-Rouco**, J. Navarro, E. Xoplaki, P. A. Jimenez and J. P. Montavez. "North Atlantic atmospheric circulation and surface wind in the Northeast of the Iberian Peninsula: uncertainty and long term downscaled variability" *Clim. Dyn.*.,**38**, 141-160 , doi:10.1007/s00382-010-0969-x, 2012

Neukom, R., J. Gergis, D. Karoly, H. Wanner, M. Curran, J. Elbert**, F. Gonzalez-Rouco**, B. Linsley, A. D. Moy, I. Mundo, C. C. Raible, E. J. Steig, T. van Ommen,T. Vance, R. Villalba, J. Zinke1 and D. Frank, "Inter-hemispheric temperature variability over the past millennium", *Nature Climate Change*, **4**, 362-267, 2014

Joan Cuxart
UIB – SPAIN

Brief description of the main domain of research

Joan Cuxart Rodamilans has more than 20 years of experience in Atmospheric-Boundary Layer research, including modelling, field experimentation and data analysis.

Relevant professional experience

2002-now: Senior Researcher and Lecturer at the University of the Balearic Islands.

1991-2001: Senior Meteorologist (Level WMO-A, Spanish Meteorological Institute)

1985- 1990: Technical Meteorologist (Spanish Meteorological Institute WMO B and C levels)

He has been working at the CNRM at Toulouse (France) and at the University of Oregon State in Corvallis. He has been supervisor of 4 PhD theses and has more than 50 peer- review papers in the journals of his discipline.

Relevant degrees

1989: Degree in Physics (University of Barcelona)

1997: PhD in Physics (University of Barcelona, European Mention)

List of the five most relevant publications within the last five years

Jiménez, M. A., & **Cuxart, J.** (2014). A study of the nocturnal flows generated in the north side of the Pyrenees. *Atmospheric Research*, *145*, 244-254.

A. A. M. Holtslag; G. Svensson; P. Baas; S. Basu; B. Beare; A. C. M. Beljaars; F. C. Bosveld; **J. Cuxart**; J. Lindvall; G. J. Steeneveld; M. Tjernstrom; B. J. H. Van de Wiel. B (2013). Stable Atmospheric Boundary Layers and Diurnal Cycles: Challenges for Weather and Climate Models. *Bull. Amer. Meteor. Soc.*, 94, 1691–1706

Martinez, D.; Whiteman, C.D.; Hoch, S.W.; Lehner, M. and **Cuxart, J.** (2013) The upslope-downslope flow transition on a basin sidewall. Journal Of Applied Meteorology And Climatology, 52, 2715–2734

Cuxart, J.; Jiménez, M.A.; Martínez, D.; Molinos, F.; Cunillera, J.; Palau, J.L. (2012) Study of mesobeta basin flows by remote sensing. Boundary-Layer Meteorology, 143, 143-158

Cuxart, J., & Jiménez, M. A. (2012). Deep radiation fog in a wide closed valley: Study by numerical modeling and remote sensing. *Pure and applied geophysics*, *169* (5-6), 911-926.

Francisco J. Doblas-Reyes IC3 – SPAIN
Brief description of the main domain of research
His main research interest is the development and assessment of dynamical and statistical methods for the probabilistic prediction of global and regional climate on time scales ranging from a few weeks to several years.
Relevant professional experience
December 2009 to present: ICREA research professor at the Institut Català de Ciències del Clima (IC3, Barcelona, Spain), working as senior scientist and head of the Climate Forecasting Unit. From March 2000 to November 2009: Research scientist at the European Centre for Medium-Range Weather Forecasts (ECMWF, Reading, UK).
Relevant degrees
Ph. D. in Physics with honors at the Universidad Complutense of Madrid (Spain). Thesis entitled "Atmospheric blocking: GCM simulation and associated precipitation patterns" (in Spanish). Post-graduate courses at the University Complutense of Madrid and at Météo-France. MSc degree in Physics at the Universidad Complutense of Madrid (Spain). BSc degree in Mathematics at the Universidad Complutense of Madrid.
List of the five most relevant publications within the last five years
Doblas-Reyes, F.J., I. Andreu-Burillo, Y. Chikamoto, J. García-Serrano, V. Guemas, M. Kimoto, T.Mochizuki, L.R.L. Rodrigues and G.J. van Oldenborgh (2013). Initialized near-term regional climate change prediction. Nature Communications, 4, 1715, doi:10.1038/ncomms2704. Guemas, V., **F.J. Doblas-Reyes**, I. Andreu-Burillo and M. Asif (2013). Retrospective prediction of the global warming slowdown in the past decade. Nature Climate Change, 3, 649-653, doi:10.1038/nclimate1863. **Doblas-Reyes, F.J**., J. García-Serrano, F. Lienert, A. Pintó Biescas and L. R. L. Rodrigues (2013). Seasonal climate predictability and forecasting: status and prospects. WIREs Climate Change, 4, 245-268, doi:10.1002/WCC.217. Kirtman, B., S. Power, J.A. Adedoyin, G.J. Boer, R. Bojariu, I. Camilloni, **F.J. Doblas-Reyes**, A.M. Fiore, M. Kimoto, G.A. Meehl, M. Prather, A. Sarr, C. Schär, R. Sutton, G.J. van Oldenborgh, G. Vecchi and H.J. Wang (2013). Near-term climate change: Projections and predictability. Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (Eds), 953-1028, Cambridge University Press. Thomson, M.C., **F.J. Doblas-Reyes**, S.J. Mason, R. Hagedorn, S.J. Connor, T. Phindela, A.P. Morse and T.N. Palmer (2006). Malaria early warnings based on seasonal climate forecasts from multi-model ensembles. Nature, 439, 576-579.

Arnau Folch BSC – SPAIN
Brief description of the main domain of research
The main domains of research of the PI include meso and micro-scale scale atmospheric flow modelling; meteorological forecast and modelling of atmospheric transport phenomena (with emphasis on volcanic ash clouds and pollutant dispersion at urban scale).
Relevant professional experience
Dr. Arnau Folch is a senior researcher at the CASE Department of the BSC-CNS. Author of >50 scientific publications, he leads the "Environmental Simulations" research group composed by 2 Post-docs, 5 PhD students and 2 junior researchers. He has participated in >25 national and European competitive research projects and in multiple contracts with private companies. Professional experience covers also project management and execution, PhD supervision, editorial board of scientific journals and convening multiple sessions in international meetings (EGU, AGU, IUGG, etc). Since 2011 he acts as liaison officer of the International Union of Geophysics and Geodesy (IUGG) at the World Meteorological Organization (WMO) and leads the Commission on tephra Hazard Modelling of the International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI).
Relevant degrees
Degree in physics (1994) and PhD in applied mathematics (2000) at the Technical University of Catalonia (UPC). Spanish Ramón y Cajal (2008-2012) and IC3 (2012-2014) programme.
List of the five most relevant publications within the last five years
Barcons, J., **A. Folch**, A. Sairouní, J.R. Miró, A comparison between 3DVAR and LAPS analysis assimilating surface observations and their effects on a short-range high resolution forecast, Tellus A, under review, 2014. **Folch, A**., L. Mingari, S. Osores, E. Collini, Modeling volcanic ash resuspension. Application to the 15-16 October 2011 outbreak episode in Central Patagonia, Argentina, Nat. Hazards Earth Syst. Sci, doi:10.5194/nhessd-1-4565-2013, 2013. Costa, A., **A. Folch**, G. Macedonio, Density-driven transport in the umbrella region of volcanic clouds: Implications for tephra dispersion models, Geophysical Research Letters, 40, 1–5, doi:10.1002/grl.50942, 2013. **Folch, A**., A review of tephra transport and dispersal models: evolution, current status and future perspectives, Journal of volcanology and Geothermal Research, doi: 10.1016/j.jvolgeores.2012.05.020, 2012. **Folch, A**., A. Costa, S. Basart, Validation of the FALL3D ash dispersion model using observations of the 2010 Eyjafjallajökull volcanic ash clouds, Atmospheric Environment, doi:10.1016/j.atmosenv.2011.06.072, 2011.

Stefan Ivanell
UU (Uppsala University) - SWEDEN

Brief description of the main domain of research

The main research interest of the PI is numerical simulations of wind turbine wakes, stability of the tip spiral originating from a wind turbine, simulations of wind turbine wake interaction, simulations of production variation inside large wind farms and optimization of large wind farms. The experience of the PI together with experiences of the project team, which include long experience of mesoscale simulations, results in a solid base to perform micro/meso scale coupling, which is a needed step to fully understand flows around wind farms and flows in complex terrain and forested areas. Work that will be supported by measurements within this project.

Relevant professional experience

2014- Director, StandUp for Wind, KTH and Uppsala University, Sweden.
2013- Head of Section, Wind Energy Section, Uppsala University Campus Gotland, Sweden.
2013- Associate Professor, Dep. of Earth Sciences, Wind Energy Section, Uppsala University Campus Gotland.
2011- Assistant Professor, Dep. of Mechanics, KTH, Stockholm, Sweden.
2012-2013 Director, KTH Wind Centre, KTH, Stockholm, Sweden.
2010-2013 Associate Professor, Energy Technology, Gotland University.
2008-2013 Director, Energy Technology, Gotland University.
2002-2010 Lecturer and Researcher in wind power technology, Gotland University.

Relevant degrees

2009 - PhD in the subject area of Mechanics, Royal Institute of Technology, KTH, Stockholm. Sweden. Thesis title: Numerical Computations of Wind Turbine Wakes.
2005 - Licentiate of Engineering in the subject area of Fluid Mechanics, KTH, Stockholm.
2002 - Master of Science in Engineering Physics, KTH, Stockholm, Sweden. Focus on fluid mechanics and numerical methods.

List of the five most relevant publications within the last five years

Nilsson, K., Shen, W.Z., Sørensen, J.N., Breton, S.-P., **Ivanell, S**. Validation of the actuator line method using near wake measurements of the MEXICO rotor. Wind Energy, 2014.

Nilsson, K., **Ivanell, S**., Hansen, K.S., Mikkelsen, R., Sørensen, J.N., Breton, S.-P., Henningson, D. Large-eddy simulations of the Lillgrund wind farm. Wind Energy, 2014.

Breton, S.-P., Nilsson, K., Olivares-Espinosa, H., Masson, C., Dufresne, L., **Ivanell, S**., Study of the Influence of Imposed Turbulence on the Asymptotic Wake Deficit in a Very Long Line of Wind Turbines. Renewable Energy, 10.1016/j.renene.2014.05.009, 2014.

Ivanell, S., Mikkelsen, R., Sorensen, J.N., Henningson, D.S., Stability analysis of the tip vortices of a wind turbine, Wind Energy, 2010, 13(8): p. 705-715.

Ivanell, S., Sorensen, J.N., Mikkelsen, R., Henningson, D.S., Analysis of Numerically Generated Wake Structures. Wind Energy, 2009, 12(1): p. 63-80. Other relevant information

Stefan Söderberg WeatherTech Scandinavia AB (WeatherTech) – SWEDEN
Brief description of the main domain of research
The main research interest of the PI is numerical simulations of the atmospheric boundary layer and applications of mesoscale numerical models for a better understanding of conditions vital for the wind power industry. Areas of special interest are the boundary layer turbulence structure, icing conditions, and farm-farm interactions. The experience of the PI together with experiences of the project team provide a solid base to perform micro/meso scale coupling, which is a needed step to fully understand flows around wind farms and flows in complex terrain and forested areas.
Relevant professional experience
2006-present Founder and model specialist, WeatherTech Scandinavia AB. 2005-2006 Model specialist, Swedish Weather Center AB. 2004-2006 Research fellow, Department of Meteorology, Stockholm University.
Relevant degrees
2004 - PhD in dynamic Meteorology, Stockholm University, Stockholm, Sweden; Thesis title: Mesoscale Dynamics and Boundary-Layer Structure in Topographically Forced Low-Level Jets. 2001 - Licentiate in dynamic Meteorology, Stockholm University, Stockholm, Sweden. 1999 - Master of Science in Meteorology, Uppsala University, Uppsala, Sweden.
List of the five most relevant publications within the last five years
Bergström, H., H. Alfredsson, J. Arnqvist, I. Carlén, J. Fransson, E. Dellwik, H. Ganander, M. Mohr, A. Segalini, and **S. Söderberg** (2013). Wind power in forests - Winds and effects on loads, Elforsk report 13:09. Bergström, H., E. Olsson, **S. Söderberg**, P. Thorsson, and P. Undén (2013). Wind power in cold climates - Ice mapping methods. Elforsk report 13:10. **Söderberg, S**., M. Baltscheffsky, and H. Bergström (2013). Estimation of production losses due to icing - a combined field experiment and numerical modelling effort. EWEA annual event 2013, Vienna. Baltscheffsky, M. and **S. Söderberg** (2013). Using a mesoscale atmospheric model to study wind turbine wakes and farm-farm interaction. EWEA offshore 2013, Frankfurt. Saarnak, E, H. Bergström, and **S. Söderberg** (2014). Uncertainties connected to long-term correction of wind observations. Wind Engineering, Vol 38, 233-248.

Erman Terciyanlı
TÜBİTAK Marmara Research Center Energy Institute - TURKEY

Brief description of the main domain of research

Erman focuses his research on wind meteorology, energy markets and forecasting. He has expertise on developing efficient databases and on developing wind mapping studies. Erman is highly experienced on managing experiment campaigns and collecting remote data.

Relevant professional experience

Project Manager of the following projects:
• 2014 – 2017 - Design and Optimization of a Wind Powered Pumped Storage Hydroelectric Power Plant (funded by Turkish Electricity Transmission Company)
• 2010 - 2013 - Monitoring and Forecasting System Development for Wind Generated Electrical Power in Turkey (funded by Republic of Turkey Ministry of Energy and Natural Sources General Directorate of Renewable Energy);

Participated in the following projects:
• Development of Wind Map of Turkey for Grid Extension Project of Transmission System Operator;
• IRPWIND: İntegrated Research Programme Wind Energy.

Relevant degrees

MSc. and PhD (exp. 2015) in Industrial Engineering

List of the five most relevant publications within the last five years

Terciyanlı, E., Demirci, T., Küçük, D., Saraç, M., Çadırcı, I., Ermiş, M., "Enhanced Nationwide Wind-Electric Power Monitoring and Forecast System," *IEEE Transactions on Industrial Informatics*, vol. 10, no. 2, pp. 1171-1184, May 2014.

Terciyanlı, E., Demirci, T., Küçük, D., Buhan, S., Özkan, M. B., Er Köksoy, C., Koç, E., Kahraman, C., Haliloğlu, A. B., Demir, T., Günindi, M., Gökmen, M., Karayılanoğlu, Z. 2013. "The Architecture of a Large-Scale Wind Power Monitoring and Forecast System". IEEE International Conference on Power Engineering, Energy and Electrical Drives. İstanbul, Turkey.

Özkan, M. B., Küçük, D., **Terciyanlı, E.**, Buhan, S., Demirci, T., Karagöz, P. 2013. A Data Mining-Based Wind Power Forecasting Method: Results for Wind Power Plants in Turkey. International Conference on Data Warehousing and Knowledge Discovery. Prag, Czech Republic. L. Bellatreche and M.K. Mohania (Eds.): DaWaK 2013, LNCS 8057, pp. 268–276.

Özkan, M. B., **Terciyanlı, E.**, Küçük, D., Buhan, S., Demirci, T., Yıldız, C., Günindi, M. 2013. "Verification of a Real Time Wind Power Monitoring and Forecast System for Turkey". IET Renewable Power Generation Conference. Beijing, China.

Buhan, S., **Terciyanlı, E.**, Özkan, M. B., Küçük, D., Haliloğlu, A. B., Demirci, T., Tuna, H., Ünsal, H. 2013. "Verification of a Very Short Term Wind Power Forecasting Algorithm for Turkish Transmission Grid". IEEE International Conference on Power Engineering, Energy and Electrical Drives. İstanbul, Turkey.

Ferhat Bingöl
İzmir Institute of Technology (IZTECH) – TURKEY

Brief description of the main domain of research

The main domains of research are: wind engineering, wind meteorology, wind GIS. Ferhat has focused his research activities on wind turbine measurements, complex terrain and forest measurements and offshore satellite wind data analysis.

Relevant professional experience

06/2014 - Ongoing Assistant professor İzmir Institute of Technology, Urla, İzmir, Turkey
06/2010 - 05/2014 - Researcher (Assistant professor) Denmark Technical University, Wind Energy Department, Roskilde, Denmark
07/2005- 08/2009 - Research Assistant Risø National Laboratory for Sustainable Energy, Wind Energy Division, Roskilde, Denmark
Participated in

- Global Wind Atlas (funded by Danish Energy Authority) ongoing project
- MERMAID: Innovative Multi-purpose offshore platforms: planning, design and operation. (FP7)
- ICEWIND: Forecast of wind, waves and icing at Icelandic Sea (Finland, Iceland, Norway, Sweden)
- EU NORSEWInD: Northern Seas Wind Index database (FP7)
- EU-South Baltic OFF.E.R: South Baltic Offshore Energy Regions (FP7)
- WindScanner: Full Scale Laser Wind Scanner: Design, construction and testing (ENERI2010)
- Wind Profiles above Forests (Danish Energy Authority)
- EU-UpWind: Design of very large wind turbines (8-10MW), both onshore and offshore (FP6)

Relevant degrees

08/2006 - 08/2009 - PhD in Wind Turbine Meteorology, Thesis:" Complex Terrain and Wind Lidars", Denmark Technical University, Lyngby, Denmark.
08/2002 - 08/2005 - MSc. in Wind Energy, Thesis:" Adapting Laser Doppler Anemometers into Wind Energy", Denmark Technical University, Roskilde, Denmark.
09/1993 - 08/1998 - B.Sc. in Aeronautical Engineering, Istanbul Technical University, Maslak, Istanbul.

List of the five most relevant publications within the last five years

Off-shore Wind Atlas of the Central Aegean Sea: A simple comparison of NCEP/NCAR RE-analysis data, QuickSCAT and ENVISAT Synthetic Aperture Radar (SAR) by use of Wind Atlas Method **Bingöl, Ferhat** ; Hasager, Charlotte Bay ; Karagali, Ioanna ; Badger, Jake ; Badger, Merete ; Foussekis, Dimitri ; Nielsen, Morten; Topouzelis, Konstantinos part of: Proceedings of EWEA 2012 - European Wind Energy Conference & Exhibition, 2012, EWEA - The European Wind Energy Association, Presented at: EWEA 2012 - European Wind Energy Conference & Exhibition, Copenhagen Type: Article in proceedings (Peer reviewed)

SAR-based Wind Resource Statistics in the Baltic Sea Hasager, Charlotte Bay ; Badger, Merete ; Pena Diaz, Alfredo ; Larsén, Xiaoli Guo ; **Bingöl, Ferhat** in journal: Remote Sensing (ISSN: 2072-4292) (DOI: http://dx.doi.org/10.3390/rs3010117), vol: 3, issue: 1, pages: 117-144, 2011 Type: Journal article (Peer reviewed)

Lidar Scanning of Momentum Flux in and above the Atmospheric Surface Layer Mann, Jakob ; Pena Diaz, Alfredo ; **Bingöl, Ferhat** ; Wagner, Rozenn ; Courtney, Michael in journal: Journal of Atmospheric and Oceanic Technology (ISSN: 0739-0572) (DOI: http://dx.doi.org/10.1175/2010JTECHA1389.1), vol: 27, issue: 6, pages: 959-976, 2010

Light detection and ranging measurements of wake dynamics Part I: One-dimensional Scanning **Bingöl, Ferhat** ; Mann, Jakob ; Larsen, Gunner Chr. in journal: Wind Energy (ISSN: 1095-4244) (DOI: http://dx.doi.org/10.1002/we.352), vol: 13, issue: 1, pages: 51-61, 2010 Type: Journal article (Peer reviewed)

Conically scanning lidar error in complex terrain **Bingöl, Ferhat** ; Mann, Jakob ; Foussekis, Dimitri in journal: Meteorologische Zeitschrift (ISSN: 0941-2948) (DOI: http://dx.doi.org/10.1127/0941-2948/2009/0368), vol: 18, issue: 2, pages: 189-195, 2009 Type: Journal article (Peer reviewed)

Ismail Hakki Tuncer
Middle East Technical University - Center for Wind Energy (METUWIND) – TURKEY

Brief description of the main domain of research
The current research interest of the principal investigator is the computation of atmospheric flows coupled with mesoscale weather prediction models. His research fields are, in general, computational aerodynamics, unsteady flows and high performance computing.
Relevant professional experience
Faculty member and researcher at METU since 1998.
Relevant degrees
Ph.D. degree in Aerospace Engineering from Georgia Institute of Technology in 1988 M.S. degree from Purdue University, in Mechanical Engineering in 1983.
List of the five most relevant publications within the last five years
Unsteady Atmospheric Turbulent Flow Solutions Coupled With A Mesoscale Weather Prediction Model, E. Leblebici, G. Ahmet and **I.H. Tuncer**, RUZGEM'2013 Conference on Wind Energy Science and Technology, Ankara, Turkey, Oct. 3-4, 2013 Terrain Fitted Turbulent Flow Solutions Coupled with a Mesoscale Weather Prediction Model , G. Ahmet, E. Leblebici and **I.H. Tuncer**, EAWE 9th PhD Seminar on Wind Energy in Europe, Visby, Sweden, Sept 18-20, 2013 Wind Potential Estimations Based on Unsteady Turbulent Flow Solutions Coupled with a Mesoscale Weather Prediction Model, E. Leblebici, G. Ahmet and **I.H. Tuncer**, 7th Ankara International Aerospace Conference, Ankara, Turkey, Sept. 11-13, 2013 E. Leblebici, G. Ahmet and **İ.H. Tuncer**, Atmospheric Turbulent Flow Solutions Coupled with a Mesoscale Weather Prediction Model, Eccomas special Interest Conference, 3rd South-East European Conference on Computational Mechanics, Kos Island Greece, June 12-14, 2013 Atmospheric Turbulent Flow Solutions Coupled with a Mesoscale Weather Prediction Model, Engin Leblebici, Gokhan Ahmet and **Ismail H. Tuncer**, 4th conference on The science of Making Torque from Wind, Oldenburg, Germany, Oct 9-11, 2012

Mehmet Karaca
Istanbul Technical University (ITU) – TURKEY

Brief description of the main domain of research

Main research areas of Professor Karaca are related with atmospheric sciences. These could be listed as Atmospheric and oceanic modelling, Global and regional climate change, Air pollution and quality, urban climate.

Relevant professional experience

1992 – 1993 : Assistan Professor, Istanbul Technical University

1993 – 1999 : Assoc. Professor, Istanbul Technical University

1999– : Professor, Istanbul Technical University

2012- : Rector of Istanbul Technical University

Relevant degrees

Undergraduate: Istanbul Technical University, Meteorology Department, 1979

Msc. : Istanbul Technical University, Meteorology Department, 1981

Msc. : University of California, Los Angeles (UCLA), Atmospheric and Oseanic Department, 1985

Phd. : University of California, Los Angeles (UCLA), Atmospheric and Oseanic Department, 1990

List of the five most relevant publications within the last five years

Tayanç, M., İm, U., Doğruel, M.,and **Karaca, M**. (2009) "Climate Change in Turkey for the half Century", Climatic Change, 94, 3-4, 483-502.

Kindap, T., Turunçoğlu, U., Chen, S-H., Ünal, A., and **Karaca, M**. (2009) "Potential Threats from a likely nuclear power plant accident: a climatological trajectory analysis and tracer study", Water, Air & Soil Pollution, 198, 1-4, 393-405.

Küçük, M., Kahya, E., Cengiz, T. and **Karaca, M.** (2009) "North Atlantic Oscillation Influences on Turkish Lake-Levels", Hydrological Processes, 23, 6, 893-906.

Ömer Emre Orhan
Borusan – TURKEY

Brief description of the main domain of research

The main research interests of Ömer Orhan are wind meteorology, wind energy assessment and turbulence.

Relevant professional experience

Since 2012 - Borusan

- Wind Engineering Manager - Wind and yield assessment of 455 MW consisting of 7 different wind projects
- Wind Team Leader - Assessment of 2000 MW and Due Diligence of 1000 MW international and national projects

2010-2012 - Wind Team Leader -Fichtner Gmbh Co. KG

- Energy Yield Assessments, Met Mast Installations, Technical Specifications of Wind Turbines

Relevant degrees

PhD in Aerospace Engineering (METU)

M.Sc. in Mechanical Engineering (METU)

List of the five most relevant publications within the last five years

Orhan, Ö.E., Ünal, U., and Taşkın, E. "Understanding the Complex Flow Inside a Wind Farm Using Advanced CFD Methodology". ICCI 2013.

Orhan, Ö.E., and Ünal, U. "Comparison of Forest Parameters for an Operational Wind Farm using CFD". METU Rüzgem Conference, 2013.

Orhan, Ö.E., Ahmet, G. "A Comperative Study of virtual and operational met mast data". Torque 2014.

Orhan,Ö.E. Ünalan, Ç. Bayırlar, B., Ahmet, G. "Assessment and Comparison of an Operational Wind Farm using Wind Atlas and CFD methods", ICCI, İstanbul-Turkey, April 2012

Orhan,Ö.E., Ahmet, G., Yıldız, M. Uzol,O. "A Comparative Study of Yield Assessment Using Data from an Operational Wind Farm and the Predictions Obtained Using Wind Atlas Methodology and CFD Calculations", Torque Conference, October 2012

12. Financial plan: sum of year 1-5. (Please note that eligibility of costs is subject to national rules and regulations)

Note: NEWA consortium has considered sum of 1-5 years. The rules of the national funding agencies have not been harmonized, so not all funding agencies allow for project duration of five years. However, almost all partners have managed to extend the duration of their national project, except Flanders, who has a maximum duration of three years. The activities of Flanders can be tailored to be executed in three years, but we will work to try to extend the duration of their national project as well.
The four last rows have been added to the table in order to show the total budget and funding rate.

Acronym:	NEWA						
No.	Project coordinator DTU	Partner 2 DNV-GL	Partner 3 Vestas	Partner 4 3E	Partner 5 KULeuven	Partner 6 Nazka Mapps	Partner 7 ATM-PRO
Name (principal investigator)	Jakob Man	Lars Landberg	Mark Žagar	Rory Donnelly	Johan Meyers	Ides Bauwens	Alexis Dutrieux
Funding organization	DEA	DEA	DEA	IWT	IWT	IWT	DGO4
Person months (€)[1]	PM=20 231,300	PM=7.6 94,000	PM=4 0	PM=66.8 285,835	PM=12 51,840	PM=25 109,410	PM=37 129,500
Person months (€)[1]	PM=100 708,300						
Person months (€)[1]	PM=23 82,800						
Person months (€)[1]	PM=28 113,400						
Person months (€)[1]	PM=13 80,100						
Person months (€)[1]	PM=35 187,200						
Person months (€)[1]	PM=17 99,000						
Personnel total (€)	1,502,100	94,000		285,835	51,840	109,410	129,500
Consumables (€)	82,800	30,000		10,500			43,874
Equipment (€)	162,000			9,450		2,000	38,500
Travel (€)	164,984	10,000	25,000	5,600		2,400	14,000
Other direct costs (€)[2]	144,242					8,000	28,000

				128,100	7,200		
Overheads (€)	769,949			77,933	14,400	33,600	18,738
Total requested budget (€)	2,826,074	134,000	25,000	517,418	73,440	155,410	272,612
Funding Rate (%)	90	40	40	70	72	80	70
Total requested Budget per country (€)	**Denmark: 2,985,074**			**Belgium-F: 746,268**			**Belgium-W: 519,973**
Total Budget	3,140,083	335,000	62,500	739,169	102,000	194,263	389,445
Total Budget per country (€)	Denmark:3,537,583			Belgium-F:1,035,432			Belgium-W: 719,260

[1] Please detail number of person months and € requested. Please use one cell per person to provide this information.

[2] e.g. subcontracting, provisions, licensing fees; publications

Acronym:	NEWA						
No.	Partner 8 Cenaero	Partner 9 IWES	Partner 10 ForWind	Partner 11 IPE	Partner 12 ERI VIRAC	Partner 13 UL	Partner 14 LEGMC
Name (principal investigator)	Ariane Frère	Bernhard Lange	Detlev Heinemann	Valerijs Bezrukovs	Vladislavs Bezrukovs	Uldis Bethers	Lita Lizuma
Funding organization	DGO4	BMWi	BMWi	LAS	LAS	LAS	LAS
Person months (€)[1]	PM=26 137,850	PM=3 24226	PM=83 522,549	PM=33.9 130275	PM=16 46509	PM=2.4 5932	PM=26.4 61,375
Person months (€)[1]		PM=20 140263		PM=10.9 31652	PM=34.5 100416	PM= 43 89281	
Person months (€)[1]		PM=54.5 341080		PM=10.9 31652	PM=17.1 39153		
Person months (€)[1]		PM=8 46353		PM=10.9 31652	PM=17.1 39153		
Personnel total (€)	137,850	551,922	522,549	225,231	225,231	95,214	61,375
Consumables (€)	36,160	9,000	18,450	3,000	1,000	2,607	7,000
Equipment (€)	30,000	327,091	114,800			-	
Travel (€)	15,000	77,590	64,000	38,600	38,600	10,000	10,000
Other direct costs (€)[2]		100,616		29,600	31,600	10,050	96,244
Overheads (€)	28,352	451,630		59,286	59,286	23,574	17,230
Total requested budget (€)	247,361	1,517,849	719,799	355,717	355,717	141,445	191,849
Total requested budget per country (€)		**Germany: 2,237,648**		**Latvia: 1,044,728**			
Funding Rate (%)	75	100	100	100	100	100	100

Total Budget	329,815	1,517,849	719,799	355,717	355,717	141,445	191,849
Total Budget per country (€)		Germany: 2,237,648		Latvia: 1,044,728			

[1] Please detail number of person months and € requested. Please use one cell per person to provide this information.

[2] e.g. subcontracting, provisions, licensing fees; publications

Acronym:	NEWA						
No.	Partner 15 UPORTO	Partner 16 INEGI	Partner 17 IPMA	Partner 18 LNEG	Partner 19 CENER	Partner 20 CIEMAT	Partner 21 UCM
Name (principal investigator)	José Palma	Álvaro Rodrigues	Pedro Viterbo	Ana Estanqueiro	Javier Rodrigo	Jorge Navarro	Fidel González Rouco
Funding organization	FCT	FCT	FCT	FCT	MINECO	MINECO	MINECO
Person months (€)[1]	PM=12 52391	PM= 31 44788	PM=12 19,940	PM=18 17464	PM=15 104,318	PM=36 139526	PM=40 167600
Person months (€)[1]	PM=24 38893	PM=9 20938		PM=18 17464	PM=27 146,045	PM=30 100298	PM=40 138320
Person months (€)[1]		PM=3.6 13033			PM=60 250,364		
Person months (€)[1]					PM=38 129,200		
Person months (€)[1]					PM=13 38,173		
Person months (€)[1]							
Personnel total (€)	91 284	78 759	19,940	34,928	668,100	239,824	305,920
Consumables (€)	4 941	10 000	10,400		34,000		
Equipment (€)	53 829	136 737		24,000	101,033		4,000
Travel (€)	12 000	69 700	5,000	5,000	37,000	15,000	14,920
Other direct costs (€)[2]	22 373	34 000	9000		255,909		
Overheads (€)	36 885	65 839	8,868	12,785	-		
Total requested budget (€)	221 312	395 036	53,208	76,713	1,096,042	254,824	324,840

Total requested budget per country [€]	**Portugal: 746,269**				**Spain: 2,238,806**		
Funding Rate (%)	100	100	100	100	100	100	100
Total Budget	221 312	395 036	53,208	76,713	1,096,042	254,824	324,840
Total Budget per country (€)	Portugal: 746,269				Spain: 2,238,806		

[1] Please detail number of person months and € requested. Please use one cell per person to provide this information.

[2] e.g. subcontracting, provisions, licensing fees; publications

Acronym:	NEWA						
No.	Partner 22 UIB	Partner 23 IC3	Partner 24 BSC	Partner 25 UU	Partner 26 WeatherTech	Partner 27 TUBITAK MRC	Partner 28 IZTECH
Name (principal investigator)	Joan Cuxart	Francisco Doblas-Reyes	Arnau Folch	Stefan Ivanell	Stefan Söderberg	Erman Terciyanlı	Ferhat Bingöl
Funding organization	MINECO	MINECO	MINECO	Energimyndigheten	Energimyndigheten	TUBITAK	TUBITAK
Person months (€)[1]	PM=24 64800	PM=42 151200	PM=54 205200	PM=27 194941	PM=15 113926	PM=62.4 64,000	PM=26.5 12,400
Person months (€)[1]	PM=12 20400			PM=2.4 15723	PM= 12 81014		
Person months (€)[1]				PM=48 263364			
Person months (€)[1]							
Personnel total (€)	85,200	151,200	205,200	474,028	194,941	64,000	12,400
Consumables (€)		4,000		92,064		92,351	
Equipment (€)	32,500	-		215,196	10,811	47,667	82,667
Travel (€)	15,000	10,000	10,000	60,025	21,622	16,667	8,333
Other direct costs (€)[2]	50,000	-		95,846			16,600
Overheads (€)		-		328,005			
Total requested budget (€)	182,700	165,200	215,200	1,265,164	227,373	220,685	120,000
Total requested budget per country [€]				**Sweden: 1,492,537**		**Turkey: 1,042,735**	

Funding Rate (%)	100	100	100	100	80	100	100
Total Budget	182,700	165,200	215,200	1,265,164	284,217	220,685	120,000
Total Budget per country (€)				Sweden: 1,549,381		Turkey: 1,271,391	

[1] Please detail number of person months and € requested. Please use one cell per person to provide this information.

[2] e.g. subcontracting, provisions, licensing fees; publications

Acronym:	NEWA						
No.	Partner 29 METUWIND	Partner 30 ITU	Partner 31 BORUSAN				
Name (principal investigator)	Ismail Tuncer	Mehmet Karaca	Ömer Orhan				
Funding organization	TUBITAK	TUBITAK	TUBITAK				
Person months (€)[1]	PM=108 57600	PM=207.2 104,600	PM=78 176904				
Person months (€)[1]							
Person months (€)[1]							
Person months (€)[1]							
Personnel total (€)	57,600	104,600	176,904				
Consumables (€)	3,333	9,733					
Equipment (€)	50,000	95,667	160,080				
Travel (€)	8,333	16,667	6,000				
Other direct costs (€)[2]		13,133					
Overheads (€)							
Total requested budget (€)	119,266	239,800	342,984				
Total requested budget per country [€]							
Funding Rate (%)	100	100	60				
Total Budget	119,266	239,800	571,640				
Total Budget per							

country (€)					

[1] Please detail number of person months and € requested. Please use one cell per person to provide this information.
[2] e.g. subcontracting, provisions, licensing fees; publications

13. Individual financial plan: sum of year 1-5. (Please note that eligibility of costs is subject to national rules and regulations)

13.1 (please duplicate as necessary, one form per partner)

Note: NEWA consortium has considered sum of 1-5 years. Two columns have been added to the table in order to show the total budget and funding rate.

Partner name:	**DTU**			
Funding organisation	Danish Energy Agency (Energy Development and Demonstration Programme)			
Country	Denmark			
	Total budget	Funding Rate %	Requested Budget	Justification
Personnel (€)	1,669,000	90	1,502,100	Staff categories: - Professor (Prof): WP1: 7 pm, WP2: 9 pm, WP 3: 2 pm, amount to be used for the common good of the NEWA consortium: 2pm - Senior Research Scientist (SRS): WP1: 4 pm, WP2: 45 pm, WP 3: 40 pm, WP4: 9 pm, amount to be used for the common good of the NEWA consortium: 2pm - Postdoc/Research scientist (PD/RS): WP2: 3 pm, WP 3: 12 pm, WP4: 8 pm - PhD (PhD): WP 3: 28 pm - Development Engineer (DE): WP2: 8, WP4: 5 pm - Technician (Tech): WP2: 35 pm, - Administrative staff (Adm): WP1: 10 pm, amount to be used for the common good of the NEWA consortium:7pm
Consumables (€)	92,000	90	82,800	WP2: EUR 60,000 (Spare parts for maintenance of Windscanners) WP4: EUR 32,000 (Educational fee PhD)
Equipment (€)	180,000	90	162,000	WP2: EUR 180,000 (50 Sonics, data acquisition hardware, temperature and humidity sensors to be used in NEWA intensive),
Travel (€)	183,315	90	164,984	app. 50 travels to yearly project and WP meetings (1 to 5 persons travelling per meeting), 10 travels to conferences, travels in connection with the 5 experiments).
Other direct costs (€)	160,269	90	144,242	Amount to be used for the common good of the NEWA consortium: EUR 34.000 (travels in connection with coordination of the project), EUR 50.000 (interaction with ESA/ECMWF), EUR 26.269 (part of lease of NCAR instruments) and EUR 50.000 travels for Advisory board and other invited persons
Overheads (€)	855,499	90	769,949	44% overhead of all costs except equipment costs and amount to be used for the common good of the NEWA consortium other than personnel. Overhead of equipment costs and of the amount to be used for the common good of the NEWA consortium other than personnel will be financed by DTU.
Total budget (€)	3,140,083	90	2,826,074	

Partner name:	**DNV-GL**			
Funding organisation	Danish Energy Agency (Energy Development and Demonstration Programme)			
Country	Denmark			
	Total budget	Funding Rate (%)	Requested Budget	Justification
Personnel (€)	235,000	40	94,000	DNV GL will contribute to all work packages according to the following approximate distribution: WP1 20%; WP2 20%; WP3 50%; WP4 10% Total PM: 7.6 over the 5 year period
Consumables (€)	75,000	40	30,000	Computing for WP3 and 4 on the DNV GL Hornet cluster. A further 50000 EUR worth of computing is contributed free of charge from DNV GL.
Equipment (€)				
Travel (€)	25,000	40	10,000	Attendance in project meetings in all work packages, estimated at 5 trips per year at 1000 EUR per trip
Other direct costs (€)				
Overheads (€)				
Total budget (€)	335,000	40	134,000	

Partner name:	**Vestas**			
Funding organisation	Danish Energy Agency (Energy Development and Demonstration Programme)			
Country	Denmark			
	Total budget	Funding Rate %	Requested Budget	Justification
Personnel (€)	37,500			In-kind contribution WP2:1PM; WP3:3PM
Consumables (€)				
Equipment (€)				
Travel (€)	25,000		25,000	Attendance in project meetings in all work packages, estimated at 5 trips per year at 1000 EUR per trip
Other direct costs (€)				
Overheads (€)				
Total budget (€)	62,500	40	25,000	

Partner name:	**3E**			
Funding organisation	IWT, the Agency for Innovation by Science and Technology			
Country	Belgium - Flanders			
	Total budget	Funding Rate %	Requested Budget	Justification
Personnel (€)	408,336	70	285,835	66.8 MM. 41 MM on model chain development, 21 MM on Model chain validation, 0.8 MM on interactive mapping and 4 MM on management. (WP1=4; WP2=4; WP3=58; WP4=0.8)
Consumables (€)	15,000	70	10,500	software licences etc.
Equipment (€)	13,500	70	9,450	Lidar depreciation
Travel (€)	8,000	70	5,600	1 or 2 staff to 1 or two meeting per year over 5 years
Other direct costs (€)	183,000	70	128,100	Subcontracting for in-house consultants, UGent HPC costs, NEWA contribution 25000
Overheads (€)	111333	70	77,933	As per IWT regulations (20k / person year)
Total budget (€)	739,169	70	517,418	

Partner name:	**KULeuven**			
Funding organisation	IWT, the Agency for Innovation by Science and Technology			
Country	Belgium - Flanders			
	Total budget	Funding Rate %	Requested Budget	Justification
Personnel (€)	72,000	72	51,840	WP2: 12 MM
Consumables (€)				
Equipment (€)				
Travel (€)				
Other direct costs (€)	10,000	72	7,200	computing costs
Overheads (€)	20,000	72	14,400	As per IWT regulations (20k / person year)
Total budget (€)	102,000	72	73,440	

Partner name:	**Nazka Mapps**			
Funding organisation	IWT, the Agency for Innovation by Science and Technology			
Country	Belgium - Flanders			
	Total budget	Funding Rate %	Requested Budget	Justification
Personnel (€)	136,763	80	109,410	WP2:6MM and WP4:19MM
Consumables (€)				
Equipment (€)	2,500	80	2,000	soft-hardware, vps server etc.
Travel (€)	3,000	80	2,400	workshops, seminar, etc. 1 / year for 3 years, (€1500) project meetings, 1 person for 3 years (€1500).
Other direct costs (€)	10,000	80	8,000	purchase EO data, EC management costs
Overheads (€)	42,000	80	33,600	As per IWT regulations (20k / person year)
Total budget (€)	194,263	80	155,410	

Partner name:	**ATM-PRO**			
Funding organisation	Public Service of Wallonia – DGO4 – Department of Energy and Sustainable Building			
Country	Belgium - Wallonia			
	Total budget	Funding Rate %	Requested Budget	Justification
Personnel (€)	185,000	70	129,500	At this stage, we foresee the principal investigator to work on a part time basis on the project. He is supposed to work during the whole 5 years of the project. WP2 : experiments (12 FTE = Full Time Equivalent / 18 PM = Part-Time Month man) WP3 : Model Chain (18 FTE / 30 PM) WP4 : Wind Atlas (7 FTE / 12 PM)
Consumables (€)	62,677	70	43,874	Storage capacity, computer connections, printer consumable, software, burotic, amount to be used for the common good of the NEWA consortium
Equipment (€)	55,000	70	38,500	Mainly power calculation capacity to be put in place at the beginning of and during the project.
Travel (€)	20,000	70	14,000	Expenses for the various meetings foreseen in the project + seminars and participation to some conferences.
Other direct costs (€)	40,000	70	28,000	Intend to hire a researcher to perform statistical analysis of results produced along the project.
Overheads (€)	26,768	70	18,738	10% of personnel+consumables+travel (Equipment + Other costs excluded)
Total budget (€)	389,445	70	272,612	

Partner name:	**Cenaero**			
Funding organisation	Public Service of Wallonia – DGO4 – Department of Energy and Sustainable Building			
Country	Belgium - Wallonia			
	Total budget	Funding Rate %	Requested Budget	Justification
Personnel (€)	183,800	75	137,850	Postdoc/Research scientist (PD/RS) WP3: 22PM; WP5=4PM
Consumables (€)	48,213	75	36,160	25.000€ for HPC cost: CFD computations over extremely large domain and for multiple wind direction, intensity should be performed. These calculations require long (multiple days) and highly parallelized (150 processors) runs. 500€ for buying scientific articles, book Additional costs (1% according to the Walloon Region rule), amount to be used for the common good of the NEWA consortium
Equipment (€)	40,000	75	30,000	Licence for a state-of-the-art commercial CFD solver. Although the project tends to develop an opensource platform, it is important to compare the opensource code to at least one commercial code accepted and validated by the industry.
Travel (€)	20,000	75	15,000	2 international meetings and 1 conference per year
Other direct costs (€)		75		
Overheads (€)	37,802	75	28,352	15% of personnel+consumables+travel (Equipment + Other costs excluded)
Total budget (€)	329,815	75	247,361	

Partner name:	**IWES**			
Funding organisation	German Federal Ministry for Economic Affairs and Energy (BMWi)			
Country	Germany			
	Total budget	Funding Rate %	Requested Budget	Justification
Personnel (€)	551,922	100	551,922	WP1: 3 pm, WP2: 36 pm, WP3: 22.5 pm, WP4: 23 pm, WP5: 1 pm
Consumables (€)	9,000	100	9,000	consumables necessary to carry out experiments (detailed specification to be found in section 9)
Equipment (€)	327,091	100	327,091	equipment necessary to carry out experiments (detailed specification to be found in section 9)
Travel (€)	77,590	100	77,590	travels to yearly project and WP meetings (2 to 5 persons travelling per meeting), travels to conferences and travels in connection with 2 experiments
Other direct costs (€)	100,616	100	100,616	further expenses necessary to carry out experiments (detailed specification to be found in section 9)
Overheads (€)	451,630	100	451,630	around 85% overhead on personnel costs (exact figure changes and to be adjusted over years)
Total budget (€)	1,517,849	100	1,517,849	

Partner name:	**ForWind**			
Funding organisation	German Federal Ministry for Economic Affairs and Energy (BMWi)			
Country	Germany			
	Total budget	Funding Rate	Requested Budget	Justification
Personnel (€)	522,549	100	522,549	WP2: 41 PM, WP3: 21 PM, WP 4: 21 pm
Consumables (€)	18,450	100	18,450	largely dedicated to Lidar measurements
Equipment (€)	114,800	100	114,800	extension of computing system for atlas calculation; extension and maintemance of Lidar systems
Travel (€)	64,000	100	64,000	travels to yearly project and WP meetings (1 to 4 persons travelling per meeting), travels to conferences and travels in connection with experiments
Other direct costs (€)				
Overheads (€)				No overhead costs are claimed.
Total budget (€)	719,799	100	719,799	

Partner name:	**IPE**			
Funding organisation	Latvijas Zinatnu akademija			
Country	Latvia			
	Total budget	Funding Rate %	Requested Budget	Justification
Personnel (€)	225,231	100	225,231	WP 1 10 PM; WP2 51.7 PM; WP4 5 PM
Consumables (€)	3,000	100	3,000	External data storage, books, and other consumables (paper, toners etc.).
Equipment (€)				
Travel (€)	38,600	100	38,600	Consortium meetings ~ 10 per 5 years; conferences 1 - 2 per year; Experiments ~240 days Latvia; ~60 days international
Other direct costs (€)	29,600	100	29,600	Renting masts for wind measurements; wind measurement complex maintanence and service; lidar maintanence; Equipment insurance, and security costs.
Overheads (€)	59,286	100	59,286	Overhead is equal to 20% of total direct costs according to national regulations
Total budget (€)	355,717	100	355,717	

Partner name:	**ERI VIRAC**			
Funding organisation	Latvijas Zinatnu akademija			
Country	Latvia			
	Total budget	Funding Rate	Requested Budget	Justification
Personnel (€)	225,231	100	225,231	WP1 - 5 PM; WP2 - 29.5 PM; WP3 - 33.1 PM; WP4 - 17.1 PM
Consumables (€)	1,000	100	1,000	External data storage, books, and other consumables (paper, toners etc.).
Equipment (€)				
Travel (€)	38,600	100	38,600	Consortium meetings ~ 10 per 5 years; conferences 1 - 2 per year; Experiments ~240 days Latvia; ~60 days international
Other direct costs (€)	31,600	100	31,600	Renting masts for wind measurements; wind measurement complex maintanence and service; lidar maintanence; Equipment insurance, and security costs.
Overheads (€)	59,286	100	59,286	Overhead is equal to 20% of total direct costs according to national regulations
Total budget (€)	355,717	100	355,717	

Partner name:	**UL**			
Funding organisation	Latvijas Zinatnu akademija			
Country	Latvia			
	Total budget	Funding Rate	Requested Budget	Justification
Personnel (€)	95,214	100	95,214	WP3: 45.4 PM
Consumables (€)	2,607	100	2,607	External data storage, books, and other consumables (paper, toners etc.).
Equipment (€)	-		-	
Travel (€)	10,000	100	10,000	2 International events each year (conferences, workgroup and other project meetings)
Other direct costs (€)	10,050	100	10,050	Renting masts for wind measurements; wind measurement complex maintanence and service
Overheads (€)	23,574	100	23,574	Overhead is equal to 20% of total direct costs according to national regulations
Total budget (€)	141,445	100	141,445	

Partner name:	**LEGMC**			
Funding organisation	Latvijas Zinatnu akademija			
Country	Latvia			
	Total budget	Funding Rate	Requested Budget	Justification
Personnel (€)	61,375	100	61,375	2 researchers will be involved in wind measurement site selection, wind measurement campaigns, assessment of wind data and site evaluation, evaluation and analyses of short-term. and long-term wind data. Stuff categories: 1 principle investigator and 1 researcher 13.2 PM for each, WP2
Consumables (€)	7,000	100	7,000	Paper, pens, computer discs, toner and other consumables
Equipment (€)				
Travel (€)	10,000	100	10,000	1-2 international conference and/or meeting per year to share work in the scientific community and get feedback before a study is finished. 2 trips per year at 1000 EUR per trip
Other direct costs (€)	96,244	100	96,244	Subcontracting for equipment rent. 86194 Euro - Lease of NCAR instruments; 10050 Euro renting masts for wind measurements; wind measurement complex maintenance and service
Overheads (€)	17,230	100	17,230	20% of direct costs (personal costs + travel+ consumables + part of other direct costs~ 7800 Euro)
Total budget (€)	191,849	100	191,849	

Partner name:	**UPORTO**			
Funding organisation	Fundação para a Ciência e Tecnologia (FCT)			
Country	Portugal			
	Total budget	Funding Rate	Requested Budget	Justification
Personnel (€)	91 284	100	91 284	One researcher with experience on computational modelling of atmospheric flows (12PMs). Experienced Post-Docs for developmente of model-chain, uncertainty determination (24PMs).
Consumables (€)	4 941	100	4 941	This an average value of 1000 Euros per year, meant to cover small expenses that occur during the course of any project. Examples of these small expenses include small repairs of computing equipment, printer toner, express mail, upgrade of a software licence, copies of a poster for a conference, etc.
Equipment (€)	53 829	100	53 829	Contribution to computer cluster. Further information availabe at: https://www.grid.fe.up.pt/web/guest/clusters Main characteristics as in July 2014: 58 Intel Xeon CPUs with 448 cores and 8847.8 GFlops computing performance, 1.8 TB memory, 28 TB storage capacity and 40 Gbps InfiniBand connection.
Travel (€)	12 000	100	12 000	The PI is the representative of the Portuguese consortium at Project Board Meetings and the EWEA conference is the annual event in Europe gathering all sectors related to wind energy (8000€). The annual meeting is the event where all partners must participate (5000€).
Other direct costs (€)	22 373		22 373	
Overheads (€)	36 885	100	36 885	20% of total costs
Total budget (€)	221 312	100	221 312	

Partner name:	**INEGI**			
Funding organisation	Fundação para a Ciência e Tecnologia (FCT)			
Country	Portugal			
	Total budget	Funding Rate %	Requested Budget	Justification
Personnel (€)	78 759	100	78 759	0.5 PM working at the preparation of the experimental setup at workshop; 1.0 PM working at the database setup synchronization with existing tools; 2.5 PM working at the reception and preparation of equipment from partners at INEGI facilities; 11.0 PM working at the instrumentation of 10 meteorological stations; 10,0 PM performing O&M visits and assisting partners in the installation of further equipment; 8.0 PM performing data monitoring, data cross-check and validation; 7.0 PM working at the dismantling of experiment; 3.6 PM of global coordination. WP2= 42.6; WP5=1
Consumables(€)	10 000		10 000	Consumables concern mainly the experimental apparatus support equipment, as auxiliary energy supply equipment (solar panels and controllers, batteries), communication equipment (modems, antennas), cabling and other ancillary as booms.
Equipment (€)	136 737	100	136 737	Supply and installation of 3 lattice meteorological masts with 100 m height, plus electrical supply and accesses construction. Most of the measuring equipment shall have source in existing resources from the several partners involved.
Travel (€)	69 700	100	69 700	90 % of the budget concerns travelling and overnights for the accomplishment of the instrumentation of the meteorological stations, the operation and maintenance of all experimental apparatus and its dismantling. The remaining concerns the participation in work meetings.
Other direct costs (€)	34 000	100	34 000	Includes the transportation and storage of equipment onsite; rental of local space for workshop and land lease for the masts, administrative licences and insurance for legal responsibilities.
Overheads (€)	65 839	100	65 839	20 % over direct costs
Total budget (€)	395 036	100	395 036	

Partner name:	**IPMA**			
Funding organisation	Fundação para a Ciência e Tecnologia (FCT)			
Country	Portugal			
	Total budget	Funding Rate	Requested Budget	Justification
Personnel (€)	19 940	100	19 940	1 Post-doc grant during 1 year for performing mesoscale operational modelling during the double-hill experiment in Perdigão. (12PMs); WP2=11MM; WP5=1MM
Consumables (€)	10 400	100	10 400	This budget is an estimate of costs of non-reusable equipment (spare parts) to be used during the course of the experiments. IPMA will be responsible for launching radiosonds twice a day, as part of the short-duration (two-week) intensive (staff and foreing teams in Perdigão) campaigns.
Equipment (€)				
Travel (€)	5 000	100	5 000	The annual meeting is the event where all partners must participate.
Other direct costs (€)	9 000		9 000	
Overheads (€)	8 868	100	8 868	20% of total costs
Total budget (€)	53 208	100	53 208	

Partner name:	**LNEG**			
Funding organisation	Fundação para a Ciência e Tecnologia (FCT)			
Country	Portugal			
	Total budget	Funding Rate	Requested Budget	Justification
Personnel (€)	34,928	100	34,928	MSc grant 1: Data processing and quality control. Contribution to the terrain descritption and map processing. Contribution to the Dissemination.Terrain and roughness refinements in perdigao area using ENVI or other similar model. Maps quality check (National and refined). WP2, WP3, WP5 (18PMs) MSc grant 2: Roughness Maps processing and terrain conversion (National and refined). Terrain and roughness descriptions processing with GIS. Formating of the mapped information for dissemination. WP2, WP3, WP5 (18PMs)
Consumables (€)				
Equipment (€)	24,000	100	24,000	GIS Software update (ArcGIS). Update of the license extensions included in ArcGIS/ArcInfo software, for maps (terrain and roughness) conversion and classification. (6000€) Image processing and analysing software (ENVI). Spatial data processing and image conversion and ortorectification (terrain and roughness refinments at perdigao area). (15500€) Workstation (Dell) (2500€).
Travel (€)	5,000	100	5,000	Annual project meetings. Meetings participation in Porto for work discussion and strategies definition. Visits to the experiment site for roughness and terrain characterization. (2000€) Project meetings. Meetings participation with the European consortium members for presentation on the work being developed. (3000€)
Other direct costs (€)				
Overheads (€)	12,785	100	12,785	20% of total costs
Total budget (€)	76,713	100	76,713	

Partner name:	**CENER**			
Funding organisation	Ministry of Economy and Competitiveness (MINECO)			
Country	Spain			
	Total budget	Funding Rate	Requested Budget	Justification
Personnel (€)	668,100	100	668,100	Head of Department/Service: WP1: 4 p-m, WP2: 4 p-m, WP3: 4 p-m, WP5: 3 p-m Senior Researcher: WP2: 6 p-m, WP3: 14 p-m, WP4: 4 p-m, WP5: 3 p-m Researcher 1: WP2: 20 p-m, WP3: 30 p-m, WP4: 10 p-m Researcher 2: WP2: 4 p-m, WP3: 24 p-m, WP4: 10 p-m Technician: WP2: 13 p-m
Consumables (€)	34,000	100	34,000	WP2: Data storage, maintenance (4000€); WP5: dissemination material like leaflets, loggistics in connection with conferences (30000€)
Equipment (€)	101,033	100	101,033	WP2: Instrumentation for Alaiz campaign; 19.5% share of a windscanner (74701€); data server
Travel (€)	37,000	100	37,000	Progress meetings, travel costs related to Alaiz campaign, conferences; WP5 travel costs (7000€)
Other direct costs (€)	255,909	100	255,909	WP2: Subcontracting of Alaiz mast campaign installation and maintenance (220000€); WP5: Subcontracting dissemination (project identity, promotion, etc; 35909€)
Overheads (€)	-		-	
Total budget (€)	1,096,042	100	1,096,042	

Partner name:	**CIEMAT**			
Funding organisation	Ministry of Economy and Competitiveness (MINECO)			
Country	Spain			
	Total budget	Funding Rate	Requested Budget	Justification
Personnel (€)	239,824	100	239,824	Senior Expert: WP3: 18 p-m, WP4: 18 p-m, Expert:WP3: 15 p-m, WP4: 15 p-m
Consumables (€)				
Equipment (€)				
Travel (€)	15,000	100	15,000	Progress meetings, conferences
Other direct costs (€)				
Overheads (€)				
Total budget (€)	254,824	100	254,824	

Partner name:	**UCM**			
Funding organisation	Ministry of Economy and Competitiveness (MINECO)			
Country	Spain			
	Total budget	Funding Rate	Requested Budget	Justification
Personnel (€)	305,920	100	305,920	WP4 (40 p-m, 4190 €/month): Hiring post-doc personnel for development of validation techniques for spatial and temporal uncertainties from probabilistic modeling on Task 4.4 WP2 (24 p-m, 3458 €/month) and WP3 (4p-m, 3458 €/month): recruitment of post-doc personnel to apply the quality control procedures to the European database. WP4 (12 p-m, 3458 €/month): recruitment of post-doc personnel for the developing of the validation of the European wind atlas
Consumables (€)				
Equipment (€)	4,000	100	4,000	To buy 1 PC and 1 laptop to be used in the development of several of the assigned tasks
Travel (€)	14,920	100	14,920	Travels for progress meetings and other dissemination tasks.
Other direct costs (€)				
Overheads (€)				
Total budget (€)	324,840	100	324,840	

Partner name:	**UIB**			
Funding organisation	Ministry of Economy and Competitiveness (MINECO)			
Country	Spain			
	Total budget	Funding Rate	Requested Budget	Justification
Personnel (€)	85,200	100	85,200	Scientist: WP2: 24 p-m Technician: WP2: 12 p-m
Consumables (€)				
Equipment (€)	32,500	100	32,500	10 Surface energy balance stations
Travel (€)	15,000	100	15,000	Progress meetings, travel costs related to Alaiz campaign, conferences
Other direct costs (€)	50,000	100	50,000	Hiring of WindRASS profiler
Overheads (€)				
Total budget (€)	182,700	100	182,700	

Partner name:	**IC3**			
Funding organisation	Ministry of Economy and Competitiveness (MINECO)			
Country	Spain			
	Total budget	Funding Rate	Requested Budget	Justification
Personnel (€)	151,200	100	151,200	WP1: 2 p-m, WP3: 30 p-m, WP4: 10 p-m
Consumables (€)	4,000	100	4,000	WP3, WP4: Data storage
Equipment (€)	-		-	
Travel (€)	10,000	100	10,000	Progress meetings, conferences
Other direct costs (€)	-		-	
Overheads (€)	-		-	
Total budget (€)	165,200	100	165,200	

Partner name:	**BSC**			
Funding organisation	Ministry of Economy and Competitiveness (MINECO)			
Country	Spain			
	Total budget	Funding Rate	Requested Budget	Justification
Personnel (€)	205,200	100	205,200	Scientist: WP1: 2 p-m, WP3: 40 p-m, WP4: 12 p-m
Consumables (€)				
Equipment (€)				
Travel (€)	10,000	100	10,000	Progress meetings, conferences
Other direct costs (€)				
Overheads (€)				
Total budget (€)	215,200	100	215,200	

Partner name:	**UU**			
Funding organisation	Energimyndigheten (The Swedish Energy Agency)			
Country	Sweden			
	Total budget	Funding Rate	Requested Budget	Justification
Personnel (€)	474,028	100	474,028	77,4 PM (WP1:2; WP2: 28.2; WP3:22.2; WP4: 24; WP5:1)
Consumables (€)	92,064	100	92,064	The consumables mainly consists of costs related to the measurement campaign
Equipment (€)	215,196	100	215,196	The equipment mainly consists of costs related to the measurement campaign. In addition costs for storing data etc. of simulations are included. (Including the Swedish contribution to the be used for the common good of the NEWA consortium, i.e., 123 134)
Travel (€)	60,025	100	60,025	The traveling costs covers costs for international meetings, working group meetings, visits to met masts etc.
Other direct costs (€)	95,846	100	95,846	The direct costs mainly consists of costs related to the measurement campaign
Overheads (€)	328,005	100	328,005	35% on all costs
Total budget (€)	1,265,164	100	1,265,164	

Partner name:	**WeatherTech**			
Funding organisation	Energimyndigheten (The Swedish Energy Agency)			
Country	Sweden			
	Total budget	Funding Rate	Requested Budget	Justification
Personnel (€)	243,676	80	194,941	27 PM (total): 15 PM (1 PM WP1, 3 PM WP2, 10 PM WP3, 1 PM WP4) 12 PM (1.2 PM WP2, 10.8 PM WP3)
Consumables (€)				
Equipment (€)	13,514	80	10,811	Costs for storing and processing data from numerical simulations.
Travel (€)	27,028	80	21,622	
Other direct costs (€)				
Overheads (€)				
Total budget (€)	284,217	80	227,373	

Partner name:	**TUBITAK MRC**			
Funding organisation	Scientific and Research Council of Turkey (TUBITAK)			
Country	Turkey			
	Total budget	Funding Rate	Requested Budget	Justification
Personnel (€)	64,000	100	64,000	Totally 62.4 person-month at WP1, WP2 (Experimental Database and Experiments in Turkey) and WP4.
Consumables (€)	92,351		92,351	Lease of NCAR Instruments
Equipment (€)	47,667	100	47,667	Storage unit for experimental database.
Travel (€)	16,667	100	16,667	Participation in meetings (Expected number 16)
Other direct costs (€)				
Overheads (€)				
Total budget (€)	220,685	100	220,685	

Partner name:	**IZTECH**			
Funding organisation	Scientific and Research Council of Turkey (TUBITAK)			
Country	Turkey			
	Total budget	Funding Rate	Requested Budget	Justification
Personnel (€)	12,400	100	12,400	Requested budget here is for the MSc and PhD students for total of 26.5 months in total, all being used in WP2.
Consumables (€)				
Equipment (€)	82,667	100	82,667	Installation of a tall met mast at Çeşme Peninsula and equip it with cups, vanes, sonic, temperature and pressure anemometers. Also includes the signal processing and data logging stages.
Travel (€)	8,333	100	8,333	Participation in meetings (Expected number 8)
Other direct costs (€)	16,600	100	16,600	Consultancy service for tall met mast design and installation. We would like to get support from local o international experts who had worked in similar tall tower design and installation processes. This will ensure the project schedule and quality of the work since such tall tower has never been made for academic use in Turkey before.
Overheads (€)				
Total budget (€)	120,000	100	120,000	

Partner name:	**METUWIND**			
Funding organisation	Scientific and Research Council of Turkey (TUBITAK)			
Country	Turkey			
	Total budget	Funding Rate	Requested Budget	Justification
Personnel (€)	57,600	100	57,600	108 person-month. WP1 and WP3 (Micro models and meso-micro coupling)
Consumables (€)	3,333	100	3,333	Paper-work expenditures
Equipment (€)	50,000	100	50,000	Upgrade expenditures for High Performance Computing Cluster
Travel (€)	8,333	100	8,333	Participation in meetings (Expected number 8)
Other direct costs (€)				
Overheads (€)				
Total budget (€)	119,266	100	119,266	

Partner name:	**ITU**			
Funding organisation	Scientific and Research Council of Turkey (TUBITAK)			
Country	Turkey			
	Total budget	Funding Rate	Requested Budget	Justification
Personnel (€)	104,600	100	104,600	207.2 PMs. WP1 and WP3 (Adverse weather conditions and climate change effects to wind climate-potential; Mesoscale models and meso-micro coupling).
Consumables (€)	9,733	100	9,733	Storage disks and paper-work expenditures.
Equipment (€)	95,667	100	95,667	Server, storage units and computers for model runs.
Travel (€)	16,667	100	16,667	Participation in meetings (Expected number 8, 2 representatives)
Other direct costs (€)	13,133	100	13,133	It includes two types of service costs. First one is the service costs for implementation and maintenance of the workstations. Second one is the service costs for dissemination activities, such as web page design, meetings in Turkey and etc.
Overheads (€)				
Total budget (€)	239,800	100	239,800	

Partner name:	**Borusan**			
Funding organisation	Scientific and Research Council of Turkey (TUBITAK)			
Country	Turkey			
	Total budget	Funding Rate	Requested Budget	Justification
Personnel (€)	294,840	60	176,904	Totally 78 person-month at WP1 and WP2 (High altitude experiment in Turkey).
Consumables (€)				
Equipment (€)	266,800	60	160,080	Met mast equipment, LIDAR and softwares
Travel (€)	10,000	60	6,000	Participation in meetings (Expected number 8)
Other direct costs (€)				
Overheads (€)				
Total budget (€)	571,640	60	342,984	

14. Number of person months of personnel participating in the project for which no funding is requested (if applicable).

No.	**Partner 3 Vestas**	**Partner 15 UPORTO**	**Partner 16 INEGI**	**Partner 17 IPMA**	**Partner 18 LNEG**	**Partner 28 IZTECH**
Funding organization	Vestas	Universidade do Porto	INEGI	IPMA	LNEG	TUBITAK
Person months (1)	4	1	2	1	0.9	25.2
Person months (2)					1.8	
Person months (3)					1.2	
Person months (4)					1.2	

No.	**Partner 29 METUWIND**	**Partner 30 ITU**				
Funding organization	TUBITAK	TUBITAK				
Person months (1)	27	104.4				
Person months (2)						
Person months (3)						
Person months (4)						

15. Signed declaration by the project coordinator and by the principal investigators partners in the project concerning the agreement of their respective team members to participate in the proposal (signed PDF).

We, the undersigned Jakob Mann and Peter Hjuler Jensen (DTU) Coordinator of the Project "Development of a New European Wind Atlas" (NEWA), declare to keep records with evidence that each of my respective team members agreed to participate in the proposal submitted.

Jakob Mann

Signature.. 15/7 2014

(Project Coordinator)

Peter Hjuler Jensen

Signature.. 15/7- 2014

(DTU's authorised legal representative)

Signed declaration by the project coordinator and by the principal investigators partners in the project concerning the agreement of their respective team members to participate in the proposal (signed PDF).

I, the undersigned ....Lars Landberg (DNV GL)....... Partner n. 2 of the Project "Development of a New European Wind Atlas" (NEWA), declare to keep records with evidence that each of my respective team members agreed to participate in the proposal submitted.

Signature..... (9th July 2014)
(by the authorised legal representative)

Signed declaration by the project coordinator and by the principal investigators partners in the project concerning the agreement of their respective team members to participate in the proposal (signed PDF).

I, the undersigned Dr..Line Gulstad, Director Plant Siting & Forecasting, Vestas Wind Systems A/S, Partner n. 3 of the Project "Development of a New European Wind Atlas" (NEWA), declare to keep records with evidence that each of my respective team members agreed to participate in the proposal submitted.

Signature..............................
(by the authorised legal representative)

Aarhus 16.07.2014

Signed declaration by the project coordinator and by the principal investigators partners in the project concerning the agreement of their respective team members to participate in the proposal (signed PDF).

I, the undersigned ....Geert Palmers (3E N.V.)...
Partner no. 4 of the Project "Development of a New European Wind Atlas" (NEWA), declare to keep records with evidence that each of my respective team members agreed to participate in the proposal submitted.

Signature...................................
(by the authorised legal representative)

Geert Palmers
CEO
Quai à la chaux 6 - Kalkkaai 6
BE-1000 Brussel/Bruxelles

Signed declaration by the project coordinator and by the principal investigators partners in the project concerning the agreement of their respective team members to participate in the proposal (signed PDF).

I, the undersigned Paul Van Dun (KU Leuven, for the purposes of this agreement represented by KU Leuven Research & Development), Partner n. 5 of the Project "Development of a New European Wind Atlas" (NEWA), declare to keep records with evidence that each of my respective team members agreed to participate in the proposal submitted.

Paul VAN DUN
General Manager

Signature.................................
(by the authorised legal representative)

K.U.LEUVEN RESEARCH & DEVELOPMENT
Waaistraat 6 - bus 5105
BE-3000 Leuven

1 6 JULI 2014

For approval: prof. Johan Meyers

Signed declaration by the project coordinator and by the principal investigators partners in the project concerning the agreement of their respective team members to participate in the proposal (signed PDF).

I, the undersigned Ides Bauwens, Managing partner of ‘nazka mapps’, Partner n. 6 of the Project “Development of a New European Wind Atlas” (NEWA), declare to keep records with evidence that each of my respective team members agreed to participate in the proposal submitted.

Signature................................
(by the authorised legal representative)

Signed declaration by the project coordinator and by the principal investigators partners in the project concerning the agreement of their respective team members to participate in the proposal (signed PDF).

I, the undersigned **Dr. Alexis DUTRIEUX (Managing Director of ATM-PRO) Partner n. 7** of the Project "Development of a New European Wind Atlas" (NEWA), declare to keep records with evidence that each of my respective team members agreed to participate in the proposal submitted.

Signature................................
(by the authorised legal representative)

Dr. Alexis DUTRIEUX
Managing Director
ATM-PRO SPRL
Rue Saint-André, 5-7,
BE-1400 Nivelles
Belgium

ATM-PRO SPRL
RUE SAINT ANDRE,7
B-1400 NIVELLES
☎:067/84.33.04

Signed declaration by the project coordinator and by the principal investigators partners in the project concerning the agreement of their respective team members to participate in the proposal (signed PDF).

I, the undersigned Dr Philippe Geuzaine (Cenaero) Partner n. 8 of the Project "Development of a New European Wind Atlas" (NEWA), declare to keep records with evidence that each of my respective team members agreed to participate in the proposal submitted.

Dr. Philippe Geuzaine
General Manager, Cenaero

Signature............................

Cenaero
Bâtiment Eole - 1er étage
Rue des Frères Wright, 29
B-6041 Gosselies
Tél. +32 (0)71 910 930 - Fax +32 (0)71 910 931
N° entr. 0477 703 125

Signed declaration by the project coordinator and by the principal investigators partners in the project concerning the agreement of their respective team members to participate in the proposal (signed PDF).

I, the undersigned ....Bernhard Lange (Fraunhofer IWES)......... Partner no. 9 of the Project "Development of a New European Wind Atlas" (NEWA), declare to keep records with evidence that each of my respective team members agreed to participate in the proposal submitted.

Signature.................................

(by the authorised legal representative)

Signed declaration by the project coordinator and by the principal investigators partners in the project concerning the agreement of their respective team members to participate in the proposal (signed PDF).

I, the undersigned Dr. Detlev Heinemann (University of Oldenburg/ForWind), Partner 10 of the Project "Development of a New European Wind Atlas" (NEWA), declare to keep records with evidence that each of my respective team members agreed to participate in the proposal submitted.

Signature

D. Heinemann

ForWind
Zentrum für Windenergieforschung
26129 Oldenburg - Ammerländer Heerstraße 136
Tel. 0441 - 798-5090 Fax 0441 - 798-5099
www.forwind.de Mail: info@forwind.de

Signed declaration by the project coordinator and by the principal investigators partners in the project concerning the agreement of their respective team members to participate in the proposal (signed PDF).

I, the undersigned Juris Ekmanis (in Latvian: Fizikalas energetikas instituts; in English: Institute of Physical Energetics) Partner n.11 of the Project "Development of a New European Wind Atlas" (NEWA), declare to keep records with evidence that each of my respective team members agreed to participate in the proposal submitted.

Signature................................

(by the authorised legal representative)

FIZIKĀLĀS ENERĢĒTIKAS INSTITŪTS * Valsts zinātniskais institūts

Signed declaration by the project coordinator and by the principal investigators partners in the project concerning the agreement of their respective team members to participate in the proposal (signed PDF).

I, the undersigned Acting Vice Rector for Administration and Finance **Marina Mekša** (Ventspils University College), Partner n. 12 of the Project "Development of a New European Wind Atlas" (NEWA), declare to keep records with evidence that each of my respective team members agreed to participate in the proposal submitted.

Signature ....
(by the authorised legal representative)

Signed declaration by the project coordinator and by the principal investigators partners in the project concerning the agreement of their respective team members to participate in the proposal (signed PDF).

I, the undersigned Prorector of Science Indriķis Muižnieks (University of Latvia) Partner n. 13 of the Project "Development of a New European Wind Atlas" (NEWA), declare to keep records with evidence that each of my respective team members agreed to participate in the proposal submitted.

Signature.................................. acting Prorector of Science Jānis Stonis
(by the authorised legal representative)

Signed declaration by the project coordinator and by the principal investigators partners in the project concerning the agreement of their respective team members to participate in the proposal (signed PDF).

I, the undersigned **Inita Stikute**, **[**State limited Liability Company "Latvian Environment, Geology and Meteorology Centre"] Partner n. 14 of the Project "Development of a New European Wind Atlas" (NEWA), declare to keep records with evidence that each of my respective team members agreed to participate in the proposal submitted.

Signature..
(by the authorised legal representative)

Signed declaration by the project coordinator and by the principal investigators partners in the project concerning the agreement of their respective team members to participate in the proposal (signed PDF).

I, the undersigned Luís António de Andrade Ferreira Partner n. 15 of the Project "Development of a New European Wind Atlas" (NEWA), declare to keep records with evidence that each of my respective team members agreed to participate in the proposal submitted.

Signature.................................
(by Luís de Andrade Ferreira, interim director)

Date: 09/07/2014

Signed declaration by the project coordinator and by the principal investigators partners in the project concerning the agreement of their respective team members to participate in the proposal (signed PDF).

We, the undersigned Jorge Humberto Oliveira Seabra and Alcibíades Paulo Soares Guedes (INEGI – *Instituto de Engenharia Mecânica e Gestão Industrial*), Partner n. 16 of the Project "Development of a New European Wind Atlas" (NEWA), declare to keep records with evidence that each of my respective team members agreed to participate in the proposal submitted.

Jorge Humberto Oliveira Seabra

Signature...

Alcibíades Paulo Soares Guedes

inegi Instituto de Engenharia Mecânica e Gestão Industrial

Signature...

(by the authorised legal representatives)

Signed declaration by the project coordinator and by the principal investigators partners in the project concerning the agreement of their respective team members to participate in the proposal (signed PDF).

I, the undersigned, Jorge Miguel Alberto de Miranda (IPMA), Partner n. 17 of the Project "Development of a New European Wind Atlas" (NEWA), declare to keep records with evidence that each of my respective team members agreed to participate in the proposal submitted.

Signature..................................
(by the authorised legal representative)

IPMA

Instituto Português do Mar e da Atmosfera

I, the undersigned Maria Teresa Costa Pereira da Silva Ponce de Leão, President of the Administration Board of National Laboratory of Energy and Geology partner n.18 of the Project "Development of a New European Wind Atlas" (NEWA), declare to keep records with evidence that each of my respective team members agreed to participate in the proposal submitted.

Date: Amadora, July 11th 2014

President of LNEG

(Teresa Ponce de Leão)

HELDER GONÇALVES

Vogal do LNEG, I.P.

Laboratório Nacional de Energia e Geologia, I.P.

Signed declaration by the project coordinator and by the principal investigators partners in the project concerning the agreement of their respective team members to participate in the proposal (signed PDF).

I, the undersigned Elena Arbizu Jimeno (Fundación CENER-CIEMAT) Partner n. 19 of the Project "Development of a New European Wind Atlas" (NEWA), declare to keep records with evidence that each of my respective team members agreed to participate in the proposal submitted.

Signature.................................
(by the authorised legal representative)

CENER
CENTRO NACIONAL DE ENERGÍAS RENOVABLES
FUNDACIÓN CENER-CIEMAT

Signed declaration by the project coordinator and by the principal investigators partners in the project concerning the agreement of their respective team members to participate in the proposal (signed PDF).

I, the undersigned Cayetano López (Centro de Investigaciones Energéticas Medioambientales y Tecnológicas – CIEMAT) Partner n. 20 of the Project "Development of a New European Wind Atlas" (NEWA), declare to keep records with evidence that each of my respective team members agreed to participate in the proposal submitted.

Signature..
(by the authorised legal representative)

16 - 7 - 2014

Signed declaration by the project coordinator and by the principal investigators partners in the project concerning the agreement of their respective team members to participate in the proposal (signed PDF).

I, the undersigned Francisco Tirado Fernández, Vice-chancellor for Research of the Universidad Complutense de Madrid, Partner n. 21 of the Project "Development of a New European Wind Atlas" (NEWA), declare to keep records with evidence that each of my respective team members agreed to participate in the proposal submitted.

Signature................................
(by the authorised legal representative)

Signed declaration by the project coordinator and by the principal investigators partners in the project concerning the agreement of their respective team members to participate in the proposal (signed PDF).

I, the undersigned JAUME CAROT, VICERECTOR FOR RESEARCH AND POSTGRADUATE STUDIES OF THE UNIVERSITY OF THE BALEARIC ISLANDS Partner n. 22 of the Project "Development of a New European Wind Atlas" (NEWA), declare to keep records with evidence that each of my respective team members agreed to participate in the proposal submitted.

J. Carot

Signature................................
(by the authorised legal representative)

UIB
Universitat de les Illes Balears
Vicerectorat d'Investigació i Postgrau

Signed declaration by the project coordinator and by the principal investigators partners in the project concerning the agreement of their respective team members to participate in the proposal (signed PDF).

I, the undersigned .....Mercè Carrasco (IC3) .... Partner n. 23 of the Project "Development of a New European Wind Atlas" (NEWA), declare to keep records with evidence that each of my respective team members agreed to participate in the proposal submitted.

Signature.................................
(by the authorised legal representative)

IC3
Institut Català de Ciències del Clima

Signed declaration by the project coordinator and by the principal investigators partners in the project concerning the agreement of their respective team members to participate in the proposal (signed PDF).

I, the undersigned Mateo Valero Cortés (Barcelona Supercomputing Center) Partner n. 24 of the Project "Development of a New European Wind Atlas" (NEWA), declare to keep records with evidence that each of my respective team members agreed to participate in the proposal submitted.

Signature.................................
(by the authorised legal representative)

Signed declaration by the project coordinator and by the principal investigators partners in the project concerning the agreement of their respective team members to participate in the proposal (signed PDF).

I, the undersigned Ari Tryggvason (Uppsala University) Partner n. 25 of the Project "Development of a New European Wind Atlas" (NEWA), declare to keep records with evidence that each of my respective team members agreed to participate in the proposal submitted.

Signature..............................
(by the authorised legal representative)

Signed declaration by the project coordinator and by the principal investigators partners in the project concerning the agreement of their respective team members to participate in the proposal (signed PDF).

I, the undersigned Stefan Söderberg (WeatherTech Scandinavia AB) Partner n. 26 of the Project "Development of a New European Wind Atlas" (NEWA), declare to keep records with evidence that each of my respective team members agreed to participate in the proposal submitted.

Signature..................................
(by the authorised legal representative)

Signed declaration by the project coordinator and by the principal investigators partners in the project concerning the agreement of their respective team members to participate in the proposal (signed PDF).

I, the undersigned ......**Bahadır TUNABOYLU (TUBITAK)**..... Partner n. 27 of the Project "Development of a New European Wind Atlas" (NEWA), declare to keep records with evidence that each of my respective team members agreed to participate in the proposal submitted.

Signature............ Assoc. Prof. Bahadir TUNABOYLU President of MRC

(by the authorised legal representative)

Signed declaration by the project coordinator and by the principal investigators partners in the project concerning the agreement of their respective team members to participate in the proposal (signed PDF).

I, the undersigned . Prof.Dr.Mustafa GÜDEN, Rector, (Izmir Institute of Technology – IZTECH) Partner n. 28 of the Project "Development of a New European Wind Atlas" (NEWA), declare to keep records with evidence that each of my respective team members agreed to participate in the proposal submitted.

Signature............................... M. Güden
(by the authorised legal representative)

Prof.Dr.Mustafa GÜDEN

Signed declaration by the project coordinator and by the principal investigators partners in the project concerning the agreement of their respective team members to participate in the proposal (signed PDF).

I, the undersigned Prof. Dr. H. Nevzat Özgüven (Middle East Technical University / Center for Wind Energy (METUWIND)) Partner n. 29 of the Project "Development of a New European Wind Atlas" (NEWA), declare to keep records with evidence that each of my respective team members agreed to participate in the proposal submitted.

July 18, 2014

Signature..................................

(by the authorised legal representative)

T.C.

Signed declaration by the project coordinator and by the principal investigators partners in the project concerning the agreement of their respective team members to participate in the proposal (signed PDF).

I, the undersigned Professor Dr. Mehmet KARACA (Istanbul Technical University). Partner number 30 of the Project "Development of a New European Wind Atlas" (NEWA), declare to keep records with evidence that each of my respective team members agreed to participate in the proposal submitted.

Signature..................................

Rector

Signed declaration by the project coordinator and by the principal investigators partners in the project concerning the agreement of their respective team members to participate in the proposal (signed PDF).

We, the undersigned Enis Amasyalı, and Mehtap Anık Zorbozan (Güney Rüzgarı Elektrik Üretim ve Ticaret A.Ş.) Partner n. 31 of the Project "Development of a New European Wind Atlas" (NEWA), declare to keep records with evidence that each of our respective team members agreed to participate in the proposal submitted.

Signature..............................

GÜNEY RÜZGARI ELEKTRİK
ÜRETİM VE TİC. A.Ş.
Pürtelaş Hasan Mah. Meclisi Mebusan Cad.
No:35/7 Salıpazarı - Beyoğlu - İST.
Beyoğlu V.D. 435 049 5935

Enis AMASYALI MEHTAP ANIK ZORBOZAN

External Partner	Full name	
1	DLR - Institute of Atmospheric Physics	

The DLR-Institute of Atmospheric Physics (IPA) investigates the physics and the chemistry of the global atmosphere from its boundary layer to the top of the middle atmosphere. IPA employs the full range of methodology as sensor development, observation tools at local, regional and global scales, analysis, theory, and numerical modelling / prediction tools. In NEWA DLR will: act as an adviser to the project; perform wind remote sensing measurements by lidar at the Forest Experiment in Kassel, Germany, or at the Orography Experiment in Perdigao, Portugal; compare large-eddy simulation data with field measurement data of both the Forest and the Orography Experiments.

Letter of Intent

Prof. Dr. Markus Rapp
Direktor des Instituts für Physik der Atmosphäre

Deutsches Zentrum für Luft- und Raumfahrt

DLR Institut für Physik der Atmosphäre
Oberpfaffenhofen, Postfach 11 16, 82230 Weßling

Ihr Zeichen
Ihr Schreiben
Unser Zeichen

Ihr Gesprächspartner Prof. Markus Rapp
Telefon 08153 28- 2521
Telefax 08153 28- 1841
E-Mail Markus.Rapp@dlr.de

15.07.2014

Letter of Intent

The Institut für Physik der Atmosphäre (IPA) of the Deutsches Zentrum für Luft- und Raumfahrt (DLR) is interested to become an External Partner in the NEWA project proposal, focused on the development of a New European Wind Atlas, being submitted to the NEWA ERA-NET PLUS call.
DLR-IPA foresees that the NEWA project will significantly contribute to reduce the overall uncertainties in determining wind conditions, which will translate in an optimized design and operation of large-scale turbines and in an effective and efficient wind farms' siting.
Therefore, on behalf of DLR-IPA, I hereby confirm that we are happy to contribute to the implementation of the NEWA project, by providing advice or support to the project activities. In return for our contributions we expect early access to selected NEWA data.
DLR-IPA will, once NEWA has been funded, specify the period over which the cooperation is active, agree on the nature of the cooperation (advising, data exchange, experiment participation, modelling issues, etc.), and clarify ownership and economical issues with the coordinator of NEWA.
DLR-IPA will, once the objectives have been successfully achieved, seek to further disseminate project results to ensure knowledge sharing and a rapid utilisation of the project results.

Prof. Dr. Markus Rapp

Oberpfaffenhofen
82234 Weßling
Telefon 08153 28-0
Internet http://www.dlr.de/Oberpfaffenhofen

External Partner	Full name	
2	International Renewable Energy Agency	IRENA International Renewable Energy Agency

The International Renewable Energy Agency (IRENA) is an intergovernmental organization that supports international cooperation on renewable energies. It also acts as a repository for knowledge of renewable energies, and has coordinated the Global Atlas for Renewable Energy with a GIS interface. IRENA will both act as an advisor for NEWA and work with us to host NEWA data in a five year period after the project end.

Letter of Intent

IRENA SECRETARIAT

IRENA
International Renewable Energy Agency

Abu Dhabi, July 21st 2014.

Letter of Intent: contribution to the New European Wind Atlas (NEWA)

Dear Professor Mann,

The International Renewable Energy Agency (IRENA) has developed the Global Atlas for Renewable Energy (Global Atlas (www.irena.org/GlobalAtlas), which makes available more than 1,000 solar and wind datasets over the globe. On behalf of IRENA, Masdar Institute is hosting a dedicated server that allows this information to be disseminated to the public.

The current technical capabilities of the Global Atlas allow a user to display large maps in Geographic Information Systems (GIS) format and to access the underlying values. The interface also allows users to embed tools and access large time series. A new interface is under development, and the upcoming 2014 release should include the capability of drawing graphs and charts, including wind roses.

The New European Wind Atlas (NEWA) is a project proposal being submitted to the NEWA ERA-NET PLUS call for proposals, organised the European Commission. The project will generate a large amount of detailed and accurate wind maps and wind time series, which would bring much added value once made available to the public domain.

NEWA is an international project expected to have a direct impact in the development of new technologies related to wind energy, through the publication of a European Wind Atlas designed to promote:

- The reduction of the cost of electricity generated by wind farms by mitigating risks related to the design and operation of large-scale wind turbines through an enhanced knowledge of wind conditions;
- Better quantification of the European wind energy potential, and provision of data and models that can improve spatial planning tools and operations, ensuring an effective and efficient deployment of wind power.

On behalf of IRENA, I would like to propose a constructive dialogue with NEWA regarding sharing and hosting data for at least five years beyond the expected end of the NEWA project in 2019, by using the existing data infrastructure of the Global Atlas with no dedicated upgrades for the NEWA project.

IRENA would, once NEWA has been funded, specify the period over which the cooperation is active, agree on the nature of the cooperation, and clarify ownership and funding issues with the coordinator of NEWA, in particular if specific upgrades of the Global Atlas are required for the project.

Through the Global Atlas, IRENA will, once the objectives have been successfully achieved, seek to further disseminate project results to ensure knowledge sharing and a rapid utilisation of the project results.

I look forward to establish a fruitful collaboration to enhance and disseminate renewable energy resource information and support the uptake of renewable energy.

Dr. N. Fichaux

Programme officer resource for resource assessment

Attn: Pr. Jakob Mann
DTU Wind Energy, Technical University of Denmark, coordinating the NEWA project
Department of Wind Energy
Risø Campus, Frederiksborgvej 3994000 Roskilde

www.irena.org
IRENA Secretariat C! Tower, Khalidiyah (32nd) Street
P.O. Box 236, Abu Dhabi, United Arab Emirates

External Partner	Full name
3	SIA “Energo Wind”

SIA “Energo Wind” is a developer of wind energy projects in Latvia since 2007. Main shareholders are Austrian investors. The company has a project pipeline of 114 MW. All necessary documents are issued and a building permit is issued for building. Energo Wind has a wind studies at project site of total 18 month period. The company could potentially share the data of the wind studies for the new projects in pipeline. The company is also ready to help with research activities and developments of new projects or wind studies in other sites.

Letter of Intent

SIA „ENERGO WIND”
Reģ. Nr. 41203031447
Dārzu iela 6, Ventspils, LV-3601, Latvija
Tālr.: (+371) 283 285 87
Tālr./ fakss: (+371) 63656110
E-pasts: info@energowind.lv

Ventspilī

18.07.20014.

Letter of Intent

SIA “ENERGO WIND“ is a committed External Partner in the NEWA project proposal, focused on the development of a New European Wind Atlas, being submitted to the NEWA ERA-NET PLUS call.
SIA “ENERGO WIND“ foresees that the NEWA project will significantly contribute to reduce the overall uncertainties in determining wind conditions, which will translate in an optimized design and operation of large-scale turbines and in an effective and efficient wind farms’ sitting.
Therefore, on behalf of SIA “ENERGO WIND“, I hereby confirm that we are happy to contribute to the implementation of the NEWA project, by providing on-going advice or support to the project activities. In return for our contributions we expect early access to selected NEWA data.
SIA “ENERGO WIND“ will, once NEWA has been funded, specify the period over which the cooperation is active, agree on the nature of the cooperation (data exchange, experiment participation, modelling issues, etc.), and clarify ownership and economical issues with the coordinator of NEWA.
SIA “ENERGO WIND“will, once the objectives have been successfully achieved, seek to further disseminate project results to ensure knowledge sharing and a rapid utilisation of the project results.

Arturs Nehajenko
member of the board

External Partner	Full name	
4	ECOGEN	

The company was founded in 2008. Initially Ecogen practised only resale of foreign technologies in Latvia, but this type of activity restricted the development of the company. We created our team by involving engineers from the Riga Technical University, and, together with the representatives of the Hohenheim University, elaborated our station, using the latest technologies. In the end of 2010, we began construction of the first station designed in Latvia. In July 2011 the station began its work at full capacity. The company provides financial and logistical support for locating and installing measurement systems.

Letter of Intent

Riga, 28th July 2014

Letter of Intent

ECOGEN is a committed External Partner in the NEWA project proposal, focused on the development of a New European Wind Atlas, being submitted to the NEWA ERA-NET PLUS call.
ECOGENforesees that the NEWA project will significantly contribute to reduce the overall uncertainties in determining wind conditions, which will translate in an optimized design and operation of large-scale turbines and in an effective and efficient wind farms' siting.
Therefore, on behalf of ECOGEN, I hereby confirm that we are happy to contribute to the implementation of the NEWA project, by providing on-going advice or support to the project activities. In return for our contributions we expect early access to selected NEWA data.
ECOGEN will, once NEWA has been funded, specify the period over which the cooperation is active, agree on the nature of the cooperation (data exchange, experiment participation, modelling issues, etc.), and clarify ownership and economical issues with the coordinator of NEWA.
ECOGEN will, once the objectives have been successfully achieved, seek to further disseminate project results to ensure knowledge sharing and a rapid utilisation of the project results.

Sergejs Izmestjevs

Member of the Board

External Partner	Full name	
5	National Center of Atmospheric Research (NCAR)	

National Center of Atmospheric Research is funded by the US National Science Foundation and provides a number of tools and technologies for the scientific community. Of particular importance for NEWA is the Weather Research and Forecast model (WRF) and a deployable array of specialized instruments to measure atmospheric processes. NCAR will advise NEWA and will work actively to get involved with the Perdigao experiment.

Letter of Intent

National Center for
Atmospheric Research

Vanda Grubišić
NCAR Associate Director for
Earth Observing Laboratory (EOL)

P.O. Box 3000, Boulder, CO 80307-3000
Phone: 303.497.2040
Email: grubisic@ucar.edu

July 28, 2014

Jakob Mann, Professor
Technical University of Denmark
DTU Wind Energy, Risø Campus
Frederiksborgvej 399, Building 118
DK-4000 Roskilde

Dear Dr. Mann,

The National Center for Atmospheric Research (NCAR) is excited by the possibility of participating in activities to support the New European Wind Atlas (NEWA) project as an External Partner. Of course, NEWA activities will contribute to the more effective use of wind energy. However, they also will contribute to the understanding of airflow over complex terrain, which will benefit research in other disciplines, such as air pollution, climate, and water use.

We are aware that the NEWA proposal consists of modeling activities and experimental campaigns. NCAR's Integrated Surface Flux System (ISFS) is being requested by a team of U.S. research scientists to participate in the NEWA campaign near Perdigão, Portugal. If this request is approved and funded (by the U.S. National Science Foundation [NSF]), ISFS would supply sensors for atmospheric turbulence and meteorology, along with supporting data acquisition and communication infrastructure. The instrumentation would be mounted on short towers provided by us and on taller towers provided by Portuguese NEWA participants. Our data would be added to the NEWA archive, to share with other Perdigão participants.

To augment the instrumentation that could be deployed for Perdigão, we intend to apply for an NSF "Major Research Instrumentation" grant. This process requires 30% cost sharing. We are excited by the prospect that NEWA may be able to provide us funding in the amount of €370.000 for research instrumentation that could be considered cost sharing. If NSF approves our grant request, this cost sharing would be highly leveraged and could allow us to sample turbulence at many more locations, perhaps 100 rather than just 20. This increased spatial sampling will greatly increase the usefulness of the Perdigão data set.

Following its use by NEWA, NCAR would retain and make this augmented instrumentation available to the research community through NSF's facility allocation process. NCAR also could provide facilities for other NEWA field campaigns, however each campaign would require approval by NSF via a request process, as is now being sought for the Perdigão campaign.

Sincerely,

Vanda Grubišić, Ph. D.
NCAR Associate Director for the Earth Observing Laboratory

EOL provides state of the art Deployment, Development and Data Services to the earth and atmospheric research communities.

The National Center for Atmospheric Research is operated by the University Corporation for Atmospheric Research under sponsorship of the National Science Foundation.

Consortium Agreement

between the companies and institutions shown below

Technical University of Denmark (Coordinator)
Anker Engelundsvej 1, Bygning 101
2800 Kongens Lyngby, Denmark

DNV-GL Energy
Tuborg Parkvej 8
2900 Hellerup, Denmark

Vestas Wind Systems A/S
Hedeager 42 8200 Aarhus M, Denmark

3E N.V.
Kalkkaai 6 Quai à la Chaux
1000 Brussels, Belgium

KU Leuven
Celestijnenlaan 300A
3001 Leuven, Belgium

Nazka Mapps bvba
Ravesteinstraat 48a
3191 Hever, Belgium

ATM-PRO SPRL
Rue Saint-André, 5-7,
1400 Nivelles, Belgium

CENAERO
Rue des Frères Wright 29
6041 Gosselies, Belgium

Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e. V.,
Hansastraße 27 c, 80686 München, Germany
as legal entity for its
Fraunhofer Institute for Wind Energy and Energy System Technology (IWES),
Am Seedeich 45, 27572 Bremerhaven, Germany
and
Fraunhofer Institute for Wind Energy and Energy System Technology,
Kassel Department (IWES-KS)
Königstor 59, 34119 Kassel, Germany

ForWind – OL – Center for Wind Energy Research - Univ. of Oldenburg
Ammerländer Heerstr. 136
26129 Oldenburg, Germany

Institute of Physical Energetics/Fizikalas energetikas instituts (IPE)
Aizkraukles 21
LV1006 Riga, Latvia

Ventspils University College (VUC)
Inzenieru st 101a
LV3601 Ventspils, Latvia

University of Latvia (UL), Faculty of Physics and Mathematics
Zellu Iela 8
LV-1002 Riga, Latvia

Latvian Environment, Geology and Meteorology Centre (LEGMC)
Maskavas Str. 165
LV-1019 Riga, Latvia

UPORTO, Universidade do Porto
RUA DR ROBERTO FRIAS S/N
4200 – 465 Porto, Portugal

INEGI – Instituto de Engenharia Mecânica e Gestão Industrial
Campus da FEUP, Rua Dr. Roberto Frias, nr. 400
4200-465 Porto, Portugal

IPMA – Instituto Português do Mar e da Atmosfera
Rua C Aeroporto de Lisboa
1749-077 Lisboa, Portugal

LNEG – National Laboratory for Energy and Geology
Estrada da Portela, Bairro do Zambujal- Apartado 7586 – Alfragide
2610-999 Amadora, Portugal

CENER – National Renewable Energy Centre of Spain
Calle Ciudad de la Innovación 7
31621 Sarriguren, Spain

CIEMAT – Centro de Investigaciones Energéticas, Medioambientales Tecnológicas
AVENIDA DE LA COMPLUTENSE, 40
28040 Madrid, Spain

UCM – Universidad Complutense de Madrid
Jesús Fidel González Rouco
Universidad Complutense de Madrid, Facultad de CC. Físicas
Física de la Tierra, Astronomía y Astrofísica II
Avd. Complutense s/n
28040 Madrid, Spain

UIB – Universitat de les Illes Balears
Carretera de Valldemossa km 7.5
E-07122 Palma de Mallorca, Spain

IC3 – FUNDACIO INSTITUT CATALA DE CIENCIES DEL CLIMA
Calle Doctor Trueta, 203
08005 Barcelona, Spain

BSC – Barcelona Supercomputing Centre
Jordi Girona, 20, 3rd floor
08034 Barcelona, Spain

Uppsala University
Villavägen 16
752 36 Uppsala, Sweden

WeatherTech Scandinavia
Uppsala Science Park
751 83 Uppsala, Sweden

TÜBITAK MRC: The Scientific and Technological Research Council of Turkey Marmara Research Center
METU Campus
06531 Ankara, Turkey

IZTECH – Izmir Institute of Technology
Gülbahçe Köyü, Urla
35430 Izmir, Turkey

METUWIND
ODTU-RUZGEM
Havacilik ve Uzay Muh Bol.
06800 ODTU Ankara Turkey

ITU – Istanbul Technical University
Faculty of Aeronautics and Astronautics
Department of Meteorology
34469 Maslak-Istanbul, Turkey

BORUSAN – Güney Rüzgarı Elektrik Üretim ve Ticaret A.Ş
Büyükdere Caddesi Nurol Plaza No.255 – 257 A-B Blok Kat:4
Maslak - Sisli
34398 Istanbul, Turkey

- collectively hereinafter referred to as "Partners" or individually as "Partner" -

for the joint implementation of the project

"New European Wind Atlas Joint Programme (NEWA Joint Programme)".

Preamble

The Partners, having considerable experience in the field concerned, are interested in collaborating together for the joint implementation of the project "New European Wind Atlas Joint Programme (NEWA Joint Programme)" (the "Project").

Within the framework of the "ERA-NET Plus" Program, each Partner has applied for governmental funding for its participation in the Project.
The Danish Partner(s) receive funding from the Energy Development and Demonstration Programme under the Danish Energy Agency (DEA).
The Walloon Partner(s) receive funding from the Department of Energy and Sustainable Buildings (DGO4) in Belgium.
The Flemish Partner(s) receive funding from the government agency for Innovation by Science and Technology (IWT) in Belgium.
The German Partner(s) receive funding from the German Federal Ministry for Economic Affairs and Energy (BMWi).
The Latvian Partner(s) receive funding from the Latvian Academy of Sciences (LAS).
The Portuguese Partner(s) receive funding from Fundação para a Ciência e Tecnologia (FCT) in Portugal.
The Spanish Partner(s) receive funding from Ministerio de Economia y Competitividad (MINECO) in Spain.
The Swedish Partner(s) receive funding from the Swedish Energy Agency (SWEA).
The Turkish Partner(s) receive funding from The Scientific and Technological Research Council of Turkey (TÜBITAK).
Subject to each Partner's obtaining of the necessary funding allocation from its respective national funding authority, the Partners wish to set forth and memorialize in this Consortium Agreement the terms and conditions pursuant to which they agree to be bound in connection with the Project.

So, the purpose of this Consortium Agreement is to specify with respect to the Project the relationship among the Partners, in particular concerning the organization of the work between the Partners, the management/coordination of the project and the rights and obligations of the Partners concerning liability, rights of use and dispute resolution.

Now, therefore, the Partners hereby agree as follows:

1 Subject

Subject matter of this Consortium Agreement shall be the Partners' co-operation in carrying out the joint project

"NEWA".

The type and scope of the work to be performed by each Partner shall be determined by the terms of its respective funding authority's funding notification and the underlying request for allocation of funds (including the work plan) as listed in detail in the "Full Project Proposal" attached as Annex A to this Consortium Agreement and forming an integral part hereof. Every Partner shall be responsible for the implementation of its assigned tasks.

2 Duration

The Project shall commence on October 20, 2014 and has an expected period of performance until October 19, 2019.

3 Project Coordination and Organizational Structure

3.1 The Project shall be coordinated by the Technical University of Denmark, which shall serve as the Coordinator of the Project.

3.2 The Coordinator shall be responsible for his tasks according to Annex A as well as for the following:

- Monitoring compliance by the Partners with their obligations.
- Keeping the address list of Partners and other contact persons updated and available.
- Collecting, reviewing and submitting information on the progress of the Project and reports and other deliverables.
- Preparing meetings of the Partners, chairing the meetings, preparing the minutes of the meetings and monitoring the implementation of decisions taken at the meetings or by written consent of all the Partners in lieu of a meeting.
- Transmitting documents and information connected with the Project to the Partners.

3.3 Unless stipulated otherwise in Annex A, the Coordinator shall convene ordinary meetings at least once every six months and shall also convene extraordinary meetings at any time upon written request of any Partner.

The Coordinator shall give provide written notice of a meeting to each Partner as soon as possible and in any case at least 28 calendar days preceding an ordinary meeting and at least 14 calendar days preceding an extraordinary meeting. Meetings may be held at a location within Europe acceptable to all of the Partners; they may also be held by teleconference or other telecommunication means provided that each of the Partners is able to hear and be heard at the meeting. The Coordinator shall produce written minutes of each meeting which, after written approval by each Partner, shall be the formal record of all decisions taken with regard to the Project.

3.4 No Partner, in particular not the Coordinator, shall be entitled to act or to make legally binding declarations on behalf of any Partner.

3.5 In order to ensure a clear and balanced distribution of decision making powers and responsibilities, the structure in the Project shall be organized as established in the "3.4.2 Description of Management structure and procedures" of Annex A. In particular, the "Decision making and conflict resolution" rules in Annex A shall apply. Section 12.4 of this consortium agreement shall remain unaffected.

4 Rights and Obligations

4.1 The Partners shall inform each other about the attained research results or work progress, and shall exchange interim and final reports as given in their respective funding authority's funding notification.

4.2 The overall goal of the Project is to create a database containing up-to-date wind data for the whole of Europe, the New European Wind Atlas (NEWA).

4.2.1 It is the intention of the Partners and the request of the public sponsor that the NEWA database shall be made publicly available after the Project. It shall be run by a third party, the host, who will make the NEWA available for the public via internet and free of charge. The Partners have foreseen the International Renewable Energy Agency (IRENA) as the host; the Coordinator is responsible for contracting with the host.

4.2.2 A respective Partner's data resulting out of a measurement campaign shall also be made publicly available. Each Partner shall be obligated to supply free of charge his measurement data into a public database to be agreed on by the Partners.

4.2.3 In order to create the NEWA, the Partners will analyze data by using software

models. Those software models may be software models that are either newly developed during the Project (Foreground software model) or that already exist (Background software model) or that already exist and are further developed during the Project (Further Developments).
It is another important goal of the Project and the Partners' obligation that the final model chain software model used for analyzing data for the NEWA shall become publicly available free of charge at the end of the Project as open source software.

The Partners shall therefore at the end of the Project make available for the public via internet all software models used by them for analyzing data for the NEWA. For this purpose, each Partner shall upload the software models he used in open source version either onto a joint server platform or onto their own website, as agreed on by the Partners.

The use of the Foreground software models and of Further Developments shall be free of charge. The Partners shall make sure that if the use of those software models requires a license for already existing basic software of a third party or for already existing Background software of a Partner, they shall use their best effort to obtain a free and fully paid up license to the software or existing Background software. If they are not able to obtain a free and fully paid-up license, they shall inform the Coordinator who shall decide on the matter before incorporating it or using it in the Project deliverables.

For other research and development results generated during the Project the following shall apply:

4.3 The ownership of inventions or industrial property rights generated during the performance of the Project shall belong to the Partner who has generated them. For the duration and implementation of the project only, the Partners shall grant to each other a non-exclusive, non-transferable, non-sublicensable, royalty free right of use to any inventions generated by them during the performance of the project as well as to industrial property rights filed by and granted to the respective Partner for these inventions; compared to conditions for third parties the respective Partner shall be granted a significant allowance.

For further purposes, upon request that has to be made within a year after the end of the Project, each Partner shall be granted a non-exclusive, non-transferable, non-sublicensable license on fair market conditions which shall be mutually agreed upon prior to the intended use. When assessing the fair market conditions, the necessary contribution of such a Partner to the invention made in the framework of the cooperation shall be taken into consideration.

In the case of copyright protected works and know-how created during the performance of the Project Section 4.3, paragraph 1 and 2 shall apply correspondingly.

4.4 The Partners shall agree for each individual case on the treatment of joint inventions (i.e. inventions in which employees of several Partners participate, whose contributions to the invention cannot be registered separately by each Partner as industrial property rights). The involved Partners shall within a six (6) month period as from the date of the generation of such joint invention, establish a separate written joint ownership agreement regarding allocation of ownership, registration, maintenance, defense, division of related costs and exploitation (i.e. use and licensing). Where no joint ownership agreement is concluded, the involved Partners are entitled to use and license such joint inventions and the industrial property rights granted to them without any financial compensation for non-commercial research. The rights of the non-involved Partners to such joint inventions shall be governed by Section 4.3.

In the case of copyright protected works and know-how jointly created during the performance of the Project Section 4.4, sentence 2 and 3 shall apply correspondingly.

4.5 This Consortium Agreement has no effect on the Partners ownership to their already existing inventions or industrial property rights created prior to the Project or to their inventions or industrial property rights created outside of the Project. If during the performance of the Project already existing inventions or industrial property rights created prior to the Project by one of the Partners are required for the implementation of the project, a non-exclusive, non-transferable, non-sublicensable royalty free right of use shall be granted to the other Partner provided that the granting Partner is legally free to do so. Such right of use does not comprise the right to modification or further development of such inventions or industrial property rights.

In the case of already existing copyright protected works and know-how created prior to the Project Section 4.5 paragraph shall apply correspondingly.

5 Confidentiality

The Partners shall keep in confidence for the duration of the Project and for five years after the termination of the Project any Partner's technical or business information which was declared as confidential, and shall not disclose such information to third parties without the prior written consent of the respective Partner. This obligation shall not apply to any information which is:

- proven to have been known to the receiving party prior to the time of its receipt pursuant to this Agreement; or
- in the public domain at the time of disclosure to the receiving party or thereafter enters the public domain without breach of the terms of this Agreement; or

- lawfully acquired by the receiving party from an independent source having a bona fide right to disclose the same; or
- independently developed by an employee of the receiving party who has not had access to any of the Confidential Information of the other party; or
- required to disclose by reason of legal, accounting or regulatory requirements beyond the reasonable control, and despite the reasonable efforts to restrict such disclosure, of the receiving party.

6 Publications

6.1 Publications containing confidential information or research results of another Partner, shall be submitted to the concerned Partner in advance and shall require his prior consent. The consent may not be unreasonably withheld. Unless the consent is denied within 30 days after submission the consent shall be deemed to be given.

6.2 For clarification, each Partner is entitled to make publications that do not contain any confidential information or research results of another Partner without prior consent of any other Partner.

6.3 The applicable publication rules or obligations to notify of the Partners towards their respective national funding authority shall remain unaffected.

7 Involvement of third parties

A Partner that enters into a subcontract or otherwise involves third parties in the Project remains solely responsible for carrying out its relevant part of the Project and for such third party's compliance with the provisions of this Consortium Agreement, especially with regard to confidentiality. The Partner shall ensure that the involvement of third parties does not affect the rights and obligations of the other Partners under this Consortium Agreement; this includes but is not limited to the obligation to ensure that the results attained by the subcontractor or third party will be made available to the other Partners according to Section 4 of this contract.

8 Liability

8.1 The Partners shall not be liable for the correctness, sufficiency or fitness for purpose of the research results exchanged or the information communicated during the Project. Likewise, the Partners do not warrant that the rights of use granted by them can be executed without infringement of any third party's rights or that information disclosed does not infringe any third party's rights. Such limitation of liability shall not apply in case of intent.

8.2 Unless otherwise stipulated in this Agreement, the Partners shall, including liability for their senior executives, legal representatives and vicarious agents, not be liable for breach of duty or tort except in case of intent. Except in case of intent, liability for indirect or consequential damages, especially loss of profit, shall be excluded. To the fullest extent permitted under the applicable governing law, a Partner's total aggregate liability to the other Partners collectively for any and all loss or damage arising under or in connection with the Project, shall not exceed 350,000 €.
Such limitations of liability shall not apply in case of breach of confidentiality obligations according to section 6 of this contract.

8.3 Each Party shall be solely liable for any loss, damage or injury to third parties resulting from the performance of the said Party's obligations by it or on its behalf under this Consortium Agreement. The internal liability of the Partners towards each other for such losses, damages or injuries to third parties shall only be limited to the respective Partner's share of fault, whereas the limitations of liability according to section 8.2 shall not apply. The Partners shall insofar indemnify the other Partners from any further claims.

9 Financial provisions

9.1 Each Partner shall bear its own costs relating to the Project.

9.2 The Partners acknowledge that the total funding available for this Project is made up of national budgets and an EU contribution. National or regional partners will receive funding from their respective funding agencies that will incorporate the EC contribution. Partners of the consortium are therefore subject to national/regional and EU funding rules.

25 % of the EU contribution incorporated in the Partners' respective national funding is foreseen to cover management expenses, support to external partners, travel money for the advisory board, meetings with external partners and common workshops as well as for the purchase and/or lease of selected instruments/equipment. With regard to purchased equipment, the Partners will at the latest at the end of the Project agree on the ownership, further use, etc., in compliance with their national funding rules and regulations.

10 Export laws and regulations

Where fulfilment of contractual obligations of the Partners requires a permit due to national, European, United States or international foreign trade law regulations, including an embargo (and/or other sanctions), contractual performance will be subject to authorization by the competent authority; in case the authorization is not granted, there shall be no breach of contract or contractual obligation on that Partner's part. The same applies if fulfilment of the contract should be prohibited due to the regulations cited.

If a Partner is entitled under section 4 of this contract to award licences to research results of another Partner for use outside of the country of that other Partner, then this will require the prior consent by the other Partner, who will only refuse its consent if the competent authority fails to grant the required permit.

Any damage compensation obligation due to delays or obstructions to performance in view of national, European, United States or international foreign trade law regulations, including an embargo (and/or other sanctions) is expressly barred. The same applies to other claims (such as repayment or guarantee claims, which are due to advance payment bonds, etc.).

11 Termination

11.1 Each Partner may terminate its participation in the project subject to a three-month period of notice for good cause only. This applies in particular if further co-operation has become unacceptable or funding has been reduced significantly. In the event of termination the respective funding authority shall be notified about the withdrawal from the project.

11.2 In the event of the withdrawal of a Partner

- its rights according to Section 4, except Section 4.3 (2), 4.3 (3) in conjunction with 3.2. (2), 4.3, shall terminate;
- the licenses or rights of use granted to the other Partners on the basis of this Consortium Agreement shall not be affected;
- its obligation according to Section 5 (Confidentiality) shall remain unaffected;
- as far as the continuation of the joint project is reasonable, the tasks of the withdrawing Partner which have not been carried out yet may be taken on by a new partner after mutual written agreement of the remaining Partners.

The obligations of the remaining Partners to the withdrawing Partner set forth under Sections 4, 5, 6 and 8 of this Consortium Agreement shall be applicable only for research results that were attained prior to the receipt of notice. His rights under this Section 11.2 as well as the obligations of the withdrawing Partner set forth under Sections 4, 5, 6 and 8 shall continue to apply to all research results and industrial property rights that are granted to him on the basis of activities which were assumed and/or started in connection with the Project.

11.3 In the event that the Partners mutually agree that the development goal of the Project cannot be attained and that thus the basis for this Consortium Agreement ceases to exist the Partners shall agree on further proceedings, including any rights to already attained research results, and shall conclude a separate agreement, if necessary.

12 Concluding provisions

12.1 Ancillary agreements, amendments, additions hereto shall be made in writing. This applies also if the requirement of the written form shall be waived.

12.2 Nothing contained in this Consortium Agreement shall be deemed to constitute a joint venture, agency, partnership, interest grouping or any other kind of formal business grouping or entity between or among the Partners. No Partner shall have the right or authority to assume or create obligations or responsibilities, express or implied, on behalf of or in the name of another Partner, or to bind another Partner in any manner without the prior written consent of the other Partner or Partners.

12.3 In case this Consortium Agreement is in conflict with the national funding regulations applicable to any Partner, the terms of the latter shall prevail.

12.4 This Consortium Agreement shall be governed by the laws of Belgium. All disputes arising out of or in connection with this Consortium Agreement shall be finally settled under the Rules of Arbitration of the International Chamber of Commerce. Place of Arbitration shall be Brussels, Belgium. The laws of Belgium shall apply; the United Nations Convention on the International Sale of Goods (CISG) shall not apply. The proceedings shall be conducted in the English language.

12.5 If any provision of this Agreement is determined to be illegal or in conflict with the applicable law, the validity of the remaining provisions shall not be affected. The ineffective provision shall be replaced by an effective provision which is economically equivalent. The same shall apply in case of a gap.

12.6 This Agreement will come into force with its signature by all Partners with (retroactive) effect on October 10, 2014.

Authorised to sign on behalf of

1. Technical University of Denmark
Mr. Claus Nielsen
Director

Signature Date

2.) DNV-GL Energy
[Name]
[Title]

____

Signature Date

3.) Vestas Wind Systems A/S
[Name]
[Title]

Signature Date

4.) 3E N.V.
[Name]
[Title]

____

Signature Date

5.) KU Leuven
[Name]
[Title]

____
Signature   Date

6.) Nazka Mapps bvba
[Name]
[Title]

____
Signature Date

7.) ATM-PRO SPRL
[Name]
[Title]

____

Signature Date

8.) CENAERO
[Name]
[Title]

Signature Date

9.) IWES - Fraunhofer Institute for Wind Energy and Energy Systems
[Name]
[Title]

Signature Date

10.) ForWind - OL - Center for Wind Energy Research – Univ. of Oldenburg
[Name]
[Title]

____
Signature Date

11.) Institute of Physical Energetics/ Fizikalas energetikas instituts (IPE)
[Name]
[Title]

____

Signature Date

12.) Engineering Research Institute "Ventspils International Radio Astronomy Centre" of Ventspils University College (ERI VIRAC)

[Name]
[Title]

____

Signature Date

13.) University of Latvia (UL), Faculty of Physics and Mathematics
[Name]
[Title]

Signature Date

14.) Latvian Environment, Geology and Meteorology Centre (LEGMC)
[Name]
[Title]

Signature Date

15.) UPORTO, Universidade do Porto
[Name]
[Title]

Signature Date

16.) INEGI - Instituto de Engenharia Mecânica e Gestão Industrial
[Name]
[Title]

____

Signature Date

17.) IPMA - Instituto Português do Mar e da Atmosfera
[Name]
[Title]

Signature Date

18.) LNEG - National Laboratory for Energy and Geology
[Name]
[Title]

Signature Date

19.) CENER - National Renewable Energy Centre of Spain
[Name]
[Title]

____

Signature Date

20.) CIEMAT - Centro de Investigaciones Energéticas, Medioambientales Tecnológicas

[Name]
[Title]

____

Signature Date

21.) UCM - Universidad Complutense de Madrid
[Name]
[Title]

Signature Date

22.) UIB - Universitat de les Illes Balears
[Name]
[Title]

____

Signature Date

23.) IC3 - FUNDACIO INSTITUT CATALA DE CIENCIES DEL CLIMA
[Name]
[Title]

____

Signature Date

24.) BSC - Barcelona Supercomputing Centre
[Name]
[Title]

Signature Date

25.) Uppsala University
[Name]
[Title]

Signature Date

26.) WeatherTech Scandinavia
[Name]
[Title]

Signature Date

27.) TÜBITAK MRC: The Scientific and Technological Research Council of Turkey Marmara Research Center
[Name]
[Title]

____

Signature Date

28.) IZTECH - İzmir Institute of Technology
[Name]
[Title]

Signature Date

29.) METUWIND Middle East Technical University Center for Wind Energy
[Name]
[Title]

Signature Date

30.) ITU - Istanbul Technical University
[Name]
[Title]

Signature Date

31.) BORUSAN - Güney Rüzgarı Elektrik Üretim ve Ticaret A.Ş
[Name]
[Title]

Signature Date

Annex A: Full project proposal