

Understanding of the Physics of Wind Turbine and Rotor Dynamics through an Integrated Simulation Framework

UPWARDS



CHALLENGE

UPWARDS is building a paradigm-shifting wind turbine simulation framework in a situation where societies will exceed the global CO₂ budget within the next 15 years



MISSION

UPWARDS will make it possible to meet an ever growing demand for electricity by the world's economies as they continue to develop



OPPORTUNITY

UPWARDS is an European Commission (EC) backed project that promises to make achieving ambitious sustainability goals a reality

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... What is the major challenge that the economies of the world must surmount?

Over 35GT of CO₂ was produced in 2017. Emissions have grown 2% per year for the past 25 years. At this rate, the world's CO₂ budget will be exceeded in 15 years, meaning a rise above the 1.5°C tipping point threshold identified by the Intergovernmental Panel on Climate Change (IPCC). In response to this challenge UPWARDS' core objective is to use high performance computing to improve the understanding of wind-turbine-related physical phenomena which will optimize and accelerate design, development, testing and implementation of newer and larger wind turbines. UPWARDS will also aim to incorporate stakeholder feedback and technical, economic and societal demands on wind turbines.

... What does this mean for the future of energy production & consumption?

The UPWARDS project will establish a high-fidelity, multi-physics, mechatronic and multi-scale simulation framework that enables integrated modelling of wind flow, mechanical movements, structural/control dynamics and stress with a level of detail only achievable in a piecemeal fashion today, meaning that a comprehensive, holistic understanding is not possible. This is essential to realistically meeting future demand. The growth of global energy demand represents an enormous market opportunity. A 2018 IRENA study projecting a sustainable energy scenario, sees wind providing about a third of the installed renewables capacity needed by 2050. This equates to over 5,500GW of installed capacity an order of magnitude larger than the current global installed capacity (540GW in 2017).

...How do we accomplish this goal in the face of the afore mentioned challenge?

Thus the **UPWARDS project** is critical in reaching an IC on the **Tera-Watts (TW) scale in the timeline needed**. The **advanced simulation capabilities** that will be developed in the UPWARDS project will not only make it possible to **build wind turbines** in the **15MW range**, but will also **enable generation of realistic and relevant simulation results** for knowledge extraction and further exploitation.

IPCC, Special Report 15 IRENA: Global Energy Transformation: A Roadmap to 2050 Global Wind Energy Council: Global Wind Statistics 2017 Wind Europe: Wind in Power 2017

Upwards Consortium

SINTEF, Fraunhofer ITWM, UL – AWS TRUEPOWER, SIEMENS Wind Power, SIEMENS Industry Software, Von Karman Institute, WAGENINGEN University, Aalborg University, Universidad Nacional del Litoral, Wavestone The UPWARDS project has received funding from the European Union's Horizon 2020 research and innovation programme under GA No. 763990. The information on this presentation reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

