



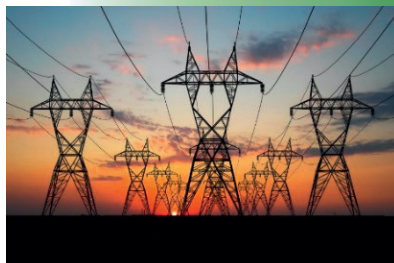
Understanding of the Physics of Wind Turbine and Rotor Dynamics through an Integrated Simulation Framework

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**



...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**.

