



Report 2022

Task 53

Photo: *labsas / Getty Images Signature-Canva.*

Wind Energy Economics

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Wind power serves as a key source of low-cost clean energy in markets around the world. The wind industry's future depends on a sophisticated understanding of cost reduction opportunities, as well as a robust approach to how society can maximise the value of wind energy in the electricity and energy sectors.

The work within Task 53 aims to inform the analysis, policy, and regulatory communities of the current and future cost of wind energy for land-based and offshore wind technologies and the technology's value proposition. The Task is focused on new wind applications, new insights on evolving economic metrics, and analysis and outcomes that examine a future where wind energy is tailored for a fundamentally different power system of the future. Specifically, a future

where wind power is at or approaching half of the electricity supply across continents and hemispheres. By providing high-quality data that supports analyses related to the cost and value of wind energy, the Task enhances the broader energy community's efforts to plan for the future. The Task also develops novel models that are often applied by key stakeholder groups and industry. Organisations such as IEA and the International Renewable Energy Agency have used the Task 53

wind project cost and performance statistics and participants regularly use this data for internal and external purposes.

Introduction

Wind power is becoming a more abundant clean energy source around the world. However, its future is still dependent on research and development which facilitates a deeper understanding of cost reduction opportunities, in addition to solutions suggesting how society can maximise the value of wind energy in the electricity and energy sectors. To meet these ends,

Task 53 was formed in 2022 to generate data and insights that highlight and help realise the potential role of wind power in the future energy system. The focus areas of Task 53 include new wind applications and new insights on evolving economic metrics. Furthermore, it aims to analyse and prepare societal sectors for future power systems which are anticipated to become more reliant on wind energy. The work of the Task considers the full array of land-based and offshore wind power applications but focuses primarily on utility-scale technologies and plants. The scope of work is projected to extend through the calendar year of

2025, and was formally approved in the minutes of ExCo 88 delivered in February 2022 as the new IEA Wind Task 53 Wind Energy Economics. A virtual kick-off meeting was held in March of 2022 and the first in-person meeting took place in late January 2023, hosted by TNO in Amsterdam, the Netherlands (Figure 1). Industry stakeholders regularly collaborate on work products and participate in the Task's in-person meetings. Ten IEA Wind TCP Members, representing 17 distinct organisations and participation from 22 individuals constitute the membership of Task 53 (Table 1).

Table 1. Countries Participating in the Task.

	COUNTRY/SPONSOR	INSTITUTION(S)
1	Denmark	Denmark Technical University (DTU) EA Energy Analysis
2	European Commission	Joint Research Centre (JRC)
3	Germany	Deutsche WindGuard Fraunhofer IEE Fraunhofer ISI
4	Ireland	Sustainable Energy Authority of Ireland University College Cork
5	Japan	University of Tokyo
6	Norway	Norwegian Water Resources and Energy Directorate (NVE)
7	Sweden	Swedish Energy Agency (SEA)
8	United Kingdom	Offshore Renewable Energy (ORE) Catapult University of Sussex
9	United States	Lawrence Berkeley National Laboratory (LBNL) National Renewable Energy Laboratory (NREL)
10	The Netherlands	Netherlands Organisation for Applied Scientific Research (TNO) Eneco

Collaborators observing the work of the Task in the past year include the International Renewable Energy Agency (IRENA) and wind energy finance professionals. An array of additional research organisations and stakeholders have participated in events organised or coordinated with the work of Task 53.



Figure 1. Experts Participating in IEA Wind Task 53. Photo: Bernard Bulder, TNO.

Progress and Achievements

Task 53 initiated its activities in early 2022. The work has focused so far on conceptualising the work that is planned over the next phase and working towards a first set of deliverables. A summary of the collaboration, dissemination, and publications accomplished in 2022 include:

- Submission of a manuscript titled “Beyond Subsidies: The Enduring Role of Contracts-for-Difference in Risk Management and Market Creation for Renewables” to Nature Energy (currently in peer review).
- Researchers participated in the 2022 Association for Public Policy Analysis & Management (APPAM)

Conference to present the above-mentioned manuscript.

In addition to monthly one hour-long web meetings, a virtual kick-off meeting was held in March of 2022 and an extended 3-day in-person Task meeting took place from the 31st of January to the 2nd of February 2023. Collaborations among the group have been fruitful and covered a variety of areas, with a few highlights from select Work Packages (WPs):

WP 1: How does the design and operation of wind power plants change in a deep decarbonisation future, and impact the value of wind energy?

- A core team led by NREL with support from LBNL is actively developing a survey instrument.

This survey seeks to gain insights into questions such as how wind costs, technology, and manufacturing evolve as favourable wind areas become saturated, yet the demand for wind energy is still projected to grow 8-10 times.

- The team is currently generating version two of the survey instrument. A discussion of the survey was held during the in-person meeting in early 2023, with survey dissemination planned in the Summer of 2023.

WP 3: How does uncertainty impact wind energy economics and financing?

- Task participants have developed a manuscript that describes the structure, impact, and value of

contract-for-differences policies and how they can play a fundamental role in supporting high levels of new financing and investment.

to address questions, such as how combined international offshore electricity transmission systems limit the costs of and ensure the value of offshore wind energy.

government ‘subsidy’, suggesting they support uneconomic activity. In this manuscript, the Task co-author team argues that the primary role of (wind energy) CfDs is rather one of risk management through creating a market for electricity supply at stable long-term prices. Similar to its use in other sectors of the economy, this contract type transforms a variable for a fixed price to reallocate volatility risks (Figure 2). Such long-term contracts are often necessary for renewables financing due to limited hedging options in existing markets and the capital-intensive nature of the technologies. Our perspective could imply a shift in perception toward CfDs as a fundamental and lasting market feature. We hope to stimulate a timely discussion about the impact of greater CfD diffusion on electricity market mechanisms, risk allocation, and combining fragmented streams of energy finance, market, and policy research.

WP 4: What data and methods best inform our understanding of current and historical wind energy economics?

- This work package supported updates in our cost and performance data collection process and methods including the data repository and viewer on the IEA Wind website. Data collection commenced this past Autumn and is ongoing. Development of the new data repository and viewer is also underway with expected completion in 2023.

WP 5: How do transmission infrastructure and hydrogen affect the cost and value of offshore wind energy?

- A core team led by EA Energy Analyses is actively engaged in scoping

Highlight(s)

The Task has produced a manuscript titled “Beyond Subsidies: The Enduring Role of Contracts-for-Difference in Risk Management and Market Creation for Renewables” [1], which is currently under review as a perspective with the journal *Nature Energy*. In this manuscript, the co-author team brings together researchers and investment practitioners to explore renewables procurement, market design, and the role of governments through the lens of financing. Contracts-for-Difference (CfDs) have been used in more than 50% of the global offshore wind supply. They are at the centre of ongoing electricity market reforms in many jurisdictions. The payments awarded through CfDs are sometimes labelled as a direct

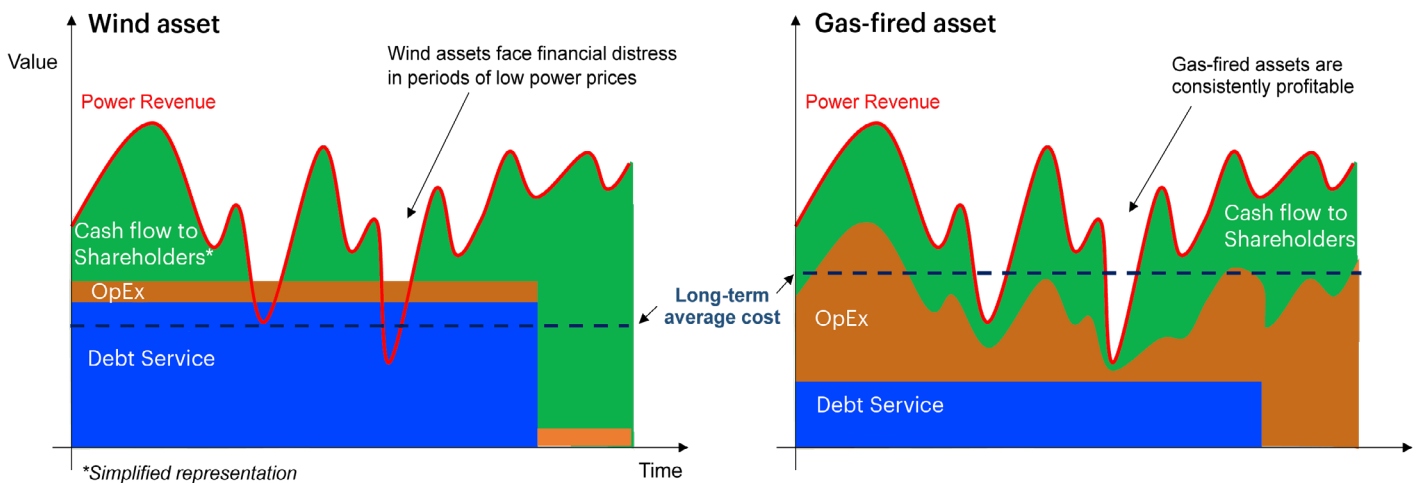


Figure 2. Costs of wind and natural gas assets. Figure Source: [1].

Outcomes and Significance

The work of Task 53 aims to inform the analysis, policy, and regulatory communities of the current and future cost of wind energy for land-based and offshore wind technologies and the technology's value proposition within an evolving power system. By providing high-quality data and published analyses that expand our understanding of the cost and value of wind energy, the Task enhances the broader energy community's efforts to plan for the future. The Task furthermore develops novel approaches and insights that can be applied by key stakeholder groups and industry. Organisations such as IEA and the International Renewable Energy Agency have used the Task 53 wind project cost and performance statistics, and participants regularly use these data for internal and external purposes. Task 53 members are frequent presenters at conferences and industry-leading events around the world.

Next Steps

In the coming months, the Task participants plan to host in-person and virtual collaborative meetings to facilitate cooperation on Task deliverables. We anticipate one more in-person meeting during this calendar year, likely in the Autumn of 2023 in Europe. Virtual meetings are also anticipated to be held in all months except July and August.

Major upcoming deliverables include a journal article on accounting of wind energy uncertainties and risks, dissemination activities for our planned expert survey, a technical report or journal article on cost and value considerations for offshore wind and hydrogen coupling, and an inventory of supply chain and port capabilities.

References

[1] Beiter, P., J. Guillet, M. Jansen, E. Wilson, L. Kitzing (Forthcoming) "Beyond Subsidies: The Enduring Role of Contracts-for-Difference in Risk Management and Market Creation for Renewables". *In peer review.*

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