International Energy Agency (IEA)
Implementing Agreement for Co-operation in the Research and Development of Wind Energy Systems (IEA Wind TCP)

Task Extension Proposal

Wind Energy Economics

The changing economics of wind power in high renewables futures

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1 Introduction and Scope

Wind energy is among the least-cost technology choices in many power markets globally. As a result, an average of more than 100 gigawatt (GW) of global wind energy has been deployed annually over the last 5 years. [1] As wind energy's share of total electric generating capacity grows, new solutions for wind energy technologies, market design, and supply chains are arising – all of which require a nuanced assessment of their cost and value proposition.

A rapidly evolving energy sector demands greater knowledge how the cost and value from wind energy is impacted by the deployment of system-wide energy assets (e.g., storage systems and transmission), growing electrification of the economy and fuels conversion (e.g., power sector load growth and hydrogen applications), a depletion of the most favorable wind energy sites (e.g., further distances to grid connections), and new contracting instruments (e.g., a greater diffusion of wind energy contracts-for-difference). Assessments on how these trends affect the economics of wind energy have emerged in the research literature, yet these are often one-off analyses that are limited to single markets or points in time. Our Task aims to draw on its research participants to conduct comparative analyses that span multiple power markets and wind energy technologies with regular data reporting on the evolving economics of wind energy.

In this Task Extension, we propose a new work programme that focuses on the economic evaluation of wind energy technology choices and operations under high renewables futures (Figure 1). During our period of performance from 2026-2029, we aim to characterize (1) the cost and value proposition of wind energy technologies in a future power system and siting regimes (WP1 and WP2), (2) the impact of market designs and wind plant operations on technological choices (WP4), and (3) impacts from revenue and commodity price uncertainty on wind energy's economic offering (WP3). Further, (4) the Task will continue its tracking of wind energy costs with a shifted focus on how cost and value change with technological choices and merchant exposure (WP5).

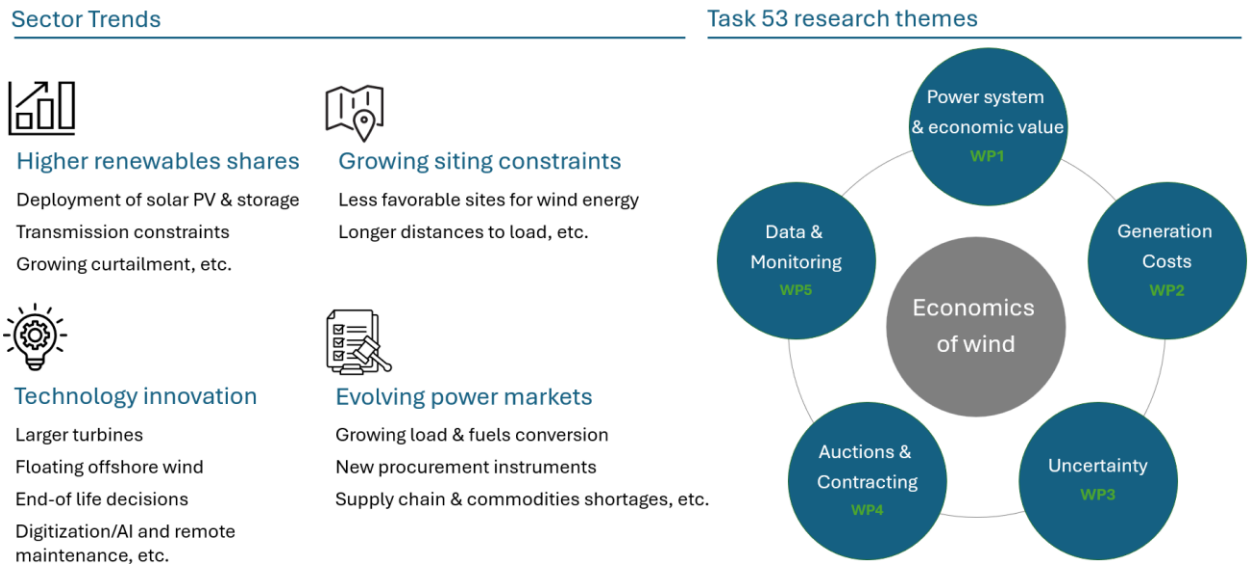


Figure 1: Sector trends and research themes in the economics of wind energy
Note: WP = Work Package; AI = Artificial Intelligence; Solar PV = Solar Photovoltaic.

[1] International Renewable Energy Agency (IRENA). 2025. "Wind Energy Data" https://www.irena.org/wind. Accessed 10/06/2025.

This new phase of Task 53 builds upon a successful track-record from its initial phase between 2021-2025 and its predecessor IEA Wind Task 26 ("The cost of wind energy", 2009-2021). The prior Task phase established impactful publications, research dialogue, and policy input on the evolving wind energy economics under deep decarbonization scenarios, such as emerging wind energy contracting regimes (i.e., contracts-for-difference), cost of finance (in collaboration with the International Renewable Energy Agency [IRENA]), hydrogen coupling, cost structures for fixed-bottom offshore wind, and global supply chain mapping. In this extended Task we continue this work effort with a clearer focus on nearer-term challenges that confront the sector over the next decade.

Anticipating the economic impacts from changes in technology, markets, and siting conditions under high renewables futures is essential to inform today's investment, research, and development (R&D), and energy system planning decisions. To explore these issues, the proposed new collaborative work detailed here features five work packages (WP) that each address a specific research question:

WP1: How does wind energy's economic value change under high renewables futures?

WP2: How does technology innovation, age, and operational strategies impact the economics of wind energy?

WP3: How do uncertainty and offtake contracts impact wind energy economics and financing?

WP4: How do auction design and markets impact the cost and value of wind energy?

WP5: What data and methods best inform our understanding of current and historical wind energy economics?

By exploring these research questions and continuous tracking of wind power cost and value data, this Wind Energy Economics Task builds upon the research methodologies and external relationships developed during Phase 1 and deploys them to some of the most pressing topics in wind energy economics. Further, this work supports the international community, including the IEA in understanding future wind power economics holistically. The work of the Task considers the full array of onshore and offshore wind power applications but focuses on utility scale (i.e., > 1 megawatt) technologies and plants. By compiling data from participating countries, analyzing differences with transparent and consistent methodologies, and disseminating our research findings to the broader IEA and international community, the Task serves as a catalyst in bringing about a clean, affordable, and reliable energy future.

2 Background

In November of 2005, IEA Wind Topical Expert Meeting No. 47 focused on methodologies for estimating the cost of wind energy. This meeting demonstrated significant international interest in a Task dedicated to the analysis and evaluation of the cost of wind power systems. IEA Wind Task 26 formally began work in January 2009, with the first phase extending through 2012. A second phase of the Task commenced in October 2012 and concluded in September 2015. In the second phase of the Task, investigation of onshore wind cost of energy provided a common

format to present project-level data that contributes to cost of energy calculations. The Task also conducted offshore balance of station model comparisons and analyses. Further interest in the work of Task 26 resulted in a third collaboration phase extending from October 2015 to September 2018. This phase focused on in-depth cost comparisons of offshore wind among the participating countries and analysis of the impacts from higher turbine hub heights and lower specific power on the value of wind energy in Europe. The Task also held an experts' workshop on the value of wind energy and published an expert elicitation of future onshore and offshore wind energy costs. The fourth phase of the Task, which ran from 2018 through 2021 has been similarly productive. The Task generated several high impact publications across a variety of wind energy cost topics, which have increasingly broadened beyond the Task's initial focus on the cost of wind energy. Because of this broader focus, the Task was re-launched in 2021 with a focus on the economics of wind energy, spanning wind energy's cost and value proposition, financing, auction and procurement design, and global supply chains. The work has been featured in top-energy journals, such as *Nature Energy* and *Applied Energy*. We also organized workshops with sector professionals and participated in conferences to disseminate our research findings. A sample of key accomplishments from this latest period include:

- Published journal manuscript (*Nature Energy*) "The enduring role of contracts for difference in risk management and market creation for renewables", 2024
- Published journal manuscript (*Applied Energy*) "Assessment of capital expenditure for fixed-bottom offshore wind farms using probabilistic engineering cost model", 2023
- Published journal manuscript (Energy Research & Social Science) "Five grand challenges of offshore wind financing in the United States", 2024
- Published Technical Report (IRENA/IEA Task 53/ETH Zurich) "The cost of financing for renewable power", 2023
- Published Technical Report (European Commission - JRC) "Knowledge gaps in the wind energy technology supply chain", 2025
- Submitted journal manuscript "How will the wind blow in 2050? A global expert elicitation survey on the future of land-based wind energy siting and technology development", Forthcoming
- Journal manuscript draft "Quantifying risk profiles in offshore wind investments: a comparative study across policy schemes", Forthcoming
- Joint workshop co-hosted by DTU and Columbia University on challenges in U.S. offshore wind financing, held with participation of 15 finance professionals in New York City (23-24 June, 2022)
- Participation in an IEA Wind Topical Expert Meeting on "net zero" and a joint workshop with IEA Task 25 ("Design and Operation of Energy Systems with Large Amounts of Variable Generation") to explore shared research projects, both held in Dublin, Ireland (April 8-12, 2024)
- Disseminated findings on the role of contracts-for-difference during the 2022 *Association for Public Policy Analysis & Management* (APPAM) Conference (November 17-19, 2022)

Throughout all phases of work completed to date, the Task has demonstrated significant and increasing value-add in the international wind energy community. Based on sustained interest in the work of the Task and a vibrant participant group, the co-Operating Agents (Aquilo Energy GmbH and NREL) and participating members are proposing to extend the Task's work programme. This work will be conducted during a period that extends from January 2026 through December 2029. This proposal details the activities and focus of the Task in the proposed new collaborative work.

3 Objectives and Expected Results

Increasing the global supply of low cost and reliable clean energy is a common goal of the IEA. The vibrancy of the future wind energy sector depends in part on a sophisticated understanding of how the cost and value of wind energy might change in the coming years and decades, especially under high market shares of renewables. Further economic considerations include an enhanced understanding of how uncertainty (e.g., from fluctuating commodity prices or wholesale electricity prices) affect wind energy's cost and value, as well as continued methods development that supports a common and holistic understanding of cost and value trends.

The proposed objectives for our new collaborative work builds upon the objectives of the Task's prior phase. First and foremost, we seek to provide new insight and intelligence on the economics of wind energy in future power systems. In the new phase, the Task will build upon its long record of investigating cost drivers for wind energy technologies. Based on an extensive benchmarking of fixed-bottom and floating offshore wind among our participants, we aim to extend our cost and performance characterization of emerging technology trends (e.g., advanced O&M strategies, coupling with hydrogen, larger turbine systems) and wind energy's assets' age (WP2). The Task plans to continue its public cost data viewer with a greater emphasis on featuring cost differences from technology choices and siting regimes (WP5). For a holistic assessment of wind energy's economic offering, we complement our efforts on cost characterization with appraisals of wind energy's power system and societal value (WP1). Specifically, we aim to provide a quantitative perspective on the flexibility provision and needs from wind energy under high renewables scenarios. Further, we aim to explore trade-offs in measuring wind energy's value holistically, encompassing job creation, environmental benefits, and supply chain resiliency. In an effort to further develop a relatively new field of research, the Task's participants aim to spearhead explorations of uncertainty in wind energy offtake contracts from wake effects, merchant exposure, and commodity prices – all topics of high relevance to wind energy's commercial future (WP3). Our work efforts on design features and non-price criteria of wind energy auctions (WP4) bring together much of the learnings and methods development for all other Work Packages in an effort to inform the policy dialogue for tendering wind energy.

Throughout its work, the Task seeks to develop and maintain methodologies and data that are consistent and transparent for the international community. Such methodologies and data facilitate ongoing and future comparisons and validation of wind power analyses, research and strategic decision support.

Anticipated results from the work of the Task include:

- International collaboration and coordination in the study of wind energy costs, value, and auction design in support of a common global understanding of the status of the economic offering from wind power technologies and how they might evolve under high renewables futures
- Data that characterize and illuminate costs and value as well as future applications of onshore and offshore wind energy and their drivers among the participating countries, providing opportunities for comparison. This serves the goal of fostering future research opportunities and providing an enhanced understanding of drivers and constraints on wind power technology evolution and change

- Insights into the potential future costs and value streams of onshore and offshore wind energy, including from specific or general innovation opportunities and informed through expert consultation, engineering analysis, stochastic assessments, and other methods; these data inform wind power technology stakeholders as well as the broader energy sector modeling and analysis community in understanding the potential role for wind power in the future energy system
- Journal articles, technical reports, fact sheets, webinars and workshops that highlight key analyses and research conducted under the auspices of the Task, enabling broad-based stakeholder uptake and internalization of the diverse work activities of the Task including among policymakers and decisionmakers inside and outside of the wind power industry.

The Task will seek collaboration opportunities with other IEA Tasks and external partners, building on ongoing dialogue during the ongoing and past Task phases. In preparation for this Task extension proposal, we have already identified common research activities with IEA Task 25/63 ("Integration of Variable Energy") for WP 1 and WP 4. We also consider exploring collaboration opportunities with Task 42 ("Wind Turbine Lifetime Extension") for WP 2. In addition, we will plan to continue our informal partnerships. The Task has an extraordinary reach with the wind industry more broadly to inform its research and for data collection efforts. Some examples include our participants past collaboration and workshops with the International Renewable Energy Agency (IRENA) and ETH Zurich on a renewable energy finance survey (> 75 industry participants), and two broad industry surveys focused on understanding the cost and value of wind energy (> 600 industry participants), results of which were published twice in *Nature Energy*.

4 Approach and Methodologies

The following sections provide detail on the anticipated contents and participant contributions in each of the proposed work packages. Specific country or organizational contributions to each of the work packages and estimated level of effort are summarized below and will be detailed more fully in the Task's forthcoming work plan delivered after approval of the proposed scope and formalization of commitments among the participants.

Work Package (WP) 1: How does wind energy's economic value change under high renewables futures?

Description: Wind energy has emerged as a least-cost electricity generation option in many power markets globally. Concurrently, wind energy contributes valuable ancillary services and enhances energy security. With increased deployment, the value of wind to the power system comes increasingly into focus. Wind energy's incremental value tends to decline the higher its share in a power system is because of coincident generation patterns. In this Work Package, we study the flexibility required to mitigate such wind value decline through wind plant design, siting choice, and turbine operations (e.g., through ancillary services provision). As such, we build upon a survey among global wind energy experts from the Task's first phase (2022-2025) on mitigation strategies to enhance wind energy value. The assessment might also include an analysis of how transmission buildout impacts flexibility requirements. Furthermore, we will explore alternate definitions of wind energy value that could include factors such as supply chain resiliency, local job creation, environmental benefits, and sustainability, and will classify how these complementary factors affect the value of wind at increasing market share. We will compare value-enhancing strategies of wind energy through e.g., recyclability, local

manufacturing, and non-price criteria in wind energy tenders. Within this Work Package we focus on: 1) Studying flexibility needs in a future power system scenario with very high wind energy deployment and identifying measures for mitigating losses in wind energy value; and 2) an evaluation of trade-offs between a diverse set of wind energy value streams (e.g., generation costs, supply chain resiliency, sustainability).

We expect at least one technical report that focuses on power system flexibility needs and provision from wind energy. We also will work toward a journal article that evaluates trade-offs between a diverse set of economic value streams from wind energy.

WP Participants List: We currently anticipate varying levels, but broad-based participation in WP1 from many countries and institutes of the research task, including representatives from Denmark, the European Commission, Germany, Ireland, Japan, Norway, Sweden, the U.K. and the U.S.

Participant Contributions: As currently scoped all Task participants will be encouraged to support the WP. These discussions will be led by Denmark.

Deliverables List:
Year 3: Journal article on the evaluation of trade-offs between a diverse set of economic value streams from wind energy (Lead: Denmark, DTU)
Year 3: Technical report on flexibility needs in a high wind energy scenario and measures for mitigating losses in wind energy value (Lead: Denmark, Ea Energianalyse; Contributions: U.S., ESIG)

WP2: How does technology innovation, age, and operational strategies impact the economics of wind energy?

Description: The cost of wind energy has declined substantially in recent years, driven largely by turbine technology, plant, and system design innovations, as well as operational efficiencies. Surveying of wind energy experts suggest that further cost reduction opportunities are available through 2050 and beyond; however, we know relatively little about the specific turbine, plant, system, and O&M advancements needed to achieve those cost declines. Moreover, while these technological and operational advancements can reduce the cost of wind energy, they also interact with the grid-system value of wind energy and innovations are needed to strike an adequate balance between cost (this WP) and value (WP1).

This collaborative research will address these knowledge gaps through three approaches: 1) benchmarking the cost representation of fixed-bottom and floating offshore wind technologies among our Task participants; 2) identifying a range of drivers that explain cost differences across markets and over time (incl. a critical learning rate application). This assessment might be conducted in collaboration with IEA Wind Task 49 and feature a set of representative case studies for offshore wind cost characterization with a focus on emerging technology opportunities, such as hydrogen coupling, advanced O&M strategies (incl. remote inspection, predictive maintenance, and autonomous condition monitoring) and insurance solutions, supply chain, turbine size, and export cable system configurations; and 3) an enhanced understanding of the impact from wind energy assets' age, technology choices, end-of-life decisions (e.g.,

decommissioning or repowering), and operational strategies on their performance. Such assessment could extend to an investigation of wind energy materials' properties, substitution, and recycling practices.

We expect three publications covering the results from 1) the Task 53 cost benchmarking for offshore wind technologies (technical report or journal article); 2) an assessment of wind project performance and its relationship to age, technology, and end-of-life decisions (journal article); and 3) an evaluation of cost drivers for offshore wind (journal article).

WP Participants List: We currently anticipate varying levels, but broad-based participation in WP2 from many countries and institutes of the research task, including representatives from Denmark, the European Commission, Germany, Ireland, Japan, Norway, Sweden, the U.K. and the U.S.

Participant Contributions: As currently scoped all Task participants will be encouraged to support the WP. These discussions will be co-led by Ireland and Japan.

Deliverables List:
Year 2: Technical report or journal article highlighting cost benchmarking results for offshore wind technologies (Lead: Japan, The University of Tokyo; Contributions: Ireland, University College Cork; UK, ORE Catapult ORE Catapult; Denmark, ea Energianalyse; Norway, NVE)
Year 3: Journal article on the cost drivers of offshore wind technologies (Lead: Ireland, University College Cork; Co-lead: Denmark, DTU & ea Energianalyse; Contributions: Japan, The University of Tokyo; UK, ORE Catapult; Norway, NVE; EC, JRC)
Year 3: Journal article exploring the impact of age, technology features, end-of-life decisions, and operational strategies on wind project performance (Lead: US, LBNL; Contributions: EC, JRC; Operating Agent)

WP3: How do uncertainty and offtake contracts impact wind energy economics and financing?

Description: The levelized cost of wind energy (LCOE) is typically calculated deterministically. However, costs are inherently uncertain because they are subject to sparse data, complex technology-cost relationships, limited foresight, and fluctuating commodity prices and wind plant performance. This is further exacerbated by the growing share of merchant sales, which introduces additional revenue uncertainty for wind projects globally. If these uncertainties, including market valuation uncertainties, are not properly accounted for in the economic appraisal of wind energy assets, the conclusions drawn from cost analysis can be misleading.

In this work package, we plan to focus on three areas of uncertainty characterization for wind energy: 1) Quantifying the impact of merchant exposure in offtake contracts (e.g., power purchase agreements or contracts-for-difference) on the cost of capital for wind energy; 2) Inter-farm wake effects' impact on the cost and value of offshore wind farms and potential strategies for regulatory or financial mitigation. This analysis on wake effects will build upon a work effort that started under the prior Task phase; and 3) Impacts of fluctuating electricity market and commodity prices through high-fidelity stochastic representation to capture uncertainty in

revenue and cost structures. This will provide insights into how different offtake instruments can mitigate exposure to wholesale market volatility and improve project bankability.

We expect at least three publications highlighting the core results, one focused on the impact of wake effects on the cost and value of offshore wind farms (Technical report); an investigation of the impacts from merchant exposure onto wind energy's cost of finance (journal article); and a third study featuring how fluctuating commodity prices and price uncertainty in offtake regimes affect investment risk and financing conditions (journal article).

WP Participants List: We currently anticipate varying levels, but broad-based participation in WP2 from many countries and institutes of the research task, including representatives from Denmark, the European Commission, Germany, Ireland, Japan, Norway, Sweden, the U.K. and the U.S.

Participant Contributions: As currently scoped all Task participants will be encouraged to support the WP. These discussions will be co-led and facilitated by Denmark and the Operating Agent.

Deliverables List:
Year 1: Technical Report on wake effects' impact on the cost and value of offshore wind farms and potential strategies for regulatory or financial mitigation (Lead: UK, ORE Catapult; Contributions from U.S., LBNL)
Year 2: Journal article on value and cost uncertainty from varying commodity prices and offtake regimes (Lead: Denmark, DTU; Co-lead: Operating Agent; Contributions from Japan and Ireland)
Year 2: Journal article on the impact from offtake merchant exposure on wind energy's cost of finance (Co-Lead: Operating Agent and Denmark, DTU; Contributions from Japan)

WP4: How do auction and support design impact the cost and value of wind energy?

Description: Fixed-price offtake regimes awarded in renewable energy auctions, such as contracts for Difference (CfD), have been effective in providing revenue stability for renewable energy investments. Increasingly, attention has turned towards CfDs design features and non-price criteria for CfD awards. Support schemes and auction regimes can introduce market distortions and – if not adequately designed – fail to align incentives with desired policy preferences and market conditions. For instance, generation-based payments CfDs might incentivize electricity generation even when electricity prices are negative or qualitative criteria may counteract incentives for market integration.

In this Work Package, we focus on the design elements of CfDs and award auctions by focusing on: 1) an enhanced representation of CfD design features and their impacts on market outcomes and bid curves; CfD features we may consider include CfD reference price design, volume base for payments, exit fees, distortion safeguards (e.g., dynamic payouts/clawbacks), and strike price designs (e.g., CfD price corridors); and 2) A framework for non-price factors in CfD auctions, which may feature techno-economic, environmental, and social dimensions. We will analyse the categories and scoring methodologies of non-price criteria currently used in multicriteria auctions—such as sustainability, system integration, and local content—and how these have

evolved in countries like the Netherlands, France, and Norway. The study will also assess the implications of EU-level efforts toward standardization and their impact on auction effectiveness. This will inform policy recommendations and broader auction design strategies that align bidder incentives with multiple policy objectives.

We expect at least two journal articles highlighting the cost and value impacts of various CfD design features, and a second article focused on the role and implementation of non-price criteria in renewable energy auctions.

WP Participants List: We currently anticipate varying levels, but broad-based participation from many countries and institutes of the research task, including representatives from Denmark, the European Commission, Germany, Ireland, Japan, Norway, Sweden, the U.K. and the U.S.

Participant Contributions:
As currently scoped all Task participants will be encouraged to support the WP. These discussions will be led and facilitated by Denmark.

Deliverables List:
Year 3: Journal article on CfD design features (Lead: Denmark, DTU; Co-lead: Operating Agent)
Year 4: Journal article on a non-price criteria framework for wind energy auctions (Lead: Denmark, DTU; Co-lead: EC, JRC)

WP5: What data and methods best inform our understanding of current and historical wind energy economics?

Description: Evaluation of data and methods that best inform our understanding of current and historical wind energy costs has been one of the core research activities of the Task (incl. its predecessor Task 26) in the past and is essential to enhance a better understanding of wind energy systems. There exists a diverse set of data and methods for calculating wind energy costs which introduce complexities and sometimes fallacies or errors in cost estimates. Presenting the evolving and diverse new methods that have arisen clearly and from a methodological viewpoint and illustrating those for the participating IEA Task countries remains necessary for consistent and equal comparisons across countries, projects, and over time. At the same time, new data are generated regularly that merit continued tracking and analysis. To be sure, Task 53 has shaped and supported methods development, data availability, and broader understanding of wind energy costs and value in the international research community during past collaboration phases. However, important new challenges that have arisen and deserve continued study include a re-assessment of which metrics are adequate for considering new wind applications (such as hydrogen or storage solutions), holistic cost evaluations (e.g., costs that are inclusive of transmission or energy island infrastructures), and a differentiation between a variety metrics to assess wind energy's economic viability. As the methods have evolved, the translation of this knowledge into accessible forms for a new generation of wind energy professionals and decision-makers also remains critical.

The work within this research category focuses on gathering internationally comparable data on wind energy economics. The cost and performance data are intended to cover existing

technologies, technologies under economic and technological development, and an option to evaluate technologies at an earlier stage of technology maturity. Emphasis will be placed on the first two categories. The data will be used to calculate the levelized cost of energy, using a common methodology, to identify key differences such as technology selection among different resources and country-specific terrains. This assessment will span onshore and offshore wind applications. The annual collection of cost and performance data will be archived on the IEA Wind TCP website to identify different technology and locational choices for wind energy across participating countries.

From this WP, we expect annual data to be collected with a focus on featuring how costs vary by site and technology choices, as well as offtake regime (e.g., various contracts-for-difference and PPA structures) for both onshore and offshore technologies. We will also work toward an public data viewer portal to feature these data and might summarize our findings in a Technical report.

WP Participants List: We currently anticipate broad participation across countries, including representatives from Denmark, the European Commission, Germany, Ireland, Japan, Norway, Sweden, the U.K. and the U.S.

Participant Contributions: As currently scoped all Task participants will be encouraged to support the WP. These discussions will be led and facilitated by the U.S. (NREL) and Ireland (SEAI), building on the cost benchmarking task under WP 2.

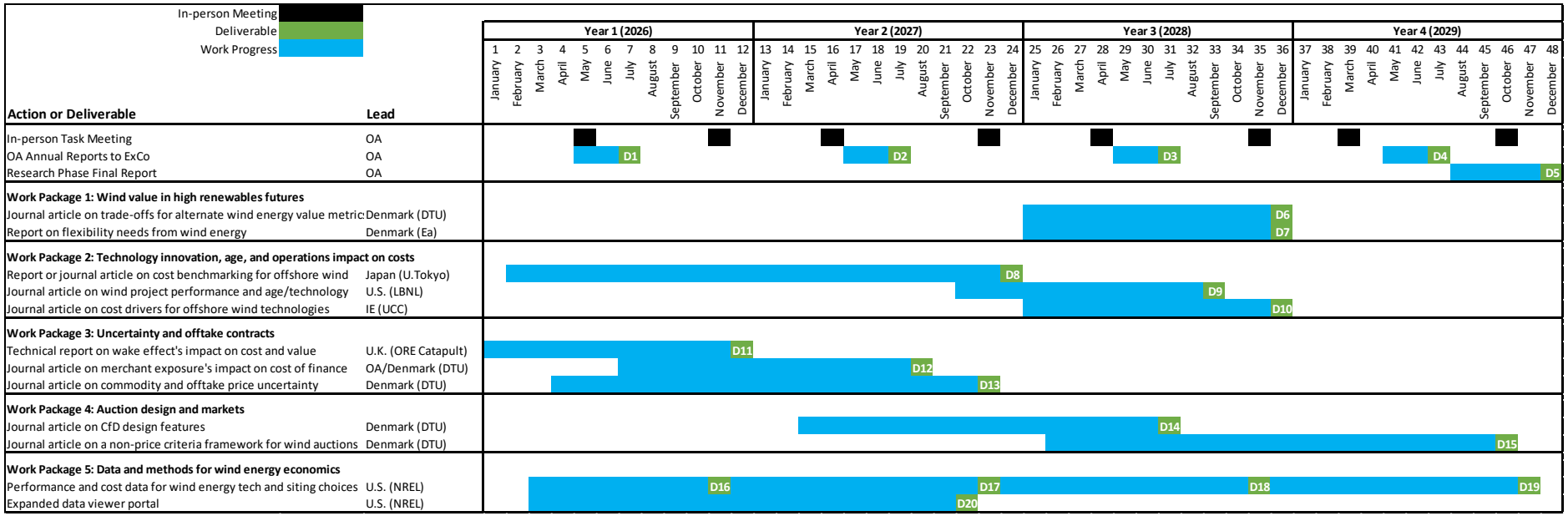
Deliverables List:
Annual: Performance and cost data elicited from Task participants on onshore and offshore wind costs/value for different locations and technological choices (Lead: U.S., NREL; Contributor: Denmark, ea Energianalyse)
Year 2: Expanded data viewer portal and potentially a Technical report summarizing our findings (Co-lead: U.S., NREL and Ireland, SEAI).

5 Time Schedule with Key Dates

To maintain continuity of the Task's work and participation, we propose to initiate the Task on January 1, 2026, and to continue, in principle, for a period of four years, through December 31, 2029. At the conclusion of this four-year period, two or more Participants, acting in the IEA Wind Executive Committee, have the option of extending the Task for a period to be determined at that time. Any extension shall apply only to the Participants who agree to the extension.

The proposed schedule for the activities and deliverables described in Section 4 of this document are shown in Figure 2. Details include planned meetings, OA administrative deliverables and deliverables and activities associated with each of the specific work packages.

Figure 2. Proposed Timeline for Work Plan



6 Reports, Deliverables, and Dissemination of Results

Reports will be accessible through the Task website, and any other Participant web-based dissemination mechanism at the discretion of the Participant. In addition to the committed deliverables, all participants are encouraged to seek opportunities to disseminate results through conferences, webinars, or other means. Publications created by participants in association with the Task will be posted or linked from the IEA Wind website assuming permission is granted by the appropriate publishing organization.

Table 1. Planned Deliverables and Schedule

No.	Deliverable	Month Due
D1-D4	OA Annual Reports to ExCo	7, 19, 31, 43
D5	OA Research Phase Final Report	48
D6	WP 1: Submitted journal article on alternate value metrics for wind (Lead: Denmark)	21
D7	WP 1: Submitted Technical Report on wind energy flexibility (Lead: Denmark)	36
D8	WP 2: Submitted technical report or journal article on cost benchmarking (Lead: IE)	24
D9	WP 2: Submitted journal article on wind project performance (Lead: U.S.)	33
D10	WP 2: Submitted Journal article on cost drivers for offshore wind technologies (Lead: Japan)	36
D11	WP 3: Technical report on wake effect's impact on cost and value (Lead: U.K.)	12
D12	WP 3: Submitted journal article on merchant exposure's impact on cost of finance (Lead: OA)	20
D13	WP 3: Submitted journal article on commodity and offtake price uncertainty (Lead: Denmark)	16
D14	WP 4: Submitted journal article on CfD design features (Lead: Denmark)	31
D15	WP 4: Submitted journal article on non-price criteria for wind energy auctions	46
D16, D17, D18, D19	WP 5: Published annual cost and performance data for wind energy (Lead: U.S.)	11, 23, 35, 47
D20	WP 5: Published data viewer portal with expanded functionality (Lead: U.S.)	22

7 Methods of Review and Evaluation of Work Progress

The Operating Agent will consult and monitor each project participant on the progress made in relation to the plan through monthly web-meetings and bi-annual in-person meetings. Initially, more frequent communication is planned to ensure that the full work plan is completed and up to date with descriptions of each party's contribution. Based on input from these regular consultations, a status report which summarizes the progress of each work package will be developed and submitted to the IEA Wind Executive Committee. Participants can consider additional activities during the proposed phase if funds become available. Changes to the work plan will be managed on an as needed basis pending potential changes in participating personnel, budgets, or data availability.

8 Obligations and Responsibilities

This Task requires collaboration among all participants as well as contributions of technical work that are conducted independently. The obligations of the Operating Agent and the Participants are described more broadly below. Data and products developed through the Task will be available equally to all participants. Data and products of the Task will not be available externally until completion of the Task or by agreement of the participants. New entrants joining throughout the Task phase are welcome and will be obligated to contribute to the cost-share for the year in which they join the Task. Participants who wish to withdraw from this Task after it begins will be obligated to contribute their cost-share for the year in which they wish to withdraw.

Operating Agent

In addition to the responsibilities enumerated in Article 4 of the IEA Wind Agreement the Operating Agent shall:

- prepare a detailed Program of Work in co-operation with the other Participants;
- be responsible for organizing meetings of representatives designated by Participants;
- be responsible for the performance of the Task and report annually to the Executive Committee on the progress and the results of the work performed under the Program of Work;
- provide to the Executive Committee, within six months after completion of all work defined in the Work Program, a final report summarizing the findings of the Task for its approval and transmittal to the Agency.

The responsibilities of the Operating Agent relate to the international co-operation in the Task. The Operating Agent shall not be liable for the national efforts of the Participants even if the national efforts are in relation to the Task.

Participants

In addition to any obligations listed in the IEA Wind Agreement, the following obligations and responsibilities are to be adhered to by the participants of the project:

- Each Participant shall bear its own cost for the scientific work, including travel expenses.
- The host country shall bear the costs of workshops and meetings of experts.
- The total costs of the Operating Agent shall be borne jointly and in equal shares by the Participants.
- Each Participant shall transfer to the Operating Agent its annual share of the costs in accordance with a time schedule to be determined by the Participants, acting in the Executive Committee.
- Each Participant shall submit presentation materials and reports presented at the Task meetings to the Operating Agent for posting on the Task website, the format of which shall be agreed upon by the Participants.
- Each Participant will participate in editing and review of Task articles and the Final Report. In addition to the activities described in the Work Packages in Section 4, each participating country is conducting related work. The planned effort from each participating country is estimated in Table 2. The portions denoted “Approximate Direct Contribution” indicates the effort taken specifically for this Task while the column “Approximate Indirect Contribution” indicates the effort for related work that will partly support this Task. The Task officially begins January 1, 2026 and will conclude December 31, 2029.

Table 2. Planned effort from each Participant

Expected role

	WP1	WP2	WP3	WP4	WP5
Denmark	Lead (2)	Contributor	Co-Lead (2)	Co-Lead (2)	Contributor
EU JRC	Contributor	Observer	Observer	Contributor	Contributor
Germany	Contributor	Observer	Observer	Observer	Contributor
Ireland	Observer	Co-Lead	Contributor	Contributor	Co-Lead
Japan	Observer	Co-Lead	Contributor (2)	Contributor	Contributor
Norway	Observer	Contributor	Contributor	Contributor	Contributor
Sweden	Observer	Observer	Observer	Observer	Contributor
UK	Contributor	Contributor (2)	Co-Lead	Contributor	Contributor
US	Contributor	Co-Lead	Contributor	Contributor	Co-Lead

Approximate Direct Contribution (Person Months)

	WP1	WP2	WP3	WP4	WP5
Denmark	20.0	1.0	10.0	10.0	1.0
EU JRC	1.0	0.1	0.1	1.0	1.0
Germany	1.0	0.1	0.1	0.1	1.0
Ireland	0.1	5.0	1.0	1.0	5.0
Japan	0.1	5.0	2.0	1.0	1.0
Norway	0.1	1.0	1.0	1.0	1.0
Sweden	0.1	0.1	0.1	0.1	1.0
UK	1.0	2.0	5.0	1.0	1.0
US	1.0	5.0	1.0	1.0	5.0
Total (Person Months)	24.4	19.3	20.3	16.2	17.0
Approximate Value (USD)	$936,960	$741,120	$779,520	$622,080	$652,800

Approximate Indirect Contribution (Person Months)

	WP1	WP2	WP3	WP4	WP5
Denmark	25.0	1.3	12.5	12.5	1.3
EU JRC	1.3	0.1	0.1	1.3	1.3
Germany	1.3	0.1	0.1	0.1	1.3
Ireland	0.1	6.3	1.3	1.3	6.3
Japan	0.1	6.3	2.5	1.3	1.3
Norway	0.1	1.3	1.3	1.3	1.3
Sweden	0.1	0.1	0.1	0.1	1.3
UK	1.3	2.5	6.3	1.3	1.3
US	1.3	6.3	1.3	1.3	6.3
Total (Person Months)	30.5	24.1	25.4	20.3	21.3
Approximate Value (USD)	$1,171,200	$926,400	$974,400	$777,600	$816,000
Combined Total (Person Months)	54.9	43.4	45.7	36.5	38.3
Combined Total (USD)	$2,108,160	$1,667,520	$1,753,920	$1,399,680	$1,468,800

9 Funding

This Task will be both “cost shared” and “task-shared” in that the costs of the Operating Agent (Table 3) shall be borne jointly and in equal shares by the participating IEA Member Countries. The cost of the scientific work, including travel expenses, will be borne by each participant.

The Operating Agent is Aquilo Energy GmbH, based in Switzerland. This is not the Contracting Party, but it accepts the rights and powers, and will carry out the obligations and functions of the Operating Agent as provided in the Agreement. Philipp Beiter, Managing Director of Aquilo Energy GmbH, will conduct the Operating Agent’s tasks and obligations.

10 Budget Plan

The total costs of the Operating Agent for coordination, management, and reporting are estimated to be $458,880 over a projected four-year period and may not exceed this level except by unanimous agreement of the Participants, acting in the Executive Committee. Table 3 shows the estimated annual costs for these activities; assuming 10 participants (Table 4), the annual fee will be $11,472. If additional participants are identified or substantial changes to the USD-CHF currency exchange rate are incurred throughout the four-year period, the scope of work and budget for the Operating Agent will be re-assessed with Participant recommendations to be provided to the Executive Committee.

Table 3. Operating Agent Costs

	Person-months	USD/yr	USD	Euro/yr	Euro
Meetings and coordination	3.75	$35,700	$142,800	€ 30,345	€ 121,380
Reporting (incl. publications)	6.50	$61,880	$247,520	€ 52,598	€ 210,392
Travel costs	n/a	$10,000	$40,000	€ 8,500	€ 34,000
Other costs (editing/design support)	0.75	$7,140	$28,560	€ 6,069	€ 24,276
TOTAL	**11.00**	**$114,720**	**$458,880**	€ 97,512	€ 390,048

Note: Euro denominations based on 0.85 Euro for 1.00 USD

11 Management of Task

The Task's management structure is designed to conduct the work packages as described in Section 4 of this document according to the planned scope and budget. The Operating Agent will coordinate with the participants to: 1) define the scope and estimated labor for each country's contribution, for inclusion in the work plan; 2) establish a communication method and procedure for collaboration to conduct the work; 3) monitor progress through annual reporting; 4) conduct plenary meetings at approximately 6-month intervals at which progress is evaluated by all participants.

To facilitate the required collaboration, regular (e.g., monthly or bi-monthly) web meetings will be conducted through most of each year. The existing Task website will be updated to contain the data and models developed through the Task. E-mail will be the primary method of communication among participants. Meeting notes will be distributed to all participants after each of the plenary meetings. The semi-annual status reports that are prepared for the Executive Committee will also be distributed to the participants. All Task documentation and content will be available on the IEA Wind website.

12 Organization

See detailed work plan in Section 4.

13 Information and Intellectual Property

(a) **Executive Committee's Powers**. The publication, distribution, handling, protection and ownership of information and intellectual property arising from activities conducted under this Annex, and rules and procedures related thereto shall be determined by the Executive Committee, acting by unanimity, in conformity with the Agreement.

(b) **Right to Publish.** Subject only to copyright restrictions, the Annex Participants shall have the right to publish all information provided to or arising from this Task except proprietary information.

(c) **Proprietary Information.** The Operating Agent and the Annex Participants shall take all necessary measures in accordance with this paragraph, the laws of their respective countries and international law to protect proprietary information provided to or arising from the Task. For the purposes of this Annex, proprietary information shall mean information of a confidential nature, such as trade secrets and know-how (for example computer programmes, design procedures and techniques, chemical composition of materials, or manufacturing methods, processes, or treatments) which is appropriately marked, provided such information:

(1) Is not generally known or publicly available from other sources;

(2) Has not previously been made available by the owner to others without obligation concerning its confidentiality; and

(3) Is not already in the possession of the recipient Participant without obligation concerning its confidentiality.

It shall be the responsibility of each Participant supplying proprietary information, and of the Operating Agent for arising proprietary information, to identify the information as such and to ensure that it is appropriately marked.

(d) **Use of Confidential Information.** If a Participant has access to confidential information which would be useful to the Operating Agent in conducting studies, assessments, analyses, or evaluations, such information may be communicated to the Operating Agent but shall not become part of reports or other documentation, nor be communicated to the other Participants except as may be agreed between the Operating Agent and the Participant which supplies such information.

(e) **Acquisition of Information for the Task.** Each Participant shall inform the other Participants and the Operating Agent of the existence of information that can be of value for the Task, but which is not freely available, and the Participant shall endeavour to make the information available to the Task under reasonable conditions.

(f) **Reports on Work Performed under the Task.** Each Participant and the Operating Agent shall provide reports on all work performed under the Task and the results thereof, including

studies, assessments, analyses, evaluations and other documentation, but excluding proprietary information, to the other Participants. Reports summarizing the work performed and the results thereof shall be prepared by the Operating Agent and forwarded to the Executive Committee.

(g) **Arising Inventions.** Inventions made or conceived in the course of or under the Task (arising inventions) shall be identified promptly and reported to the Operating Agent. Information regarding inventions on which patent protection is to be obtained shall not be published or publicly disclosed by the Operating Agent or the Participants until a patent application has been filed in any of the countries of the Participants, provided, however, that this restriction on publication or disclosure shall not extend beyond six months from the date of reporting the invention. It shall be the responsibility of the Operating Agent to appropriately mark Task reports that disclose inventions that have not been appropriately protected by the filing of a patent application.

(h) **Licensing of Arising Patents.** Each Participant shall have the sole right to license its government and nationals of its country designated by it to use patents and patent applications arising from the Task in its country, and the Participants shall notify the other Participants of the terms of such licences. Royalties obtained by such licensing shall be the property of the Participant.

(i) **Copyright.** The Operating Agent may take appropriate measures necessary to protect copyrightable material generated under the Task. Copyrights obtained shall be held for the benefit of the Annex Participants, provided however, that the Annex Participants may reproduce and distribute such material, but shall not publish it with a view to profit, except as otherwise directed by the Executive Committee, acting by unanimity.

(j) **Inventors and Authors.** Each Annex Participant will, without prejudice to any rights of inventors or authors under its national laws, take necessary steps to provide the co-operation from its inventors and authors required to carry out the provisions of this paragraph. Each Annex Participant will assume the responsibility to pay awards or compensation required to be paid to its employees according to the law of its country.

14 List of Potential Participants

The individuals below have expressed interest in participating in the Task Relaunch.

Table 4. Participants with expressed interest in a relaunched Task

Expert Participants	Organization
Denmark	
Lena Kitzing	Technical University of Denmark (DTU)
Anastasia Ioannu	Technical University of Denmark (DTU)
Fabian Wagner	Technical University of Denmark (DTU)
Matt Shields	Technical University of Denmark (DTU)
Peter Børre Eriksen	EA Energy Analyses
Phil Swisher	EA Energy Analyses
European Commission – Joint Research Centre (JRC)	
Evdokia Tapoglou	Joint Research Center (JRC)
Germany	
Silke Lüers	Deutsche WindGuard
Dorothee Ellherhorst	Deutsche WindGuard
Volker Berkhout	Fraunhofer Institute for Energy Economy and Energy System Technology (IEE)
Barbara Breitschopf	Fraunhofer ISI
Ireland	
Fiona Devoy McAuliffe	University College Cork
Forest Mak	Sustainable Energy Authority of Ireland
Japan	
Yuka Kikuchi	The University of Tokyo
Keiji Kimura	Osaka Sangyo University
Netherlands	
Iratxe Gonzalez Aparicio	**Netherlands Organisation for Applied Scientific Research** (TNO)
Norway	
Magnus Wold	Norwegian Water Resources and Energy Directorate (NVE)
Sweden	
Hans Ohlsson	Swedish Energy Agency (SEA)
Switzerland	
Philipp Beiter	Aquilo Energy GmbH
UK	
Tom Quinn	Offshore Renewable Energy (ORE) Catapult
Kabindra Dhakal	Offshore Renewable Energy (ORE) Catapult
Ken Kasriel	Offshore Renewable Energy (ORE) Catapult
Malte Jansen	University of Sussex
Suguang Dou	Électricité de France (EDF)

USA	
Tyler Stehly	National Renewable Energy Laboratory (NREL)
Ryan Wiser	Lawrence Berkeley National Laboratory (LBNL)
Joe Rand	Lawrence Berkeley National Laboratory (LBNL)
Trieu Mai	Energy Systems Integration Group (ESIG)