IEA IMPLEMENTING AGREEMENT FOR CO-OPERATION IN THE RESEARCH, DEVELOPMENT, AND DEPLOYMENT OF WIND ENERGY SYSTEMS

Minutes of the 85th IEA Wind Executive Committee (ExCo) Meeting

May 26 - 29, 2020, online meeting due to COVID situation

Agenda Summary

Date	Event	Times	Location
Tuesday May 26	**ExCo Meeting**	13:30–16:00 CEST	Online
Wednesday May 27	**ExCo Meeting**	13:30–16:25 CEST	Online
Thursday May 28	**ExCo Meeting**	13:30–16:30 CEST	Online
Friday May 29	**ExCo Meeting**	13:30–16:30 CEST	Online
Friday May 29	**Social online event**	16:30-17:30 CEST	Online

Participants

ExCo Members	Representative	Organization
Chair	John McCann, Chair, Member	Sustainable Energy Authority of Ireland (SEAI)
Secretary	Ignacio Marti	DTU Wind Energy
Deputy Secretary	Klaus Rosenfeldt Jakobsen	DTU Wind Energy
Austria	Andreas Krenn, Alternate	Energiewerkstatt
	Theodor Zillner, Member	Republic of Austria
Belgium	Jan Hensmans, Member	Government of Belgium
Canada	Paul Dockrill, Member	Natural Resources Canada
	Ryan Kilpatrick, Alternate	Natural Resources Canada
CWEA	Du Guangping, Alternate	Chinese Wind Energy Association (CWEA)
Denmark	Karina Remler, Member	Danish Energy Agency
	Peter Hauge Madsen, Alternate	Technical University of Denmark (DTU)
European Commission	Carlos Eduardo Lima Da Cunha, Member	European Commission
	Matthijs Soede, Alternate	European Commission
	Thomas Telsnig, Alternate	Directorate General Research and Innovation/DG Joint Research Centre
Finland	Timo Karlsson, Member	Business Finland, VTT
	Niina Helistö, Alternate	Business Finland, VTT
	Raul Prieto, Alternate	Business Finland, VTT
France	Daniel Averbuch, Member	IFP Energy nouvelles
Germany	Franciska Klein, Member	Forschungszentrum Juelich GmbH, Project Management Juelich (PtJ) on behalf of Federal Ministry for Economic Affairs and Energy
	Friederike Barenhorst, Alternate	Forschungszentrum Juelich GmbH, Project Management Juelich (PtJ) on behalf of Federal Ministry for Economic Affairs and Energy

	Stephan Barth, vice Chair, Alternate	ForWind Center for Wind Energy Research
Greece	Nikolaos Stefanatos, Member	Center of Renewable Energy Sources and savings (CRES)
Ireland	See Chair	Sustainable Energy Authority of Ireland (SEAI)
Italy	Laura Serri, Member	RSE S.p.A.
	Luca Greco, Member	CNR
Japan	Yoshitomo Watanabe, Alternate	New Energy and Industrial Technology Development Organization (NEDO)
Republic of Korea	Seung-Ho Song, Member	Kwangwoon University
Mexico	José Manuel Nava Franco, Member/Vice Chair	Instituto de Investigaciones Electricas (IIE)
	Jaime Agredano Diaz	Instituto de Investigaciones Electricas (IIE)
Netherlands	Ruud Oerlemans, Alternate	Rijksdienst voor Ondernemend Nederland (RVO.nl)
Norway	Ann Myhrer Østenby, Member/ Vice Chair	The Norwegian Water Resources and Energy Directorate (NVE)
	Harald Rikheim, Alternate	The Norwegian Water Resources and Energy Directorate (NVE)
Portugal	Apologies	
Spain	Ignacio Cruz, Member/Vice Chair	CIEMAT
	Luis Arribas	CIEMAT
Sweden	Pierre-Jean Rigole, Alternate	Swedish Energy Agency
Switzerland	Katja Maus, Member	Swiss Federal Office of Energy
	Lionel Perret, Alternate	Planair
United Kingdom	Steven Wyatt, Member	Offshore Renewable Energy Catapult
United States	Jim Ahlgrimm, Member/Vice Chair	U.S. Department of Energy
	Brian Smith, Alternate/Vice Chair	National Renewable Energy Laboratory (NREL)
WindEurope	Ivan Pineda, Member	WindEurope

Task Number	**Operating Agent Representatives**	**Operating Agent Organization**
Task 11	Nicolas El-Hayek	Planair, Switzerland
	Lionel Perret	Planair, Switzerland
Task 19	Timo Karlsson	VTT, Finland
Task 25	Hannele Holttinen	Recognis , Finland
Task 26	Eric Lanz	NREL, United States
Task 28	Garry Keegan	CSS/IPC, Ireland
	Suzanne Tegen	Colostate, United States
Task 29	Gerard Schepers	TNO, Netherlands
	Koen Borsmann	TNO, Netherlands
Task 30	Apologies	NREL, United States
Task 31	Javier Sanz Rodrigo	CENER, Spain
Task 32	Andrew Clifton	University of Stuttgart, Germany
Task 34	Cris Hein	NREL, United States
	Karin Sinclair	NREL, United States
Task 36	Gregor Giebel	DTU, Denmark
	Karl Merz	SINTEF Energy Research, Norway
Task 37	Katherine Dykes	DTU, Denmark
Task 39	Franck Bertagnolio	DTU, Denmark
Task 40	Masataka Owada	Wind Energy Institute of Tokyo, Japan
	Shigeo Yoshida	Kyushu university, Japan
Task 41	Alice Orrell	Pacific Northwest National Laboratory, United States
	Ian Baring-Gould	NREL, United States
Task 42	Anand Natarajan	DTU, Denmark
Task 43	Berthold Hahn	Fraunhofer Institute for Wind Energy and Energy System Technology IWES

Country	**Observers**	**Organization**
Austria	Mauro Peppoloni	University of Applied Sciences Technikum Wien
Belgium	Jan-Willem van Wingerden	TU Delft
Canada	Sergio Gualteros	Nergica

Denmark	Anca Hansen	DTU
Denmark	Anna Maria Sempreviva	DTU
Denmark	Birte Holst Jørgensen	DTU
Denmark	Charlotte Hede Linde	DTU
Denmark	Justine Beauson	DTU
Denmark	Kirstine Dahlgaard	DTU
Denmark	Nicolaos Cutululis	DTU
Denmark	Simon Rubin	DTU
France	Hideki Kamitatara	IEA
France	Piotr Bojek	IEA
India	Dr. K. Balaraman	National Institute of Wind Energy
Ireland	Conor Lynch	Cork Institute of Technology
Ireland	Daniel Toal	University of Limerick
Ireland	Eugene McKeown	SEAI
Ireland	Greg Bohan	IWEA
Ireland	Mahdi Ebrahimi Salari	University of Limerick
Ireland	Raymond Byrne	Dundalk Institute of Technology
Ireland	William Finnegan	NUI Galway
Netherlands	Marco Caboni	TNO
Romania	Mihai Balan	Romanian Wind Energy Association
Spain	Luis Cano	CIEMAT
United Kingdom	Jean-Pierre Roux	University of Exeter
United Kingdom	Robert Wade	Queen's University Belfast
United States	Breton Barker	DoE
United States	Alexsandra Lemke	NREL
United States	Bryan Miller	DoE
United States	Danielle Preziuso	Pacific Northwest National Laboratory
United States	Derek Berry	NREL
United States	Maureen Clapper	DoE
United States	Phillip Dougherty	Redhorse Corporation
United States	Sarah Barrows	Pacific Northwest National Laboratory

REMARK!

The minutes are a summary of presentations and discussions. For details, participants should check the original documents. All meeting materials are uploaded on https://community.ieawind.org/membersarea/ourlibrary/excolibrary

ACTION LIST

Meeting	Description	Responsible	Deadline	Status
ExCo84, September 2019	**ACTION E84-1:** Create a working group involving OAs to propose a strategy on the implementation of FAIR data	Chair	ExCo85, March 2020	On going
ExCo84, September 2019	**ACTION E84-2:** Send ExCo and OAs a survey on Task evolution options	Secretariat	ExCo85, March 2020	Done
ExCo84, September 2019	**ACTION E84-3:** Vice Chairs to take charge of Strategic Plan Research Areas, start mapping Task outputs against Research Areas	Planning Committee	ExCo85, March 2020	Done
ExCo84, September 2019	**ACTION E84-4:** Secretary to organize email ballot to approve common fund budget	Secretariat	October 2019	Done
ExCo 83 Actions				
ExCo83, March 2019	**ACTION 12:** Update ExCo member list	Secretariat	June, 2019	Done
ExCo83, March 2019	**ACTION 13:** Send email ballot to approve Task 37 Extension proposal	Secretariat	June, 2019	Done
ExCo83, March 2019	**ACTION 14:** Secretariat to check with IEA Paris how to get our webinars in their web. Check how to make webinars more easily accessible.	Secretariat	ExCo84, September 2019	on going
ExCo83, March 2019	**ACTION 15:** Secretary to send to ExCo the Recommend Practice on Task 36 and get the ballot	Secretariat	ExCo84, September 2019	Done
ExCo83, March 2019	**ACTION 16:** Decision to develop an enhanced model for Task management. Volunteers: Garry Keegan (lead), Ian Baring-Gould, Hannele Holttinen	Chairman	ExCo84, September 2019	Done
ExCo 82 Actions				
ExCo82, October 2018	**ACTION 2:** The Operating Agent Representative for Task 27 Small Wind Turbines should work with the Secretary to submit the Task's Final Technical Report and Final Management Report to the ExCo for approval via email ballot.			on going
ExCo82, October 2018	**ACTION 6:** The Planning Committee should request additional information regarding the IEA's Renewable Industry Advisory Board (RIAB) meetings that can be distributed to the ExCo.			Done
ExCo82, October 2018	**ACTION 8:** The Planning Committee and Strategic Plan Working Group should establish mission and vision statements for inclusion in the strategic Plan.			on going

Summary of decisions taken during ExCo 85

ExCo approvals in the following list were obtained via email ballot after ExCo 85.

New members:

- *Invitation to **Romania** to join IEA Wind TCP was **approved** unanimously*
- *Invitation to **India** to join IEA Wind TCP was **approved** unanimously*

Task extensions:

- *The extension proposal for Task 28 was **approved***
- *The extension proposal for Task 29 was **approved in principle***
- *The extension proposal for Task 34 was **approved***

New Research Tasks:

- *The new Research Task **Enabling wind turbine blade recycling** was **approved in principle** unanimously*
- *The new Research Task **Flow Farm Control** was **approved** unanimously*

Task reports:

- *Task 27 Small Wind Turbines Final Technical Report was **approved***

Budget:

- *Common Fund Audit Report and 2020 Budget Status was **approved***

Next ExCo meetings:

- *The **approved dates for ExCo 86 are 12-16 October 2020**. Detailed agenda and invitations will be sent by the secretariat in due course. ExCo 86 will be also an online meeting due to the COVID situation.*
- *ExCo 87 will be organised by Japan with a tentative date 17-21 May 2021. We are aiming at a face to face meeting in Japan*

Day 1. 26th of May

1. Session 1. Administrative and management issues

The Chair, John McCann, opened the 85th meeting of the IEA Wind TCP Executive Committee (ExCo) on 26th of May 2020.

The Chair explained that this is the first online ExCo meeting, thanked the secretariat and the participants for the flexibility with time zones and asked for support from all to ensure a successful meeting. The Chair thanked CRES (Greece) for organizing what was going to be ExCo 85 meeting in Greece, that unfortunately had to be converted into an online meeting due to COVID pandemic.

The participants and observers of the ExCo 85 introduced themselves in the beginning of the ExCo 85 meeting days.

Business items

Changes in Contracting Parties and Membership

The European Commission announces the appointment of Carlos-Eduardo Lima da Cunha as member replacing Matthijs Soede

Status of ExCo 84 and previous Action Items

The Secretary reviewed the *Status of Action Items* document posted with the pre-meeting materials; the status of actions is described in the ***Action List*** *above*. Please note the new nomenclature introduced for actions, now letter E followed by the number of ExCo meeting is used (i.e. Action E84-1)

Review decisions approved in the interim

The ExCo **approved** IEA Wind TCP budget sent by email ballot prior to Exco 85 meeting.

Adoption of Agenda

The ExCo **approved** unanimously a motion to adopt the Agenda. This is the first ExCo meeting with only half countries and half Tasks presenting as decided by the Leadership Team.

Approval of Minutes

The ExCo **approved** the minutes of ExCo 84 as they were presented in the pre-meeting materials on the IEA Wind TCP website.

Meeting purpose

The Chair reminded the participants that the focus of this ExCo meeting is **deployment**.

New IEA Wind TCP management John McCann, Chair

The Chair presented the changes in management for IEA Wind TCP introduced by the Leadership Team (Chair, vice Chairs, Task 11 OA) and Secretary. These changes focus on:

- Further involvement of the Leadership Team (previously called Planning Committee) in the development and implementation of our Strategic Plan
- Creation of committees for each priority area within our Strategic Plan, led by a vice Chair with Tasks allocated by committee. More coordination between Tasks, better communication and more strategic management is expected as a result of this management change
- Rationalise ExCo activities to facilitate growth. An specific action is to reduce the number of tasks and countries to half presenting in ExCo meetings
- Focus activities on Priority Areas by:

    - Encouraging renewal of Tasks to involve new cohorts of researchers in priority areas
    - Ensuring TEM alignment with priorities
- Streamline Processes:
    - Expedite time to delivery of TEM's, exploit underutilised capacity
    - Simplify procedure for new Tasks
- Communications:
    - Annual report, online only, streamlined delivery
    - New web-site, focused on OA's needs
- Strategy delivery
    - Develop KPI's for strategic priorities

Technical Meeting

2. Session 2. Energy Systems with High Amount of Wind Energy

Vice Chair introduction Ignacio Cruz, CIEMAT

Focus on developing the 21st century electrical system to support high levels of wind energy and to maximize the system value of wind energy in a broad range of applications. We are moving towards 100% renewable system in 2050, including heat and power to X. We need to move from grid following to a grid forming role of wind energy.

Task 25. Design and Ops of Energy Systems with Large Amount of Var Gen Hannele Holtinen, Recognis

Membership: NL came back as member in 2019, BE, RO are expected to join in 2020. Task 25 has 18 organizations from 17 countries plus Wind Europe participating. Progress and budget status: Overall progressing according to plan and budget. Task 25 ends at the end of the year and plans to continue after the present term. Technical update: recent results on energy storage cost reductions point towards changes in the way the energy system will be designed in the future. The database for renewable integration studies is growing with 2018 data now included. The benchmarking of simplified flexibility assessment and the round robin experiment of tools are delayed.

Task 41. Enabling Wind to Contribute to a Distribute Energy Future Alice Orrell, NREL

Membership: New participants expected: AU, DK, IT, JP, SP and PO (Poland is pending IEA membership). Progress and budget status: progress according to plan in WP1, WP2, WP3. Some deliverables are delayed in WP4 that needs to complete an engagement plan. Technical update: meetings in America and Europe have taken place on standards, a specification for a data sharing catalog has been produced and a report on the assessment of simulation tools has been completed.

New Task proposal: Flow Farm Control Paul Fleming, NREL and Jan van Wingerden, TUD

Following TEM#97 on Wind Farm Control, a new Research Task proposal on Flow Farm Control was presented. More than 75% of the participants in TEM#97 agreed that wind farm control will be used in the future and that there is a need for standard reference and validation tools. 24 organizations from 12 countries in Asia, America and Europe have expressed interest. The proposed scope of work includes the following work packages: WP1 Collection of research results, WP2 Uncertainty quantification, WP3 Overview of technology and algorithms and WP4 Interaction with other projects.

*The new Research Task **Flow Farm Control** was **approved** unanimously*

Day 2. 27th of May

3. Session 3. Asian focus

Japan country presentation Yoshitomo Watanabe, NEDO

Japan installed 270 MW in 2019 reaching 3923 MW and 2414 wind turbines in operation. Offshore wind power plants in the pipeline are growing quickly with 12580 MW now under planning. The Japanese government is supporting the development of offshore wind in harbor areas as well as basic research on offshore related topics like weather and subsea conditions.

Korea country presentation Seung-Ho Song, University of Korea

Korea installed 191 MW in 2019 reaching 1490 MW, 72 MW operating offshore. Auction prices for wind energy dropped to a record 46 USD/MWh, achieving more than 50% price reduction in 2 years. The main barriers for deployment are complex permitting processes and social acceptance. Grid connection availability and curtailment are emerging issues. The Korean government is focusing on the barriers preventing further deployment, with initiatives like the development of a national wind map facilitating project development or the creation of a new public organization supporting onshore project development.

China country presentation Du Guangping, CWEA

China installed 26.79 GW in 2019, including 2.49 GW offshore, reaching 236.32 GW in total with 7 GW installed offshore. The growth rate for the total installed capacity is 27%, being 44% for offshore wind power plants. In 2019 China reached a record 5.5% of the electricity demand supplied by wind, and it is on track to achieve 20% of the primary energy consumption by non-fossil energy sources by 2030. China is transforming the energy market, moving to a subsidy free market in 2021. Nine provinces have now published plans for offshore wind development, with a total target of 70 GW offshore by 2030.

4. Session 4. Social, Environmental and Economic Impacts

Vice Chair introduction Ann Østenby, NVE

The Research Tasks in this session have in common the impact on public opinion in different ways like visual impact or noise, but the impact also involves the environment and the economy.

Task 39. Quiet Wind Turbine Technology Franck Bertagnolio, DTU

Membership: Current participants in Task 39 are Denmark and Germany, while NL, IE, US, UK and CN have expressed interest but are not officially committed. NO and SZ have declined participation. Progress and budget status: DK have covered the expenses for 2019. WP1 on interdisciplinary education is progressing well, WP2 on the physics of noise is progressing but delayed, WP3 on the psychology of noise has not started. Technical update: A wind turbine noise international regulation catalogue is being developed; first comparisons of wind turbine noise simulation tools ongoing.

Task 28. Social Science of Wind Energy Acceptance Garry Keegan, IPC and Suzanne Tegen, CSU

An extension proposal for Task 28 is presented. The extension is based on research and learning from previous phases I to III. The extension includes two tracks, the first one is focused on research synthesis and gap analysis and the second one includes research dissemination, facilitation and knowledge exchange. The extension proposal is for four years. The target audiences are industry, community engagement practitioners, grid operators, governments, public stakeholders and researchers. 8 countries actually participating in Task 28 with UK, NL that have expressed interest, SW, NO and WindEurope are observers; PO lost the funding to participate in this Task.

*The extension proposal for Task 28 was **approved***

Task 26. Cost of Wind Energy Eric Lantz, NREL

Membership: 8 countries are currently participating in Task 26 plus the EC; NL is not active anymore in the Task. Progress and budget status: progress and budget are according to plan in all WP. Technical update: Accepted paper in Applied Energy for publication on Land based wind energy cost trends in Germany, Denmark, Ireland, Norway, Sweden and the US. There has been a joint workshop with IRENA to explore a Global Survey of Renewable Energy Financing Costs. An expert survey on future onshore and offshore costs is to be sent in summer.

Task 34. Working Together to Resolve Environmental Effects of Wind Energy Cris Hein, NREL

An extension proposal for Task 34 was presented. In the last phase of WREN 7 countries are participating, up to 13 countries are engaged with WREN for the next phase. Four WP are proposed for the extension: WP1 Maintain and enhance Tethys, WP2 Evaluation and establishment of current and future policies, WP3 Outreach and engagement on the state of the science, WP4 Monitoring and mitigation methodology and technology database. The extension proposal is for the period 2020-2024.

*The extension proposal for Task 34 was **approved***

New Task proposal. Enabling wind turbine blade recycling Justine Beauson, DTU and Derek Berry, NREL

Following TEM#96 a new Task proposal Enabling wind turbine blade recycling was presented to be approved in principle. The Task will focus on the identification of barriers and mitigation strategies for the implementation of large scale wind turbine blades recycling solutions. DK and US have committed to participate and IR, NO, KO, FI have expressed interest. The scope of work includes WP1 Management, coordination and dissemination, WP2 Technical focus, WP3 Analysis and value chain and WP4 Standardization, certification and legislation. The proposed duration is 3 years. The presenters inform that they intend to present the final proposal during ExCo 86.

*The new Research Task **Enabling wind turbine blade recycling** was **approved in principle** unanimously*

Day 3. 28th of May

5. Session 5. Advanced Technology

Vice Chair introduction Jose Manuel Franco, INEEL

Advanced Technology focuses on three strategic objectives, maximize the value of wind energy in systems and markets, lower the cost of wind energy and foster collaborative research and exchange of best practice and data.

Task 40. Downwind Turbine Technologies Shigeo Yoshida, Kyushu University

Membership: Current participants in Task 40 are GE, JP, SP and US, CENER has left the Task. Progress and budget status: overall good progress in all WP and according to the planned budget. Technical update: Tower shadow simulations have been successfully completed including dynamic tower shadow loads on a 2 MW wind turbine. New design load cases are being considered for downwind turbines. Blade optimization for downwind turbines is being developed.

Task 37. Wind Energy Systems Engineering Garret Barter, NREL

Membership: No changes in participation in Task 37, 21 partners from 8 countries. Progress and budget status: overall good progress in all WP and according to the planned budget. Technical update: IEA Wind 15MW reference wind turbine completed through tight NREL-DTU collaboration; this milestone has received significant media coverage. IEA Wind 10 MW and 3.4 MW reference wind turbine models have also been released. Significant progress on developing an “ontology” suitable for wind plant wake flow analysis and layout optimization

Task 42. Lifetime Extension Assessment Anand Natarajan, DTU

Membership: 12 participants from 4 countries are active in Task 42. EdF has suspended its role in the task for 2020. Several partners from BE have expressed their interest to join the task but have not formally confirmed yet. Progress and budget status: progress according to plan and budget. Technical update: Gap analysis in procedures

required for life extension has been completed, the procedures for determining risk of failure and preventive maintenance are in progress.

Task 29. Rotor aerodynamics Gerard Schepers, TNO

A extension proposal for the continuation of Task 29 activities was presented to be approved in principle. It is expected to keep the same number of participants, the duration would be 3 years. During the last Task 29 meeting the participants were asked about the continuation and there was a unanimous approval. The main areas for the new Task will be to improve the understanding of aerodynamics of large wind turbines at field conditions, advance in the comparison of CFD-BEM under turbulent inflow, modelling of large-scale wind turbines and produce more validation data.

*The extension proposal for Task 29 was **approved in principle***

6. Session 6. European Focus

Finland country presentation Raul Prieto, VTT

Wind power electricity production reached 5.99 TWh in Finland, covering 7% of the electricity demand; 243 MW were installed in 2019. All wind power plants installed in 2019 were subsidy free. All 1.4 GWh auctioned were assigned to wind power. Wind power projects serve PPAs and large electricity consumers buying completed projects. Public perception of wind energy is improving. Research projects to enable offshore wind in areas with ice ongoing.

Denmark country presentation Karina Remler, DEA

Wind power installed capacity in 2019 in Denmark reached 6104 MW (1.7 GW offshore) with 28MW installed during 2019. Wind energy supplied 47.2% of Denmark annual electricity demand, making 2019 the cleanest year for CO2 emissions related to electricity generation to date in Denmark. Horns Rev 3, Denmark largest offshore wind farm to date (406.7 MW) was inaugurated in 2019. The Danish Climate Act aims at reducing greenhouse gas emissions by 7% in 2030 and zero in 2050. In 2019, 3.3% of the GDP in Denmark was linked to the wind sector.

European Commission presentation Carlos Eduardo Lima da Cunha, EC

In the European Union, the installed capacity in 2019 reached 192 GW (12GW offshore) with 13.2GW newly installed. EU aims at reaching 32% RES by 2030 and climate neutrality in 2050. Main challenges for wind energy deployment are long permitting procedures, regulatory changes and public opposition in some countries. On the other hand, opportunities are still significant to reduce cost based on technology development and auctions. EU has spent 55.3 million euro in new wind energy projects in 2019 with focus on offshore technology and floating wind (78 million euro invested in floating since 2009), showing the high priority of offshore wind in the EU research agenda.

The Netherlands country presentation Ruud Oerlemans, RVO

The installed capacity in 2019 reached 4520 MW in the Netherlands (3563 MW offshore) with 228 MW newly installed (all onshore). The Dutch climate agreement aims at a 49% CO2 reduction by 2030, with 60GW offshore wind in 2050. The environmental impact is a key area to enable offshore wind to reach the objective in 2050. There is a new support system introduced focusing on avoided CO2 production. Onshore development going slower than planned, uncertainty created by spatial planning and financing projects in early stages. Borssele 5 innovation offshore wind power plant under construction.

Day 4. 29th of May

7. Session 7. European Focus (continuation)

Spain country presentation Ignacio Cruz, Ciemat

The installed capacity in Spain in 2019 reached 25704 MW with 2243 MW newly installed (all onshore). The Spanish market is gaining speed after several years of stagnation with 24629 MW approved by planning bodies and 2364 MW under construction. 39% of Spain electricity demand in 2019 was supplied by wind energy. A new record of 76% instantaneous penetration of wind energy in the Spanish electricity system was achieved in 2019. Another significant fact of the Spanish market is that 13800 MW of wind power participate in ancillary services market

United Kingdom country presentation Steve Wyatt, ORE Catapult

Six offshore wind projects secured CFDs without subsidies totaling 5.46 GW with a weighted average strike price of 40.67 pounds/MWh. The baseline scenario for offshore wind is to reach 28 GW by 2030, installing 2 GW per year. Onshore wind capacity is not estimated to rise significantly despite its low cost due to the government cutting support for new onshore wind farms. The overall wind share of UK electricity generation has grown from 6% in 2012 to 18% in 2018 with preliminary estimations showing that this will surpass 20% in 2019. The Contracts For Difference (CFD) mechanism is currently under review.

Austria country presentation Andreas Krenn, Energiewerkstatt

Installed capacity in Austria in 2019 reached 3159 MW with 120MW newly installed, there is a decreasing tendency in newly installed capacity per year since 2014. Wind energy supplied 11% of the electricity consumption in 2019. Austria objective is to reach 100% RES electricity in 2030, 10TWh additional from wind (7.5 GW additional capacity) are needed to achieve the goal. Main challenge on deployment is long permitting process with an average development time for wind projects from 3 to 8 years. Future projects will have to be installed in lower wind speed areas.

Italy country presentation Laura Serri, RSE

The installed capacity in Italy in 2019 reached 10510 MW with 460 MW newly installed, 6,28% of the annual electricity demand was supplied by wind. The National Energy and Climate Action Plan includes 19.3 GW of wind energy (0.9 GW offshore) for 2030. Wind projects have won 99% of the auctioned capacity in 2019. The complexity and timing of the authorization process seems to be the main barrier to the short-term development of wind projects.

Greece country presentation Nicolaos Stefanatos, CRES

The installed capacity in Greece in 2019 reached 3.58 GW with 725 MW newly installed (25% annual increase), covering 12.5% of the annual electricity demand. 2019 was a record year for wind, becoming the second source of energy in Greece. National Energy and Climate Action Plan includes 66% RES in electricity production (29% share of wind), with 7 GW of wind energy installed by 2030. To enable large scale deployment, the focus is on reducing permitting time from 7+ years to 2 years.

Task 11 update Lionel Perret, Planair

Membership: There are 18 participants in Task 11. Progress and budget status: overall good progress in all WP and according to the planned budget. Technical update: Task 11 has organized the following recent successful Topical Expert Meetings: Wind Farm Control, Wind Plant Decommissioning Repowering and Recycling, Erosion of Wind Turbine Blades. These TEMS have been the basis for proposals of new Research Tasks (two presented in ExCo85). The next Topical Expert Meetings will be: Floating Offshore Wind Arrays, Aviation System Cohabitation and Hybrid Power Plants. Task 11 has focused during the last year on having workshops with task members to dynamize processes and increase reactivity, leading to fast-track process for strategic topics, adapting operation to travel restrictions

Next Meetings

- The approved **dates for ExCo 86 are 12-16 October 2020**. Detailed agenda and invitations will be sent by the secretariat in due course. **ExCo 86 will be also an online meeting** due to the COVID situation.
- ExCo 87 will be organised by Japan with a tentative date 17-21 May 2021. We are aiming at a face to face meeting in Japan

Closure Friday May 29th – 4.30 PM

The Chair thanked all the country presenters, the OA presenters, the Vice Chairs, and the Secretary for a successful meeting. The Chair acknowledged the extra efforts that the online format of this meeting demanded from all participants.

Ignacio Marti, Secretary
John McCann, Chair

Meeting documents

All meeting documents are uploaded on https://community.ieawind.org/membersarea/ourlibrary/excolibrary

Denmark – DK Country Report

Danish Energy Agency

Session 6 – 28th May

IEA Wind TCP ExCo 85 - online

26-27 May 2020

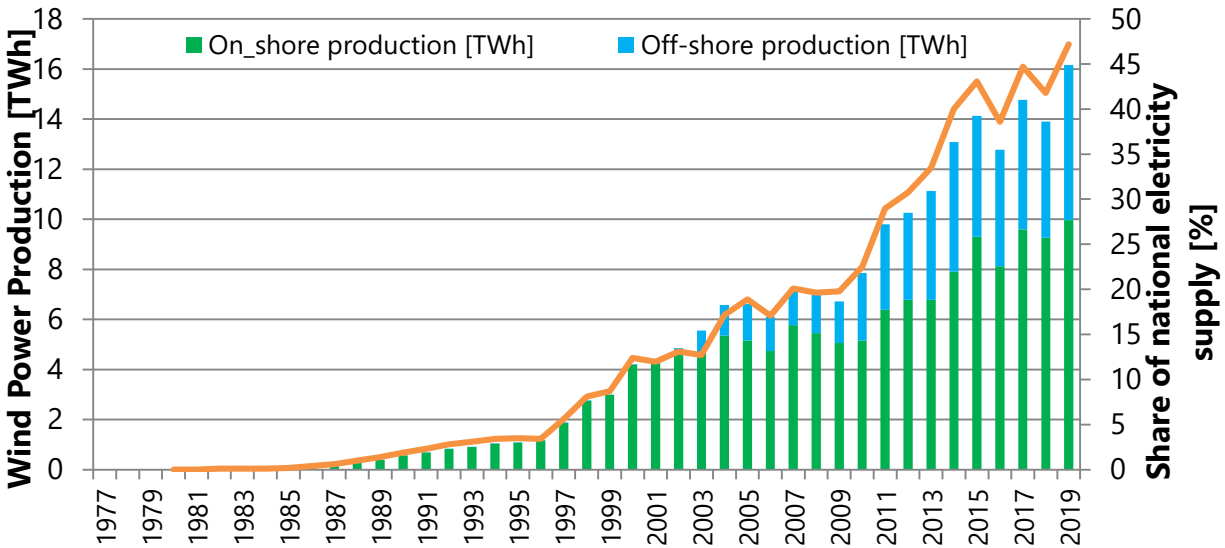
Summary - Outline

- Wind Power Production and share of electricity
- Cleanest Danish electricity ever
- Policy Updates - Highlights
- 2019 Danish Wind Turbine Industry Exports

iea wind

Wind Power production and share of electricity

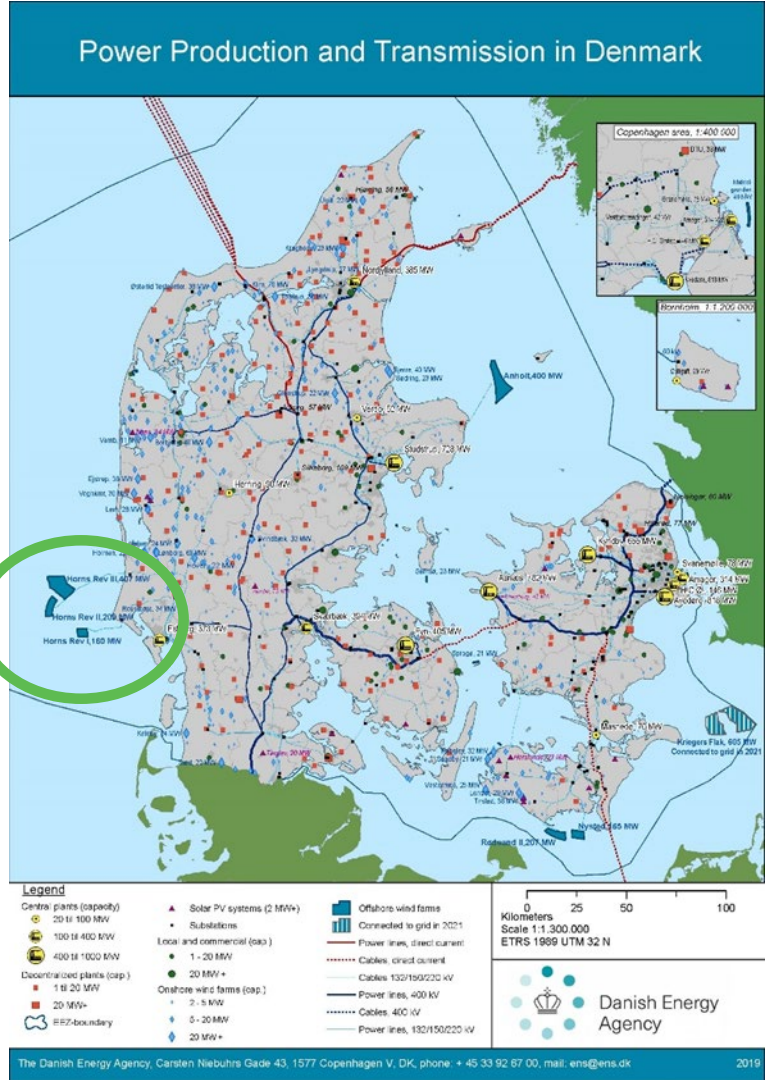
- The wind power capacity in Denmark has been stable around 6 GW in nearly 3 years.
- Denmark did not establish any new offshore wind power capacity power in 2019.
- Wind-generated electricity met **47.2% of the domestic electricity supply in 2019**.



Key National Statistics 2019	
Total (net) installed wind power capacity	6.104 GW
Total offshore capacity	1.7 GW
New wind power capacity installed	0.028 GW
Decommissioned capacity	0.039 GW
Total electrical energy output from wind	16.16 TWh
Wind-generated electricity as percent of national electricity demand	47.2 %
Average national capacity factor	0.30

Horns Rev 3 - Denmark

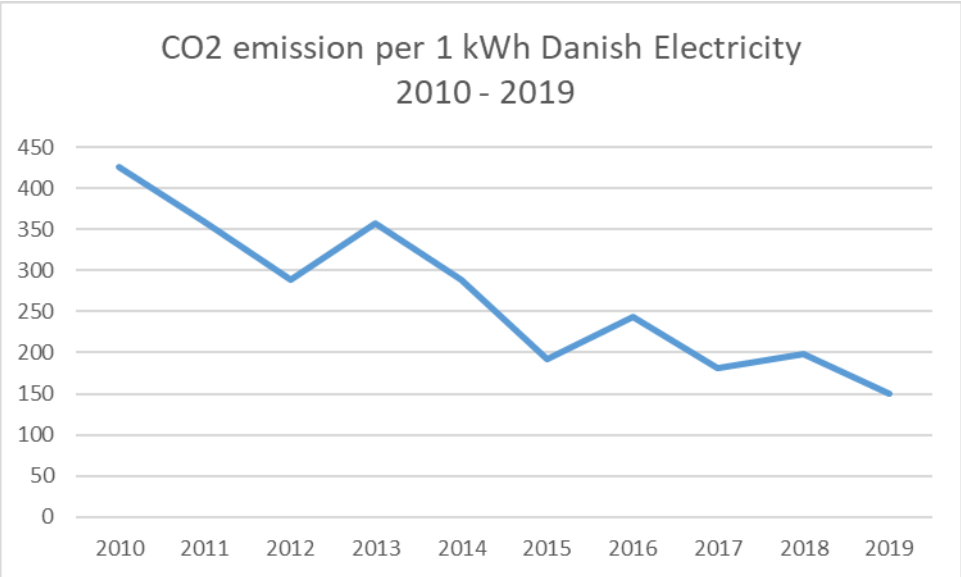
- Denmark's largest offshore wind farm to date inaugurated August 2019.
- Location: 25-40 km from the West Coast
- Number of mills: 49 windturbines
- Total effect: 406.7 MW
- 1 mill, 1 rotation generates enough green power for recharging 1.317 iPhones
- 425.000 Danish households will be supplied per year
- 25-30 full-time employees



iea wind

2019 - Cleanest Danish kWh Electricity ever

- A Danish produced kWh of electricity has never been more clean than in 2019. Most notable is the decline in production from the coal power plants, which fell by nearly 40%.
- Coal has almost been replaced by higher production from the wind turbines, which has increased by over 2.000 MWh compared to 2018 - mainly due to the commissioning of the Horn Rev 3 wind farm
- Annual solar and wind production now produces more than 50% of electricity consumption.



iea wind

2019 – Danish Exports – Wind Turbine Technology & Services

122.6 billion DKK (18.4 billion USD)

Largest market in 2019: Germany

13.5% growth compared to 2018

Wind turbine technology accounts for 55% of total energy technology exports

Share of exports of all goods 13.5%

Share of GDP 3.3%

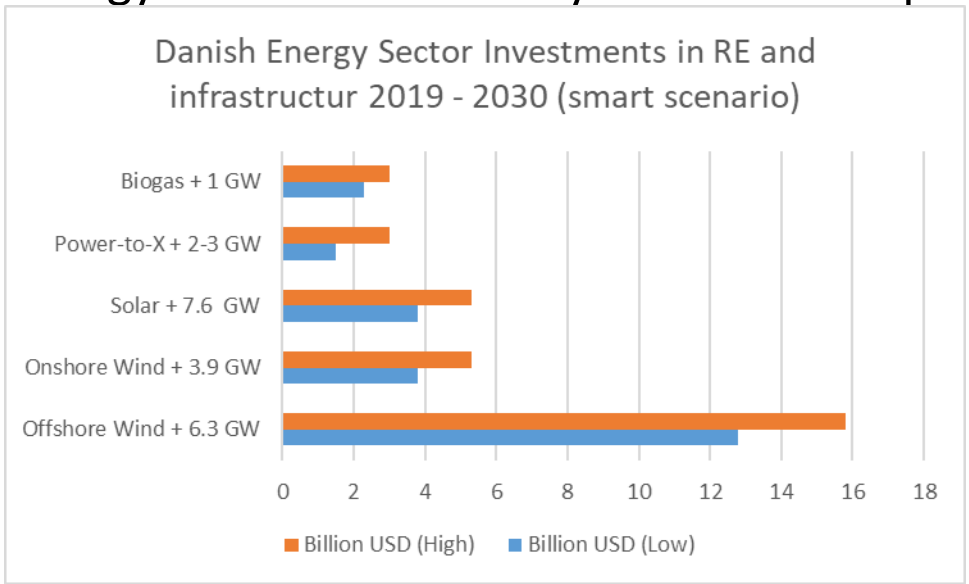
iea wind

Danish Climate Act – Key Elements

- The Climate Act ensures that Denmark works to reduce its greenhouse gas emissions by 70% in 2030 compared to 1990 levels and towards net zero by 2050
- The Climate Act is legally binding
- The Danish Government will present Climate Action Programmes each year with concrete political initiatives to decarbonize every sector from transport to agriculture and energy
- The climate programmes coming out of each year update of the climate act is expected to speed up wind energy deployment towards 2030.

Danish Industry – Climate Partnership – March 2020

- Increase of renewable energy with 64% to 125 TWh in 2030. Offshore wind from 1.7 GW to 7.6 GW, onshore from 4.4 to 6.1 GW and solar from 1.2 to 8.8 GW
- 3 extra large offshore parks together with to the 3 offshore parks in the Energy from 2018 – Stately tenders and open door – One stop shop



Responsible investor

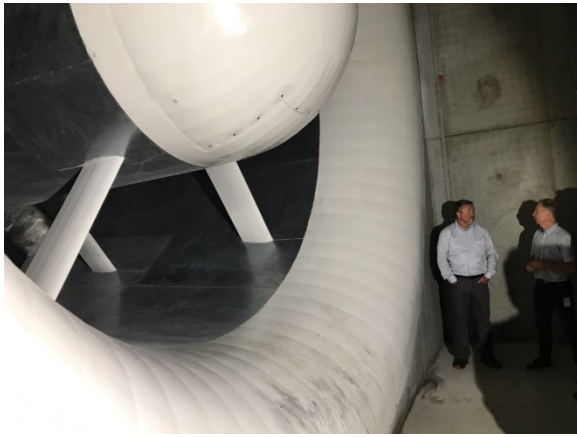
- Energy companies and agriculture
- Energy companies
- Energy companies
- Energy companies
- Energy companies

iea wind

Breaking News – World's first offshore wind "energy islands"

- May 20, Danish government published its first climate plan, thus taking a step towards the nation's goal of achieving climate neutrality by 2050. A key component of the plan is to build two energy islands, with a minimum capacity of 4 GW.

- The energy islands will be placed in the North Sea and by the Danish Island of Bornholm in the Baltic Sea. The Danish Government intends to start a dialogue with the Netherlands and Poland in order to connect the two offshore wind hubs to those countries as well.



ExCo member Karina Remler, Danish Energy Agency – EUDP Programme

kare@ens.dk

IEA IMPLEMENTING AGREEMENT FOR CO-OPERATION IN THE RESEARCH, DEVELOPMENT, AND DEPLOYMENT OF WIND ENERGY SYSTEMS

Minutes of the 86th IEA Wind Executive Committee (ExCo) Meeting

October 12 - 15, 2020, online meeting due to COVID situation

Agenda Summary

Date	Event	Times	Location
Monday October 12	**ExCo Meeting**	13:30–16:00 CEST	Online
Monday October 12	**Social online event**	16:30–17:30 CEST	Online
Tuesday October 13	**ExCo Meeting**	13:30–16:30 CEST	Online
Wednesday October 14	**ExCo Meeting**	13:30–16:30 CEST	Online
Thursday October 15	**ExCo Meeting**	13:30–16:30 CEST	Online

Participants

ExCo Members	Representative	Organization
Chair	John McCann, Chair, Member	Sustainable Energy Authority of Ireland (SEAI)
Secretary	Ignacio Marti	DTU Wind Energy
Deputy Secretary	Klaus Rosenfeldt Jakobsen	DTU Wind Energy
Austria	Andreas Krenn, Alternate	Energiewerkstatt
	Theodor Zillner, Member	Republic of Austria
Belgium	Jan Hensmans, Member	Government of Belgium
Canada	Paul Dockrill, Member	Natural Resources Canada
	Ryan Kilpatrick, Alternate	Natural Resources Canada
CWEA	Du Guangping, Alternate	Chinese Wind Energy Association (CWEA)
Denmark	Peter Hauge Madsen, Alternate	Technical University of Denmark (DTU)
European Commission	Carlos Eduardo Lima Da Cunha, Member	European Commission
	Matthijs Soede, Alternate	European Commission
	Thomas Telsnig, Alternate	Directorate General Research and Innovation/DG Joint Research Centre
Finland	Timo Karlsson, Member	Business Finland, VTT
	Aila Maijanen, Member	Business Finland, VTT
	Niina Helistö, Alternate	Business Finland, VTT
	Raul Prieto, Alternate	Business Finland, VTT
France	Daniel Averbuch, Member	IFP Energy nouvelles
Germany	Franciska Klein, Member	Forschungszentrum Juelich GmbH, Project Management Juelich (PtJ) on behalf of Federal Ministry for Economic Affairs and Energy

	Stephan Barth, vice Chair, Alternate	ForWind Center for Wind Energy Research
Greece	Nikolaos Stefanatos, Member	Center of Renewable Energy Sources and savings (CRES)
Ireland	See Chair	Sustainable Energy Authority of Ireland (SEAI)
Italy	Laura Serri, Member	RSE S.p.A.
	Luca Greco, Member	CNR
Japan	Yoshitomo Watanabe, Alternate	New Energy and Industrial Technology Development Organization (NEDO)
Republic of Korea	Seung-Ho Song, Member	Kwangwoon University
Mexico	José Manuel Nava Franco, Member/Vice Chair	Instituto de Investigaciones Electricas (IIE)
	Jaime Agredano Diaz	Instituto de Investigaciones Electricas (IIE)
Netherlands	Ruud Oerlemans, Alternate	Rijksdienst voor Ondernemend Nederland (RVO.nl)
Norway	Ann Myhrer Østenby, Member/ Vice Chair	The Norwegian Water Resources and Energy Directorate (NVE)
	Harald Rikheim, Alternate	The research council of Norway
Portugal	Teresa Simoes, Alternate	LNEG
Spain	Ignacio Cruz, Member/Vice Chair	CIEMAT
	Luis Arribas	CIEMAT
Sweden	Pierre-Jean Rigole, Alternate	Swedish Energy Agency
Switzerland	Katja Maus, Member	Swiss Federal Office of Energy
	Lionel Perret, Alternate	Planair
United Kingdom	Steven Wyatt, Member	Offshore Renewable Energy Catapult
United States	Jim Ahlgrimm, Member/Vice Chair	U.S. Department of Energy
	Brian Smith, Alternate/Vice Chair	National Renewable Energy Laboratory (NREL)
WindEurope	Ivan Pineda, Member	WindEurope

Task Number	**Operating Agent Representatives**	**Operating Agent Organization**
Task 11	Nicolas El-Hayek	Planair, Switzerland
	Lionel Perret	Planair, Switzerland
Task 19	Timo Karlsson	VTT, Finland
Task 25	Hannele Holttinen	Recognis, Finland
Task 26	Apologies	
Task 28	Suzanne Tegen	Colostate University, United States
Task 29	Gerard Schepers	TNO, Netherlands
	Koen Borsmann	TNO, Netherlands
Task 30	Amy Robertson	NREL, United States
Task 31	Javier Sanz Rodrigo	CENER, Spain
Task 32	Andrew Clifton	University of Stuttgart, Germany
Task 34	Cris Hein	NREL, United States
Task 36	Gregor Giebel	DTU, Denmark
Task 37	Katherine Dykes	DTU, Denmark
Task 39	Franck Bertagnolio	DTU, Denmark
Task 40	Masataka Owada	Wind Energy Institute of Tokyo, Japan
	Shigeo Yoshida	Kyushu University, Japan
Task 41	Alice Orrell	Pacific Northwest National Laboratory, United States
	Ian Baring-Gould	NREL, United States
Task 42	Anand Natarajan	DTU, Denmark
Task 43	Jason Fields	NREL, United States

Country	**Observers**	**Organization**
Belgium	Kristian Petrick	AWE
Belgium	Roland Schmehl	TU Delft
Belgium	Udo Zillmann	AWE
Denmark	Birte Holst Jørgensen	IEA Wind Secretariat, DTU
Denmark	Justine Beauson	DTU
Denmark	Kaushik Das	DTU
Denmark	Kirstine Dahlgaard	IEA Wind Secretariat, Deputy Secretary, DTU

Denmark	Simon Rubin	IEA Wind Secretariat, Communication Officer, DTU
France	Emmanuel Persent	IFPEN
France	Fabrice Guillemin	IFPEN
France	Jean-Babtiste le Marois	IEA
France	Kazuhiro Kurumi	IEA
India	Kannan Balaraman	National Institute of Wind Energy
Ireland	Cian Desmond	University College Cork
Ireland	David Igoe	Trinity College Dublin
Ireland	Des Farran	ServusNet
Ireland	Peter Deeney	UCC
Ireland	Philip Griffin	University of Limerick
Ireland	Raymond Byrne	Dundalk Institute of Technology
Ireland	Trevor Young	University of Limerick
Singapore	Srikanth Narasimalu	NTU
United Kingdom	Chong Ng	ORE Catapult
United States	Breton Barker	DoE
United States	Chris Vermillion	North Caroline State University
United States	Derek Berry	NREL
United States	Ivette Gonzalez	DoE
United States	Jennifer King	NREL
United States	Jian Fu	DoE
United States	Jochem Weber	NREL
United States	Maureen Clapper	DoE
United States	Michael Derby	DoE
United States	Will Shaw	PNNL
Uruguay	Bruno Lopez	UDELAR
Uruguay	Martin Draper	UDELAR

REMARK!

The minutes are a summary of presentations and discussions. For details, participants should check the original documents. All meeting materials are uploaded on https://community.ieawind.org/membersarea/ourlibrary/excolibrary

ACTION LIST

Meeting	Description	Responsible	Deadline	Status
ExCo 85 Actions				
ExCo85, May 2020	**Action E85-1:** Conduct online survey after the meeting	Secretariat	June, 2020	Done
ExCo85, May 2020	**Action E85-1:** Conduct online survey on committees' structure	Chair	June, 2020	Done
ExCo 84 Actions				
ExCo84, September 2019	**ACTION E84-1:** Create a working group involving OAs to propose a strategy on the implementation of FAIR data	Chair	ExCo85, March 2020	On going
ExCo 83 Actions				
ExCo83, March 2019	**ACTION 14:** Secretariat to check with IEA Paris how to get our webinars in their web. Check how to make webinars more easily accessible	Secretariat	ExCo84, September 2019	Done
ExCo 82 Actions				
ExCo82, October 2018	**ACTION 2:** The Operating Agent Representative for Task 27 Small Wind Turbines should work with the Secretary to submit the Task's Final Technical Report and Final Management Report to the ExCo for approval via email ballot			on going
ExCo82, October 2018	**ACTION 8:** The Planning Committee and Strategic Plan Working Group should establish mission and vision statements for inclusion in the strategic Plan			on going

Summary of decisions taken during ExCo 86

ExCo approvals in the following list were obtained via email ballot after ExCo 86.

New members:

- *Invitation to **Singapore** to join IEA Wind TCP was **approved** unanimously*

Task extensions:

- *The extension proposal for Task 25 was **approved** unanimously*
- *New proposal for Task 29 Innovative aerodynamic experiments and simulations on wind turbines in turbulent inflow was **approved** and will become Task 47*
- *The extension proposal for Task 11 was **approved** unanimously*

New Research Tasks:

- *The new Research Task **Enabling wind turbine blade recycling** was **approved** unanimously and will become Task 45*
- *The new Research Task **Leading Edge Erosion** was **approved** unanimously and will become task 46*
- *The new Research Task **Innovative aerodynamics** was **approved** and will become Task 47*

Task reports:

- *Task 19 Technical Report Performance Warranty for Wind Turbines in Icing Climates was **approved***
- *Task 30 Technical Report OC6 Phase I: Investigating the underprediction of low-frequency hydrodynamic loads and responses of floating wind turbines was **approved***

Development of new proposals:

- *Outcome of TEM 99. Proposal for developing a new Task on floating wind was **approved** unanimously*
- *Outcome of TEM 101. Proposal for developing a new Task on Hybrid Power Plants was **approved***
- *Outcome of TEM 102. Proposal for developing a new Task on Airborne Wind Energy was **approved***

Budget:

- *Common Fund Audit Report and 2020 Budget Status will be sent for approval in a separate email ballot*

Renovation of the Chair and the Leadership Team:

- *Candidates: Chair: Stephan Barth (to take over from ExCo 87. Vice Chairs: John McCann (Continue as chair until ExCo 87), Brian Smith, Ignacio Cruz, Jose Manuel Franco Nava. Other members of the LT: Jim Ahlgrim (as former Chair), Task 11 Operating Agent. Motion **approved** unanimously*

Next ExCo meetings:

- *The **approved dates for ExCo 87 are 17-21 May 2021**. Detailed agenda and invitations will be sent by the secretariat in due course. ExCo 87 will be organised by Japan with a tentative date 17-21 May 2021. We are aiming at a face to face meeting in Japan. LT will decide on face to face vs online meeting in January 2021 based on the information available related to COVID 19.*
- *ExCo 88 to be organised by Germany in Autumn 2021*

List of Actions

One new action decided during ExCo 86 has been included in the Action List:

- *ExCo survey on options to further develop communications activities*

Day 1. 12th of October

Session 1. Administrative and management issues

The Chair, John McCann, opened the 86th meeting of the IEA Wind TCP Executive Committee (ExCo) on the 12th of October 2020.

The Chair welcome ExCo members, OAs and observers and thanked the participants for the flexibility with time zones and asked for support from all to ensure a successful meeting.

The participants and observers of the ExCo 86 introduced themselves in the beginning of the meeting.

Business items

Changes in Contracting Parties and Membership
No changes have been formally communicated

Changes in Contracting Parties and Membership
Kazuhiro Kurumi has replaced Hideki Kamitatara as IEA liaison with TCPs in Paris IEA headquarters.

Status of ExCo 85 and previous Action Items
The Secretary reviewed the *Status of Action Items* document posted with the pre-meeting materials; the status of actions is described in the ***Action List*** *above*. Please note the nomenclature for actions, letter E followed by the number of ExCo meeting is used (i.e. Action E84-1)

Adoption of Agenda
The ExCo **approved** unanimously a motion to adopt the Agenda.

Approval of Minutes
The ExCo **approved** the minutes of ExCo 85 as they were presented in the pre-meeting materials on the IEA Wind TCP website.

Message from the Chair John McCann, Chair
The Chair explained the purpose of the meeting, that now includes *both Deployment as well as R&D activities*:

- Review progress in IEA Wind Collaborative Research Tasks
- Approve new Tasks & agree new initiatives
- Review and approve IEA Wind TCP administration
- Receive updates from member countries
- Continue developing IEA Wind TCP towards the strategic objectives

The Chair reminded the participants about the Strategic Objectives and Research Priorities, as well as the allocation of vice Chairs and countries to the committees established for our Strategic Areas. Our vice Chair Ann Myhrer Østenby stands down for personal reasons and nominations are invited to fill the vacancy. The Chair presented the main highlights from the last REWP meeting as well as the upcoming TCP legal modernization situation. February 2024 is the deadline for IEA Wind TCP to amend the Framework Agreement

Technical Meeting

Session 2. Advanced Technology

Vice Chair introduction Jose Manuel Franco, INEEL

The vice Chair reminded the audience about the Strategic Objectives within Advanced Technology: Maximise the value of wind energy in energy systems and markets, lower the cost of land based and offshore wind energy and foster collaborative research.

Task 30. Offshore Codes OC6 Amy Robertson, NREL

Membership: No changes in the participating countries but some new organizations joined the Task. Task 30 has 51 organizations from 11 countries. Progress and budget status: Overall progressing according to plan and budget, although WP2 has a 6-month delay with no significant impact. Technical update: 23 participants modelled 5 common load cases in their tools of choice including potential-flow and Morison-only models providing results for model comparison. Engineering modelers found that they had difficulties in accurately predicting load components across different load cases. Now looking to CFD to understand deficiencies in the modeling approach. A summary paper with the results has been produced and presented and the TORQUE conference.

Task 30 ***Technical Report*** *OC6 Phase I: Investigating the underprediction of low-frequency hydrodynamic loads and responses of floating wind turbines was* ***approved***

Task 43. Wind Energy Digitalization Jason Fields, NREL & Bethold Hahn, IWES

Membership: 10 countries have expressed interest to join but not all have confirmed yet. Progress and budget status: The Task has started recently and is actually establishing the working teams and starting the activities. Technical update: Communication of the Task objectives and expected results has been done with posters in WindEurope and AWEA conferences. Progress on the definition of a Universal Data Model aiming at efficient data exchange. Use case on value of data survey done.

Task 29 new Task proposal: Innovative aerodynamic experiment technologies and simulations on wind turbines in turbulent inflow Gerard, Schepers, TNO

Membership: No changes. Progress and budget status: according to plan. Technical update: Task 29 has finished the actual phase with most planned deliverables completed, aiming at a Final report by December this year. The main outcomes of this phase are a strong increase of aerodynamic knowledge together with improved aerodynamic models now implemented in design codes. CFD value in modelling 3D aerodynamics proven. A significant number of papers and many students now working in industry. The new Task proposal is justified on the size of wind turbines, which keeps increasing with the associated aerodynamic challenges like extreme shear and veer changes over the rotor plane. New research opportunities are available like the IEA 15 MW Reference Wind Turbine or experiments carried out in different countries. The new Task includes the following WP: WP1 Measurements and simulations, WP2 Turbulent calculations on 15 MW RWT and WP3 Cooperation with other IEA Tasks. Common benchmarks with Tasks 30 and 39 are planned. More than 29 participants from 9 countries are expected based on the participation on the previous Task. The Operating Agent will be Gerard Schepers from TNO.

The new Research Task ***Innovative aerodynamics*** *was* ***approved*** *and will become Task 47*

New Task Proposal. Leading Edge Erosion. Raul Prieto, VTT

Leading Edge Erosion (LEE) of wind turbine blades is an unsolved issue with a significant impact on the operational expenses of many wind farms. Net present value of cost associated to LEE estimated to be 2-3% offshore. LEE has an impact in power curve degradation, lost availability, increased cost of inspections and repairs creating added uncertainty in the business case. Following TEM#98 a Task proposal has been developed. The scope of work for the new Task includes 5 WP: WP1 Management, WP2 Climatic conditions, WP3 Wind turbine operation with erosion, WP4 Laboratory testing of erosion, WP5 Erosion mechanisms & material properties. The work plan is for four years and includes 10 high TRL deliverables (i.e. Recommended Practices and validated models), as well as 15 low TRL deliverables (surveys, roadmaps and reports). Operating Agents will be Raul Prieto from VTT and Charlotte Bay

Hasager from DTU. 13 participants from 7 countries have confirmed participation and 12 other organizations have expressed interest.

*The new Research Task **Leading Edge Erosion** was **approved** unanimously and will become Task 46*

Task 25 extension proposal. Design and Operation of Energy Systems with Large Amounts of Variable generation
Hannele Holtinen, Recognis

Membership: NL came back in 2019, BE, IND, RO potentially joining in 2020. Currently 17 countries and WindEurope participate in Task 25. Progress and budget status: according to plan. The motivation for an extension is that it is still high priority to solve issues related to wind integration and system impact. Important modifications in existing planning tools are needed, as well as new paradigms of operation of wind dominated power systems. Collaboration with international networks is planned (G-PST, other TCPs). This will be the last extension of Task 25. The expected results include enhanced international collaboration with inter TCP focus, national case studies, updated recommended practices considering close to 100% wind and solar events, enhanced dissemination and library of publications, creation of reference systems in collaboration with Task 37 and benchmarking of IRENA FlexTool. The Task extension includes 6 WP: WP1 Coordination and dissemination, WP2 Long term planning challenge, WP3 Balancing Challenge, WP4 Stability challenge, WP5 Market design issues, WP6 Inter TCP collaboration. The work will be developed over 4 years. Existing participants expected to continue plus new organizations from SP and NL. Cost EUR72.000 per year, OA to be shared between VTT and Recognis

*The extension proposal for Task 25 was **approved** unanimously*

Day 2. 13th of October

Session 3. North American focus

United States country presentation Jim Ahlgrimm, DOE

Wind energy supplying more than 6% of US electricity generation. US installed capacity through Q2 2020 was 109,9 GW. A record 4367 MW newly installed capacity in the first half of 2020. Top line R&D priorities are aggressive cost reduction, scaling, environmental challenges, grid services, cybersecurity and hybrid systems. Offshore wind challenges include technology development, cost reduction, siting, hurricanes, deep water and icing. The National Offshore Wind R&D Consortia include all major developers, state agencies, energy companies and research organizations have a budget over $40 million for research projects. Environmental and socioeconomic activities include the development of WREN, Tethys database and the development of monitoring tools. Land based focus is on removing subsidies and improving siting issues. Tall towers, larger, lighter and more flexible rotors, manufacturing and logistics innovation are R&D priorities for land-based wind together with wind plant optimization. Highlight projects included 3D printed concrete towers and next generation of lightweight drive trains. On distributed wind the challenges are the untapped potential on industrial applications, hardware, balance of system and development costs. R&D priorities include hybrid systems and microgrids, cost reduction, affordable resources assessment, grid services among others

Canada country presentation Paul Dockrill, NRCAN

Canada installed capacity by the end of 2019 was 13.413 MW, supplying 5.5% of the national electricity demand. 5 new wind farms were installed in 2019 with a capacity of 597MW. The Wind Energy – Grid Integration Utility Forum has shown that wind energy can effectively provide capabilities for the provision of secondary frequency regulation (Automatic Generation Control). The Utility Forum has a membership of 10 provincial utilities and system operators. The Canadian Energy Regulator Act came into force in August 2019, with authority to regulate construction and operation of offshore wind nergy projects. An open Canadian Wind Turbine Database includes 6500 wind turbines will be public in 2020. The Clean Energy for Rural and Remote Communities program includes $220millionn over 6 years with 13.4 MW for the development of wind capacity. The activities also include an analysis for 200+ diesel dependent remote communities with penetration levels and economics for solar, wind, storage and diesel systems.

Mexico country presentation Jose Manuel Franco, INEEL

The clean energy targets for Mexico including renewables are 30% by 2021 NS 55% BY 2024. Mexico has a potential for more than 50 GW, but only 17 GW more are required to meet the target for 2024. In 2019 the total installed capacity was 6215 MW, with a 26% annual increase. Wind energy supplied 5.3% of the national electricity demand with an average capacity factor of 40%. Three long term energy auctions have been called and have proven to be an effective instrument for the development of wind energy with 3407 MW contracted. In 2019 the investments for new wind energy projects reached $8969 million (USD). Some key R&D activities include the development of the 1.2MW wind turbine, construction and testing of a prototype post tensioned concrete tower of 100m for a 2 MW wind turbine. An aerodynamic design of a blade has been completed by INEEL, a 30kW horizontal wind turbine is being designed and manufactured, a test facility for blades (small wind turbines), as well as manufacturing facilities for blades have been developed. R&D projects on automated blades optimization and manufacturing are in progress, as well as projects on smart control and diagnosis of wind turbines. An R&D project on the design of a permanent magnet synchronous generator is in progress. The National Wind Map of Mexico includes 10 anemometric stations. CEMIE Eolico is sponsoring socio economic and environmental projects like the development of the concrete tower that has a contribution to reduce CO2 emissions by 3210 millions of tons/year.

Session 4. Resource and site characterization

Vice Chair introduction Stephan Barth, Forwind

How do you engineer a breakthrough in resource and site characterization? Is the focus of the session. This area has been active for long time, how to keep the momentum in this context. Industry is saying that there are still challenges on resource assessment offshore, updated models and tools needed also including basic research.

Task 19. Cold Climates Timo Karlsson, VTT

Membership: Current participants in Task 19 are AS, CA, CH, DK, FI, DE, NO, SW, SZ and UK, potentially joining IR and JP. Progress and budget status: progress according to plan although there are two delayed deliverables mainly because the standardization work is taking longer than planned. Technical update: The analysis on ice protection systems showed that performance is not meeting expectations, robustness and reliability must be improved. A technical report on performance warranty guidelines for wind turbines in icing climates about to be published. It defines test methods and performance criteria on how to evaluate turbine performance in icing conditions. A workshop with industry was attended by 36 participants.

Task 19 ***Technical Report*** *Performance Warranty for Wind Turbines in Icing Climates was* ***approved***

Task 31. Wakebench Javier Sanz, CENER

Membership: Current participants in Task 31 are CH, DK, FR, DE, JP, NL, SP, SW, SZ, US, no changes expected. Progress and budget status: progress according to plan and budget. Technical Update: SWiFT Single wake benchmark was managed by NREL with 6 participants showed challenges in simulating the non-idealized inflow, main differences in transient models come from wake meandering. OWA Wake Modelling Challenge managed by CENER with 11 participants showed good performance on array efficiency prediction of engineering models but with errors at the turbine level, there were challenges in the assessment of freestream conditions from SCADA. The American Wake Experiment managed by NREL and involving international cooperation includes instrument development roadmap, experimental planning with testable hypothesis, optimization of instruments and measurement campaigns in 2021 and 2023. Complex terrain benchmarks carried out in Perdigao (Portugal) and Alaiz (Spain). New Task proposal under discussion will be presented at Exco 87

Task 32. LIDAR Andrew Clifton, University Stuttgart

Membership: AT, CA, GR, DE, DK, FR, JP, KR, NL, NO, UK, US participate in Task32, possible new participant CH. Progress and budget status: progress and budget are according to plan in all WP. Technical update: A workshop on optimization of wind turbines with lidar assisted control based on systems engineering was held with 28 participants producing a paper presented at Torque. Other webinars have been organized on data filtering and lidar in wind tunnels. Communications in the Task have been relaunched with a webinar, white paper, repository and promotion

approach. Task 32 collaborative R&D roadmap was launched in 2019 and refined in 2020 aiming at helping stakeholders by linking activities, bring focus and introduce new participants. Renewed interest in turbulence.

Task 36. Forecasting for Wind Energy Gregor Giebel, DTU Membership: Current participants are AT, CN, DE, DK, SP, FI, FR, IE, PT, SE, UK, US. Potential new members that have expressed interest: JP, UY, ZA. Progress and budget status: progress according to status, some budget not utilized due to less travelling. Technical update: A numerical weather prediction (NWP) benchmark has been published, continuous update of the NWP database in the Task website. The Recommended Practice on Forecast Solution Selection has raised interest from the users and feedback has been collected which will be used for updating the RP. Data transfer standards are progressing with a mapping of existing standards. Definitions of forecast error spread and confidence intervals vs forecast uncertainty have been finalized. Collaboration with IEC SC 8A Workgroup successful with a Technical report soon to be public. A game on probabilistic forecasting has been developed to understand how to use it.

New Task proposal. Enabling wind turbine blade recycling Justine Beauson, DTU and Derek Berry, NREL Following the presentation in ExCo 85 a new Task proposal Enabling wind turbine blade recycling was presented to be approved. The Task aims at providing answers to the barriers for the implementation of large scale blade recycling solutions. The Task will focus on the identification of barriers and mitigation strategies for the implementation of large scale wind turbine blades recycling solutions. The Task aims at establishing best practices for the management of end of life blades, establishment of standards and providing guidance on upscaling recycling processes and establishing recycling value chains. For work packages include management, technical focus, analysis-value chain and standardization. Total cost is 54.000 euro/year. 32 organizations from 12 countries have expressed interest to join the new Task. The proposed duration is 3 years.

*The new Research Task **Enabling wind turbine blade recycling** was **approved** unanimously and will become Task 45*

Day 3. 14th of October

Session 5. Task 11 Base Technology Information Exchange

Presentation on progress and Task extension Nicolas El Hayek, Planair
Work progress: Task 11 have organized four Topical Expert Meetings (TEM) per year, during the last 2 years the TEMs have included topics like testing, reliability of electrical equipment, recycling, wind farm control, hybrid power plants, floating offshore arrays, airborne wind energy, etc. The recent TEMs have been very well attended surpassing 100 participants in TEM#99. Task 11 Operating Agent (OA) introduced online meetings in 2020 to facilitate the interaction with Task members. 2 Recommended Practices have been published and provided inputs for the improvement of IEA Wind online community platform (web). A TEM on Aviation System Cohabitation will be organized in 2020. Task 11 OA facilitated and hosted the Leadership Team meeting in Geneva in 2020 that resulted in new management approach for the TCP. Task extension: proposed duration 2021-2023, updated brand Task 11-Wind SCOUT. Four WP: WP1 Topical Expert Meetings, WP2 TCP internal needs, WP3 Task dynamics, WP4 Admin and reporting. Overall budget CHF 79.800/year, same contribution per participant: CHF 4.200/year. Three presentations about future Task proposals were shown about Floating Offshore Wind Arrays, Hybrid Power Plants and Airborne Wind Energy, the three proposals are based on the outcomes of TEM 99, 101 and 102.

Task 11 extension was **approved** unanimously

Three proposals for ***Floating Offshore Arrays, Hybrid Power Plants and Airborne Wind Energy*** were approved to be developed into Task proposals

Session 6. Strategic Areas

Session organized to review progress, identify gaps and suggest enhancements related to the delivery of strategy. Review how Tasks cover strategic priorities, identify gaps where new Tasks could be needed, collaboration opportunities, enhance communication. There are best practices across Tasks worth considering as reference for other Tasks

Session 1. Advanced Technology Facilitator: Jose Manuel Franco, INEEL

Does Task cover strategic priorities? yes, all activities are included in existing and upcoming Tasks. What about establishing a "super Task"? could be interesting but difficult to manage, establishing meetings of OAs working on related Tasks an idea. Are there gaps? There are some gaps like condition monitoring, access to datasets and quality checks for validation purposes important, specific action on data to be considered. Communication of Task achievements important to increase impact and facilitate data access.

Session 2. Resource and Site Characterization Facilitator: Stephan Barth, Forwind

Most of the topics are covered by existing Tasks, new areas like resources at high altitudes to be covered by new coming Tasks. It is missing focus on long term forecasts on wind resources. There is some silo related problems due to the fact that we have individual Tasks, example on forecasting and wind farm control both sharing some common topics. Resource and site characterization also include acceptance, consider reviewing the name of the strategy area.

Session 3. Communications Facilitator: John McCann, SEAI

We are not covering communications for all stakeholders equally, we are doing well on scientific communications at Task level by scientific papers and seminars but not so well for non-technical stakeholders. Dissemination plans in the Tasks tend to address specialists, to consider expanding Task communication to include broader audience. Consider making better use of social media to disseminate, we could provide a continuous stream of news from Tasks. Task 32 is a reference in communication, news from Tasks sometimes difficult to find. Consider communications enhancement for each Task and TCP, including a communications plan with key stakeholder mapping and stakeholder interests identified. ExCo members can support communication activities.

Session 7. European Focus

Belgium country presentation Jan Hensmans, FOD Economie

EEZ offshore wind zone in Belgian waters is the area with highest density of offshore wind energy per km2. Offshore development started in Belgium in 2020 with the legal framework and the 7 planned offshore wind power plants will be operational at the end of 2020, totaling 2262 MW offshore, producing 8 TWh/year equivalent to 10% of the electricity demand in Belgium. The Federal Government approved doubling the offshore capacity during the period 2019-2024. 5 farms have individual grid connection while 4 wind farms are connected to a modular grid. A 1GW connector to the UK started operating in 2019, a second connection is under study. North Sea Energy cooperation involving 10 countries adopted a new work program including hybrid projects, maritime spatial planning and support framework. R&D activities include new partners joining OWI Lab and broad portfolio of R&D projects in areas like digitalization of wind turbine components, cables and foundations monitoring, smart O&M, acceleration of industrial intake of surface nano technologies, a PhD community on offshore wind, etc. New test capabilities have been added with a large climatic test chamber and new icing test array, a new wave tank as part of the Coastal & Ocean Basin and a shackle chain wear test rig.

WindEurope presentation Ivan Pineda, WindEurope

In Europe, the installed capacity in 2019 reached 197GW (174 GW onshore and 23GW offshore). 5.1GW new installations in the first half of 2021 involving €14 bn investments. The electricity demand in Europe dropped 20% due to corona virus situation. Wind energy provided 17% of the electricity demand in Europe during the first half of 2021. The EU Recovery Strategy includes a €750 bn recovery package partly expected to support wind energy among other renewables. The European Green Deal involves new targets and legislative proposals due in 2021 and an impact assessment on how to achieve a 55% reduction in GHG emissions by 2050. The European Green Deal

incorporates biodiversity, energy system integration, H2, offshore renewable energy and smart mobility strategies. Wind Europe capacity scenarios point at 759 GW onshore and 450GW offshore in 2050. Permitting is a key area to address to ensure deployment, minimum distance to housing being a key topic where a recommendation has been issued about 500 m minimum distance or compliance with noise limits.

France country presentation Daniel Averbuch, IFPEN

Total installed capacity in France is 16.6 GW by the end of 2019, with 1.4 GW new capacity added that year. 7.4% of the electricity demand was supplied by wind energy. The multi-year planning law was validated in April 2020, offshore capacity will be subject to strike price levels. In February 2020 the onshore tender resulted in 62.2 €/MWh and the last offshore tender resulted in €44/MWh. Round 1 bottom fixed offshore projects are developing as planned. There is a public debate about the first commercial tender for floating wind in South Brittany. The employment related to wind energy in France has grown from 15870 employees in 2016 up to 20200 in 2019. Several manufacturing and assembly factories have been built in the Atlantic coast. Recent R&D projects include Zebra project to develop the first recyclable wind turbine blade and Eolink innovative floating wind technology demonstration.

Germany country presentation Franciska Klein, Project Management Juelich

Total installed capacity in Germany by the end of 2019 was 60.84 GW, with 1.997 GW new capacity added. During the first half of 2020, 751MW were added. It was a low level of new capacity onshore due mainly to long permitting procedures, there were undersubscribed auctions on onshore wind with average bidding value of €62/ MWh. A new Renewable Energy Act has been adopted in 2020 including elements of greenhouse gas neutrality and social acceptance of renewable energies, the target is 65% of renewables share by 2030. Decommissioning is expected to increase due to the stop of funding for wind power plants built from 2000, the topic is still under discussion. Offshore the newly added capacity decreased sharply to 200 MW but the new targets for offshore wind include 20 GW by 2030 and 40 GW by 2050 with yearly tender volumes planned of 1 GW to 3.5 GW. 122 new R&D projects on wind energy funded in 2019 with more than €80 million and 74 projects started in 2020 so far with almost €42 million budget. R&D projects include for example interaction of wind power plants with terrestrial navigation and radar, characterization and qualification of a doppler radar for wind energy applications and interaction of offshore wind farm wakes with the marine atmospheric boundary layer.

Day 4. 15th of October

Invited presentation: Singapore

Singapore have specific characteristics with many islands in a tropical environment. Remote islands rely on diesel generation, offering potential for wind energy applications. There is potential in SEA countries for wind energy but there are barriers like high installation costs, limited land area or lack of utility scale development. Research activities include an offshore renewables joint industry project combining wind and PV, the consortium is being formed including leading including leading companies and research organizations. Environmental conditions in Singapore require specific solutions in areas like coatings, foundations, weak grids, microgrids, etc. Projects in all those areas are ongoing in organizations like the Energy Research Institute of Singapore. Example R&D projects include Renewable Energy Integration Demonstrator in Singapore, aerodynamic modelling of floating offshore wind turbines, tribology research on highly saline conditions, advanced manufacturing and heat treatment, distributed energy management. Tropical wind turbine design has been developed resilient to tropical conditions including extreme events. Energy storage and hydrogen are also part of the R&D portfolio.

Session 8. European Focus (continuation) & administration

Portugal country presentation Teresa Simoes, LNEG

The installed capacity in Portugal in 2019 reached 5437 MW with 69 MW newly installed. Wind energy supplied 13.7 TWh, equivalent to 27% of the national electricity demand, no technical problems related to high penetrations or curtailment was reported. The first floating offshore wind farm in the country started operation in July 2019 with 3 wind turbines 8.4 MW each. The average capacity factor is 2378 full load equivalent hours. 2019 was slightly windier than average with 1.07 wind index. The Nation al Energy and Climate Plan establish an additional capacity for wind energy of 3.7 GW, reaching 9.3 GW by 2030 and 13 GW onshore plus 1.3 GW offshore by 2050. Recent new regulations approved on hybrid power plants, installation of overcapacity in existing wind power plants and regulation of micro and mini generation. Wind energy supported 3250 jobs. R&D projects include the creation of a network of scientist on offshore wind, high performance wind turbines, dynamic power line rating, planning marine renewable energies, implementation of windscanner, wind energy integration in urban and rural areas, floating wind turbines design, robotic solution s for O&M, power to X among others.

Norway country presentation Ann Myhrer Østenby, NVE

Installation of wind energy in Norway is breaking records every year. Installed capacity 3426 MW with annual energy production 11094 GWh. A Governmental White Paper presented and waiting parliament approval, the paper includes new deadlines to improve the permitting and development process, addressing the lack of clear permitting processes for wind energy. Hywind Tampen floating wind power plant is being built, developed as a petroleum installation due to the fact it is not connected to the electricity grid, aiming at completing installation in 2023. There are 15 areas considered for offshore wind in Norway. It is expected to have applications for offshore wind in 2023 with an expected operational deadline in 2028. The R&D funding for research centres stopped in 2018 and 2019 had an increase in the total RR&D funding for wind energy that went over €3m, in 2020 the R&D budget is expected to raise to more than €3.5m. Recent R&D projects include upscaling floating foundations, icing conditions, smart operation of wind farms, lowerable floating turbine. Project WAS-XL focuses on improving the wave loads and soil response for large monopiles.

Sweden country presentation Pierre-Jean Rigole, SEA

Installed capacity in Sweden reached 8681 MW with an annual producing 19.8 TWh. 1.7GW are expected to be installed in 2020. As the penetration level is increasing a debate has started on delivery reliability. Sweden has overproduction and is exporting electricity. For the first time negative prices have come in the Nordpool. Prices for green certificates has dropped significantly leading to stopping new allocations after 2021and earlier termination of the Green Certificate Scheme in 2035. Permitting can be challenging as shows a recent municipal veto to a wind power plan project. A National Strategy for Sustainable Wind Power Development will be completed in 2020 resulting in better permitting and planning processes, it also includes the sea as a resource. R&D highlights include a modular laminated wood wind tower with 90% lower emissions compared to conventional towers, innovative deicing systems and research on environmental and social impact.

Switzerland country presentation Katja Maus, BFE

The installed capacity in Switzerland in 2019 reached 75 MW with 5 projects in the waiting list to be approved. The long-term goal is to cover 7% of the annual electricity demand by wind energy. The National Energy and Climate Action Plan includes 19.3 GW of wind energy (0.9 GW offshore) for 2030. Wind projects have won 99% of the auctioned capacity in 2019. The complexity and timing of the authorization process seems to be the main barrier to the short-term development of wind projects. 100% renewable based scenarios are being considered with a key role for wind energy. Wind park Gotthard was inaugurated in October. R&D budget for wind energy in 2018 was CHF5.27 m, activities include airborne wind turbines, and R&D network, studying special and temporal variation of wind, optimal design of wind energy projects and quantification of hourly CO2 impact of wind energy.

Ireland country presentation John McCann, SEAI

The installed capacity in Ireland in 2019 reached 4247 MW with 517 MW newly installed, covering 30.6% of the annual electricity demand with 28% average capacity factor and 6.9% curtailment. The Climate Action Plan adopted 70% RES-E target for 2030 supported by Renewable Electricity Support Scheme with the first auction in August 2020 securing projects for PV and wind (479 MW). Enduring Connection Process 2 in place. A consultation on offshore grid

is ongoing. A draft for consultation is available on updated Wind Energy Development Guidelines. The new government increased 2030 offshore wind target from 3.5 GW to 5 GW. Recent study finds that wind energy in Ireland avoids 33 m CO2 tons (2000-2020 period). SEAI funded UCD project to create an environmental database facilitating planning processes. R&D projects include activities in best practices for offshore community engagement, open-source library for wind and solar resources, laser ablation of blade contaminants, test and classification of high-performance blade protection materials, mapping geotechnical conditions for offshore wind, damping parameters for offshore wind, airborne demonstration site and floating wind pilot project.

Communications committee John McCann, SEAI

Report on communications committee activities. A meeting with IEA secretariat, European Commission, WindEurope resulted in a list of ideas to enhance communication activities in IEA Wind TCP. The main conclusions are: The needs of influential stakeholders are not addressed properly, best practices in Task comms should be adopted by all, there are few strategic collaborative comms initiatives only at Task level, comms is under resourced and not joined up, consistency of messaging not currently assured, education is missing, social media presence is insufficient. Recommendations include to develop an IEA Wind TCP comms strategy with comms specialist inputs, task comms template, survey stakeholder needs, revamp social media with video content, identify long term means, collaborate with other organizations, TEMs on education and communication.

IEA Secretariat report Kazuhiro Kurumi, IEA

Recent IEA reports include Renewables Energy Market Update and Renewables 2020 Market Report. Key highlight is that Covid 19 caused the first decline in new RES additions in the last two decades. Other publications are digital reports on Global Energy & CO2 Status Report and Tracking Clean Energy Progress and ETP 2020. IEA Clean Energy Transitions Summit took place in July 2020 involving 40 ministers and online audience of more than 1.7 million, included a call for a grand coalition. The collaboration with IRENA has resulted in a joint Op-Ed on Sustainable Recovery and also on a study on RE Heating & Cooling Policies. A collaboration with the Solar Alliance is ongoing and IEA is facilitator of the Biofuture Platform. REWP meeting included a workshop on the role of storage beyond electricity with focus on heating and cooling and sector coupling. The Energy Technology Innovation Partnerships report was published in 2019 and included insights from interviews with TCPs.

Election of the Leadership Team

A motion to renew the Leadership Team (Chair and Vice Chairs) was presented, the candidates are:

- Stephan Barth (Chair)
- John McCann (Vice Chair)
- Brian Smith (Vice Chair)
- Ignacio Cruz (Vice Chair)
- Jose Manuel Franco (Vice Chair)

Ann Myer Østenby steps down as Vice Chair. Stephan Barth to take over the Chair position from ExCo 87.

The motion to **renew the Leadership Team** with **Stephan Barth as the new Chair** was **approved** unanimously

Presentation of the project to renew IEA Wind TCP web site Simon Rubin, DTU

DTU has taken over all the work to renew IEA Wind TCP web site, the new web template was presented as well as the approach taken to develop the web, which has taken into account inputs from OAs obtained in several specific meetings, plus a dedicated working group that included some volunteer OAs. The plan is to have the new web ready by the end of the year.

Next Meetings

- The approved **dates for ExCo 87 are 17-20 May 2021 hosted by NEDO in Japan**. Detailed agenda and invitations will be sent by the secretariat in due course. The Leadership Team will evaluate the situation regarding covid travel restrictions and take a decision about face to face or online meeting in January 2021.
- ExCo 88 will be organised by Germany in Autumn 2021. We are aiming at a face to face meeting

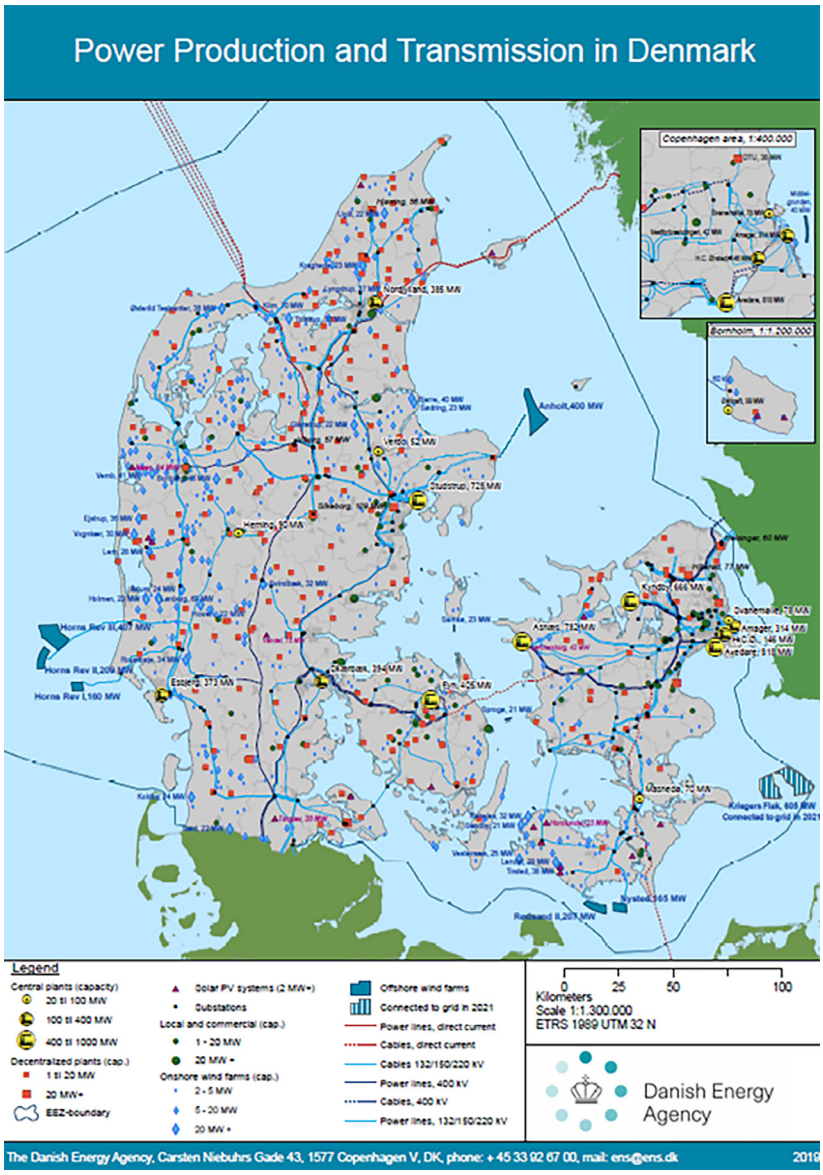
Closure Friday October 15th – 4.30 PM

The Chair thanked all the country presenters, the OA presenters, the Vice Chairs, and the Secretary for a successful meeting. The Chair acknowledged the extra efforts that the online format of this meeting demanded from all participants.

Ignacio Marti, Secretary
John McCann, Chair

Meeting documents

All meeting documents are uploaded on https://community.ieawind.org/membersarea/ourlibrary/excolibrary



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DENMARK

The wind power capacity in Denmark has been stable around 6 GW in nearly 3 years. Installed total wind power capacity decreased by 20 MW in 2019. Denmark did not establish any new offshore wind power capacity power in 2019.

KARINA REMLER, Danish Energy Agency; PETER HAUGE MADSEN, KLAUS ROSENFELDT JAKOBSEN, BIRTE HOLST JØRGENSEN, DTU Wind Energy, Denmark. Reviewed by: RASMUS ZINK SØRENSEN, LEA BIGOM WICHMAND, and SIMON MAUL HANSEN, Danish Energy Agency, Denmark.

Horns Rev 3 was finalised in January 2019, but in the offshore capacity it is counted in the 2018 statistics. However, 27.8 MW new capacity was established onshore. This brings Denmark's total capacity to 6.104 GW of which 1.7 GW is offshore (Table 1). In 2019, 35% of Denmark's energy consumption (724

TABLE 1. KEY NATIONAL STATISTICS 2019: DENMARK

Total (net) installed wind power capacity	6.104 GW
Total offshore capacity	1.7 GW
New wind power capacity installed	0.028 GW
Decommissioned capacity (in 2018)	0.039 GW
Total electrical energy output from wind	16.160 TWh
Wind-generated electricity as percent of national electricity demand	47.2 %
Average national capacity factor	30.2 %
Target	55% renewable energy by 2030
National wind energy R&D budget	148 mil DKK; 19.8 mill EUR; 22.2 mill USD

TJ) came from renewable sources; 40% from oil, 14% from natural gas, 5% from coal, 2% from non-renewable waste, and 3% from imported electricity [2]. Coal declined with 4% from 9% in 2018 to 5% in 2019 [2].

Wind-generated electricity met 47.2% of the domestic electricity supply in 2019. This is a world record, and a double world record happened on a historic day September 15 with wind power covering more than demand all 24 hours, and between 2-3 am produced wind electricity surpassed the Danish demand with up to 60% (previous record also from 2019, from June 9, when wind turbines accounted for 52% more production than consumption). The wind energy index in 2019 was 95% compared to 90% in 2018 and to 102% in 2017 [4].

Market Development

National Targets and Policies Supporting Development

In December 2019, 8 out of the 10 parties in the Danish Parliament agreed on a legally binding national Climate Act, and the new bill was approved by the Danish Parliament in February 2020. [3]

Key elements of the Danish Climate Act:

- The Climate Act ensures that Denmark works to reduce its greenhouse gas emissions by 70% in 2030 compared to 1990 levels and towards net zero by 2050
- The Climate Act is legally binding
- The Danish Government will present Climate Action Programmes each year with concrete political initiatives to decarbonise every sector from transport to agriculture and energy
- Greenhouse gas emissions are calculated in accordance with the UN accounting rules

In 1991, Denmark accelerated the green transition by building the world's first offshore wind farm. Today, offshore wind energy has become a thriving global industry that provides power cheaper than coal and nuclear plants.

Milestone Targets in Danish Climate Act

The Climate Act [10] contains a mechanism for setting milestone targets. Every five years the government must set a legally binding target with a ten-year perspective. During the government's forthcoming Climate Action Plan in 2020, an indicative milestone target will be set for 2025.

The climate programmes coming out of each annual update of the climate act are expected to speed up wind energy deployment towards 2030. A projection from Danish Energy Agency in August 2019 has an increase in annual offshore production with five times to 33 TWh and onshore with two times to 20 TWh. The binding commitments from the National Energy Agreement in 2018 (2,400 MW more offshore wind) have to be expanded. Thus, Denmark will have approximately 2,650 MW of offshore wind power installed by 2023, followed by an additional minimum of 2,400 MW by 2030.

Other important areas covered by the Energy Agreement are:

- Technology-neutral tenders of solar photovoltaics, land-based and nearshore wind power, wave power, and hydroelectric power will be supported by an allocation of 561 million EUR (643 million USD) during the agreement period (2020-2024).

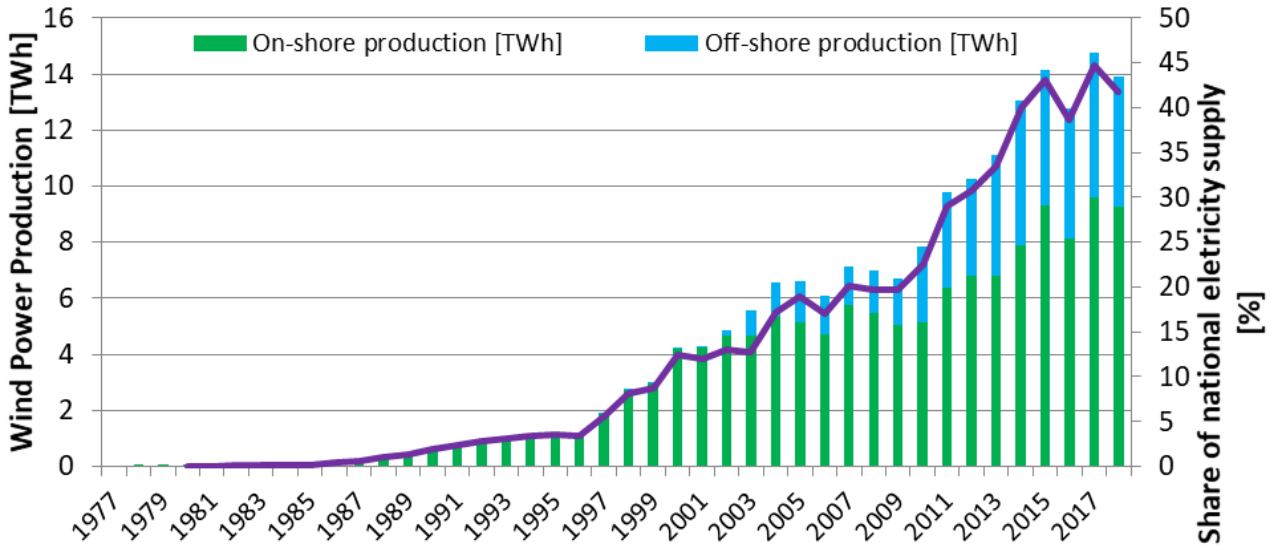


FIGURE 1 WIND-GENERATED POWER AND SHARE OF THE NATIONAL ELECTRIC ENERGY SUPPLY IN DENMARK SINCE 1977 [1]

- The number of land-based wind turbines (larger than 25 kW) will be reduced from the current level of approximately 4,300 wind turbines to a maximum of 1,850 in 2030. The policy will be gradually implemented during the agreement period, based on annual reviews and ongoing monitoring of progress.
- Direct support for new household wind turbines ceases in 2020 [4]. However, a scheme supporting installation of test or prototype wind turbines is established for installations either inside or outside the national test centres.
- After 2020, the parties in the Energy Agreement intend to increase public funding for research, development and demonstration projects in the fields of energy technology and climate. During the agreement period, funding for these efforts will increase to 134 million EUR (153 million USD). These funds will be prioritised within the framework of the Government's goal of investing at least 1% of GDP in public research and innovation.

Progress & Operational Details

Denmark's wind power capacity and number of turbines have increased since 1977 when the first turbine was connected to public grid. Today, the net installed wind power capacity is more than 6,000 MW. Of this total, offshore installed capacity accounts for 1,700 MW.

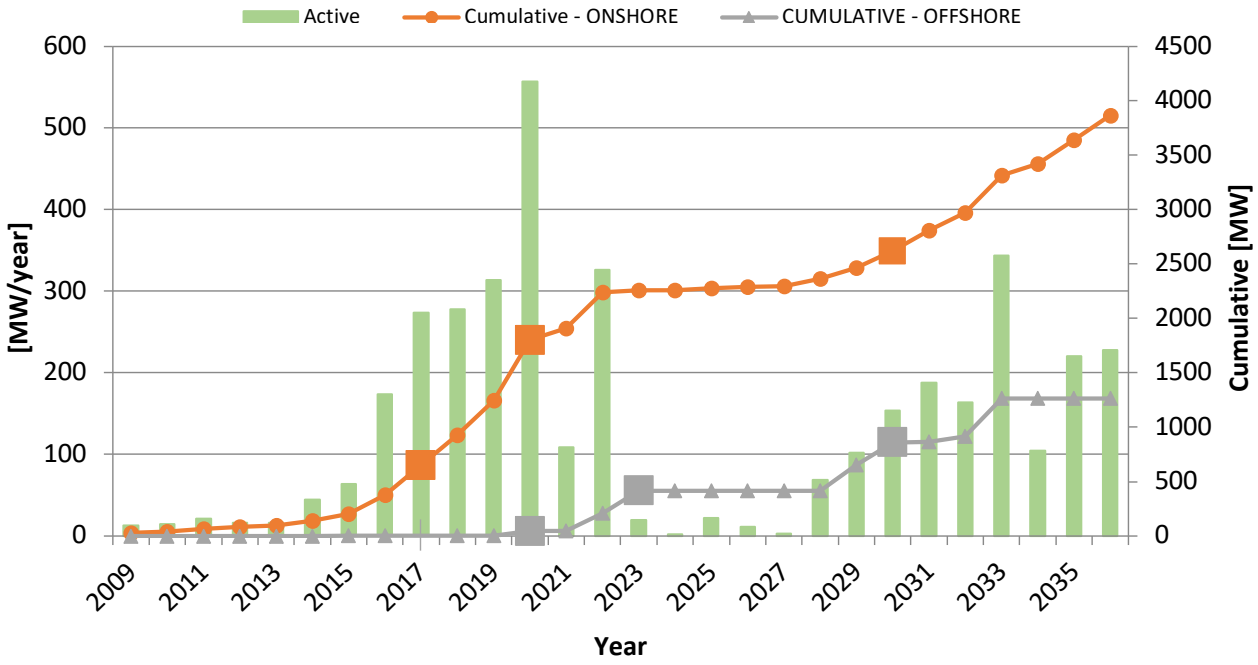


FIGURE 2 ANNUAL INSTALLED CAPACITY EXCEEDING DESIGN LIFETIME OF 20 YEARS [MW/YEAR]

Wind-generated electricity accounted for close to 45% of total electricity consumption in the past five years.

As of the end of 2019, 6,104 MW of wind power capacity has been installed. In 2000, this number was approximately 2,000 MW. Thus, by 2020 more than 30% of the installed capacity will be over 20 years old

Figure 1 illustrates the wind power capacity in MW exceeding 20 years of lifetime on an annual basis. The figure only takes into account the installed capacity. Projects in pipeline or planning are not included.

Danish TSO Strategy "Winds of Change"

In December 2019, the Danish TSO Energinet published a new strategy "Winds of Change" [91]. The Danish TSO states that "In the coming years, we need to do what we can to support energy consumption, which can realise and utilise the enormous offshore wind power resources as well as onshore solar energy and wind power, which are now becoming more widely available on market terms. So that we can use renewable energy for everything". The strategy outlines four potentials: 1) Sector coupling, 2) Large-scale off-shore wind power, 3) Solar and wind power on market terms and 4) Collaboration with society. The energy consumption in a fully electrified society will require approx. 13 GW, while the wind power potential in Danish waters alone is as much as 40 GW.

Procedures and Permits for Offshore Wind Parks

The conditions for offshore wind farms are defined in the Promotion of Renewable Energy Act. In chapter three, it is stated that the right to exploit energy from water and wind within the territorial waters and the exclusive economic zone (up to 200 nautical miles) around Denmark belongs to the Danish State.

Three different licenses are required to establish an offshore wind farm in Denmark. The three licenses are granted by the Danish Energy Agency, which serves as a "one-stop-shop" for the project developer.

The establishment of offshore wind turbines can follow a tender procedure run by the Danish Energy Agency or an open-door-procedure.

In September 2019, the Minister for Industry, Business and Financial Affairs signed an Order in which he removes the 150 meter ceiling for onshore wind turbines. The municipalities can permit to construct up-to-date wind turbines in accordance with current

Matters Affecting Growth and Work to Remove Barriers

practice, ie. wind turbines with a total tip height of more than 150 metres. The development will allow municipalities to install fewer but larger turbines, which can produce significantly more green electricity per year. In the future, municipalities will determine the maximum height of wind turbines to ensure that the planning framework for setting up modern wind turbines is in full compliance with the Energy Agreement of 2018.

R,D&D Activities

National R, D&D Priorities and Budget

The two largest public funding programmes related to technical and societal energy solutions are The Energy Technology Development and Demonstration Programme (EUDP) and Innovation Fund Denmark (IFD) [5, 6]. Financial support is given in accordance with EU state aid rules, including that foreign project participants can receive EUDP support according to the same rules as Danish participants.

The Danish Energy Agency administers EUDP, which supports private companies and universities to develop and demonstrate new energy technologies, including wind energy. Innovation Fund Denmark supports strategic and applied energy research. Both funding programmes have energy investment strategies.

The Energy Agreement together with an R&D agreement in fall 2019 has resulted in an R&D investment in green transition of approximately 66 million EUR (76 million USD) in 2019, increasing to approximately 374 million EUR (428 million USD) in 2025.

In 2019, EUDP and IFD granted 15 wind energy R&D projects with a total of 148 million DKK (19.4 million EUR; 22.2 million USD). Detailed information on funded projects and public energy research can be found on https://energiforskning.dk/en/projects [7]. The total budget in 2019 for energy research in the two programmes were 86 million EUR (96 million USD).

Megavind is Denmark's national partnership for wind energy, representing both industry and research organisations. The 2018 Megavind annual research and innovation agenda outlined six key R&D themes that were derived directly from Danish companies' internal R&D roadmaps. The R&D themes were further supported by five so-called innovation drivers that provide criteria for assessing the potential impact of R&D projects [8].

The R&D themes and innovation drivers are reiterated in the Megavind Annual Research and Innovation Agenda 2019, which also outlined the following key priorities for the sector: 1. Production and industrialisation; 2. Test and demonstration facilities; 3. The right competences; 4. Power to X and sector coupling; and 5. Floating wind power systems.

> Wind-generated electricity met 47.2% of the domestic electricity supply in 2019 setting a new record. Another record was set on September 15, when wind power covered more than demand for 24 hours and surpassed demand with up to 60% for an hour.

National Research Initiatives and Results [7]

In 2019, EUDP granted the **MADEBLADES** project (2020-2023, grant 33.3 mill. DKK (4.46 mill. EUR; 5 mill. USD) and total budget 51.64 mill. DKK (6.92 mill. EUR; 7.75 mill. USD)), which targets further development and prototype demonstration of a disruptive design and manufacturing solution for large (>90m) offshore wind turbine blades. Overall project objective and success criterion are to enable a 30% reduction in the cost of produced blades. Responsible company is LM WIND POWER A/S.

Another EUDP grant was **ReLife** (2020–2023, grant 11.6 mill. DKK (1.55 mill. EUR; 1.74 mill. USD) and total budget 18.4 mill. DKK (2.47 mill. EUR; 2.76 mill. USD)). The purpose is to develop a new methodology for the assessment of the remaining useful life of wind turbine rotor blades individually, based on their individual damage states. The methodology is particularly relevant for turbines approaching their original design life (20 years). It will enable most turbines to have their service life extended by 10-15 years, thereby lowering the levelized cost of energy. Responsible university is DTU Wind Energy.

ProbWind granted by EUDP (2020-2022, grant 5.4 mill. DKK (0.72 mill. EUR; 0.81 mill. USD) and total budget 10.8 mill. DKK (1.45 mill. EUR; 1.62 mill. USD)) will develop and demonstrate the basis for reliability-based/probabilistic design of wind turbines, leading to the development of a new international standard on probabilistic design of wind turbines. The new probabilistic design method for wind turbines will provide a reliable design at a reduced LCOE (Levelized Cost of Energy). Responsible university is Aalborg University (AAU).

Low-Wind project (2019-2021, grant 6.1 mill. DKK (0.82 mill. EUR; 0.92 mill. USD) and total budget 11.7 mill. DKK (1.57 mill. EUR; 1.76 mill. USD)) is also granted by EUDP. The overall objective of the project is to explore the

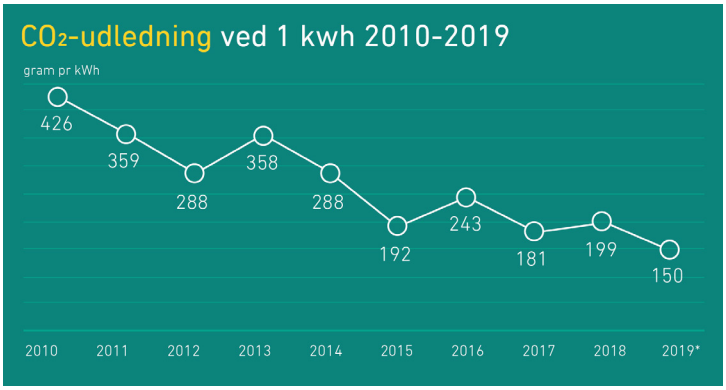


FIGURE 3: CO_2 EMISSION – 1 KWH DANISH ELECTRICITY 2010-2019

potentials of a completely new wind turbine concept – the Low-Wind turbine, designed for optimal integration in a power system with considerable amount of renewables. The Low-Wind turbine will produce more than the double amount of energy at low wind when the electricity prices typically are high but will be shut down already at 12-14 m/s. Responsible University is DTU Wind Energy.

Prestige project - Predicting Wind Turbine Stability In General Inflow (2019-2022, grant 9.6 mill. DKK (1.23 mill. EUR; 1.44 mill. USD) and total budget 13.2 mill. DKK (1.77 mill. EUR; 1.98 mill. USD)) is granted by Innovation Fund Denmark. The overall objective of the project is to provide the necessary tools and understanding for industry to avoid vortex induced instability of wind turbines in present and future designs.

Test Facilities and Demonstration Projects

In 2018, the Parliament decided that the two national test centres, operated by DTU Wind Energy in Østerild and Høvsøre, can be expanded with two test sites each. This would allow for the testing of nine wind turbines in Østerild and seven wind turbines in Høvsøre. In 2019, the expansion of the two test centres started and will be finalised in 2020.

The new Large-Scale Facility at the DTU Risø Campus—part of the Villum Center for Advanced Structural and Material Testing (CASMaT)—was completed in 2017, and operations began in November [16]. Projects related to innovative test methods, the development of digital twins and damage inspection of wind turbine blades are ongoing. The Poul la Cour Wind Tunnel was inaugurated in April 2018. The wind tunnel's combination of Reynolds Number and acoustic properties is unique in the world [13]. Innovative aerodynamic blade profiles are being tested for both commercial and research projects.

Collaborative Research

The Danish Energy Agency supports, directly or via international cooperation schemes, Danish companies, universities and research institutions when participating in international projects. This includes the direct financial support for participating in the TCPs under the International Energy Agency (IEA) and indirectly by means of common calls in the European Union (ERA-net schemes) and Nordic Energy Research.

Impact of Wind Energy

Environmental Impact

Assuming that each kWh of wind-generated electricity displaces a kWh of average electricity consumption, the 16.17 TWh (13.9 TWh in 2018) of wind-generated electricity that Denmark produced in 2019 corresponds to the following environmental reductions (based on the environmental declaration from the Transmission System Operator (TSO) Energinet) [11]:

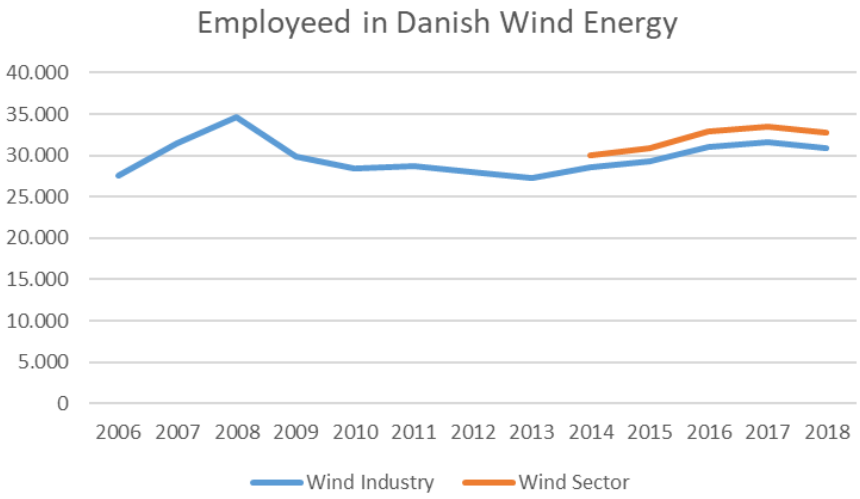
- 2.5 million tonnes of CO_2 eq. (153 g/kWh)
- 0.485 tonnes of SO_2 (0.03 g/kWh)
- 3.23 tonnes of NO_X (0.20 g/kWh)
- 0.161 tonnes of particles (0.01 g/kWh)

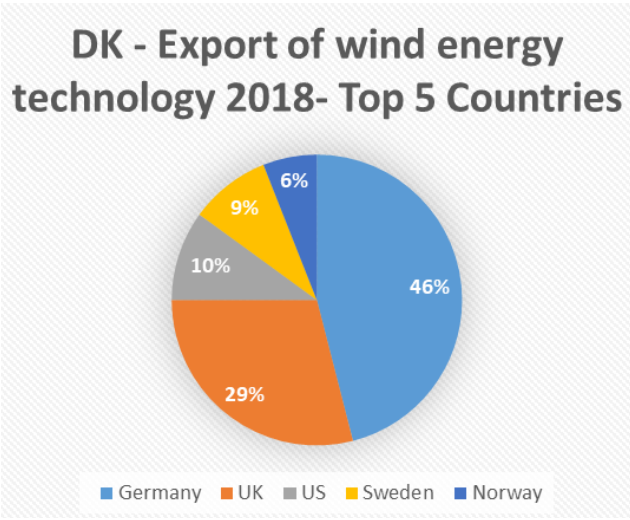
A Danish produced kWh of electricity has never been cleaner than in 2019 [Figure 3]. Most notable is the decline in production from the coal power plants, which fell by nearly 40%. This has almost been replaced by higher production from the wind turbines, which has increased by over 2,000 MWh compared to 2018. This is mainly due to the commissioning of the Horns Rev 3 wind farm. Annual solar and wind production now covers more than 50% of consumption. Power exchanges with neighbouring countries imply export of excess wind power and import of power from mostly Sweden and Norway (hydropower). Overall, renewable power including bioenergy covers approx. 75% of Danish consumption.

Economic Benefits and Industry Development

In 2018, the Danish wind industry turnover was just under 20 billion EUR (22.4 billion USD; 149 billion DKK). This corresponds to a fall of 4% or just under 0.8 billion EUR (0.9 billion USD; 6 billion DKK) compared to the record year 2017.

Revenue per man-year in the industrial part of the wind industry has fallen by 15% to 0.4 million EUR (0.5 million USD; 3.3 million DKK). The wind industry employed 32,774 full-time equivalents in 2018. The number of full-time employees decreased by 2% from 2017 to 2018. In all, an estimated 2.2% of the private employees in Denmark work in the industrial part of the wind industry.





In 2018, Denmark's export of energy technology and services is DKK 108 billion, which is a decrease of 3% compared to 2017. Compared to 2010, exports were 42% higher in 2018. Exports of energy technology amounted to 12.5% of total Danish goods exports in 2018. This is a decline compared to recent years. Exports of wind turbine-related products account for 6.7% of total Danish exports of goods.

The main reason for the decline in energy technology and service exports from 2017 to 2018 is that exports in 2017 were extraordinarily high. The export of wind energy technology to the UK was e.g. 16.3 billion DKK (2.18 billion EUR; 2.45 billion USD) in 2017 against 7.4 billion DKK (991.6 million EUR; 1.11 billion USD) in 2018. The Danish wind industry accounts for 3.7% of total Danish exports.

Export of wind energy technology to the five largest export markets in 2018 is 22.5 billion EUR (25.2 billion USD), corresponding to 58.6% of the total Danish exports of wind energy technology. Germany and the UK are the two largest markets for Danish wind energy technology. The US is the third largest market with 9.5%, and Sweden and Norway are receiving 9.2% and 6.4%, respectively, of Danish exports of wind energy technology.

Newer data from 2019 will be available in the Danish Wind Industry Association's report entitled "Branchestatistik 2019" (expected release June 2020) [12]. 2018 was the first time that Confederation of Danish Industry; Danish Energy, the Danish Energy Agency, Wind Denmark and Danish District Heating have presented a joint statement of exports of energy technology and services. The statement of exports of energy technology and services in 2019 is expected to come in June 2020 [12].

As of March 30th 2019, the Danish Wind Energy Association and the Danish Wind Industry Association have united into a new organisation called Wind Denmark. Wind Denmark will represent both wind turbine owners and the industry.

Effect on Tax Revenues

In total, the wind industry's primary value chain contributed with 1.8 billion EUR (2.0 billion USD; 13.3 billion DKK) in 2016 in the form of both corporate taxes and employee taxes.

The total corporate tax effect was 0.8 billion EUR (0.9 billion USD or 5.8 billion DKK), while the total employee tax effect was 3.0 billion EUR (3.3 billion USD; 22.2 billion DKK) in 2016, which in total adds up to 3.8 billion EUR (4,2 USD; 28 billion DKK).

Next Term

The coming years will reveal the effects of the 2018 Energy Agreement and the new Climate Act and its climate programmes. The biggest impact is expected to be tenders and installation of a minimum 2,400 MW of offshore wind power capacity in the next decade.

The role of wind power in the Danish national goal of 70% reduction of CO_2 emissions in 2030 will be settled.

The future research agenda is expected to focus on system integration, including sector coupling, Power2X, storage etc. and digitalisation of wind energy.

Denmark will work for development of The North Sea Energy Cooperation. Preliminary studies on energy islands in the Baltic Sea (2 GW) and the North Sea (5 GW) will begin, co-financed by 65 million DKK (8.71 million EUR; 9.75 million USD) public funds.

References

[1] Danish Energy Agency. Monthly Energy Statistics. Download from: https://ens.dk/en/our-services/statistics-data-key-figures-and-energy-maps

[2] Key Figures from DEA's Preliminary Energy Statistics 2019 https://ens.dk/en/our-services/statistics-data-key-figures-and-energy-maps/annual-and-monthly-statistics

[3] The Danish Ministry of Energy, Utilities and Climate Energy Agreement of June 29. 2018. https://en.efkm.dk/media/12307/energy-agreement-2018.pdf

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[5] EUDP. https://ens.dk/en/our-responsibilities/research-development/eudp

[6] Innovation fund. https://innovationsfonden.dk/en

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[8] Annual Research agenda. megavind.windpower.org/publications/annual-research-and-innovation-agenda-2018

[9] Winds of Change. ENERGINET'S STRATEGY - 2019 https://en.energinet.dk/About-our-reports/Reports/New-winds---strategy---printversion

[10] Climate Act, https://stateofgreen.com/en/partners/state-of-green/news/during-cop25-denmark-passes-climate-act-with-a-70-per-cent-reduction-target/

[11] Energinet (Danish TSO). Environmental declaration 2019. https://energinet.dk/El/Gron-el/Miljoedeklarationer

[12] Wind Denmark. Exports and employment. 2018 https://winddenmark.dk/udgivelser/branchestatistik-2018

[13] Villum Center for Advanced Structural and Material Testing (CASMaT); http://www.casmat.dtu.dk/

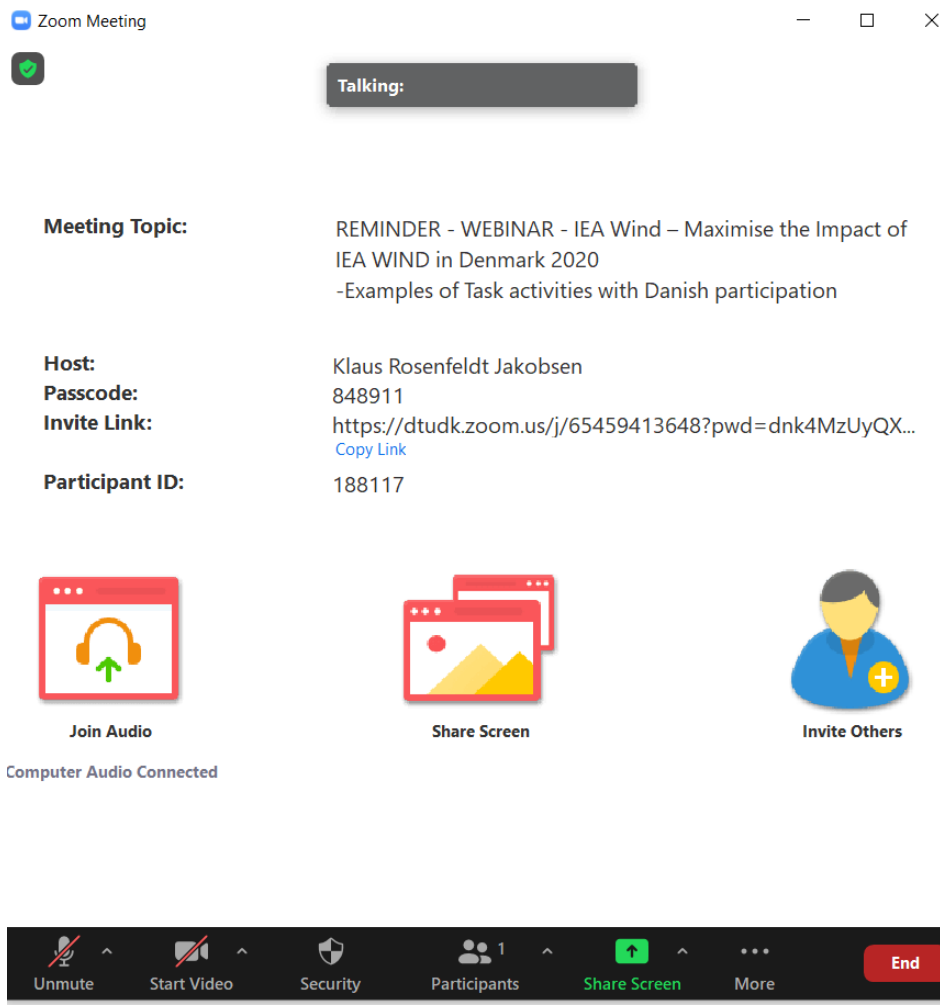
Examples of Task activities with Danish participation

WEBINAR - Maximise the Impact of IEA Wind in Denmark 2020

Wednesday 16th of December 2020, 09:00 -10:00 AM
Online Zoom Meeting

Webinar – Zoom rules

- Test speaker and microphone
- Mute your mic – when not speaking
- Use the chat for questions and comments
- Use your camera, if you like or not asked to turn off
- The webinar will be recorded
- The presentations will send to all participants after the webinar



WEBINAR - IEA Wind – Maximise the Impact of IEA Wind in Denmark 2020

09:00 – 09:10 **Introduction and overview of Danish Task activities in IEA Wind – 2020**
Ignacio Martí /Klaus Rosenfeldt Jakobsen, DTU, Secretariat IEA Wind

09:10 - 09:30 **Task 36 Forecasting for Wind Energy**

Gregor Giebel, DTU, Operating Agent Task 36
Task activities and results, Danish participation and industry participants

09:30 – 09:50 **New Task 45 Recycling Wind Turbine Blades**

Justine Beauson, DTU, Operating Agent Task 45
Background, Task proposal, Details on specific efforts, Danish participation and activities, Industry participation

09:50 **Questions – Debate**
How to maximise the impact of Danish participation in IEA Wind?

10:00 **End of Webinar**

IEA Wind DK-2020 - Maximise the Impact of IEA WIND in Denmark 2020 - (64019-0547)

- The IEA WindDK-2020 project aims to **increase the impact of IEA Wind EUDP funded activities in 2020**. The project supports the DEA participation in the IEA Wind TCP Executive Committee (ExCo), as well as the dissemination and networking activities related to IEA Wind.

- The work will build on active engagement as Alternate member (Peter Hauge Madsen) at the IEA Wind ExCo and in active IEA Wind Research Tasks with Danish participation during the project.

- Karina Remler, ExCo Member, DEA
- Mette Jessen Schultz, Alternate, DEA

Gantt diagram																								
Project title:	IEA Wind DK-2020 - Maximising impact of IEA Wind in Denmark - 2020																							
Project start:	1st of January 2020																							
Project end:	31st of December 2020																							
År	##																							
Work packages/Projektets arbejdspakker:	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
WP1 IEA Wind Executive Committee activities					M1	M2				M4														
WP2 Augmented dissemination												M3												
Milestones/Milepæle																								
M1 Danish annual report 2019 to IEA AR19																								
M2 ExCo85 spring																								
M3 ExCo86 fall																								
M4 National IEA Wind event 2020																								
Opdateret: 15-12-2020																								

Energiteknologisk Udviklings- og Demonstrations Program

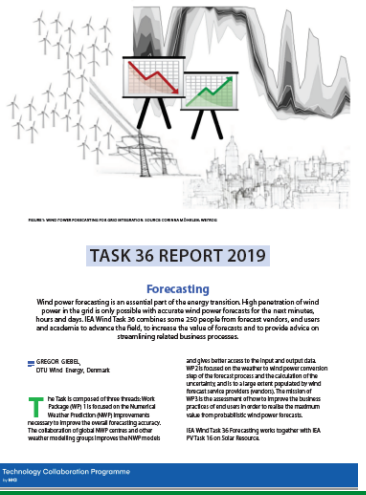
Energiteknologisk udvikling og demonstration

IEA Wind Activities - Overview

- The *IEA Wind TCP 2019 Annual Report* highlights **the activities and accomplishments** of the International Energy Agency Wind Technology Collaboration Programme (IEA Wind TCP). This global network of researchers and policy experts shares the latest technology research and best practices to advance wind energy deployment.

  Participants include **24 member countries and sponsor organisations** across Europe, North America, and Asia. This report provides a summary of how member countries benefit from wind energy, how much wind power generation each country has deployed, and how policies and research programs will increase wind power's contribution to the world energy supply.

  The report can be read as e-paper above or freely downloaded as pdf. Country Chapters and Task Chapters are also available for download.



IEA Wind Secretariat

The IEA Wind TCP Secretariat is responsible for communications between the members of the ExCo and between the ExCo and Operating Agents, and supporting the ongoing development of the Wind TCP.

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Communications & Creative Direction
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E-mail: siru@dtu.dk

Review of Danish participation in IEA Wind TCP

- Ignacio Marti

Summary

- IEA Wind activities are important supplement to Danish RD&D in Wind Energy

- EUDP supports maximising the impact of Danish IEA Wind activities and inform and include Danish stakeholders

- Danish IEA Wind ExCo members
  - Karina Remler, EUDP/DEA, Member
  - Mette Jessen Schultz, EUDP/DEA, Alternate
  - Peter Hauge Madsen, DTU, Alternate

- IEA Wind Secretariat – iewwind@dtu.dk - https://community.ieawind.org/home -
  - Ignacio Martí, DTU, Secretary
  - Kirstine Dahlgaard de Linde, Deputy Secretary

- New IEA Wind website - https://iea-wind.org/

WEBINAR - IEA Wind – Maximise the Impact of IEA Wind in Denmark 2020

09:00 – 09:10 **Introduction and overview of Danish Task activities in IEA Wind – 2020**
Ignacio Martí /Klaus Rosenfeldt Jakobsen, DTU, Secretariat IEA Wind

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Justine Beauson, DTU, Operating Agent Task 45
Background, Task proposal, Details on specific efforts, Danish participation and activities, Industry participation

09:50 **Questions – Debate**
How to maximise the impact of Danish participation in IEA Wind?

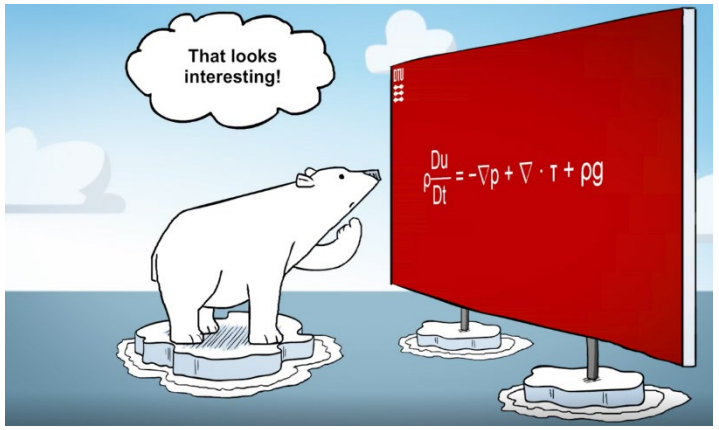
10:00 **End of Webinar**

Extra from here

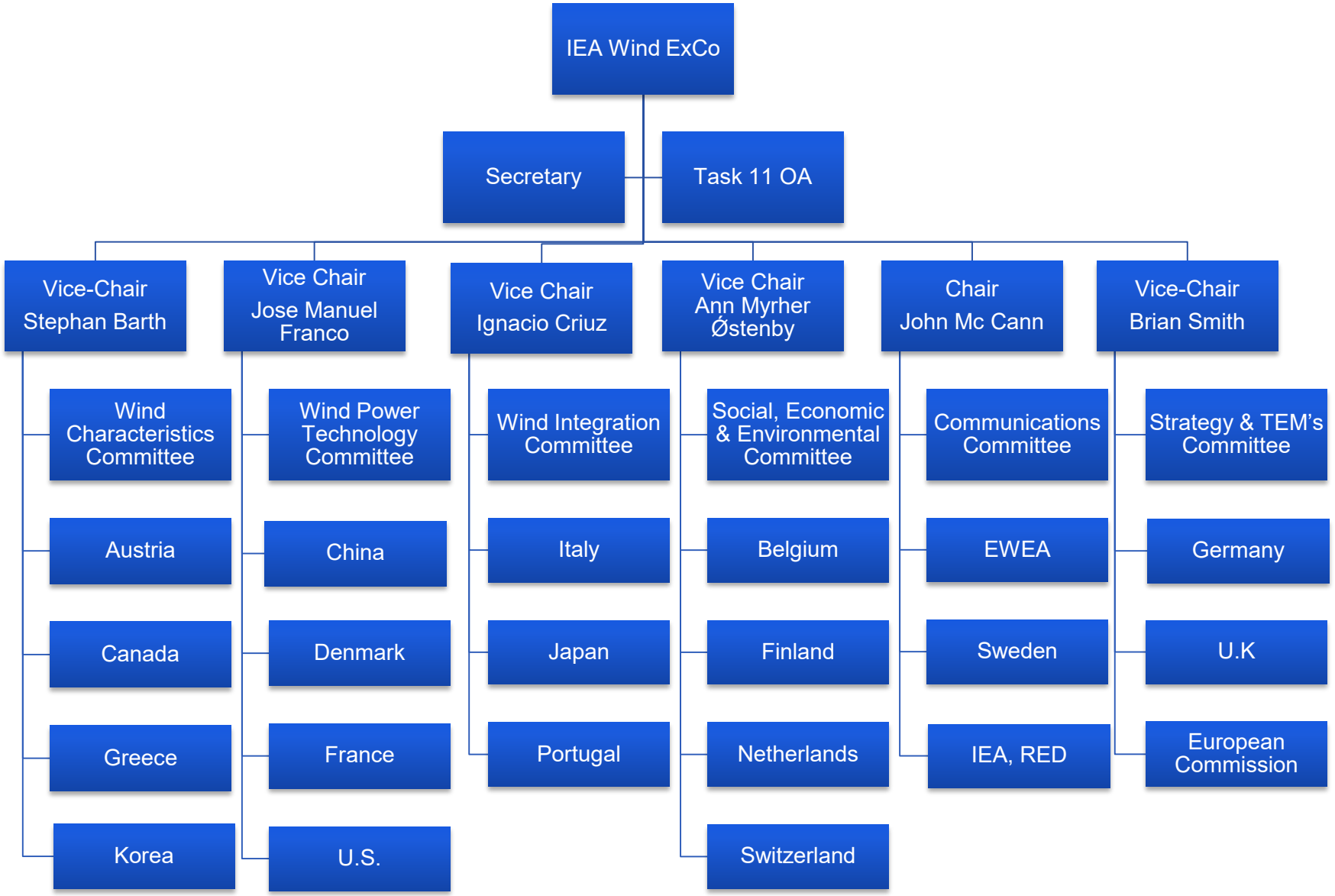
Webinar – Maximise the impact of IEA Wind in DK

- The target groups for this webinar and the IEA Wind activities are the Danish industry and the Danish research community with the purpose to maximise the impact of IEA Wind Activities in Denmark supported by Danish Energy Agency/EUDP.

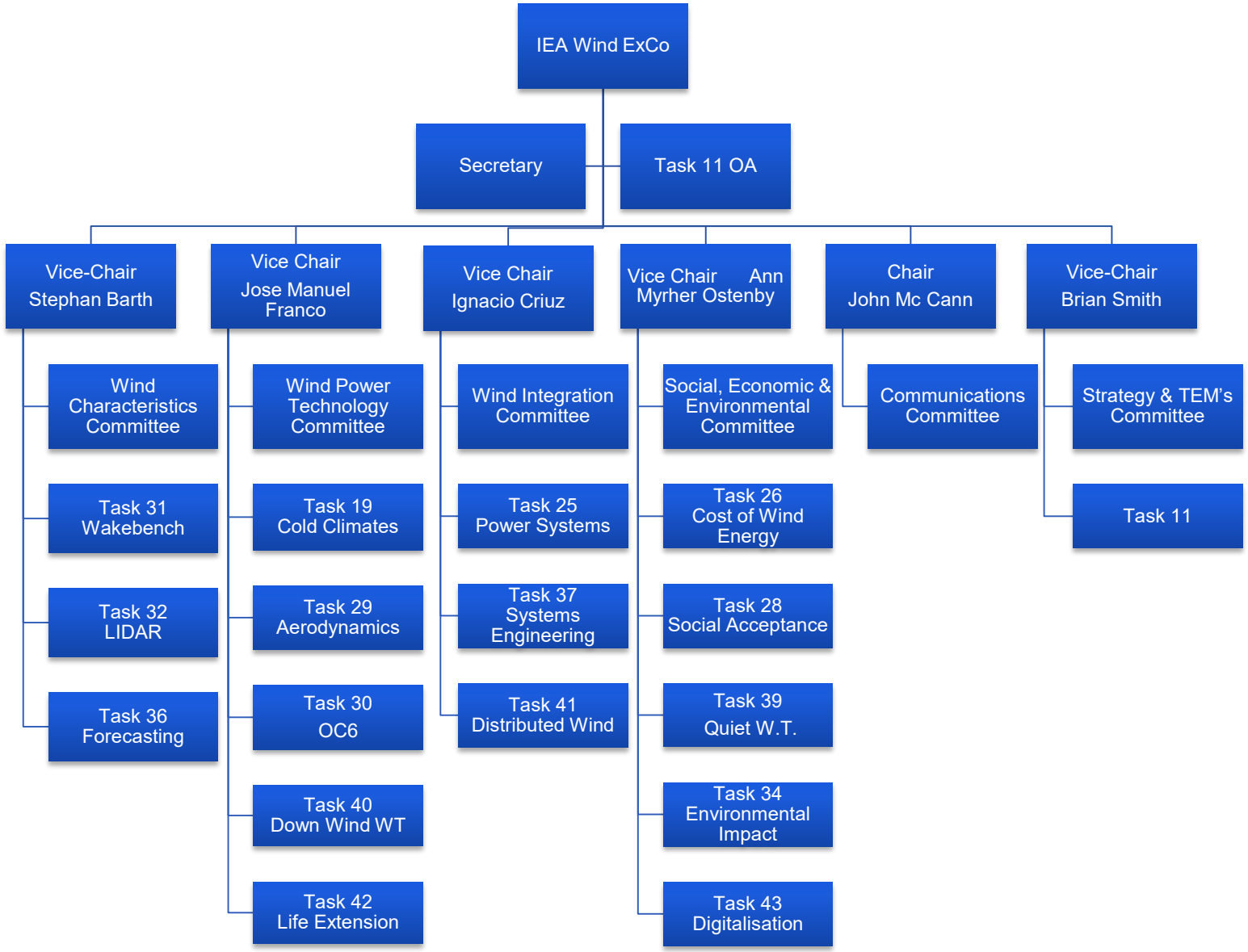
- The value will be to get a direct update on the IEA Wind activities, which are relevant for the business and the research, as well as a facilitation of the participation of Danish stakeholders both industry and research in IEA Wind.

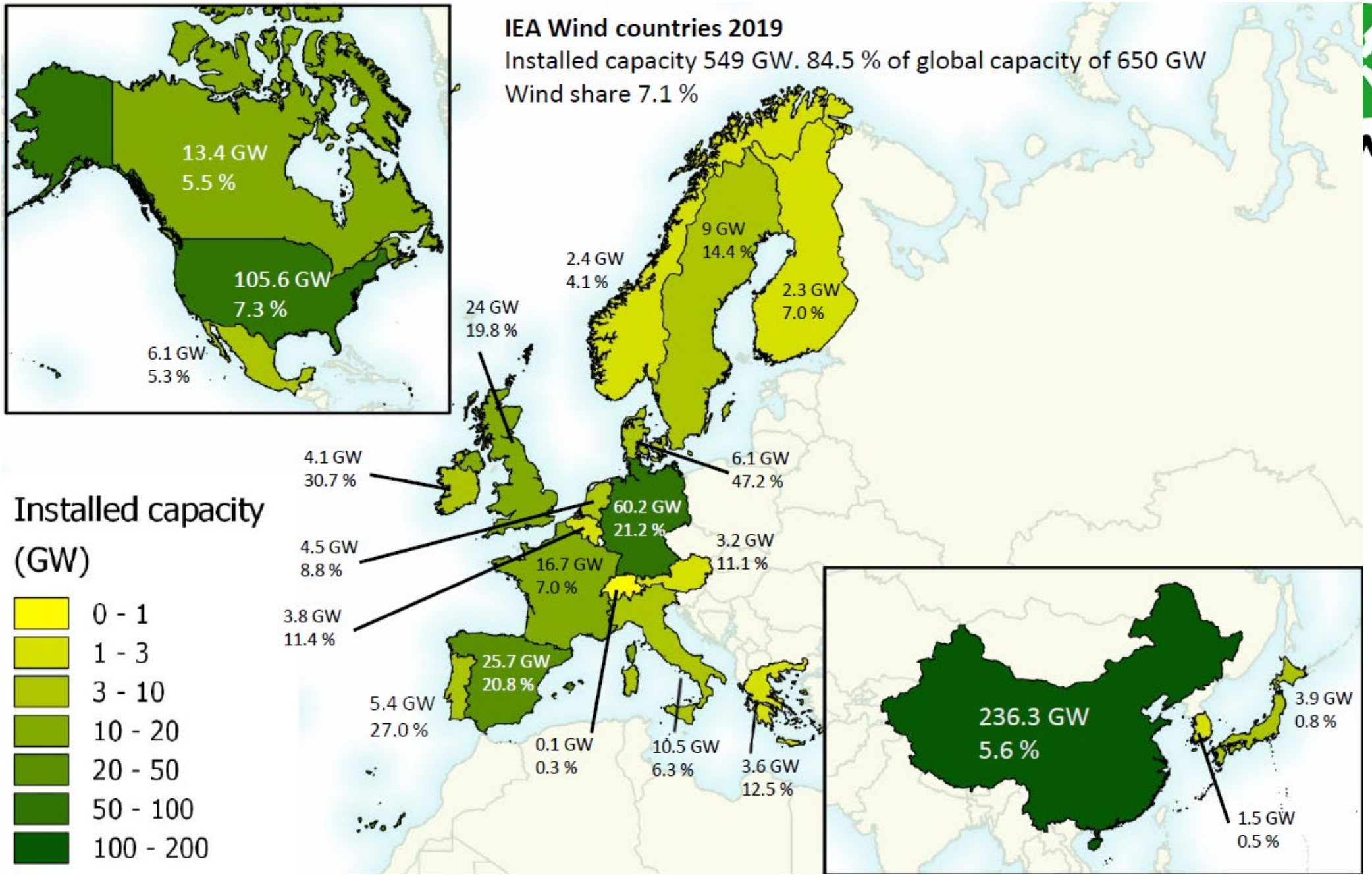


ExCo Member Allocation to Strategic Areas



Task Allocation to Strategic Areas




IEA Wind countries 2019
Installed capacity 549 GW. 84.5 % of global capacity of 650 GW
Wind share 7.1 %
13.4 GW
5.5 %
105.6 GW
7.3 %
6.1 GW
5.3 %
2.4 GW
4.1 %
9 GW
14.4 %
2.3 GW
7.0 %
24 GW
19.8 %
4.1 GW
30.7 %
6.1 GW
47.2 %
60.2 GW
21.2 %
4.5 GW
8.8 %
3.2 GW
11.1 %
16.7 GW
7.0 %
3.8 GW
11.4 %
25.7 GW
20.8 %
5.4 GW
27.0 %
0.1 GW
0.3 %
10.5 GW
6.3 %
3.6 GW
12.5 %
236.3 GW
5.6 %
3.9 GW
0.8 %
1.5 GW
0.5 %
Installed capacity
(GW)
0 - 1
1 - 3
3 - 10
10 - 20
20 - 50
50 - 100
100 - 200

IEA Wind TCP Strategic Objectives 2019-2024

iea wind

- Maximize the value of wind energy in energy systems and markets
- Lower the cost of land-based and offshore wind energy
- Facilitate wind energy deployment through social support and environmental compatibility
- Foster collaborative research and the exchange of best practices and data

Research Priorities 2019-2024

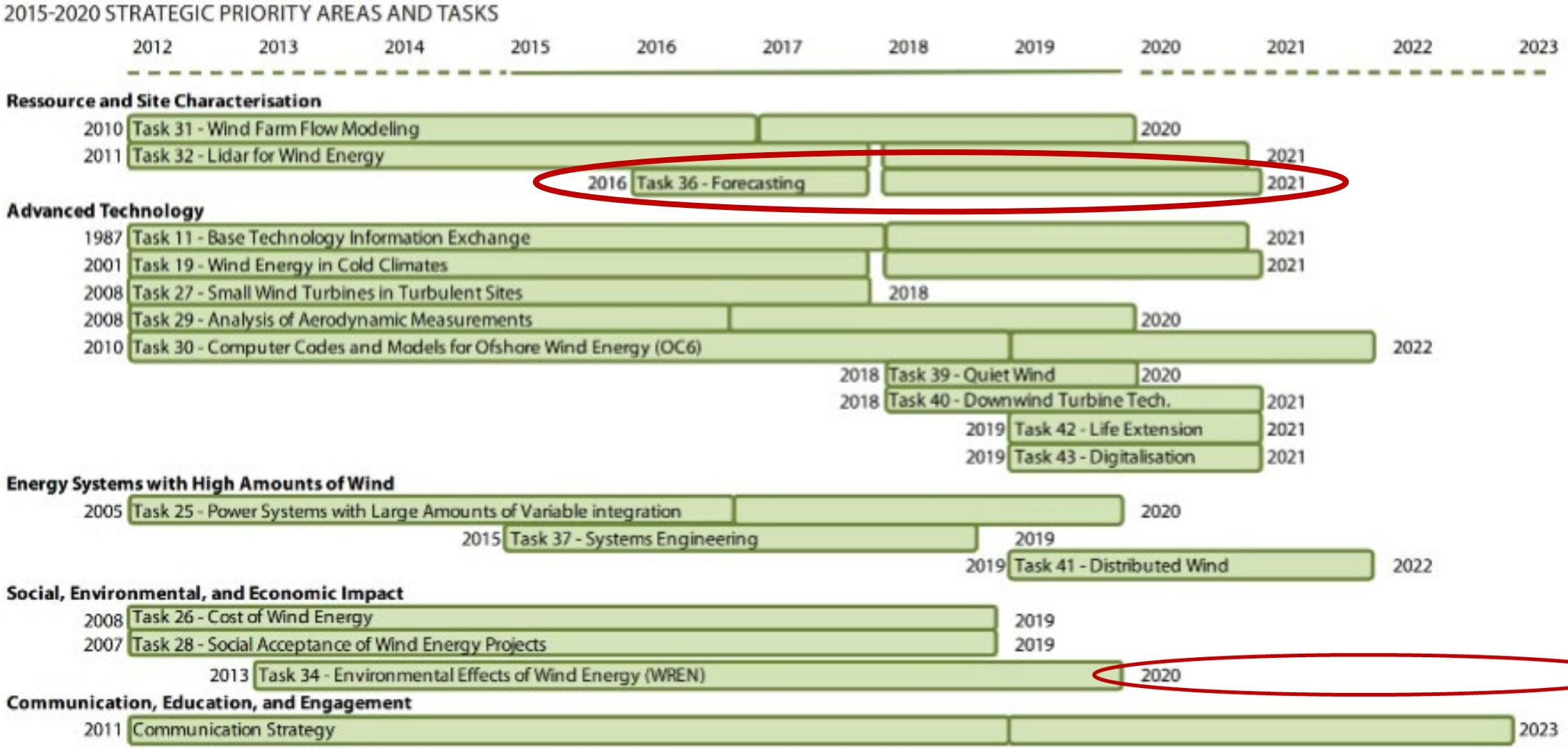
Resource and Site Characterization

Advanced Technology

Energy Systems with High Amounts of Wind

Social, Environmental, and Economic Impacts

Communication, Education, and Engagement


2015-2020 STRATEGIC PRIORITY AREAS AND TASKS
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
Ressource and Site Characterisation
2010 Task 31 - Wind Farm Flow Modeling 2020
2011 Task 32 - Lidar for Wind Energy 2021
2016 Task 36 - Forecasting 2021
Advanced Technology
1987 Task 11 - Base Technology Information Exchange 2021
2001 Task 19 - Wind Energy in Cold Climates 2021
2008 Task 27 - Small Wind Turbines in Turbulent Sites 2018
2008 Task 29 - Analysis of Aerodynamic Measurements 2020
2010 Task 30 - Computer Codes and Models for Ofshore Wind Energy (OC6) 2022
2018 Task 39 - Quiet Wind 2020
2018 Task 40 - Downwind Turbine Tech. 2021
2019 Task 42 - Life Extension 2021
2019 Task 43 - Digitalisation 2021
Energy Systems with High Amounts of Wind
2005 Task 25 - Power Systems with Large Amounts of Variable integration 2020
2015 Task 37 - Systems Engineering 2019
2019 Task 41 - Distributed Wind 2022
Social, Environmental, and Economic Impact
2008 Task 26 - Cost of Wind Energy 2019
2007 Task 28 - Social Acceptance of Wind Energy Projects 2019
2013 Task 34 - Environmental Effects of Wind Energy (WREN) 2020
Communication, Education, and Engagement
2011 Communication Strategy 2023

Member Participation in IEA Wind Research Tasks

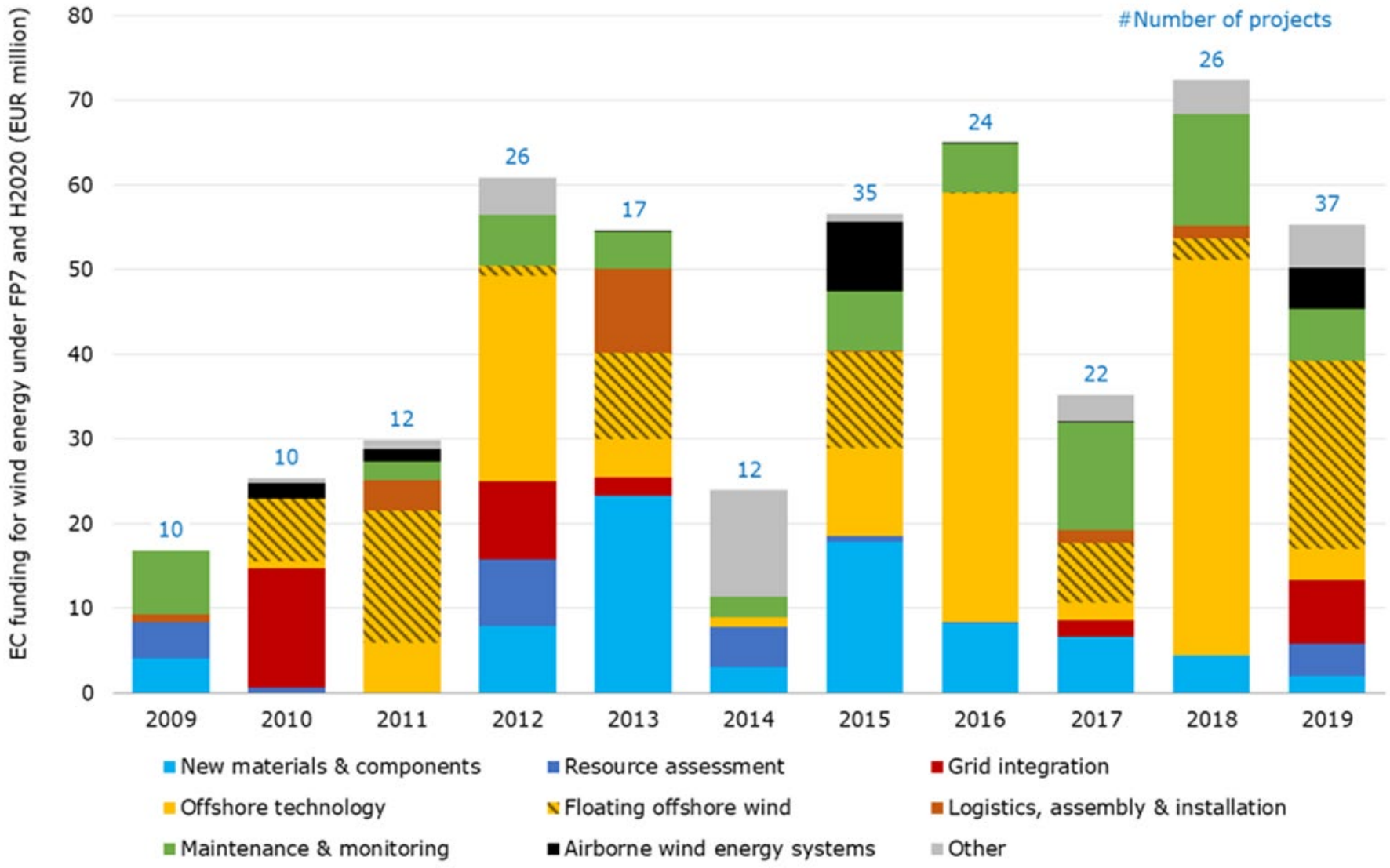
Member Participation in Research Tasks During 2019																	
	2019-2020	2019-2021	2018-2020	2019-2021	2017-2019	2018-2020	2019-2022	2019-2021	2019-2021	2018-2020	2019-2021	2015-2019	2018-2020	2018-2021	2019-2022	2018-2021	2018-2021
Participant	Research Task Number																
	11	19	25	36	38	39	50	51	52	54	56	57	59	60	61	62	63
Austria		x							x		x				x		
Belgium		x								x					x		
Canada		x	x						x	x					x		
CWEA	x	x	x			x	x	x	x		x	x	x		x		
Denmark	x	x	x	x	x	x	x	x	x		OA	x	OA		x	OA	x
European				x													
Finland	x	OA	OA		x						x						
France			x			x	x	x	x	x	x						
Germany	x	x	x	x	x	x	x	x	OA		x	x	x	x		x	Co-OA
Greece																	
Ireland	x		x	x	OA					x	x		OA		x		x
Italy	x		x			x	x			x					x		
Japan	x		x		x		x	x	x					OA	x		
Korea							x		x						x		
Mexico	x		x														
Netherlands	x		x	x		OA	x	x	x	x		x					
Norway	x	x	x	x			x		x	x	x	x					
Portugal			x		x		x			x	x						
Spain	x		x				x	OA		x	x	x		x	x		
Sweden	x	x	x	x		x		x		x	x						
Switzerland	OA	x			x			x		x							
United Kingdom	x	x	x	x			x		x	x	x	x					
United States	x		x	OA	x	x	OA	x	x	OA	x	OA		x	OA		OA
WindEurope			x														
Totals	15	11	18	9	8	7	13	10	12	13	13	8	4	4	10	3	4

OA indicates Operating Agent that manages the task; check task websites for the latest participation data.

Table 12. National R,D&D Budgets for Reporting Countries, 2010–2019										
Country	2010 Budget	2011 Budget	2012 Budget	2013 Budget	2014 Budget	2015 Budget	2016 Budget	2017 Budget	2018 Budget	2019 Budget
	million USD	million USD	million USD	million USD	million USD	million USD	million USD	million USD	million USD	million USD
Austria	---	---	---	---	---	---	---	---	---	---
Belgium	---	---	---	---	---	4.7	---	---	---	---
Canada		7.8	5.8	5.0	4.7	2.3	3.4	3.3	2.9	3.1
China	---	---	---	---	---	11.7	1.4	---	8.6	9.4
Denmark[a]	24.2	1.0	11.5	24.2	---	---	15.4	---	26.8	22.2
European Commission	47.0	36.7	80.9	90.5	29.9	315.0	68.5	32.7	81.4	62.1
Finland	5.2	12.9	2.8	4.3	1.2	1.9	1.9	0	1.7	0.4
France	---	---	---	---	---	---	---	---	---	---
Germany	71.2	105.1	103.2	50.6	46.6	99.1	93.4	108.2	103.8	90.7
Greece	---	---	---	---	---	---	---	---	---	2.1
Ireland	0.4	0.4	1.1	---	---	---	---	---	---	---
Italy	4.0	4.0	3.9	4.1	3.6	2.7		---	---	---
Japan	24.6	42.9	55.3	47.5	63.8	127.9	72.2	62.3	69.6	66
Korea	38.1	37.7	44.7	49.1	---	---	30.0	---	40.0	36
México	---	---	---	---	2.1	---	---	2	---	0.3
Netherlands	51.1	9.2	11.6	7.0	4.5			14.7	33.8	40.4
Norway	16.7	19.7	22.7	18.2	15.0	10.2	10.8	7.3	6.4	5.1
Portugal	---	---	---	---	---	---	---	---	---	---
Spain	115.9	115.9	158.2	117.8		94.0	85.5	11	17.2	26.3
Sweden	14.5	14.5	14.2	14.9	7.8	7.7	7.7	7.3	6.6	6.4
Switzerland	0.5	0.5	0.5	0.5	0.5	0.6	0.7	0.8	0.8	5.4
United Kingdom	---	---	---	---	---	---	---	---	---	---
United States	80.0	80.0	93.5	68.2	52.2	107.0		---	92	92

--- indicates no data available. Currency is expressed in year of budget. It is not adjusted to present value. a) Projects supported by public funds.

Evolution of EU R&I funding categorised by R&I priorities for wind energy under FP7 (2009-2013) and H2020 (2014-2019)



Energi20 – Danish Energy RD&D Programmes