



IEA Wind Task 52 Meeting Minutes

IEA Wind Task 52 General Meeting

Julia Gottschall, Tom Szyslo 

1 Day 1: Tuesday 13 June 2023

IEA Wind Task 52 on the "Large-scale deployment of Wind Lidar" is creating a worldwide network of wind lidar researchers and users who meet regularly and work on identified key themes.

The Task 52 General Meeting took place online. The meeting was designed to provide information about the current status of wind lidar technology, the Task 52 working groups and the collaboration with other IEA Wind Tasks. The virtual meeting was organised as a mix of presentations, discussions and polls.

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Time	Activity
14:00	Welcome and introduction from Operating Agent (OA)
14:15	What's new in the world of wind lidar Summary and review of WESC mini-symposia <ul style="list-style-type: none"> Eric Simley: "Lidar-Assisted Control, Turbulence Estimation, and Digitalization" Peter Clive: "Replacing met masts and Accelerating offshore wind"
14:50	Summary and review of Task 52 Lunch Seminar series
15:00	Working Group updates (session #1) <ul style="list-style-type: none"> Andy Oldroyd: "Scanning Lidar Offshore" Sara Koller: "Cold Climate"
15:30	Coffee / tea break
15:35	Working group updates <ul style="list-style-type: none"> Andy Clifton: "Digitalization" Jakob von Eisenhart Rothe: "Turbulence Intensity"
15:55	Working group updates – breakout rooms for Q&A
16:25	What's new in the wind lidar industry <ul style="list-style-type: none"> Rafael Tavares: "Assessing the performance of eight commercial lidars" Discussion with technology providers
17:05	Wrap-up, outlook to Day 2

Disclaimer

The presence of a person's name or company name in this document should not be taken to imply that a person or their employer agrees with any of the opinions set out here.

1.1 Welcome and introduction from OA

The day started with a welcome and introduction by the Operating Agent (OA) Julia Gottschall. House rules were explained that the online meeting is not recorded and participants should be muted while not speaking.

After presenting the agenda of the meeting, the strategy and objectives of the IEA Wind Task 52 were explained and the seven Working Groups (WG) in four different themes were introduced. The WGs are listed in Table 1 and were presented individually throughout the two-day meeting. IEA Wind Task 52 members are working closely together to support the large-scale deployment of wind lidar. Industry and academia are to cooperate closely and collaborations with the other IEA Wind Tasks are to be established. Task 52 stands





Theme	Working group (active)
#1 Universal inflow characterisation	(#1) Turbulence Intensity (TI) by Lidar → Jakob von Eisenhart Rothe
	(#2) Lidar Assisted Control (LAC) → David Schlipf
#2 Replacing met masts	(#3) Lidar in Complex Terrain → Alexander Stökl
	(#4) Lidar in Cold Climate → Sara Koller
#3 Connecting wind lidar	(#5) Digitalization → Andy Clifton
	(#7) Lidar Ontology → Francisco Costa
#4 Accelerating offshore wind deployment	(#6) Scanning Lidar Offshore → Andy Oldroyd

Table 1: Working groups of Task 52.

for the values of innovation, inclusion, diversity, collaboration and openness.

Furthermore, the work program of Task 52 was presented and ways to participate were shown by referring to the [website](#), the [Zenodo community](#), the [LinkedIn profile](#), and the mailing list for the regular newsletter and event invitations to which one can be added by sending a mail with with the subject "Please subscribe me to IEA Wind Task 52 mailing list" to IEAWind.Task52@iwes.fraunhofer.de.

1.2 What's new in the world of wind lidar?

The current state of wind lidar technology was presented through the summary and review of the Wind Energy Science Conference (WESC) mini-symposia held in Glasgow, May 23-26, 2023, and the IEA Wind Task 52 Lunch Seminar Series held online, February 13-16, 2023.

1.2.1 Summary and review of WESC mini-symposia

The WESC mini-symposia were summarized and reviewed by Eric Simley (NREL) and Peter Clive (Black & Veatch UK Ltd.).

Eric Simley summarized the following contributions of various participants at the WESC Mini-Symposium regarding the topic "**Lidar-Assisted Control and Turbulence Estimation**" by showing their slides:

- *Integration of LIDAR simulation and LIDAR-assisted control within OpenFAST* – Andrew Russell, Idcore
- *Field testing results of data-driven lidar assisted control on an active-stall regulated wind turbine* – Mark Pitter, ZX Lidars
- *Using scanning lidar data to predict future wind flows* – Wouter Engels, TNO
- *Assessment of measurement-data from nacelle-based Lidar-devices regarding their usability for the estimation of turbulence intensity* – Jakob Von Eisenhart Rothe, DNV
- *Feedforward control and load characterization for a 15-MW wind turbine using a spinner-mounted single-beam lidar* – Alfredo Peña, DTU

Peter Clive summarized the following contributions of participants at the WESC Mini-Symposium regarding the topic "**IEA Wind Task 52: Replacing met masts and Accelerating offshore wind deployment**" by showing graphs, figures, and main conclusions:

- *Introducing NEOWIND project: Next Generation of Offshore Wind Lidar Measurements* - Yiyin Chen, Stuttgart Wind Energy, University of Stuttgart
- *Anomalous wind events over the Belgian North Sea at heights relevant to wind energy* - Gertjan Glabeke, von Karman Institute For Fluid Dynamics
- *Quantification of the error induced by floating motions in wind vector and turbulence intensity estimation* - Maxime Thiébaud, France Energies Marines
- *Experimental results of the digitalization of wind flow with LIDAR for different applications: met mast substitution, urban wind & airborne* - Luis Cano, Ciemat
- *Analysing Data Availability as a Metric for Scanning Lidar Wind Resource Measurement Campaigns* - Anantha Padmanabhan Kidambi Sekar, Offshore Wind Consultants
- *Verification of dual scanning lidar for wind resource assessment: assessing turbulence, long range and multiple height scanning* - Matthew Young, Oldbaum Services

Peter Clive referred to zenodo.org/record/8007754 for more information and concluded by advocating the use of diverse measurement methods for the wind characteristic.

1.2.2 Summary and review of Task 52 Lunch Seminar series

Julia Gottschall summarized the Lunch Seminar Series in terms of its format, number of participants, and planned annual recurrence, and referred to zenodo.org/record/7683412 for seminar content.



[lidar data files](#) with known provenance to help make it easier for people to design software to read data files.”

WG (#1): Turbulence Intensity (TI) by Lidar - Jakob von Eisenhart Rothe

At 15:47, Jakob von Eisenhart Rothe (DNV) presented WG “(#1) Turbulence Intensity (TI) by Lidar” in the theme “#1 Universal inflow characterization”. The core participants from the companies DNV, OWC, FUAS and Enercon were introduced and the communication platforms MS Teams and email were announced. The WG has the goal to update an [expert report](#) towards end of the task, collect current activities on Lidar TI towards the end of 2023, and create a publicly accessible database of Nacelle lidar data. The WG wants to continue to have group meetings and form sub-groups with more specific goals.

Breakout rooms for Q&A

At 15:55, there was an opportunity for meeting participants to discuss the presentations and the future plans of the four WGs presented in breakout rooms. Interest in participating in the WGs could be expressed. Here, some participants experienced technical problems, which is why they were able to join the breakout rooms late or not at all.

1.4 What’s new in the wind lidar industry?

After attendees returned from the breakout rooms at 16:25, **Rafael Tavares** (Ørsted) presented on “**Assessing the performance of eight commercial lidars**”.

The following eight lidars were assessed for data availability and performance relative to anemometer data according to [IEC 61400-50-2](#):

- MeteoLaser LM21901, Pulsed
- Leice WP350M, Pulsed
- (1st prototype 2021) WindPro-6B, Pulsed
- Molas B300M, Pulsed
- WindCube v2.0 - SN328, Pulsed
- Windcube v2.1 - SN1015, Pulsed
- ZX300M SN957 - FW 2.2034, Continuous
- ZP300M SN632 - FW 1.3238, Continuous

Data availability for heights above 150m seems to be a problem for most lidar devices considered, while regression analysis with anemometer data produced sufficiently good results. In future, the applicability of these conclusion to an offshore environment shall be assessed. Interest in supporting the innovation in wind lidar technology was expressed.

Felix Keberlau’s (Fugro Norway AS) question regarding the data filtering method was answered by saying that it differs for the different manufacturers. When asked by Ines Wuerth (enviConnect), Rafael Tavares clarified that the results presented will not be published in a paper.

After the presentation, representatives of the manufacturing companies of the assessed lidar devices had

the opportunity to comment on the presentation. This was done by means of short presentations by the following people:

- Jennifer Tan - Leice
- John Medley - ZX Lidars
- Poul Hummelshoj - METEK Nordic ApS
- Vincent Camier - Ammonit

The day was concluded with a preview of the next day by OA Julia Gottschall.

2 Day 2: Wednesday 14 June 2023

Time	Activity
14:00	Welcome and summary of Day 1
14:10	Collaboration with other IEA Wind Tasks <ul style="list-style-type: none"> • Stephen Holleran: "Task 43 WRA Data Model – an introduction" • Konstanze Kölle: "Task 49 and reference sites for floating wind" • Review of joint meetings with Tasks 41 and 54
14:55	Coffee / tea break
15:00	Working Group updates (session #3) <ul style="list-style-type: none"> • Alexander Stoekl: "Complex Terrain" • David Schlipf: "Lidar-Assisted Control" • Dexing Liu: "Ontology"
15:45	Working group updates – breakout rooms for Q&A
16:00	Students' session with presentations from ITN LIKE project <ul style="list-style-type: none"> • Isadora Coimbra, Liqin Jin, Priscila Orozco, Mohammad Nafisifard
16:45	Wrap-up

2.1 Welcome and summary of Day 1

Day 2 began with a preview of the agenda and a brief summary of Day 1 by OA Julia Gottschall. Afterwards, the mission, vision and values of IEA Wind Task 52 were pointed out again and a strong collaboration with the other IEA Wind Tasks was emphasized. The other Wind Tasks can be divided into 5 subgroups, as can be seen on the [website](#).

2.2 Collaboration with other IEA Wind Tasks

To inform about the collaborations with the other IEA Wind Tasks, presentations were given by the representatives involved.

Task 43: WRA Data Model - Stephen Holleran

At 14:10, Stephen Holleran (Brightwind), representing "IEA Wind Task 43 - Wind Energy Digitization", started with his presentation about the Wind Resource Assessment (WRA) Data Model. The mission was formulated to make the process of energy balancing more efficient, transparent and reproducible through digitization and automation. The contributors to the model as well as its release history and workshops taking place were shown. To show the function of the model, the example of data transfer from an installation report of a met mast in pdf format to the JSON file format was explained and the lessons learned from the project were summarized. The contribution of many volunteers was emphasized and the desire for fundings was expressed.

In response to a question from Guillermo Tornero (Ocean Winds), it was explained that handling lidar data is easier than handling met mast data because

replacing an anemometer introduces complications in data processing. Furthermore, reference was made to the [GitHub repository](#) and a [workshop](#) for further information. When asked by Konstanze Kölle (SINTEF), it was clarified that other data such as waves and electric currents would also be processed.

Task 49: Integrated DEsign of floating wind Arrays (IDEA) - Konstanze Kölle

At 14:32, Konstanze Kölle (SINTEF) presented the work of IEA Wind Task 49. The goal of the Task is to create a robust, open-access testbench for multidisciplinary research seeking to maximize the social, economic, and environmental benefits of floating wind arrays. The tasks are divided into the four working packages

- WP1: Reference Sites,
- WP2: Reference Farms,
- WP3: Failure Risks,
- WP4: Research Requirement Classification.

So far, WP1 has been addressed, where key site parameters are to be identified and a design basis for the floating wind farms in WP2 is to be established. This was illustrated by the example of the Havbredey offshore wind farm in Scotland. Finally, WP4 was discussed to inform the participants about possible participation in Wind Task 49.

When asked by Peter Clive if there are plans at the Havbredey site to install lidar on the island of North Rona just to the north of the site, it was explained that this information was not available but the question could be passed on to the project officers.

Furthermore, it was added at 14:48 in the chat by Konstanze Kölle that there will be an online meeting of Wind Task 49 on June 29, where the whole Wind Task will be presented. Interested persons should contact [Konstanze Kölle](#).

Review of joint meetings with Tasks 41 and 54

At 14:45, the OA Julia Gottschall informed about the joint [meetings](#) with Tasks 41 and 54 held in Vienna, October 17-20, 2022. The meetings were divided into six sessions. They were a good opportunity to meet representatives from other IEA Wind Tasks in person for the first time and learn from each other's experiences.

Poll about collaborations, meeting formats and topics of Task 52

Subsequently, a poll was launched at 14:54 in which wishes for further collaborations with IEA Wind Tasks and regarding the design of the Task 52 General Meetings could be expressed. The results are shown in [Figures 3 and 4](#). Furthermore, it was asked which further topics, not yet covered by Working Groups, the participants would like to address within Task 52 (in online seminars, workshops, Working Groups). The answers

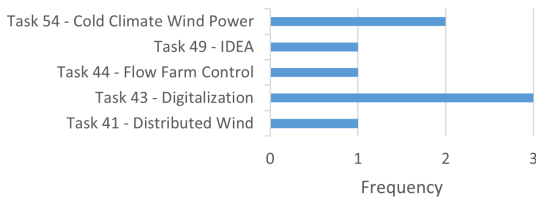


Figure 3: Poll - "With which other IEA Wind Tasks should we (→Task 52) establish a collaboration?"

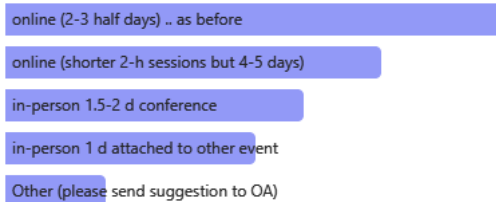


Figure 4: Poll - "Your preferred format for (future) Task 52 General Meetings?"

given are:

- Common tools, software
- Calibration of lidars without a met mast
- Complex terrain for Nacelle Mounted lidars. NML has been for a while not coordinated sufficiently, and covering solid historical antecedents from former Task 32.
- Stability
- Lidar for short-term forecasting (maybe covered in another IEA Wind Task).

2.3 Working group updates

After a five-minute break, at 15:02, the OA informed the attendees of the next agenda item of updates to the remaining three Task 52 WGs (see Table 1) and invited participation in the Q&A session that followed.

WG (#3): Lidar in Complex Terrain - Alexander Stökl

The beginning was made by Alexander Stökl (Energiewerkstatt) with the presentation of WG "(#3) Lidar in Complex Terrain" in the theme of "#2 Replacing met masts". The WG is concerned with the application of ground based and nacelle based lidar in complex terrain and complex flow. Meetings take place every 6 weeks with 15-20 people involved.

In the field of ground based lidar, complexity threshold for measurements and correction methods are to be found. A [report](#) was published in December 2022. Task 52 recommendation for application of ground based lidar in complex terrain are to be delivered. More data sets will be collected and analyzed over the next 12 months, and the results will be written down in the second half of 2024.

For the field of nacelle based lidar in complex terrain, no timeline could be given yet. The presentation concluded with a call for datasets and contributors to the WG.

WG (#2): Lidar Assisted Control (LAC) - David Schlipf

At 15:22, David Schlipf (Flensburg University of Applied Sciences) took over with the presentation of WG "(#2) Lidar Assisted Control (LAC)" in the theme of "#1 Universal inflow characterisation".

The WG wants to support the installation of at least one lidar on each wind turbine in the future, so that a predictive control can be done. Transparency and open source tools are used to advance the technology and provide recommendations for LAC. For this purpose, monthly conference calls, webinars, and joint work on programming and documentation take place. Seventeen participants from seven countries are actively participating in the WG. An open source code was published at [GitHub](#) and presented at [ACC 2023](#). Within the next 12 months, a second webinar, a workshop with [IEA Wind Task 44](#) and a contest on LAC will be held. Furthermore, the open source tool will be extended and the "Recommended Practices" on LAC will be initiated.

WG (#7): Lidar Ontology - Dexing Liu

At 15:32, Dexing Liu (University of Stuttgart) presented the WG "(#7): Lidar Ontology" in the theme of "#3 Connecting wind lidar". The objectives of the WG are to develop a common lidar language with a unified vocabulary, to make lidar knowledge findable, accessible, interoperable and reusable, and to provide long-term updates and maintenance of the ontology.

The [ontology viewer](#) was shown and reference was made to an article and the Jupyter notebook, which was further explained.

Breakout rooms for Q&A

At 15:45 there was an opportunity to discuss the presentations of the WG updates in breakout rooms, as on the [previous day](#). The technical problems from the previous day did not seem to occur.

2.4 Students' session with presentations from ITN LIKE project

At 16:00 the four PhD students Isadora Coimbra (University of Porto), Liqin Jin (DTU), Priscila Orozco (UL International GmbH), and Mohammad Nafisifard (University of Stavanger) presented the project "Lidar Knowledge Europe - LIKE, Innovative Training Network".

The project was designed to promote the education and training of 15 Early State Researchers (ESR) in emerging laser-based wind measurement technologies and their translation into industrial applications. The project was divided into 9 work packages:

- WP1 Management (DTU)
- WP2 Network Training (UOL)
- WP3 Technology and Concepts (DTU)
→presented by Isadora Coimbra



- WP4 Micrometeorology (UiB)
→presented by Liqin jin
- WP5 Wind Energy (USTUTT)
→presented by Priscila Orozco
- WP6 Wind Engineering (POLIMI)
→presented by Mohammad Nafisifard
- WP7 Digitalization and Open Science (DTU)
- WP8 Dissemination and Exploitation (DTU)
- WP9 Ethics requirements (DTU)

The research results of WP 3 to 6 were presented by the students, showing one slide of each ESR involved in the WP and then listing main takeaways in bullet points. Finally, reference was made to the [website](#) and [LinkedIn page](#) of the project for more information.

In response to a question from Frédéric Delbos (Vaisala), it was clarified that the LIKE project ends in October 2023 and no follow-up project is planned.

The meeting was wrapped up by the OA offering to join Task 52 on the various options mentioned [above](#).

3 Summary

The IEA Wind Task 52 General Meeting was held on June 13-14, 2023, online. The meeting brought together wind lidar researchers and end users from industry and academia to explore how to facilitate the large-scale deployment of wind lidar in the wind industry.

On the first day, after a welcome from the OA, reports were given on the WESC mini-symposia and the Task 52 Lunch Seminar Series. Four of the seven Task 52 working groups then presented their progress, followed by a Q&A session in breakout rooms where people could ask for participation and discuss the working groups' next steps. At the end of the first day, an assessment of eight commercial wind lidar devices was presented, on which the manufacturers were then able to comment.

The second day started with the presentation of the collaborations with other IEA Wind Tasks. This was followed by the presentation of the remaining three WG's of Task 52 with subsequent Q&A sessions in breakout rooms. The day ended with a presentation of the LIKE student project on lidar wind measurements.

Task 52 welcomes anyone interested in working together on research to make wind lidar the best and preferred wind measurement tool for wind energy applications. More details can be found at iea-wind.org/task52/. Please contact the persons listed in Table 1 if you would like to know more about the working groups.



List of Participants

The following table lists people who attended part or all of the meeting. The presence of a person's name or company name in this list should not be taken to imply that a person or their employer agrees with any of the opinions set out in these minutes. We apologise for any spelling mistakes, omissions, or other errors. Also note that some (online) participants could not be identified properly.

Name	Affiliation	Day 1	Day 2
Aidan Keane	John Wood Group PLC	X	X
Alastair Oram	SSE Pacifico K.K.	X	X
Alexander Stoekl	Energie-werkstatt	X	X
Anantha Kidambi	Offshore Wind Consultants GmbH	X	X
Andrea Vignaroli	Ørsted	X	
Andrew Black	Vaisala	X	X
Andrew Chang	General Electric	X	X
Andy Clifton	enviConnect	X	X
Andy Oldroyd	Oldbaum Services	X	
Arjun Anantharaman	University Oldenburg	X	X
Ashim Giyanani	Fraunhofer IWES	X	
Benjamin Bouvier	IFP Energies nouvelles	X	X
Chris Slinger	ZX Lidars	X	X
Christian Schiefer	Leonardo Germany	X	X
Cristina Benzo	Vaisala	X	X
Daniel Garcia Jimenez	RWE	X	X
David Durette	Nergica	X	X
David Schlipf	University Flensburg	X	X
David Stacey	Ventus Engineering	X	
Davide Medici	RenGen Consulting	X	X
Davide Trabucchi	Deutsche WindGuard GmbH	X	X
Dennis Welsch		X	
Dexing Liu	University Stuttgart	X	X
Dominic Champneys	Vaisala	X	
Erdem Demir	Skyborn Renewables GmbH	X	X

Name	Affiliation	Day 1	Day 2
Eric Simley	NREL	X	X
Felix Kelberlau	Fugro Norway AS	X	X
Feng Guo	University Flensburg	X	
Frédéric Delbos	Vaisala	X	X
George Droukas	Enallaktiki Energeiaki S.A. (2EN)	X	X
Guillaume Lea	Lumibird	X	
Guillem Verges	Windar Photonics A/S	X	X
Guillermo Tornero	Ocean Winds		X
Hugo Rubio Hurtado	Fraunhofer IWES	X	X
Ian Locker	ZX Lidars	X	
Ines Wuerth	enviConnect	X	X
Isadora Limas Coimbra	University of Porto		X
Jakob von Eisehart Rothe	DNV	X	
Jason McNeill	Skyborn Renewables	X	X
Jean-Yves Bellet	Vaisala		X
Jennifer Tan	Leice	X	X
Jens Riechert	EnBW	X	X
John Medley	ZX Lidars	X	X
Jónas Snæbjörns-son	Reykjavik University		X
Juan Teruel Arauzo	Ocean Winds		X
Julia Gottschall	Fraunhofer IWES	X	X
Julien Haize	Total Energies	X	
Jun Tanemoto	Shimizu Corporation	X	
Keiichiro Watanabe	Japan Renewable Energy	X	X
Konstanze Kölle	SINTEF Energy Research AS		X
Laura Valldecabres Sanmartin	Enel	X	X
Levent Küçük	Vattenfall	X	X
Linda Sloka	UL Renewables	X	X
Liqin Jin	DTU		X
Lois Legendre	Fraunhofer IWES	X	X
Lucas Neidhardt	SSE Renewables	X	X



Name	Affiliation	Day 1	Day 2
Ludwig Wagner	GWU-Umwelttechnik GmbH	X	X
Luiza Ramos Termignoni	Siemens Gamesa	X	X
Marcel Schedat	University of Flensburg	X	
Marco Turrini	TNO	X	X
Mark Tristram	ZX Lidars	X	X
Martin Hofsäß	University of Stuttgart	X	X
Maryam Shafa	Oldbaum Services	X	
Matthew Young	Oldbaum Services	X	
Matthieu Boquet	Vaisala	X	X
Mehdy Gooya	University of Flensburg	X	X
Mohammad Nafisifard	University of Stavanger		X
Nadiia Afanasieva	University of Flensburg	X	
Nikolaos Kouris	Windar Photonics A/S	X	X
Oliver Bischoff	enviConnect	X	X
Paul Julian Meyer	Fraunhofer IWES	X	X
Paula Doubrawa	NREL	X	
Peter Clive	Black & Veatch	X	X
Poul Hummelshøj	METEK Nordic ApS	X	X
Preethy Warriar	SSE Renewables		X
Priscila Orozco	UL International GmbH	X	X
Rafael Amaral Tavares	Ørsted	X	
Rebeca Rivera Lamata	PEAK Wind	X	X
Reesa Dexter	DNV	X	X
Ron	Movelaser	X	
Salma Yahiaoui	GEPS Techno	X	X
Sam Athey	Partrac	X	
Sam Cressall	University of Edinburgh	X	X
Sam Williamson	John Wood Group PLC	X	
Santiago Rodriguez Galvez	Enel	X	X
Sara Koller	Meteotest AG	X	X
Scott Wylie	Greenrebel	X	
Shane Holden	Bord na Móna	X	X

Name	Affiliation	Day 1	Day 2
Shogo Uchiyama	RWE	X	X
Stephen Holleran	BrightWind		X
Steven White	ZX Lidars	X	X
Théo Reffet	Movelaser	X	X
Thomas Neumann	UL International GmbH	X	X
Tobias Klaas-Witt	Fraunhofer IEE	X	X
Tom Szyslo	Fraunhofer IWES	X	X
Vicky Tsaprouni	Enallaktiki Energeiaki S.A. (2EN)	X	
Vincent Camier	Ammonit	X	
Vinod Parameshwaran Somanathan	RWE	X	X
Warren Watson	Fraunhofer IWES	X	X
Wei Fu	DTU	X	X
Xiaoying Liu	Ocean University of China	X	
Yiannis Vasileiou	Enallaktiki Energeiaki S.A. (2EN)	X	X
Yuko Ueda	ClassNK	X	
Zhaoyu Zhang	Polytechnic University of Milan	X	
Zhi Liang	Vaisala	X	X
ZhiXin Liu	Movelaser	X	X
Zoe Roberts	Corio Generation	X	

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The International Energy Agency is an autonomous organisation which works to ensure reliable, affordable and clean energy for its 30 member countries and beyond. The [IEA Wind Technology Collaboration Programme](#) supports the work of independent, international groups of experts that enable governments and industries from around the world to lead programmes and projects on a wide range of energy technologies and related issues.

[IEA Wind Task 52](#) exists to support the large-scale deployment of wind lidar for wind energy applications. (Note that our logo still needs to be updated – proposals are very welcome.)

Author team: Julia Gottschall (Task 52 Operating Agent, Fraunhofer Institute for Wind Energy Systems IWES, Germany) and Tom Szyslo (Fraunhofer IWES, Germany). **Images:** Copyright Fraunhofer IWES.