Digitalisation of Wind Lidar

Task 52 General Meeting 2023

WG5 presentation

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Online

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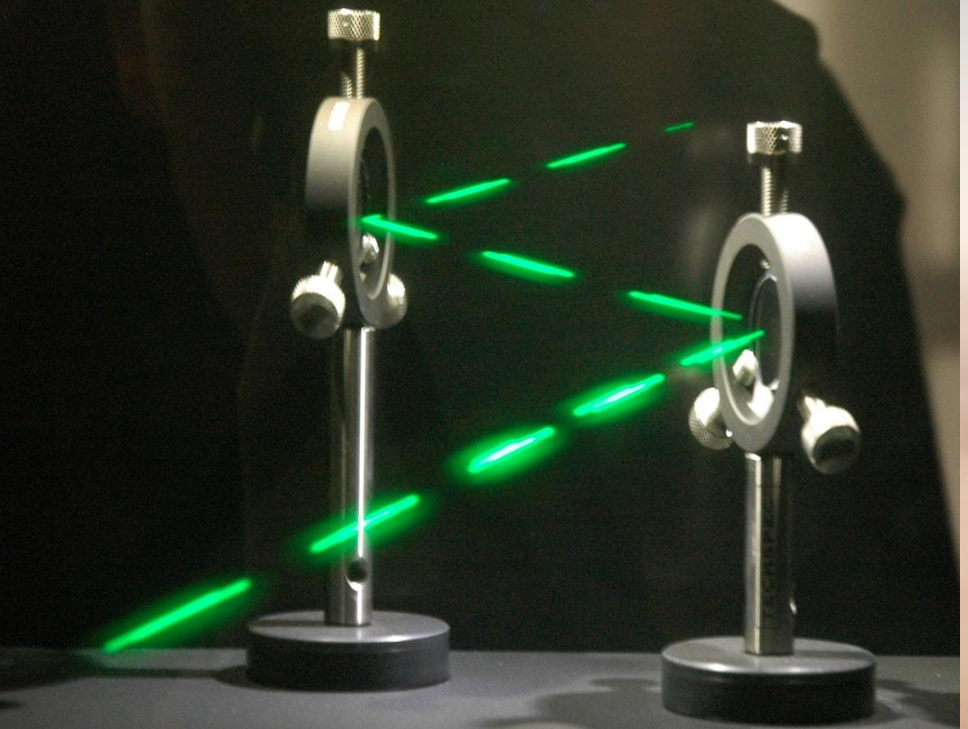
Digitalisation:

The organisational and industry-wide use of data and digital technologies to improve efficiency, create insights, and develop products and services.

Clifton, A., Barber, S., Bray, A., Enevoldsen, P., Fields, J., Sempreviva, A. M., Williams, L., Quick, J., Purdue, M., Totaro, P., and Ding, Y.: Grand Challenges in the Digitalisation of Wind Energy, Wind Energ. Sci. Discuss, https://doi.org/10.5194/wes-2022-29, in review, 2022.

What could digitalisation do for wind lidar?

Devices:
Enable the development and deployment of even cheaper, even more reliable, even more accurate, and even better documented RSD



Applications:
Enable seamless and rapid communication of high-quality, trustworthy data and metadata

Businesses:
Enable new business models based on data and connectivity

Key facts about the Working Group

Objectives:

1. Identify the **business cases for digitalisation** throughout the lifecycle of a wind lidar and the lifecycle of a wind farm
2. Identify **existing solutions and highlight gaps**
3. Provide **working demonstrations of digitalisation** in practice, including a wind lidar ontology and data processing based on open-source tools.

Deliverables and timeframe:

1. Support the publishing of a first version of **a wind lidar ontology** (a structured glossary of wind lidar terms) during 2022 → Working Group 7
2. Demonstrate a **wind lidar data processing chain** based on open source tools, including the e-WindLidar data format, during 2023
3. Additional **objectives might be added in the future**, for example aligned with the activities of Task 43.

Group approach:

The group will meet online every month in order to discuss general progress and realign.

Contact:

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The Working Group members

ZX Lidars

VAISALA

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Blue Ocean Consulting Ltd

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Fraunhofer IWES

sse Renewables

GREEN REBEL

And you?

Disclaimer: the presence of a logo here should not be taken to mean endorsement of the Working Group's activities or its results by that organisation.

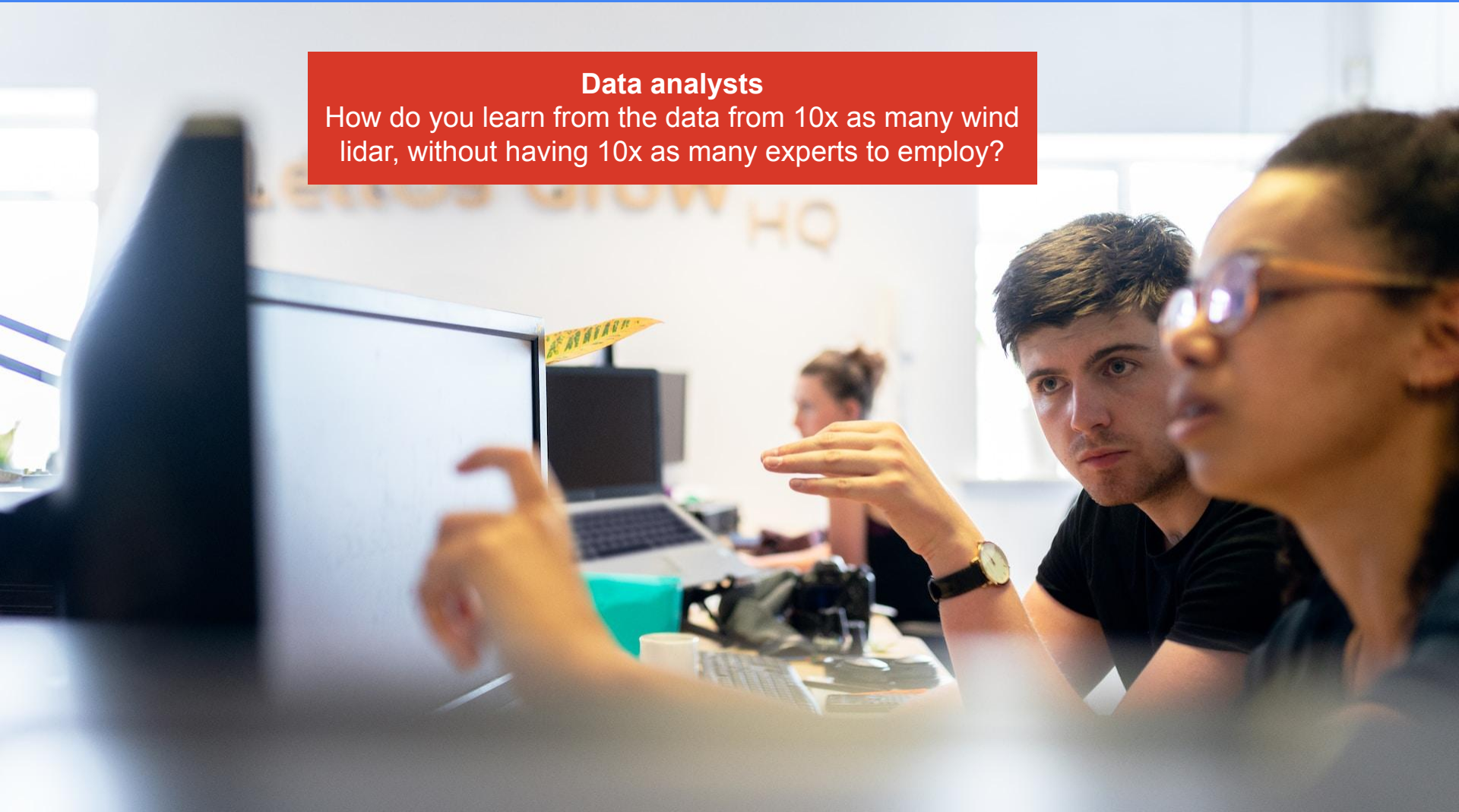
Digitalisation in the context of “Large Scale Deployment”

Wind lidar manufacturers

How do you build and manage 10x as many wind lidar, without having to build a 10x larger company?

Digitalisation in the context of “Large Scale Deployment”

Data analysts
How do you learn from the data from 10x as many wind lidar, without having 10x as many experts to employ?



Digitalisation in the context of “Large Scale Deployment”

Wind farm operators
How do you manage a fleet of 100+ wind lidar and integrate their data into daily operations?

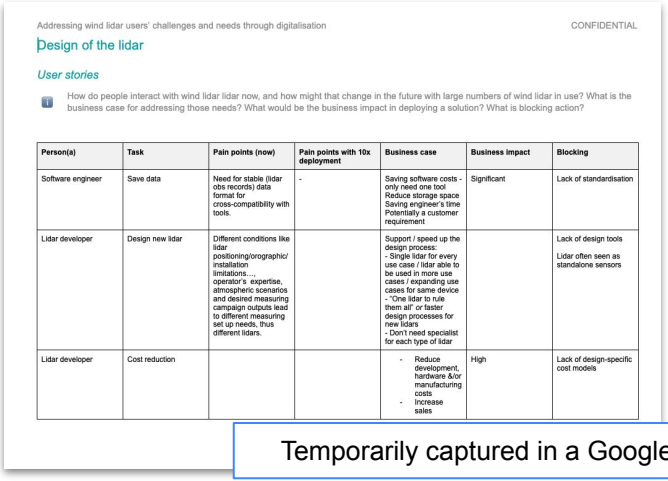
We're looking for ways to enable use cases

Identify use cases → Identify possible gaps → Act?

Started July 2022:
Identified users, goals, pain points now and at 10x, possible solutions

Started July 2022:
Identifying missing tools, technologies, etc.

Started April 2023:
Prioritising solutions, picking off low-hanging fruit.



Addressing wind lidar users' challenges and needs through digitalisation CONFIDENTIAL

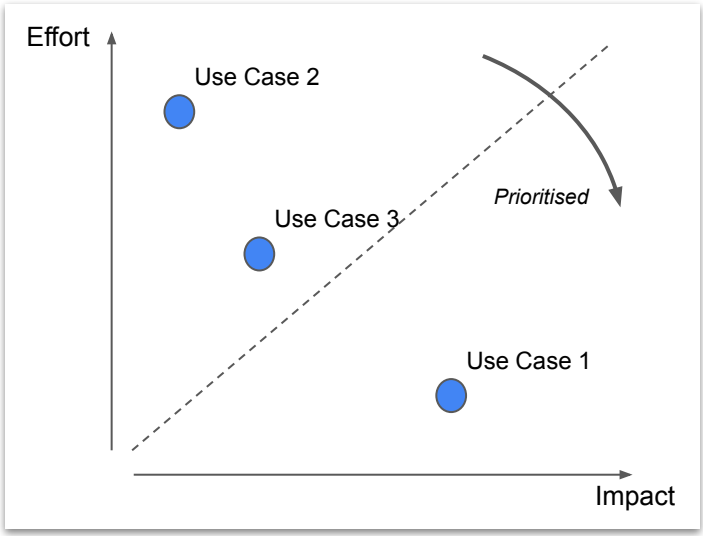
Design of the lidar

User stories

How do people interact with wind lidar lidar now, and how might that change in the future with large numbers of wind lidar in use? What is the business case for addressing those needs? What would be the business impact in deploying a solution? What is blocking action?

Person(a)	Task	Pain points (now)	Pain points with 10x deployment	Business case	Business impact	Blocking
Software engineer	Save data	Need for stable (lidar obs records) data format for cross-compatibility with tools.	-	Saving software costs - only need one tool Reduce storage space Saving engineer's time Potentially a customer requirement	Significant	Lack of standardisation
Lidar developer	Design new lidar	Different conditions like lidar positioning/orographic/ installation limitations..., operator's expertise, atmospheric scenarios and desired measuring campaign outputs lead to different measuring set up needs, thus different lidars.		Support / speed up the design process: - Single lidar for every use case / lidar able to be used in more use cases / expanding use cases for same device - "One lidar to rule them all" or faster design processes for new lidars - Don't need specialist for each type of lidar		Lack of design tools Lidar often seen as standalone sensors
Lidar developer	Cost reduction			- Reduce development, hardware &/or manufacturing costs - Increase sales	High	Lack of design-specific cost models

Temporarily captured in a Google doc



… in wind measurement

Identify use cases	Identify possible gaps	Act?
A wind data analyst wants to prepare their processes to work with data from a new type of wind lidar	Difficult to find samples of wind lidar data with known provenance	Yes: create a curated collection of data samples

Data samples

ID	Device	Operating mode	Format	Source	Link to data	Description	License
0	ZX300	VAD	Manufacturer's own	Data provided by ZX Lidars	drive.google.com	Data are direct from the wind lidar and have not been modified.	no license provided
1	WindCube V1	DBS	Manufacturer's own	Data provided by CU Boulder through A2e	a2e.energy.gov	According to the metadata, data files are direct from the wind lidar and have not been modified.	CC0 Public DomLinkin Dedication
2	WindCube V2.1	DBS	Manufacturer's own	Data provided by NREL through A2e	a2e.energy.gov	According to the metadata, data files are direct from the wind lidar and have not been modified.	CC0 Public DomLinkin Dedication
3	WindCube 200s	3-D scanning	Manufacturer's own	Data provided by UTD through A2e	a2e.energy.gov	According to the metadata, data files are direct from the wind lidar and have not been modified.	CC0 Public DomLinkin Dedication
4	Halo XR	3-D scanning	Manufacturer's own	Data provided by PNNL through A2e	a2e.energy.gov	According to the metadata, data files are direct from the wind lidar and have not been modified.	CC0 Public DomLinkin Dedication

https://github.com/IEAWindTask52/LidarDataSamples

… for wind resource assessment

Identify use cases	Identify possible gaps	Act?
A wind data analyst wants to use wind lidar data from a third-party service provider as part of the wind resource assessment for a site	Transferring data from one group to another can lead to loss of meaning	Yes: now working with IEA Wind Task 43 to extend their wind resource data model

https://github.com/IEA-Task-43/digital_wra_data_standard

… for wind lidar manufacturing

Identify use cases	Identify possible gaps	Act?
A wind lidar manufacturer wants to make sure their operations can scale to 10x their current volume	Knowledge management, technical training, component tracking	Probably not: these problems are not exclusive to wind lidar, and are well-addressed by existing products and services → This is not a Task 52 problem!

What we're up to in the next year

Interim deliverables:

- **Use case library**; looking at how to publish / communicate results
- **Prioritised actions** → will inform our own activities in the next 6-18 months

What do you need?

Over the next years:

- Demonstrate a wind lidar data processing chain based on open source tools, including the e-WindLidar data format, during 2023
  → reassessing if this is still relevant

Join us!
Contact Task 52 Operating Agents or Andy Clifton (andy.clifton@enviconnect.de) to find out more