Offshore Wind Energy in the North Atlantic

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Nordic Energy Research

Rasmus Wendt

Chief Growth Officer,
NunaGreen, Greenland

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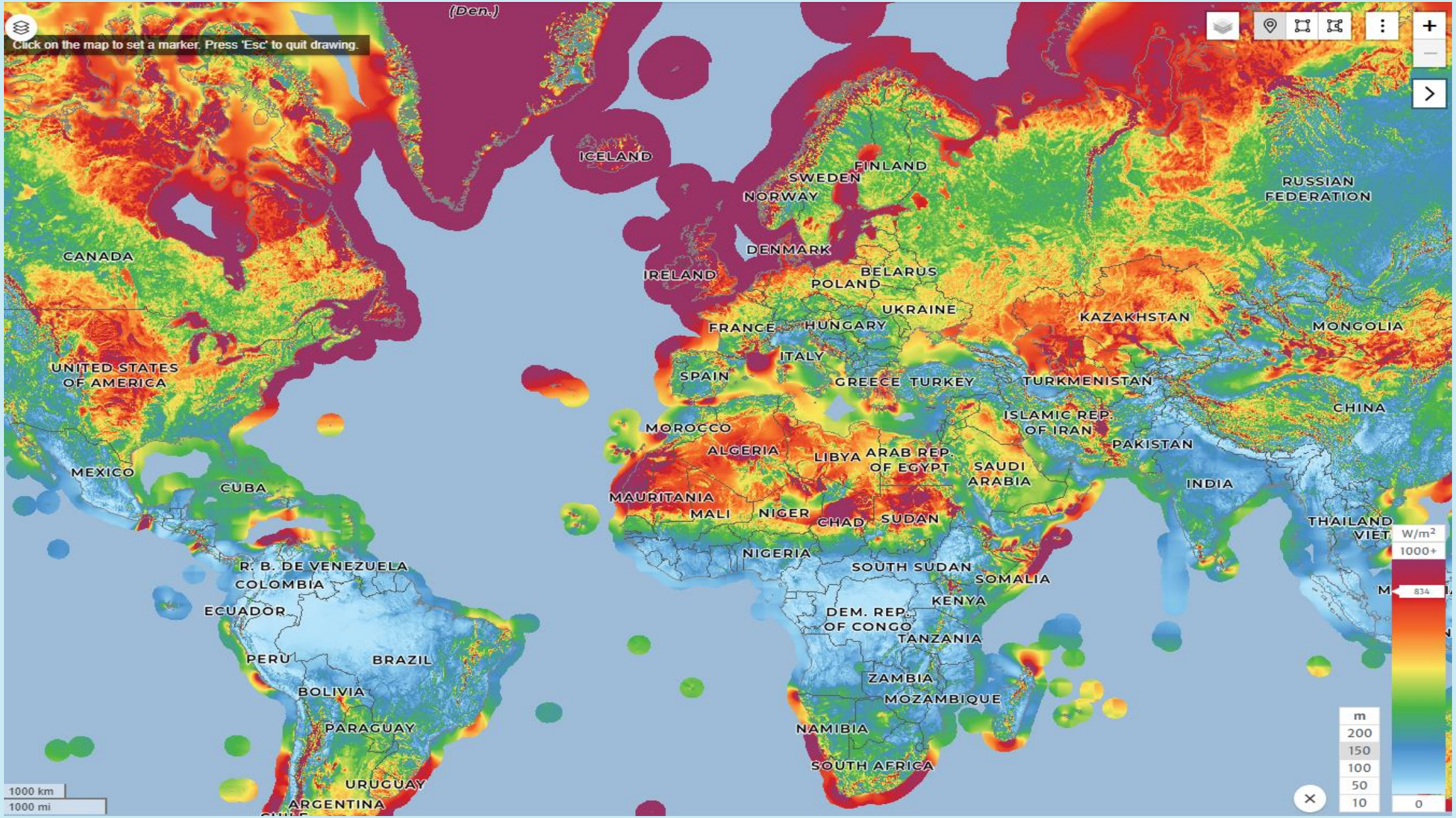

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Speakers

UNNUR ÞORVALDSDÓTTIR

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ASTRID BRATLI

MICHELLE QUINN

ARCTIC CIRCLE

Astrid Bratli

Advisor, Nordic Energy Research,
Nordic Council of Ministers

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Coexistence and nature-inclusive design in Nordic offshore wind farms

Nordic Energy Research

Astrid Bratli, Nordic Energy Research

20 October 2023

What is the deal with offshore wind?

Possible key factor for green transition

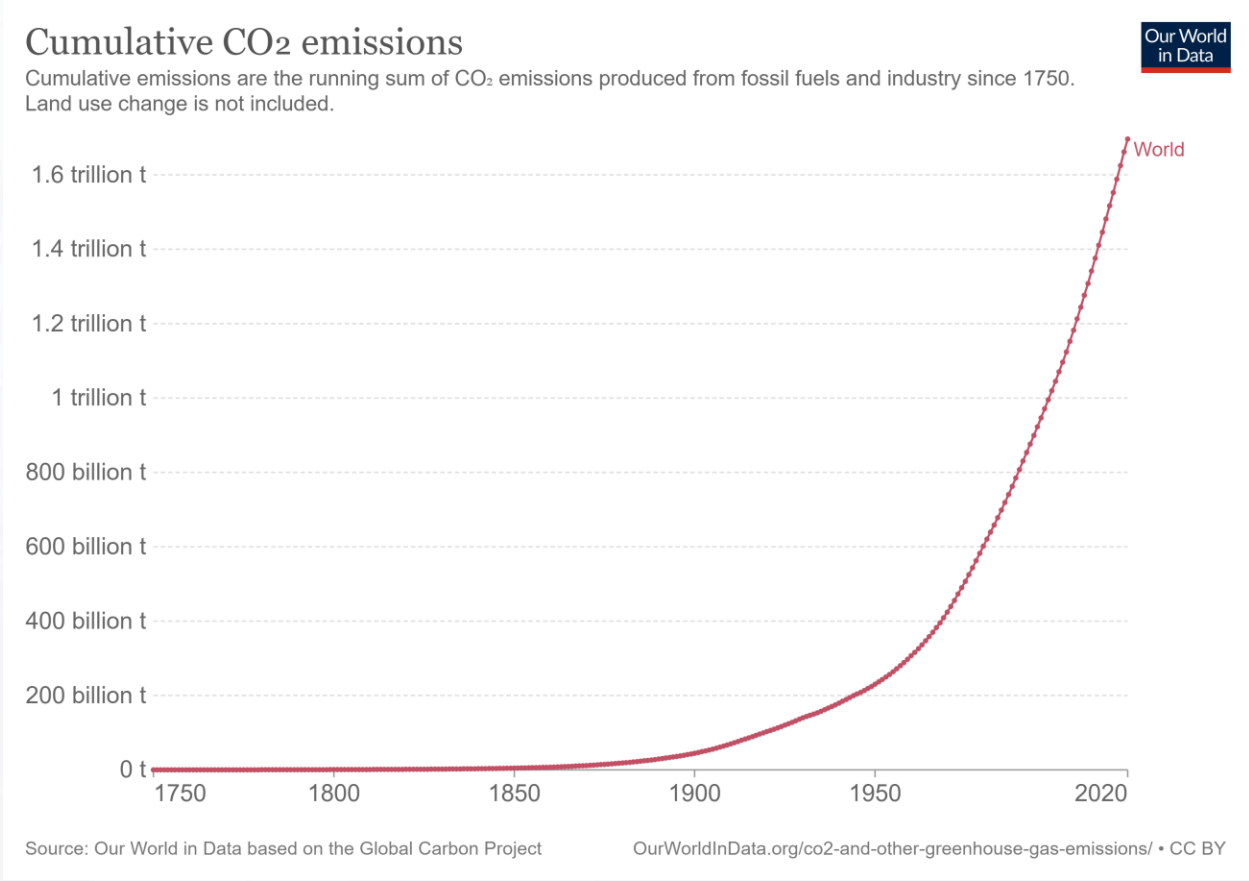
Must reduce emissions

+

Increased energy demands

=

Need sustainable solutions



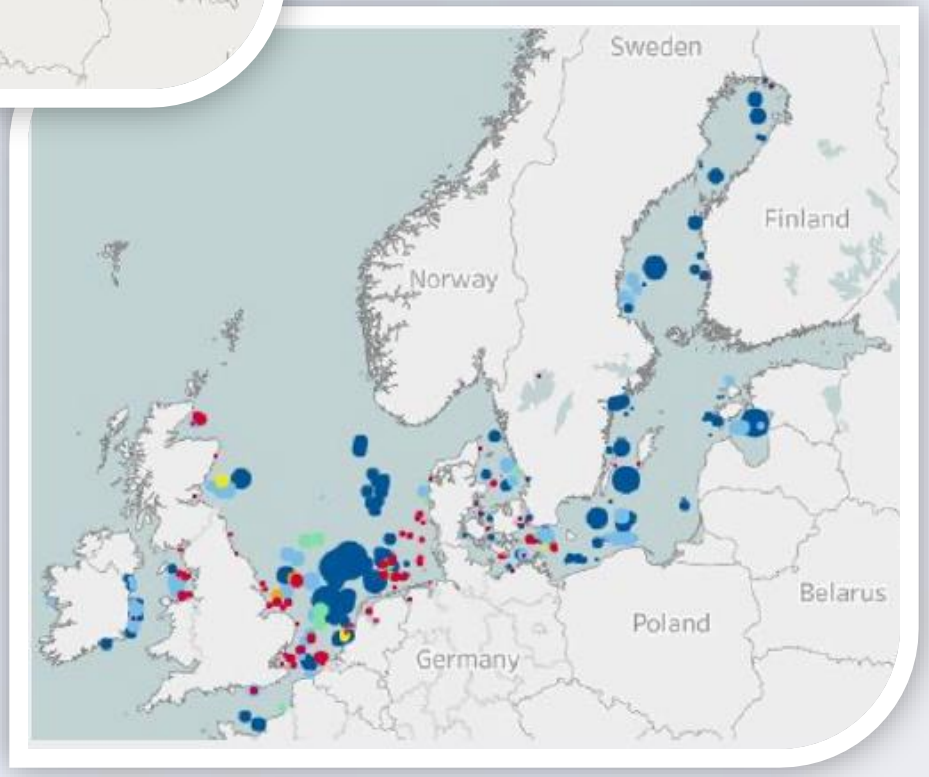
Renewable + Enormous potential

2050-vision:

North Sea 300 GW

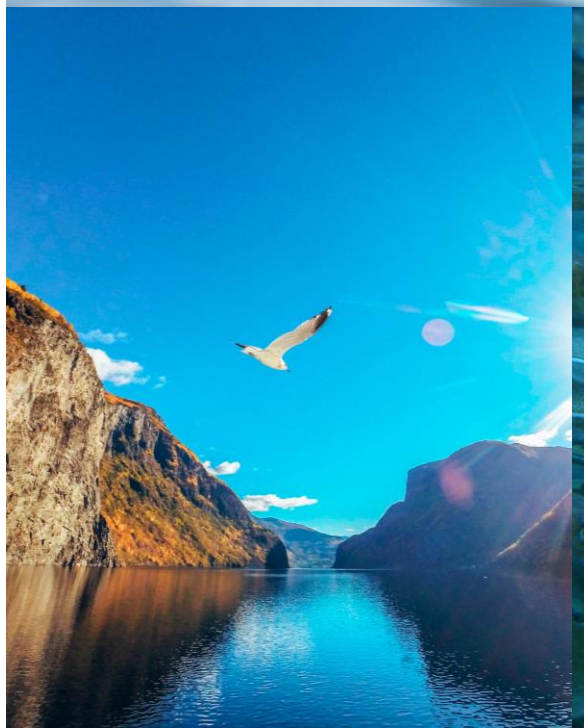
Floating

Bottom-fixed



Risk of biodiversity loss

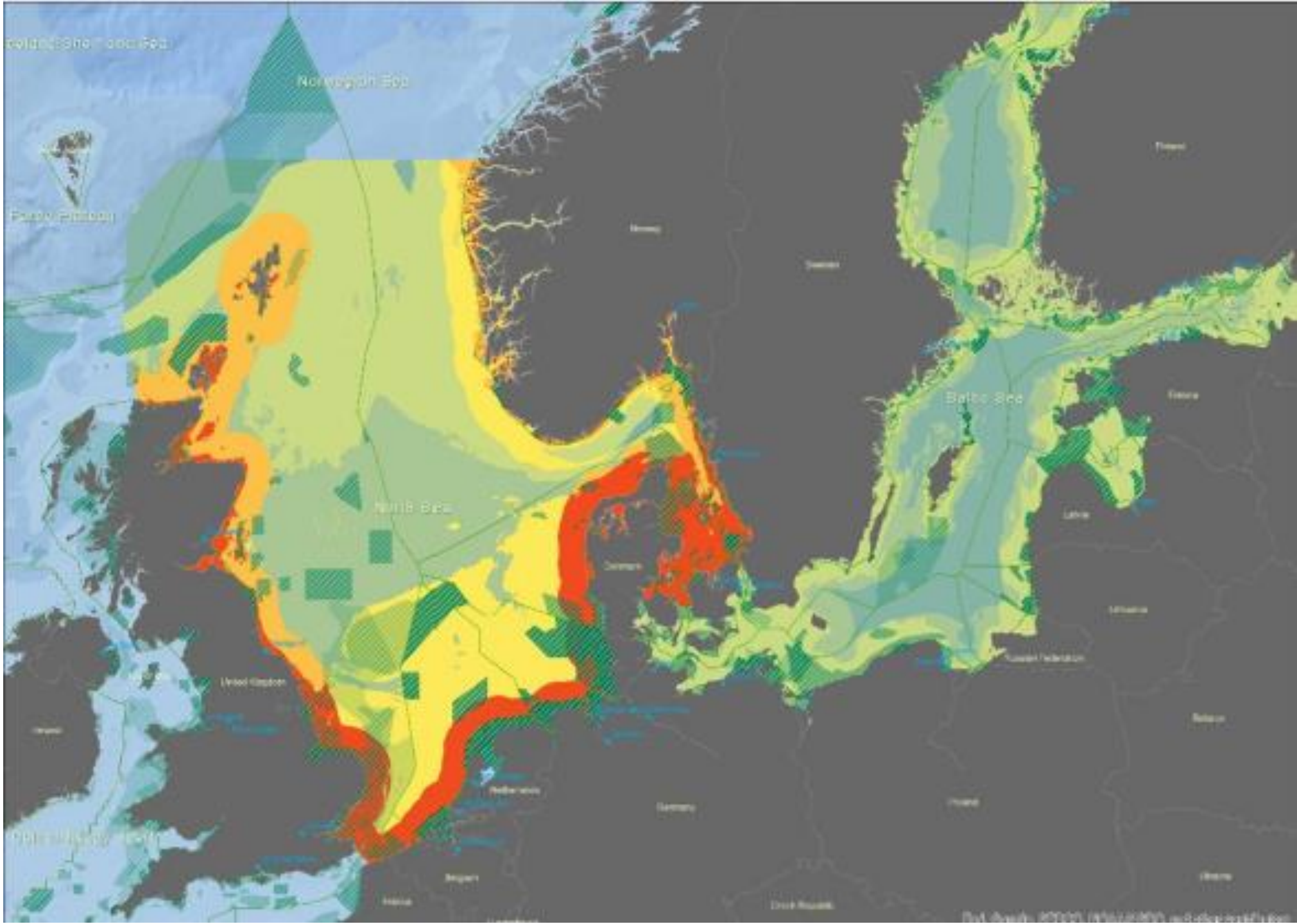
- Seabirds
- Fish
- Mammals
- Aquaculture



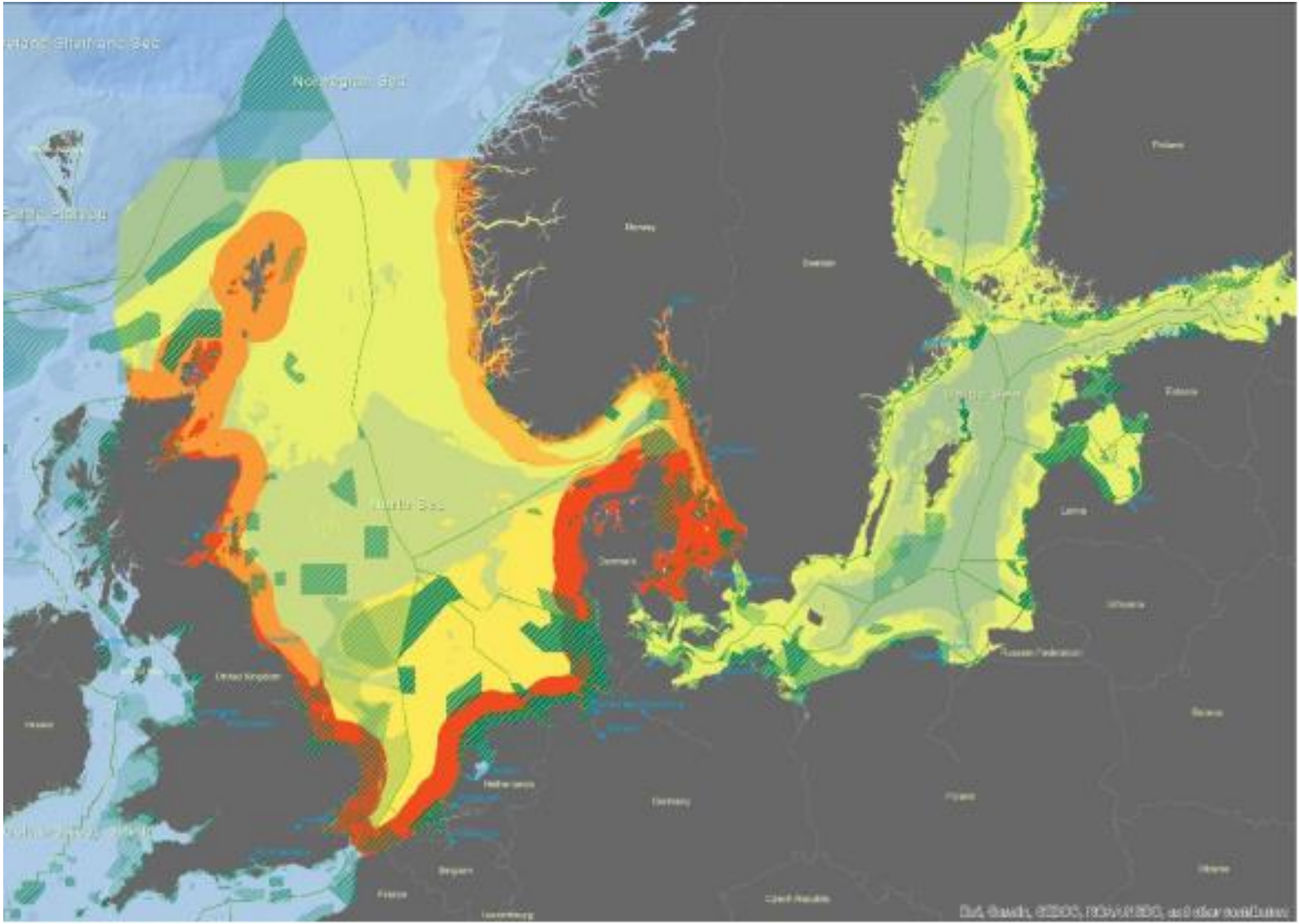
Ongoing activities

- Fishing
- Shipping
- Military activities
- Aquaculture (fish/shellfish farming, algae, etc.)
- Tourism
- Existing industry

2030



2050

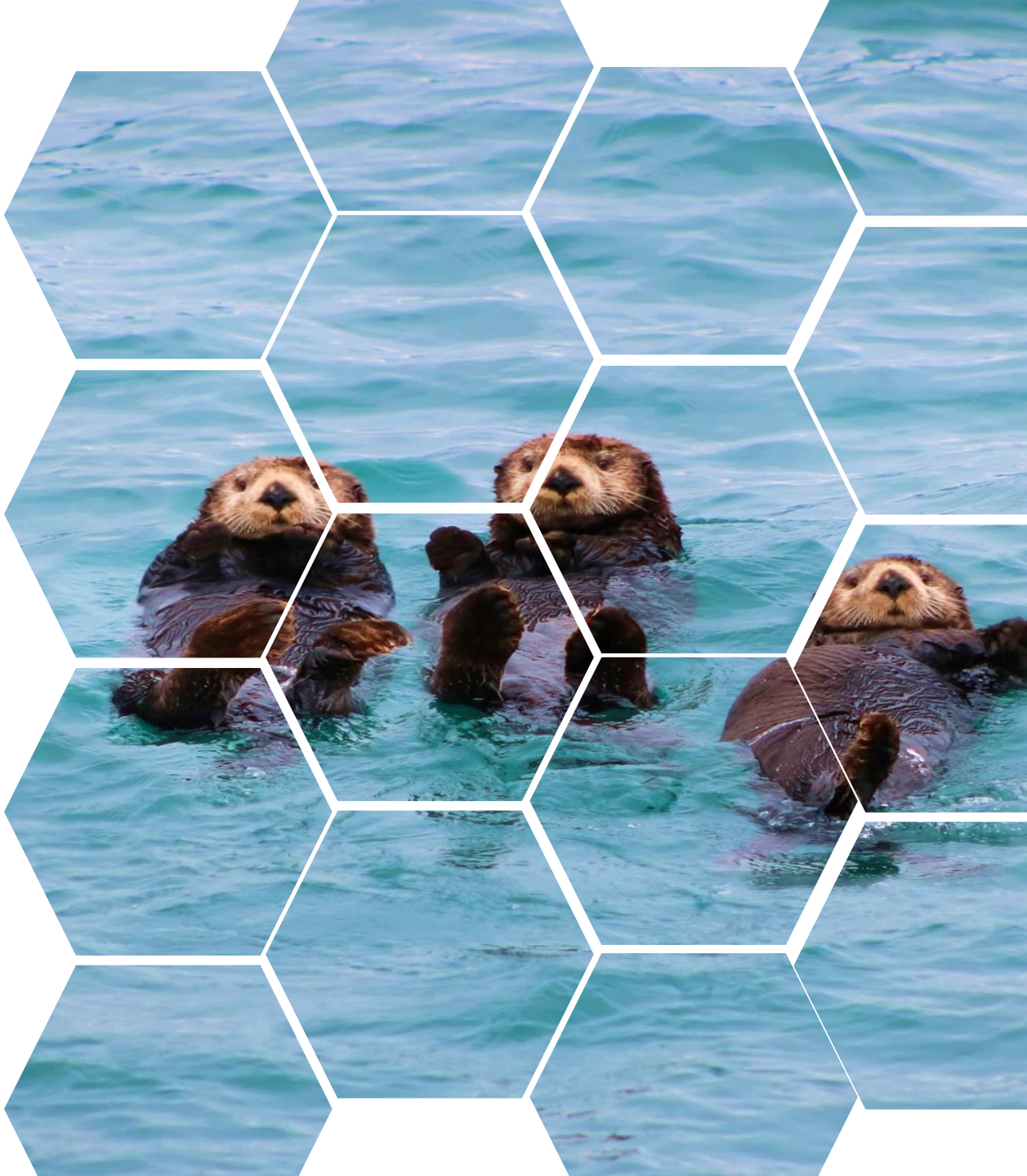


2 workshops – 70+ participants

- Authorities
- Aquaculture
- Energy companies
- Finance
- Aquaculture
- Research
- Technology suppliers
- Environmental organizations/NGOs

Goals for discussions

- Identify **barriers**
- Map out **needs**
- **Tools** for coexistence at every stage of the tender processes



Results

Compiled list of 22 tools that authorities can use to:

- Integrate coexistence at every stages of the process
- Facilitate dialogue across sectors and countries

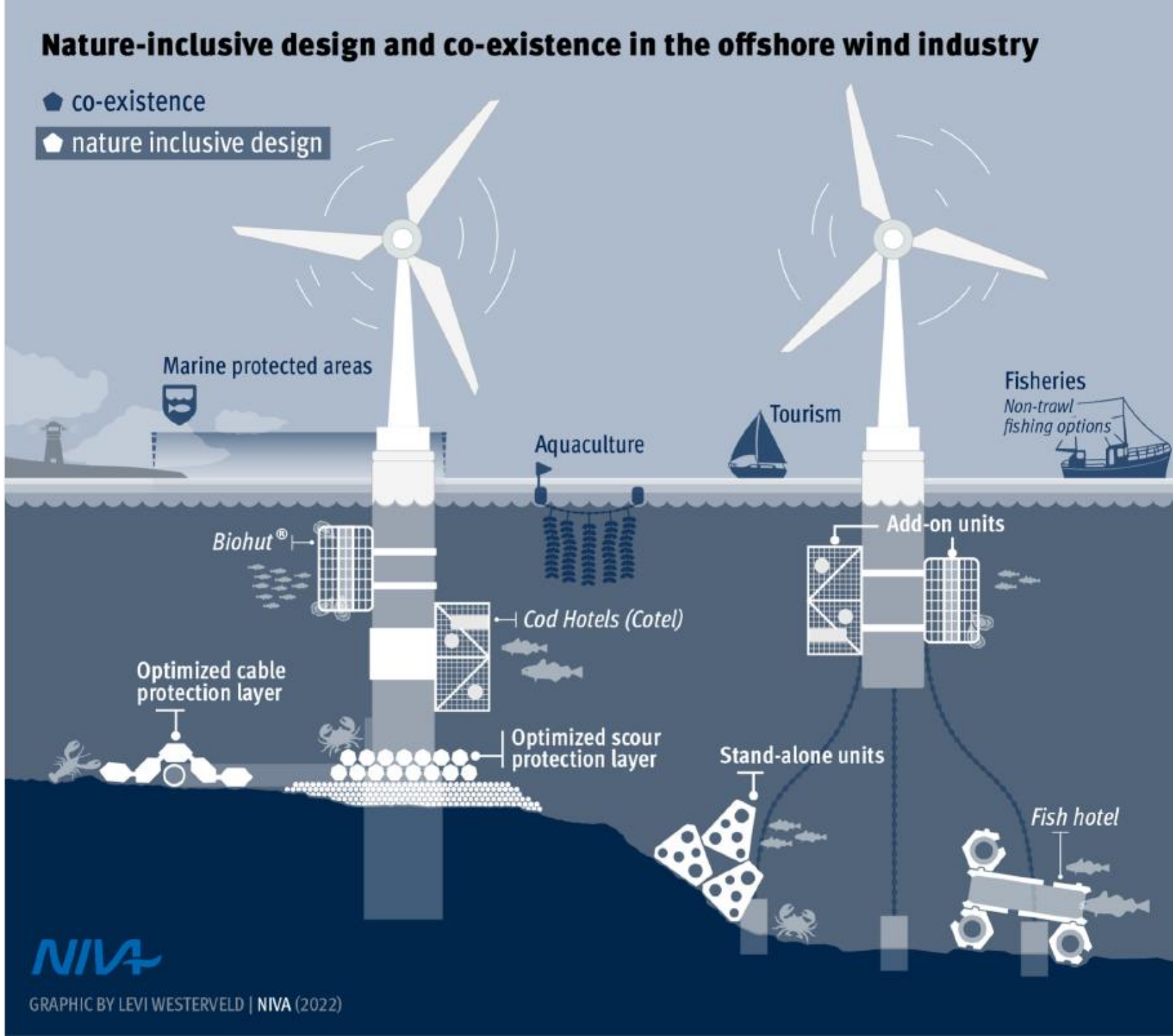
Governmental instruments for successful coexistence	General	Opening	Prequal	Tender award	Licence award
Apply a defined process to clarify what coexistence topics need handling. Explore the problem and do not focus on the solutions early.	x	x	x	x	x
Follow a clear and defined process to quantify coexistence and deliverables on coexistence, including agreed and communicated goals, basis and processes.	x	x	x	x	x
Apply transparent platforms and roundtables for processes and sharing information to secure transparent processes and trustworthy flow of data/information by using reliable third parties.	x	x	x	x	x
Make environmental monitoring programmes a "backbone" in a long-term strategy for OWFs to allow for knowledge-based adaptive management.	x	x	x	x	x
Stimulate and support strategic research and joint industry programmes and ensure knowledge transfer between programmes and towards society.	x	x	x	x	x
Consider cross-regulatory legislation and facilitate coordination between countries and between national agencies, as is the case with HELCOM or OSPAR.	x	x	x	x	x
Potential opportunities for coexistence should be a part of the process of opening areas and be integrated in Marine Spatial Planning (MSP). MSP should include mapping of stakeholders and need for coexistence in an area.	x	x			
Apply consenting criteria/solutions that enforce coexistence solutions on the developer before they construct.			x	x	x
Set non-price criteria with transparent and robust evaluation criteria to be evaluated (e.g. by expert committee) in the tender process to be fulfilled before award.			x	x	x
Utilise market (and potentially public) dialogue as an instrument to design tender criteria and to facilitate coexistence approaches in the industry at large.			x	x	x
Consider combining requirements for energy production with production of food or other products to ensure collaboration in the design phase.			x	x	x
Apply a permit requirement that operators should accept new stakeholders in the licencing area if public authorities can balance operators' interests against					x

Finding 1: Value of nature

- How do you measure **value at sea**?
  - Fish vs. Tesla
- AND: How do you measure the 'value' of **failing** to preserve biodiversity and natural resources?
- Must take precautions - set clear goals for **facilitating biodiversity**

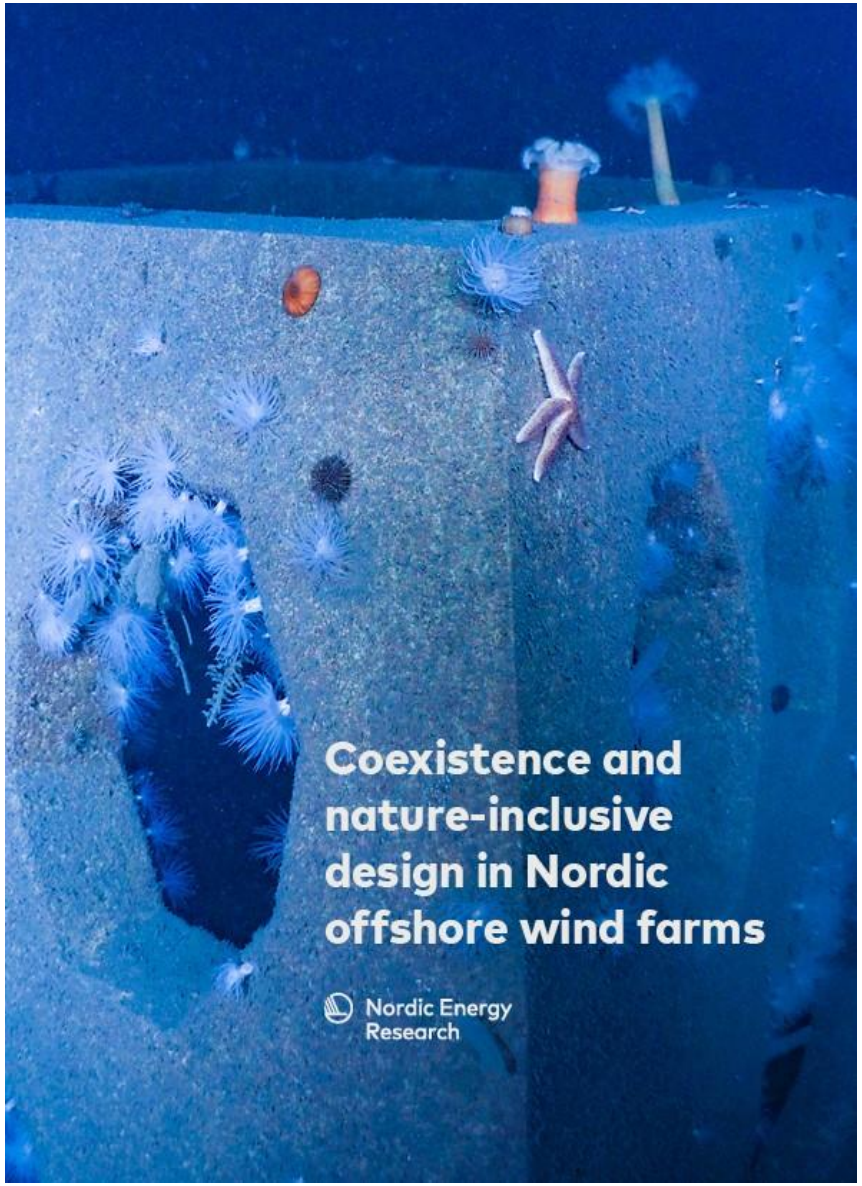
Finding 2: Nature-inclusive design

- Cod hotels
- Protective layers over cables
- Biohuts



Finding 3: Coexistence requires cooperation

- Plans for coexistence must be a **mandatory criterion** in the tendering processes.
- Ensure collaboration as **early** as possible.
- Establish knowledge exchange **platforms** – across sectors and across countries



Read the report here:

Michelle Quinn

Director for Offshore Wind,
The Scottish Government

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Scottish Government
Riaghaltas na h-Alba
gov.scot

Scotland's offshore wind journey

ARCTIC CIRCLE ASSEMBLY
20 October 2023

Scotland's offshore wind pipeline

Over 40 GW*

Scotland's offshore wind pipeline

Around 28GW of this is via ScotWind, and over 17GW of this floating offshore wind. The INTOG round could deliver an additional 5.5GW of project capacity

Avg. £1.5bn investment

per project across the 20 ScotWind projects.

23%

ScotWind's floating pipeline

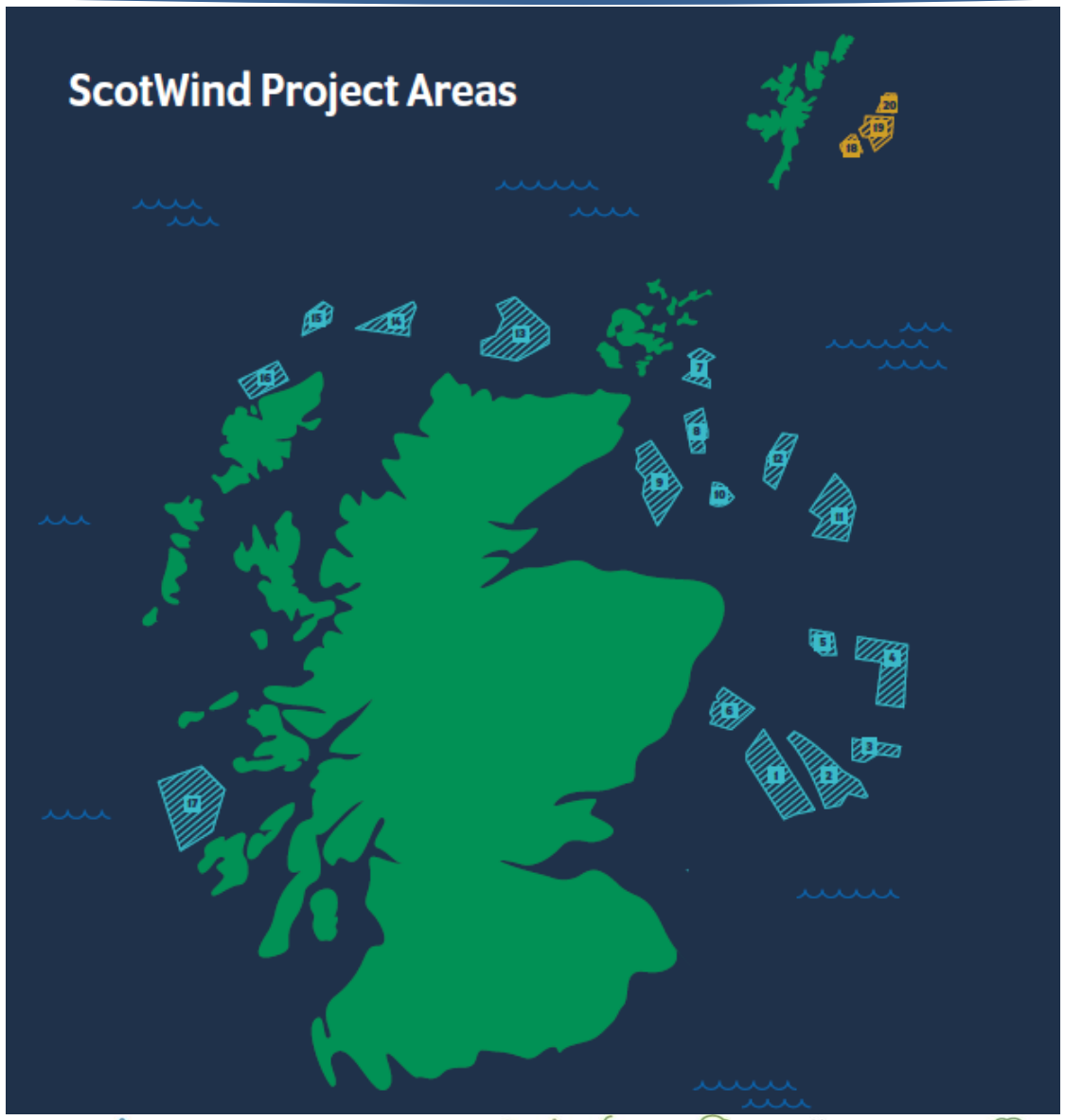
ScotWind's floating projects make up 23% of the global pipeline of projects. INTOG could grow this to 30%. **

* Subject to planning and consenting decisions and finding a route to market

** Calculation on projects with a lease in place. Based on RenewableUK Energy Pulse Data, March 2023

Sources: Draft ESJTP (January 2023); CES ScotWind Update (November 2022); Map courtesy of Crown Estate Scotland

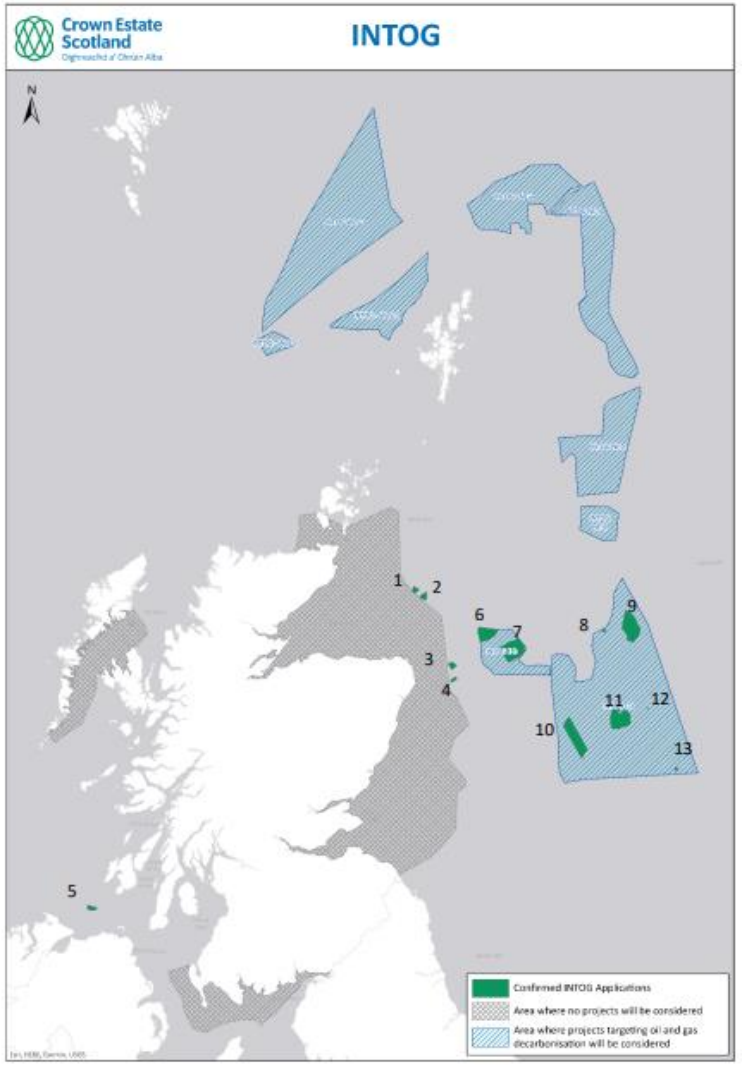
ScotWind leasing round



- **20** projects with a combined ambition to deliver around **28 GW** of offshore wind power
- **14 projects** (>17 GW) will use floating technology - making it the largest scale floating offshore wind opportunity in the world
- Over **£750 million** raised in revenues and will bring billions of investment into the Scottish economy.

Innovation and Targeted Oil and Gas (INTOG) leasing round

- **5** Innovation projects and **8** Targeted Oil and Gas Projects have been offered Exclusivity Agreements
- Seabed lease of **50 years** for Targeted Oil and Gas projects and **25 years** for Innovation projects
- Proposed capacity is **449 MW** for Innovation projects and **5 GW** for Targeted Oil and Gas projects



Marine planning and consenting

- Our **Sectoral Marine Plan**, due to be delivered in 2024, will set the course for the overall delivery of ScotWind and INTOG, maximising deployment in Scottish waters whilst protecting marine users and our environment

- We will ensure the most **efficient management** of both pre-application and post-consent processes to shorten timeframes where possible

- We are delivering £2.8m in **new research projects** this year to address evidence gaps

Where are we now

- Engaging with **industry**
- Undertaking **strategic analysis** to identify gaps and opportunities to maximise economic benefit from:
  - **Infrastructure** development
  - **Supply chain** development
  - **Skills** & training
- Engaging with the UK Government
- Engaging internationally to identify potential **strategic partnership** opportunities

Strategic Investment

- We have committed £500 million **strategic investment** of public sector funds over the next 5 years

- This investment will **support market certainty**, new jobs, innovation and skills

- It will be augmented by a Strategic Investment Model, working in **partnership with the private sector**

The opportunity ahead

- Scotland has a wealth of **pioneering expertise** to share with international partners
- Our project pipeline offers **supply chain opportunities** at a commercial scale
- **Collaboration** and **strategic partnerships** will be key
- Working, learning and growing together to **create shared success**

Unnur María Þorvaldsdóttir

Executive Director, Wind Development,
The National Power Company of Iceland
– Landsvirkjun

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Landsvirkjun

National Power Company of Iceland

Potential for Wind Energy in Iceland

Unnur María Þorvaldsdóttir, Director Wind Development

October 2023

Landsvirkjun

Landsvirkjun

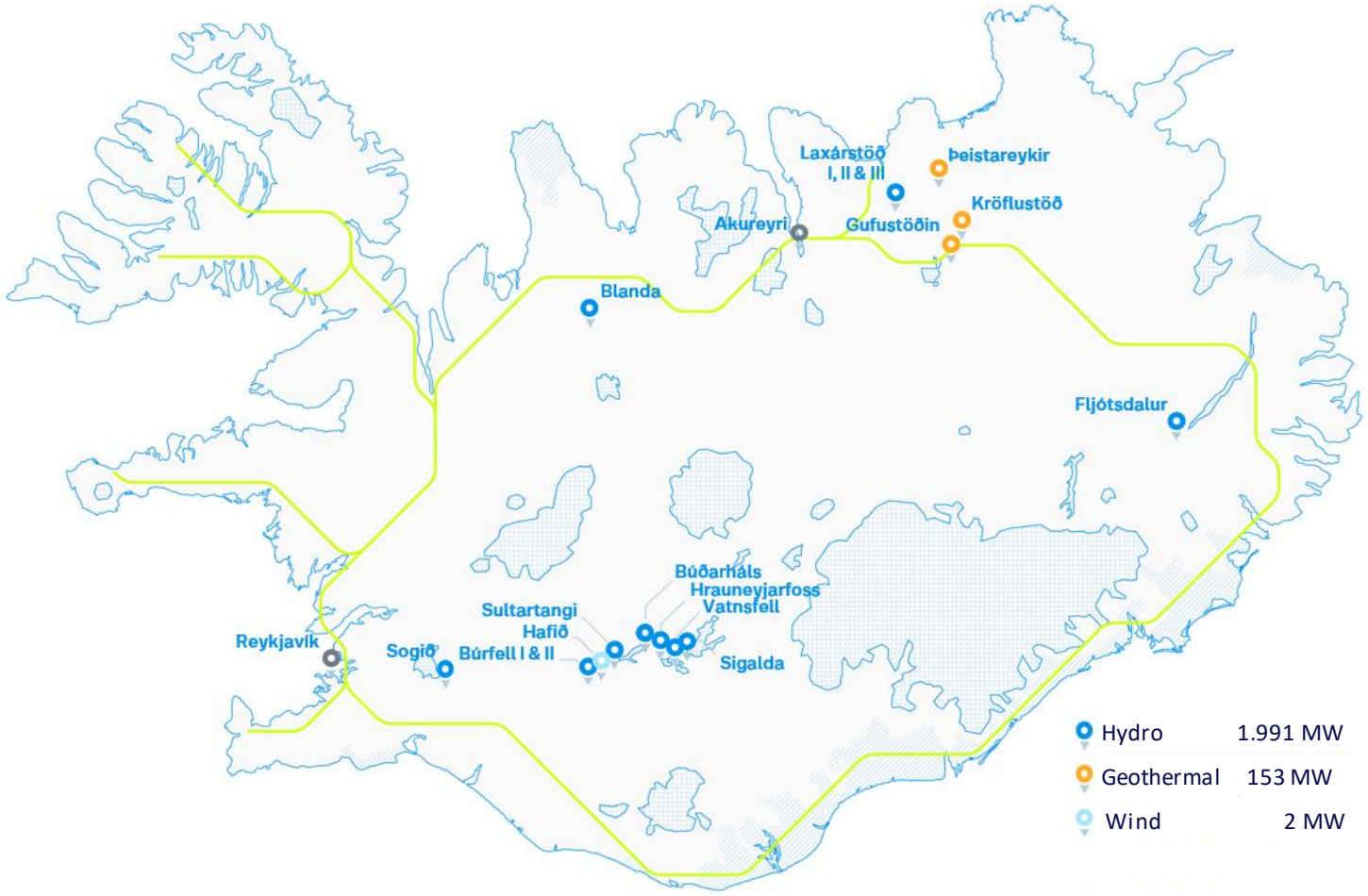
100% state owned, founded in 1965

The largest electricity generator in Iceland, generating 70% of Iceland's electricity

Capacity	2,150 MW		
Generation capacity		15	TWh

Utilization factor average:

Hydro	78%
Geothermal	92%



Wind development – onshore

- Búrfells- and Blöndulundur have been in development since 2012
- **The 3rd phase of the Icelandic Master Plan for Nature Protection and Energy Utilization** was approved by the Icelandic parliament in June 2022. This is a big milestone as the projects are the first windfarms in Iceland in the utilization category and the first step to utilize energy from other resources than water and geothermal.
- Búrfellslundur 120 MW
- Blöndulundur 100 MW
- Laws and legisltation still under devlopment

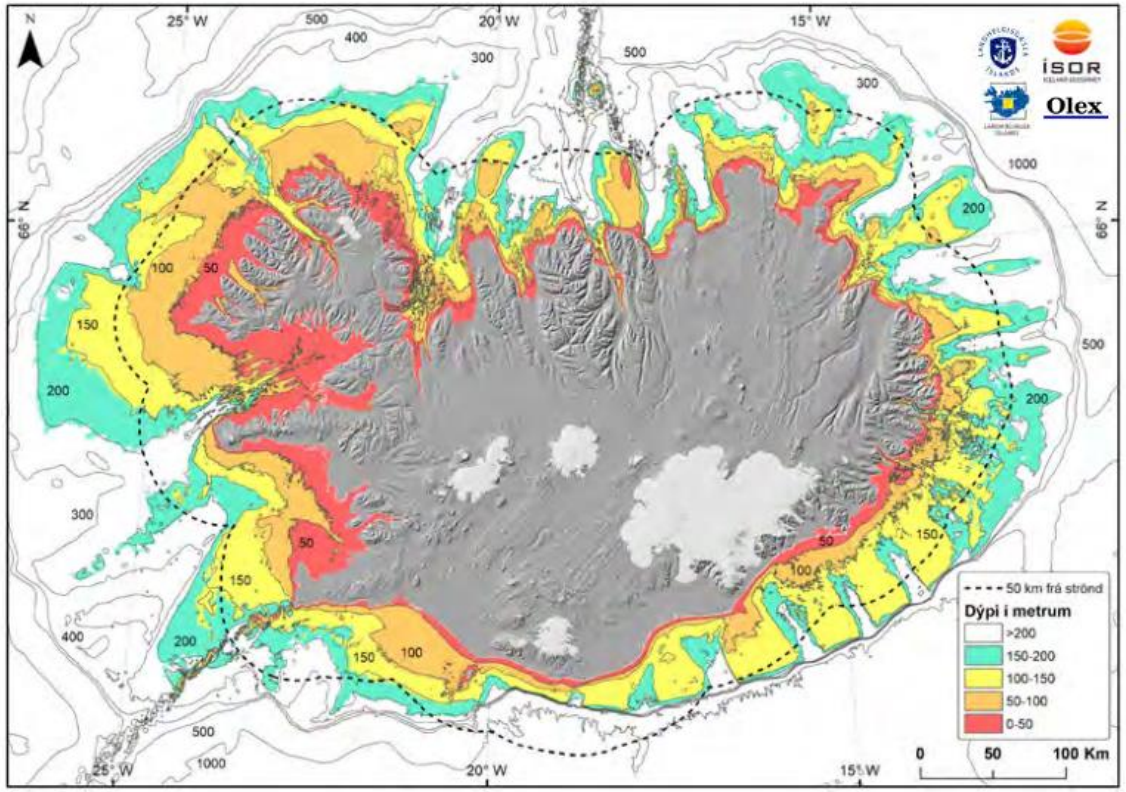

Planned Búrfellslundur 120 MW

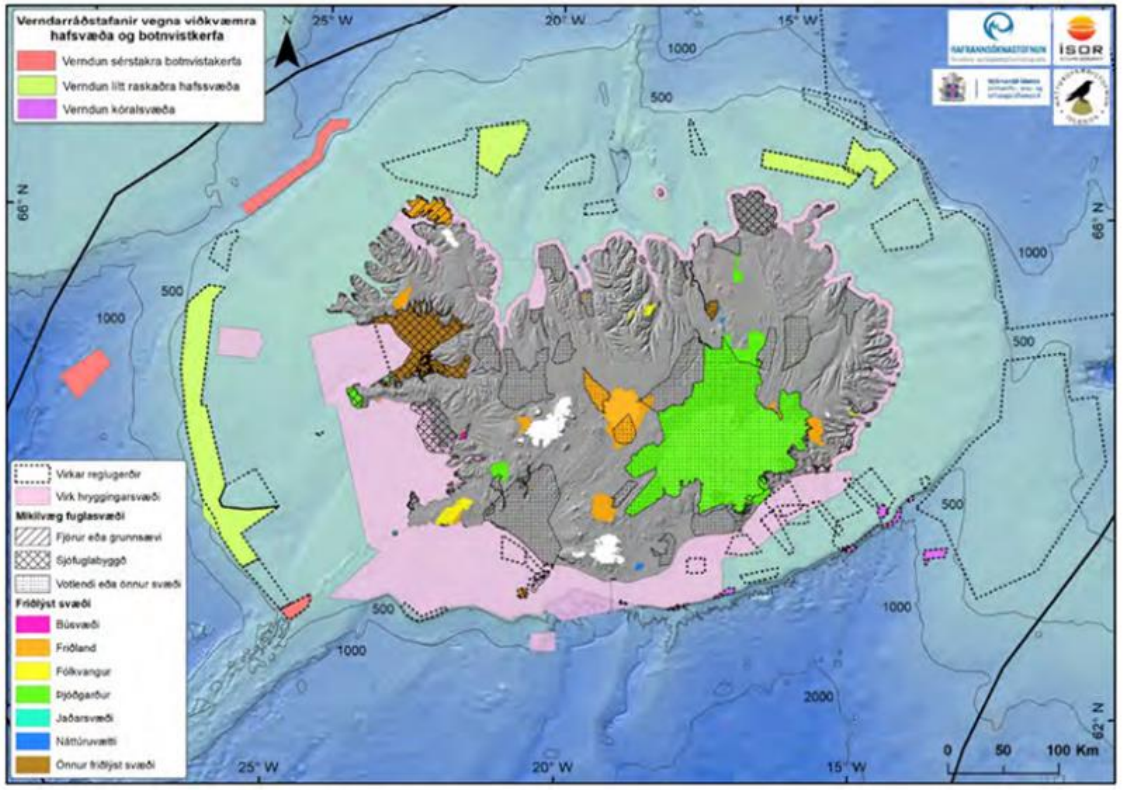
Wind development - offshore

We have just started the onshore journey – there is a need for a framework for both onshore and offshore wind

- More research needed
- Laws need to be updated
- Holistic approach – environment, fishery, and transport

Challenges around Iceland





Wind development - offshore

Comparison between onshore and offshore wind in Iceland

	Onshore wind	Offshore wind
Wind	8 -9,0 m/sec	10-12 m/sec
Capacity factor	40% - 46%	45%-50%
Capacity	5 MW	14 MW
Height	150 -180 m	200-300 m
Grid connections	Easy, depending on location	Complex and very expensive

Summary

There is an interesting ongoing development for offshore wind with great potential in the world. We have though just started the journey with onshore wind in Iceland – which is not as complex as offshore wind.

There is need for a framework for both onshore and offshore wind.

Offshore wind is still very expensive compared to onshore wind and there are still many questions which needs to be answered. Should potential development areas be auctioned and subsidized as in many countries?

We follow closely the development in the world to be able to meet future needs.

Kári Mannbjørn Mortensen

Head of Energy Department.

Environment Agency, Faroe Islands

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Exploring new horizons

2030 - 2040

SEV

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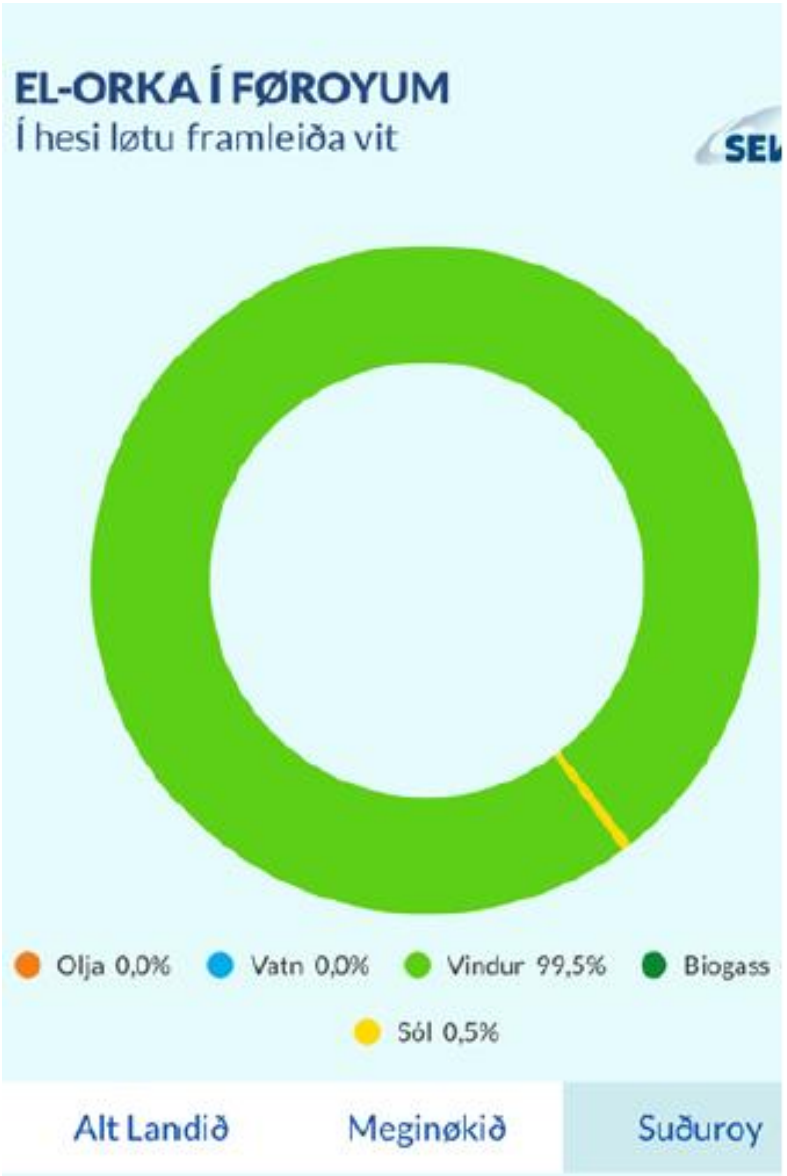
FAROESE ENVIRONMENT AGENCY

Suðuroy, new batteries, syncronous condenser and 100% windpenetration



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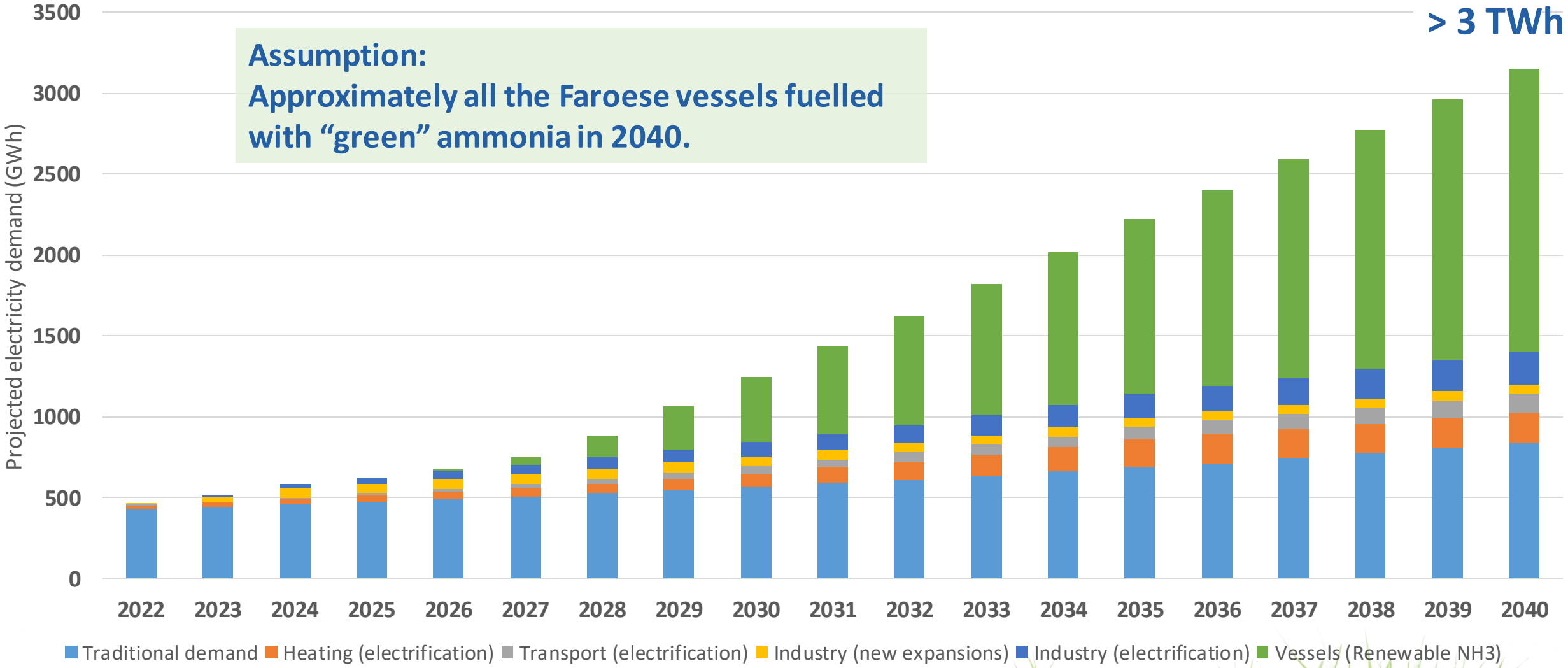
FAROESE ENVIRONMENT AGENCY

Assumption:
Approximately all the Faroese vessels fuelled with “green” ammonia in 2040.

> 3 TWh



Projected electricity consumption 2040

umhvørvisstovan
FAROESE ENVIRONMENT AGENCY

SEV

Floating windturbines in faroese waters?

The total area of the faroese continental shelf is 275.00 km^2

38.000 km^2 of these have a water depth between 100 and 200 m.

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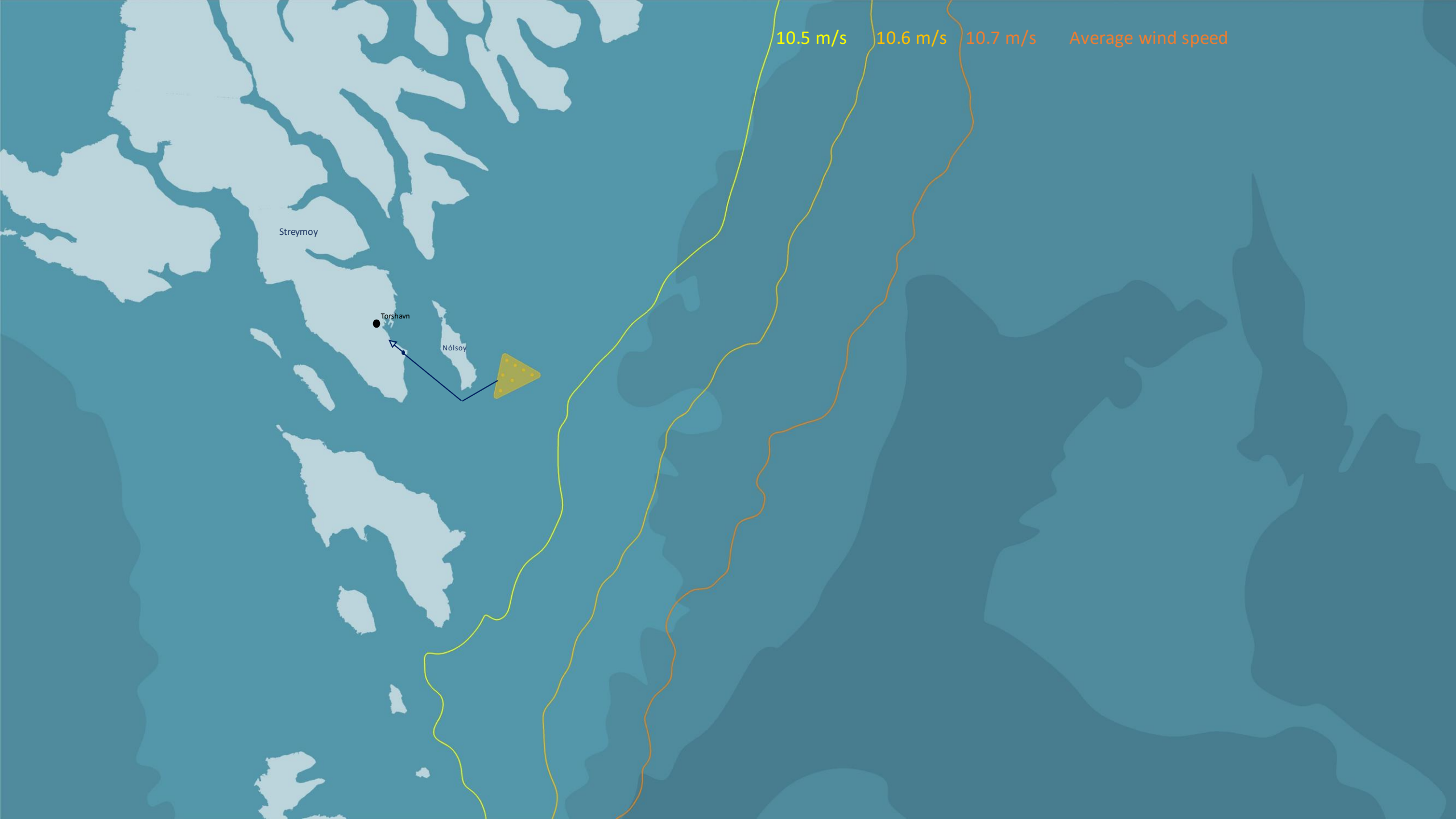
Streymoy
Torshavn
Nólsoy
Substation
60 kV
Fixed bottom wind farm
100 MW (7 x 14 MW)
AEP GROSS: 420 GWh

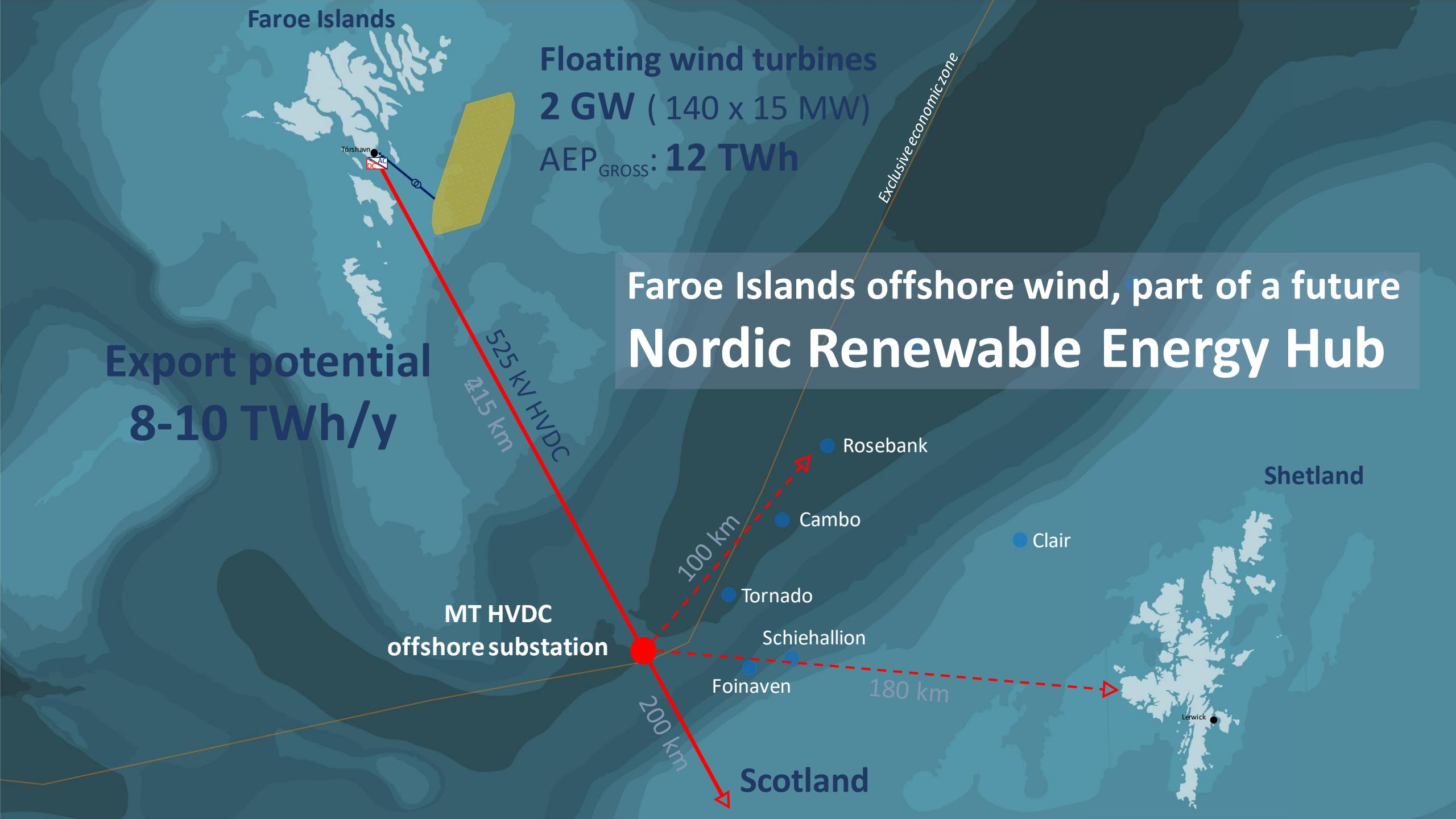

10.5 m/s
10.6 m/s
10.7 m/s
Average wind speed
Streymoy
Torshavn
Nólsoy

Floating wind farm

2 GW (ex 140 x 15 MW)

AEP_{GROSS}: 12 TWh

Turbine spacing: 10D/8D
Average wind speed: 10.6 m/s
Depth: 100-200m
Occupied area: 440 km² (< 0.2% of EEZ)


Faroe Islands
Floating wind turbines
2 GW (140 x 15 MW)
AEP GROSS: 12 TWh
Tórshavn
AC
DC
Exclusive economic zone
Faroe Islands offshore wind, part of a future
Nordic Renewable Energy Hub
Export potential
8-10 TWh/y
525 kV HVDC
415 km
Rosebank
Cambo
100 km
Clair
Shetland
Tornado
MT HVDC
offshore substation
Schiehallion
Foinaven
180 km
200 km
Lerwick
Scotland

Faroe Islands

North Atlantic Energy Network

January 2016

JARÐFEINGI

ORKUSTOFNUN

RAMBØLL

The Greenland Innovation Centre
construction • energy • environment

UNIVERSITY OF TROMSØ

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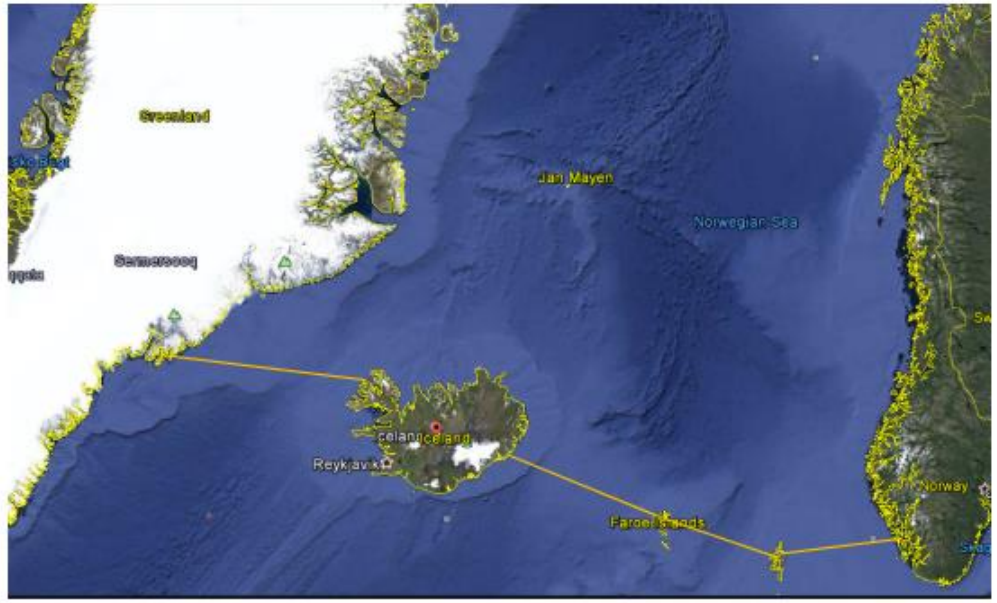


Orkustofnun (OS) - National Energy Authority of Iceland

Norges Arktiske Universitet (UiT) - The Arctic University of Norway

Energy Styrelsen - Danish Energy Agency

Jarðfeingi - Faroese Earth and Energy Directorate

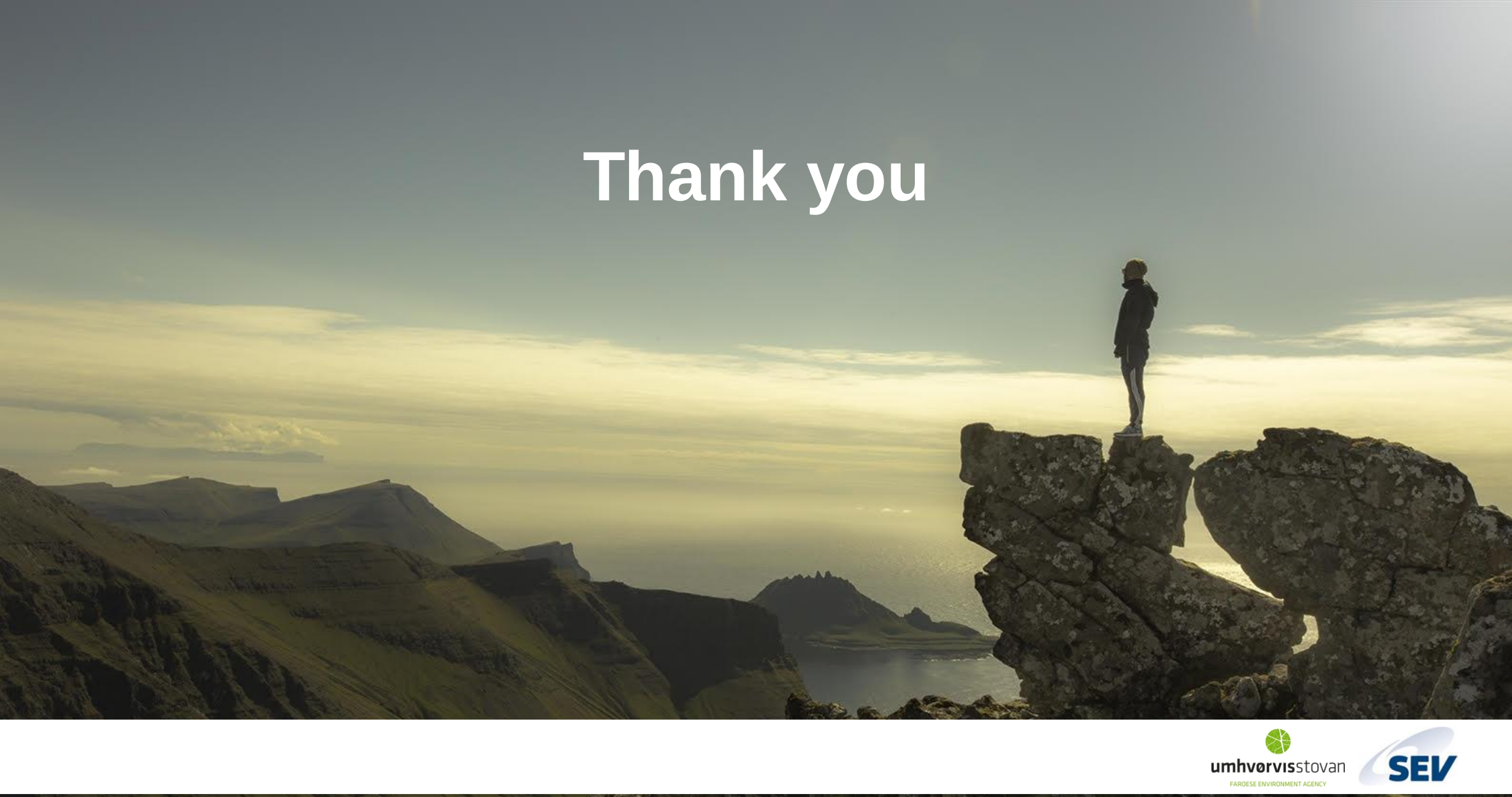
Shetland Islands Council - Economic Development Service

Greenland Innovation Centre

Shetland

Lerwick

Thank you



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Panel Discussion

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