

Offshore Hydrogen – future or myth?

Ewa Mazur

Business Development Manager
RWE Renewables Poland Sp. z o.o.

Dr. Arno Buysch

Project Director Offshore Hydrogen
RWE Offshore Wind GmbH

We are #2 offshore player globally with vast experience in the business

Very well positioned ...

... in a market with enormous investment opportunities



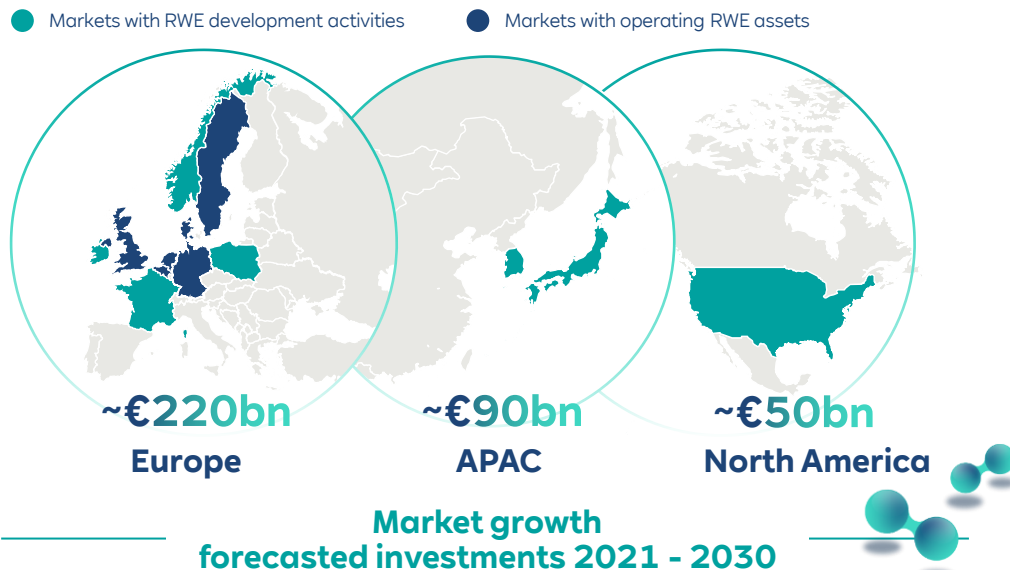
Almost 20 years in the offshore business



5 GW gross offshore wind portfolio across Europe



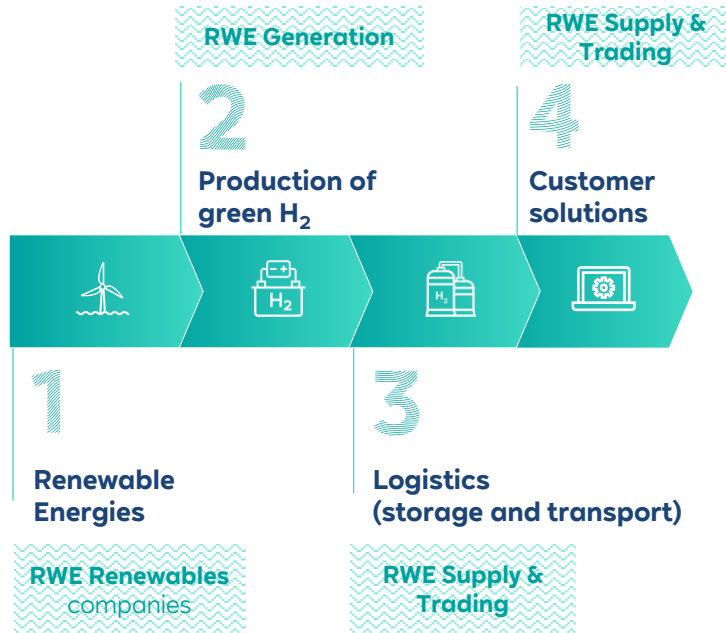
High-class partnerships in new markets



Source: Bloomberg NEF, APAC excl. China.

RWE defined a clear value proposition & set H₂ goals

Strong RWE group expertise along the H₂ value chain



RWE Hydrogen Development pipeline

10 GW
pro-rata

Tends to be in early Project phases

Ambitious growth target in electrolyser capacity

Requirements for investments:

- Regulatory and policy framework
- Support and funding programmes
- Reliable acceptance agreements



RWE hydrogen project portfolio comprises >30 integrated projects along the entire value chain

Over 300 employees work on hydrogen topics across all RWE companies



- **Development and operation of electrolyzers** in the core markets (DE, NL, UK) and beyond
- **2 GW electrolysis target** by 2030, fueled by growing **project pipeline of >10 GW**
- Dedicated **board member for hydrogen** and growing team of **>300 hydrogen professionals** across markets
- Emerging import and international **trading** business for **green fuels**
 - US gulf coast
 - Chile
 - Namibia
 - Norway

Technological concepts for H2 production from offshore wind

Different concepts for OFF H2 production explored by RWE



We are **technology agnostic**, looking into all concepts and ultimately, we will be choosing the concept that has the greatest fit to a specific opportunity and business case



There are **two major technical solutions for offshore H2 production**: hydrogen produced at the wind turbine directly – the decentralised case; and hydrogen produced at a centralised platform – the centralised case. Each option has its own pros and cons depending on the specific market conditions

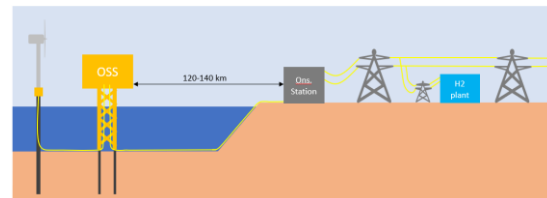


Decentral solution can be realized as integrated OFF H2 producing component in the turbine or as a non-integrated solution. We are exploring both options to **gain knowledge and make educated decisions**.

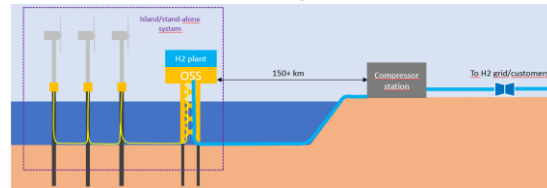


We intend to test the technology which will allow for a **step-wise approach** in technology development, from pilot to commercial scale

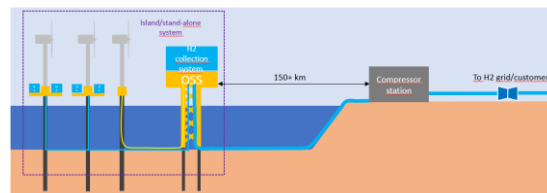
Onshore electrolysis



Offshore central electrolysis



Offshore decentral electrolysis



Why Offshore Hydrogen Production?

Local source of large H2 supply volumes



Cost benefit of OFF electrolyzer with an H2 pipeline versus cable connection to shore with ON electrolyzer for large volume and distance to shore



Local production of H2 at scale supports **energy independence** (as opposed to relying on large imported volumes of H2 and its derivatives)



Water accessibility at scale



Potential **re-use of existing infrastructure** (e.g. O&G platforms, pipelines)



Enables large scale offshore wind **development in grid constrained areas** if H2 is produced offshore and transported via pipelines



Space availability & Scale up potential for GW scale projects, plus lower rate of overplanting required due to **high base-load factor** of OFF wind



Reduced environmental impact, e.g. land use conflicts & water usage

Offshore wind in Poland

Untapped potential

Round 1&2 in force

Round 3 in EEZ

Round 3 in TS



Round 1

5,9 GW

Round 2

9,4 GW

Round 3

17,7 GW

33 GW by 2050

Source: Polish Wind Energy Association report 2022

Poland is well positioned to benefit from the future hydrogen economy

Demand side:

High demand coming from the **hard-to-electrify sectors** will trigger decarbonisation of existing hydrogen supply



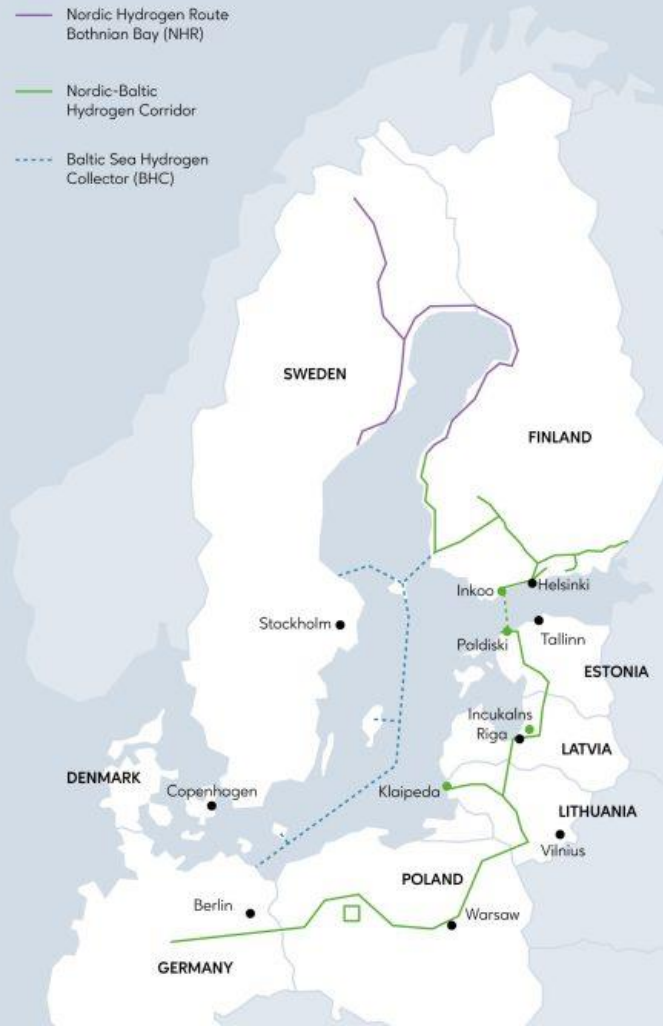
Supply side:

With 33 GW of **offshore wind** potential, Baltic Sea can provide annual average energy yield of 130 TWh



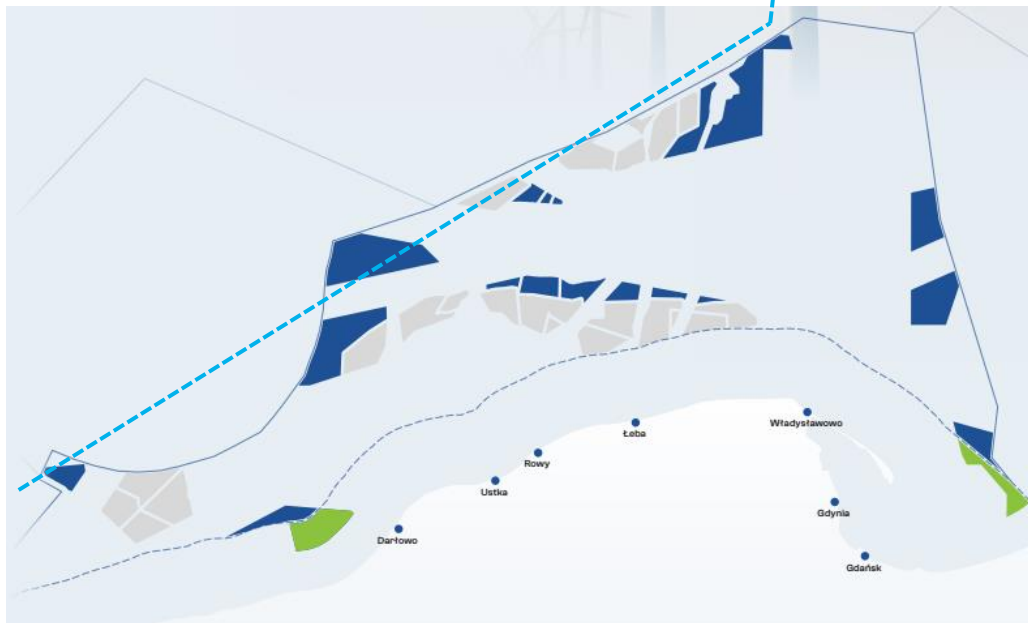
Infrastructure:

Future availability of both onshore and offshore transmission infrastructure enables **market development at scale**



Planned Baltic Sea Hydrogen Collector – solution to grid constraints?

Round 1&2 in force Round 3 in EEZ Round 3 in TS



Nordic Hydrogen Route
Bothnian Bay (NHR)

Nordic-Baltic
Hydrogen Corridor

Baltic Sea Hydrogen
Collector (BHC)



Vast offshore wind resources and local H2 demand offers an unprecedented opportunity for Offshore H2 industry in Europe...



OFF H2 targets and **designated financial support** beyond innovation phase are key for supply chain investments & local jobs



Strategic planning and timely buildout of **H2 infrastructure on- and off-shore**, including **interconnectors**, to provide certainty to OFF H2 project development at scale



Intensify **cooperation and planning between neighbouring countries** to optimize cost and support energy security



Encourage and provide confidence to H2 offtakers to invest in new or adapt cost-effective technologies & processes that utilise green hydrogen



Provide the necessary **regulatory frameworks** and **incentives across full H2 value chain: Generation, Transportation, Storage and Offtake**

Offshore wind and hydrogen

Regulatory incentives on other markets

Germany



Netherlands



Denmark



Demand

- Quota in the transport sector and industry (RED II/III) – not fully implemented
- Carbon Co (CCFD) – not fully implemented
- Use of H2 in power sector (new EEG) – not fully implemented

- Quota in the transport sector
- Considering an obligation for CO2 free H2 in industry as of 2026
- Cabinet is considering demand side CfDs

May be outdated

Supply

- Tender for 3 GW electrolyser capacity foreseen (not clear but could be a Capex subsidy with some CfD component)
- Tender for 1 GW Offshore H2 foreseen

- Upscaling instrument (until about 2025 - from then on demand-side measures should take over)
- Stimulation of sustainable energy production and climate transition (SDE++)
- Discussion about tenders for CAPEX support for electrolyzers

- Cooperation on Green Hydrogen and realization of a (land-based) H2 interconnection pipeline between West-DK and North-DE
- Danish ambition to reach 4 – 6 GW of electrolysis capacity by 2030, becoming a net exporter of certified green hydrogen
- State fund is approx. €165m, but currently only relevant for onshore H2
- Offshore tender planned for 2024, working with overcapacity from commercial offshore wind (seabed lease w/o elec. grid connection, but H2 transport not fully clarified yet)

Thank you

Ewa Mazur

Business Development Manager
RWE Renewables Poland Sp. z o.o.

Dr. Arno Buysch

Project Director Offshore Hydrogen
RWE Offshore Wind GmbH

