Implementing cross-border hydrogen valleys |

Best practice from BalticSeaH2 Hydrogen Valley

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BalticSeaH2 – A pioneering initiative for a fully sector-coupled, interregional hydrogen economy

- Main Valley connecting Southern Finland and Estonia
- 7 Connected Valleys: Norway, Sweden, Denmark, Latvia, Lithuania, Poland and Northern Germany
- Total budget 33 M€, EU funding 25 M€
- Timeline: 2023-2028
- Co-coordinated by CLIC Innovation and Gasgrid Finland

BalticSeaH2 develops a full Baltic Sea–wide Hydrogen Economy across country borders, industries, and energy sectors

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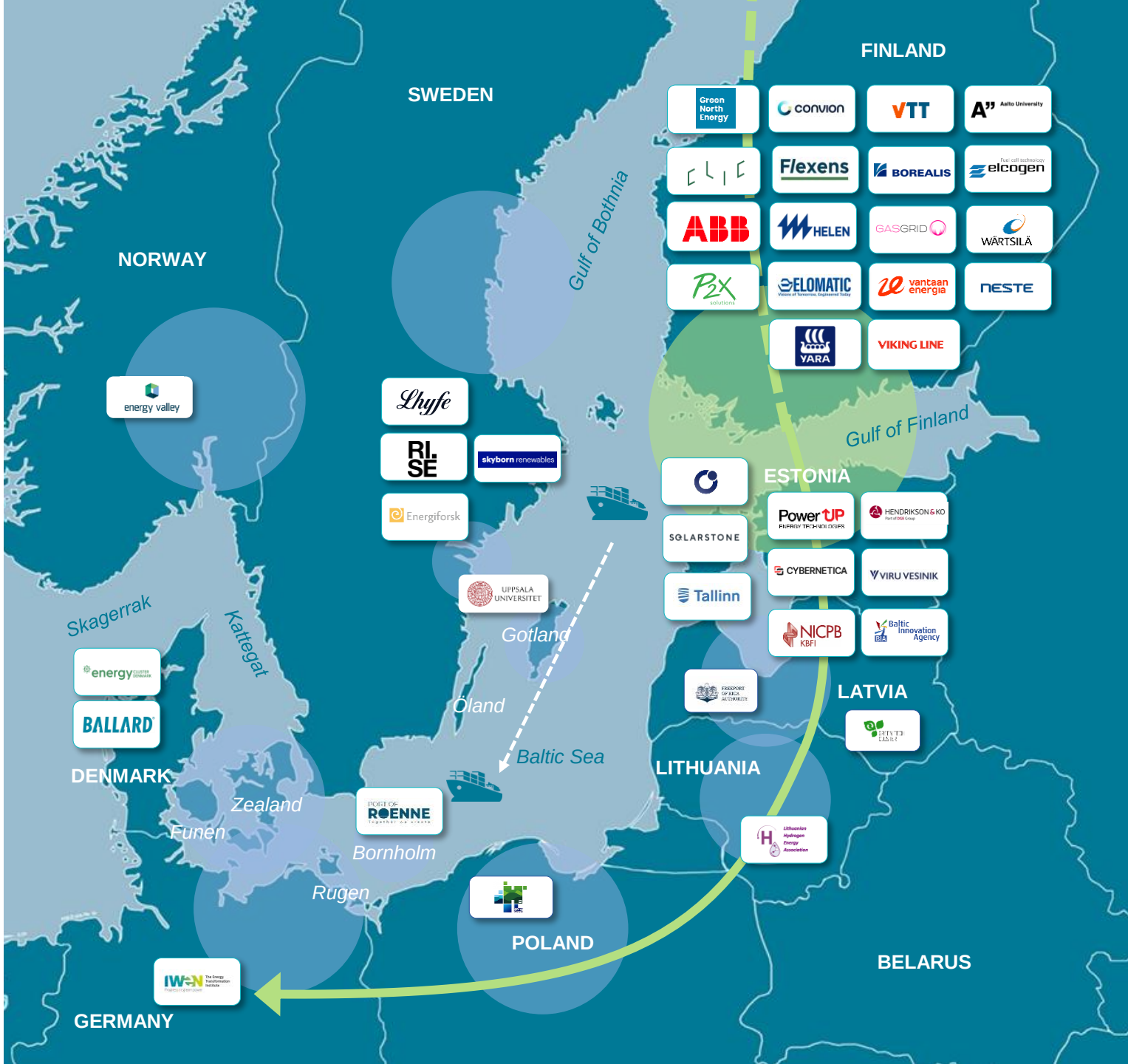
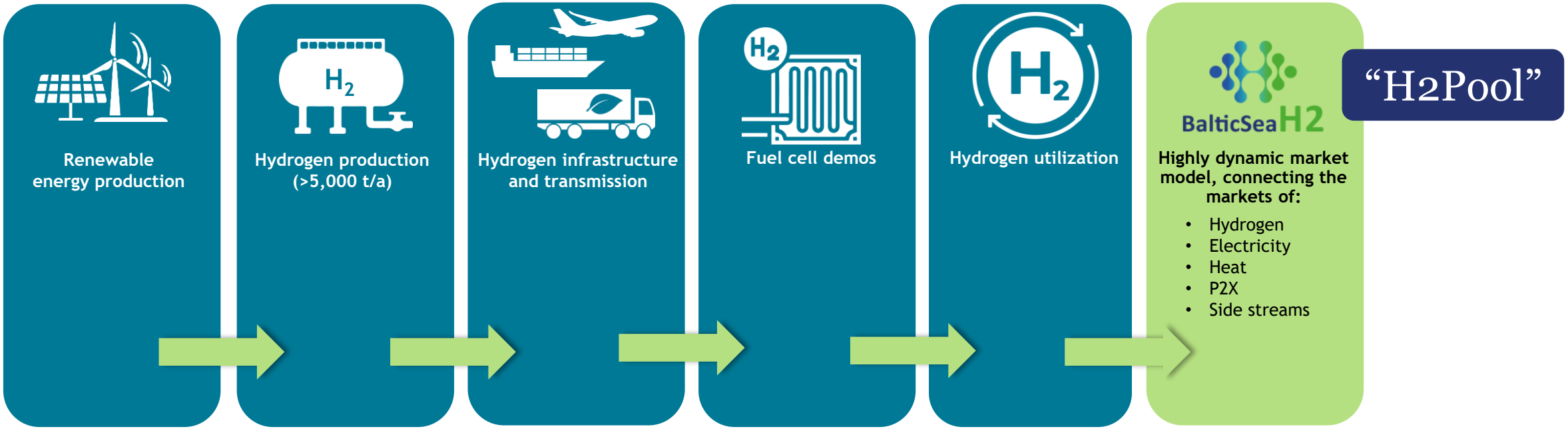


Our overall Hydrogen Valley concept

Coverage of the whole value network: renewable electricity providers - hydrogen producers / heat utilizers - H2 logistics providers - biobased CO2 sources – e-product producers & users



Sector integration leads to more efficient use of primary energy, minimizes carbon emissions in various industries, and improves energy security and self-sufficiency.

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Working on two parallel tracks

1. Valley implementation

2. Co-creation for shaping of the hydrogen economy

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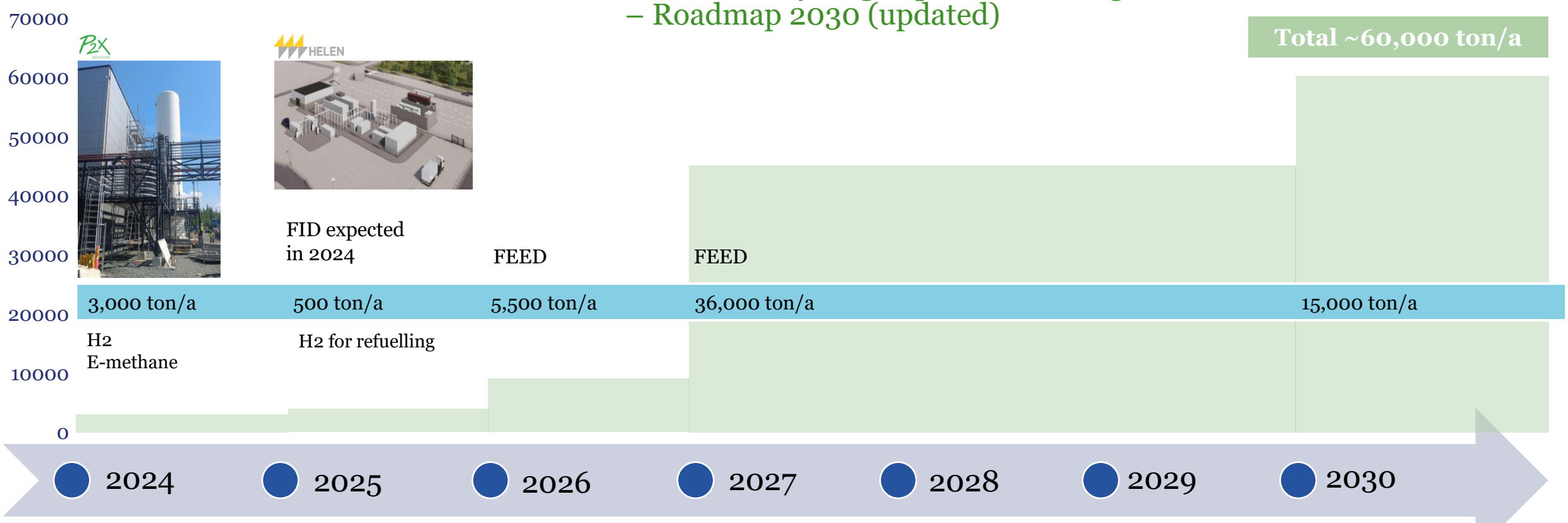
1. Valley implementation

Tons of new renewable hydrogen produced in use cases with FID

BalticSeaH2 renewable hydrogen production targets – Roadmap 2030 (updated)



Target sectors:
Transport
Industry

Target sectors:
Transport
Energy (heat)
Storage

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Target sectors:
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Target sectors:
Storage
Other

Note: The plants that are already under construction have received investment financing from the Innovation Fund, or IPCEI, RRF, or other funding from the Finnish ministry or the Finnish Climate Fund.

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BalticSeaH2 case: P2X Solutions

- P2X Solutions' 20 MW Harjavalta plant, operational in 2024, is the first industrial-scale renewable hydrogen and synthetic methane production plant in Finland
- Harjavalta plant kickstarts Finnish hydrogen economy by showing example, creating supply, and demonstrating the production part of hydrogen value chains
- …but there is more to come: Joensuu and Oulu production sites are in planning!

Harjavalta 20 MW production plant

- Finland's first industrial-scale renewable hydrogen and synthetic methane production plant
- Operational Sept 2024

Joensuu 30-40 MW production plant (planning)

- Planned to produce green hydrogen and district heating as a side stream
- IPCEI status
- Operational 2026 (tbc)

Oulu 100 MW production plant (planning)

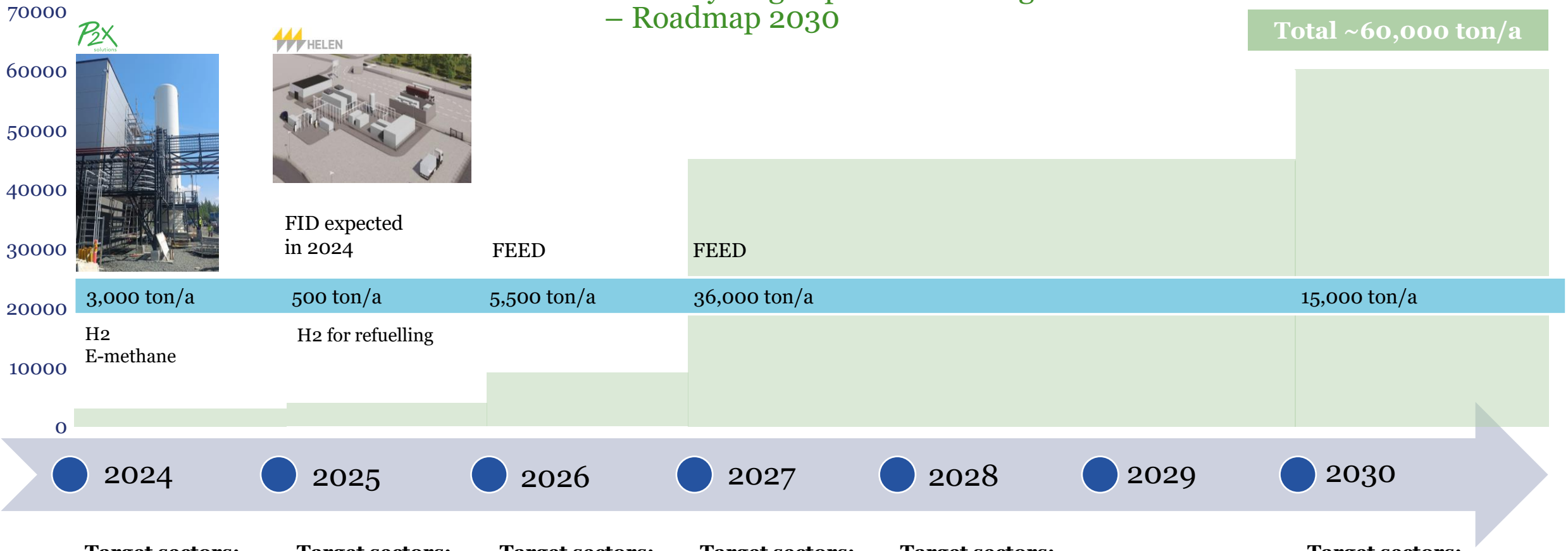
- Would also include a carbon capture plant, a hydrogen and carbon dioxide storage and processing to methanol/methane
- FID planned for 2025, operational 2028 ->

Valley implementation plan (updated)

Tons of new renewable hydrogen produced in use cases with FID

BalticSeaH2

BalticSeaH2 renewable hydrogen production targets – Roadmap 2030



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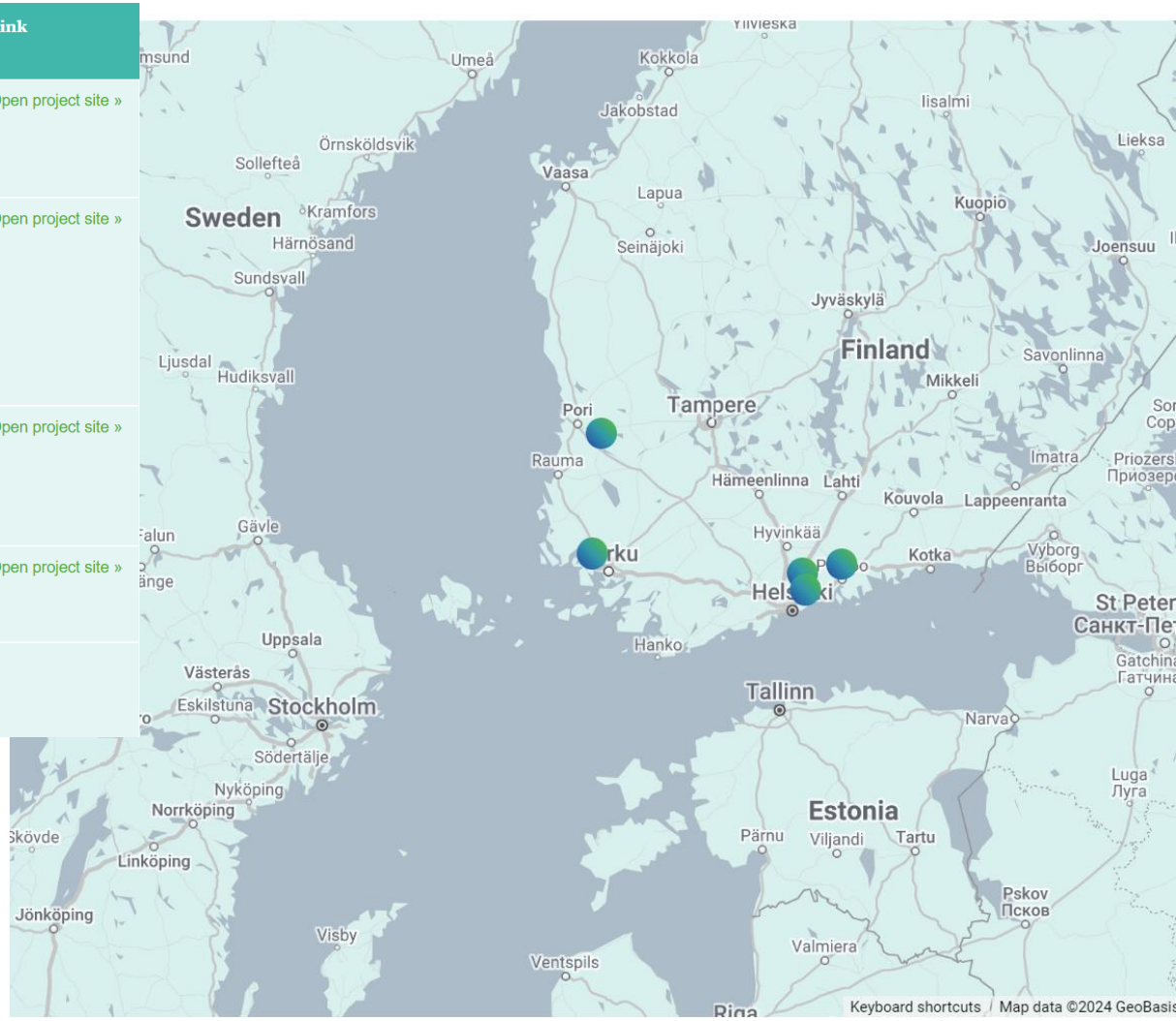
BalticSeaH2-connected investment projects

Name	Investing organisation	Location	Description	Link
GHP01 Harjavalta	P2X Solutions	Harjavalta, Finland	P2X Solutions constructs and operates 20MW electrolyser with synthetic methane production capacity in Harjavalta, Finland. Investment decision was made in Q1/2022 and plant wil be operational in Q3/2024. Plant includes the capabilities to deliver pressurized green hydrogen and synthetic methane containers to all customers in industry and transport sector.	Open project site »
3H2	Helen	Helsinki, Finland	Helen will build a green hydrogen production plant in Vuosaari, Helsinki, in the vicinity of Helsinki's district heating network and the busy Vuosaari Harbour. The capacity of 3H2 – Helsinki Hydrogen Hub pilot plant project – will be approximately 3 MW. The produced hydrogen will primarily be used through a hydrogen refuelling station that will be build next to the hydrogen plant. The refuelling station will be mainly for heavy-duty vehicles. In addition, the produced hydrogen can be delivered to customers in containers. The waste heat generated in the production process will be utilised in Helen's district heating network. The aim is to launch the hydrogen production in the new plant in 2026 and open the hydrogen refuelling station in 2027.	Open project site »
	Green North Energy	Naantali, Finland	One of the first green ammonia plants in Finland, which will also include one of the largest green hydrogen plants currently being planned in the country. As a result, contributing to 1) a substantial environmental impact through reduced carbon emissions, 2) ensuring European food security by enabling localized fertilizer production and 3) supporting maritime continuity with alternative fuel options, which is also essential for European security of maintenance.	Open project site »
	Neste	Porvoo, Finland	120 MW electrolyzer for green hydrogen production at Neste Porvoo refinery Neste's objective is to reach Final Investment Decision readiness during 2024. The aim is to utilize the heat generated in the production process for district heating purposes.	Open project site »
Industrial-scale hydrogen production	Helen	Helsinki, Finland	Helen's industrial-scale prcject case is in the range of 100 to 200 MW, where we study a possibility to construct an industrial-scale hydrogen production facility in Vuosaari, Helsinki.	



Our connected investment projects integrate multiple Use Cases to create full hydrogen value chains.

Not all investment projects are published yet – follow the project to know first when our partners publish their cases!

https://balticseah2valley.eu/investment-cases/

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2. Co-creation for shaping of the hydrogen economy

Greatest risks for the implementation of clean hydrogen economy in the Baltic Sea region include:

- Regulatory and market barriers for implementation
- Failure in raising financing for the investments
- Societal acceptance

We will co-create, engage, and share to shape the economy

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Regulatory barrier:
Case Vantaa Energy investments 1/2

- Vantaa Energy waste-to-energy case was originally a part of the BalticSeaH2 project with plans to:
  - produce **carbon-neutral synthetic methane** on a commercial scale
  - recover and **utilise carbon dioxide in large scale** to produce e.g. olefins
- Vantaa Energy decided not to invest after all.
- According to Vantaa Energy's interpretation of current regulation, **it is nearly impossible to make CCU profitable at a waste incineration plant**, as the waste that must be incinerated will include fossil-based material, even after all feasible recycling efforts.
  - RFNBO regulation advanced with more specific calculations for GHG emission reductions and specifications on what components can be used for e-fuels. Without meeting the emission reduction requirements, the product could not be sold for a carbon neutral premium price.
  - CCU is currently not recognized as an emission reduction action in waste-to-energy plants. No matter what the end-product is, the GHG emission will still show in the balance of the incineration plant even if the CO_2 leaves the plant in the form of a product.

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Regulatory barrier:
Case Vantaa Energy investments 2/2

Conclusion: Current regulation fails to promote the circulation and effective use of CO_2 in situations where emissions cannot be avoided.

Our recommendations:

- Carbon should circulate as long as possible rather than be permanently stored immediately after the first round of use.
- Regulation of CCU(S) should encourage long-term applications, such as recyclable plastics, provided that all recyclable materials have been separated from waste before incineration.
- Sustainability of waste incineration should be supervised with clear criteria: not all waste incineration is sustainable, but regulation should determine what waste can and should be incinerated and what incineration is unsustainable.
- One possible solution would be a separate status for the circulated carbon from unavoidable waste incineration:
  - Waste incineration-based carbon should have a different status than coal burning-based carbon, with different sustainability criteria, similarly to the ones stated in biomass regulation.
- Overall, waste incineration lies at the intersection of waste regulation and energy regulation. We recommend that the EU examines waste incineration comprehensively to establish functional rules for the industry.

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Lesson learnt:
CO_2 is an important part of Hydrogen Valleys

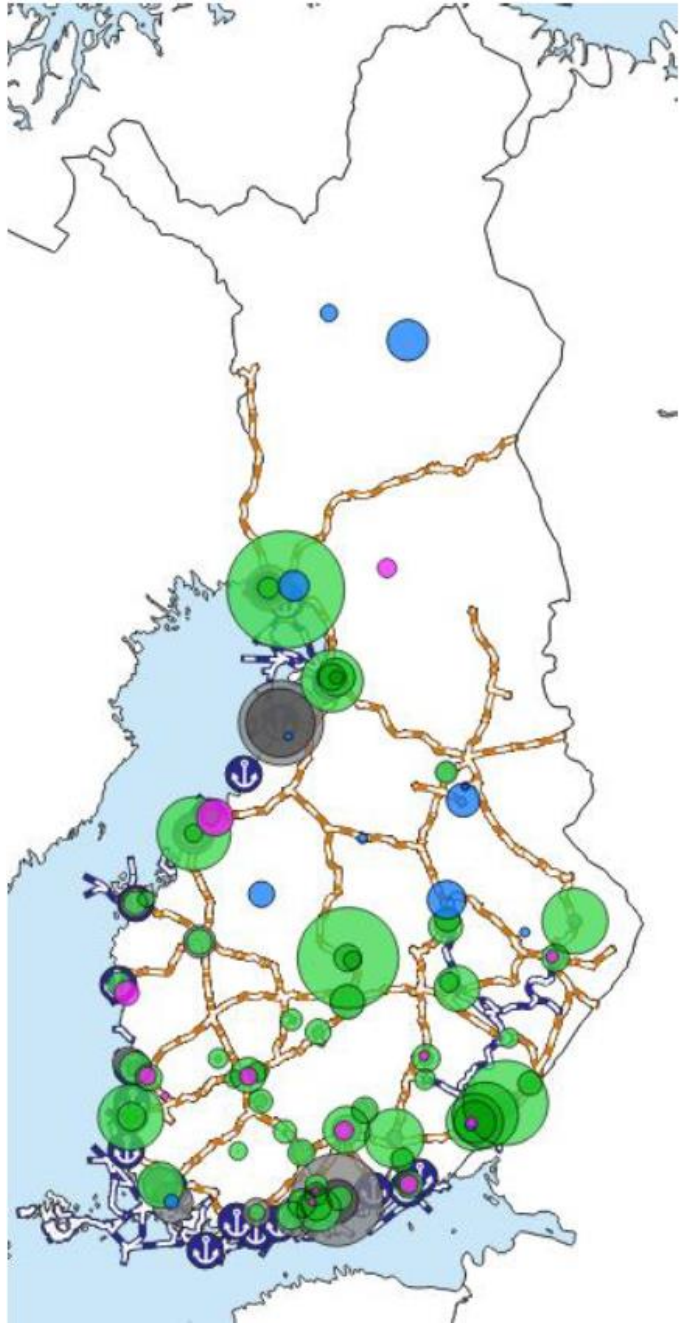
Fossil CO_2: 15.3 MtCO2

Biogenic CO_2: 28.3 MtCO2

Total: 43.6 $MtCO_2$ from 70 industrial plant

Includes facilities that are under ETS and have CO2 emissions of ≥ 100 $ktCO_2$/yr in Finland

- VTT is conducting a study on CO_2 logistics and infrastructure to create an outlook on CO_2 terminals and inland hubs and find the optimal modes of CO_2 transport
- A holistic view and planning is needed on the development of hydrogen, electricity, and CO_2 infrastructures



Source: VTT (on-going study)

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Best practice:
Success requires trust, place-technology fit and shared benefits!

Local burden and benefit-sharing

Local opposition to green energy initiatives is gaining prominence in the BSR and can pose significant challenges to H2 transition.

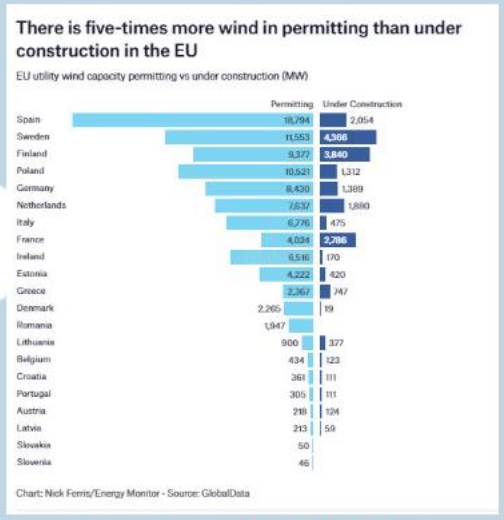
E.g., Wind power, solar power, and green steel mills have faced local opposition in the BSR, stemming from concerns over [1]

- *biodiversity*
- *noise and visual disturbance*
- *place identity & place-technology-fit*
- *perceived threats to other industries*
- *indigenous rights*

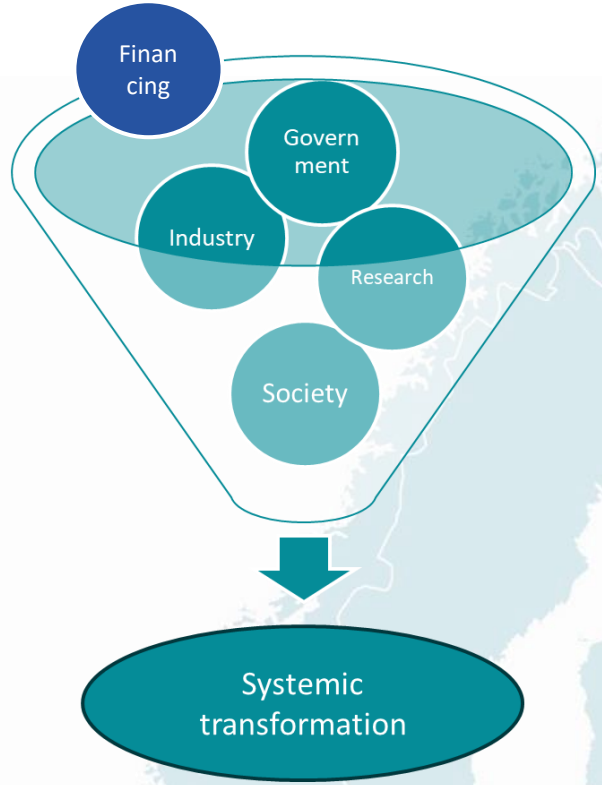
Other factors in local opposition [2]

- *lack of trust in governments, science & companies*
- *lack of meaningful engagement*
- *fast pace of the planning and execution*
- *unawareness*

H2 transit & justice.



Power Technology 24.10.2023



Geels et al. Science (2017); König et al. In: Industry, Innovation and Infrastructure (2020)

Together we will **co-create** a just Baltic Sea-wide joint Hydrogen Economy:

BSR diagnosis & RES potential analyses → Co-Creation for valley visions & market model → H2Pool marketplace development → Growth plans & Exploitation & Replication

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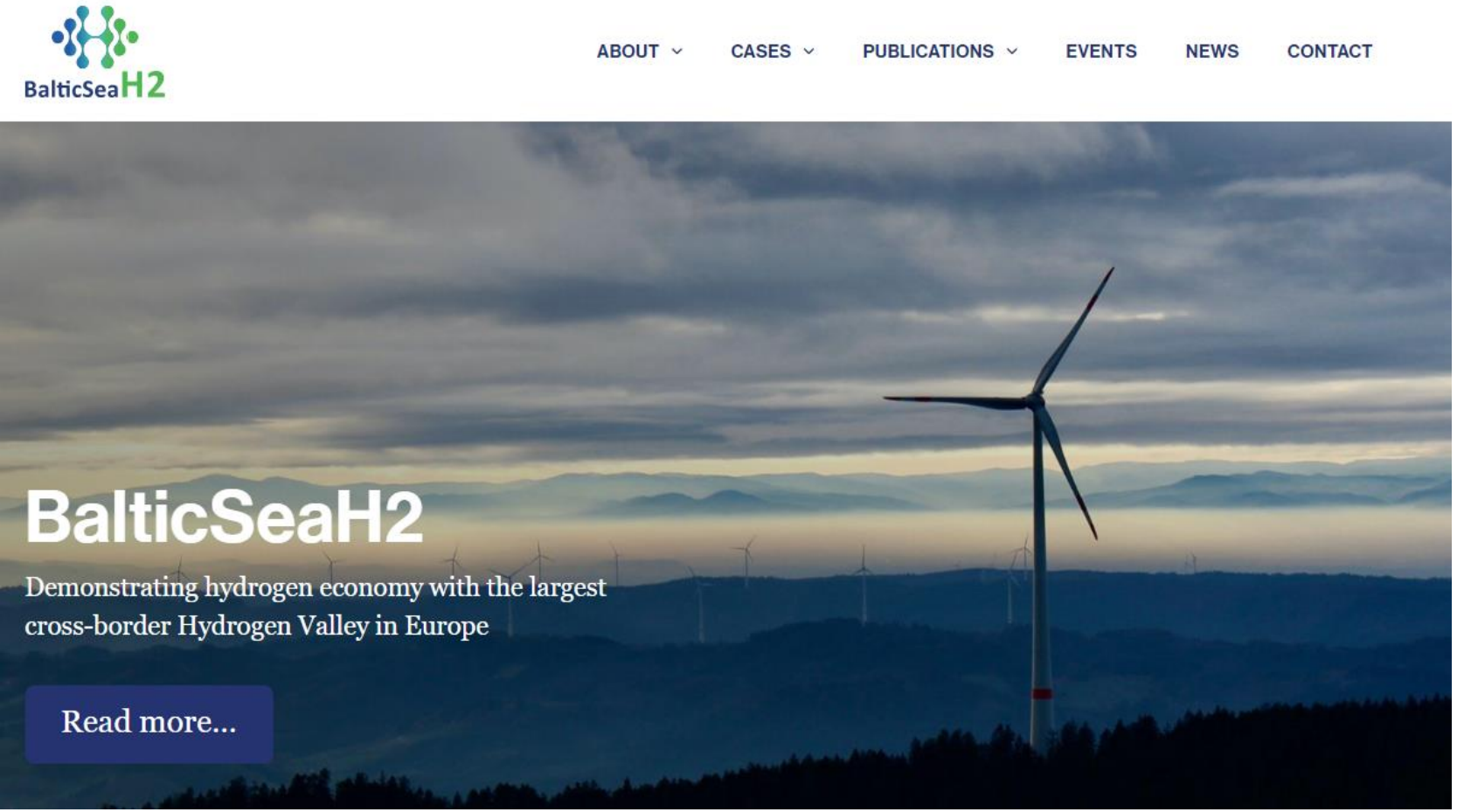
Learn more about BalticSeaH2



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Thank you!

Get in touch: Jatta.Jussila@clicinnovation.fi

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