> **“Running a society 100% on renewables affordably requires sector coupling, integration of storage solutions and implementation of emerging technologies**
>
> *Berndt Schalin, CEO Flexens*

Flexens

FLEXIBLE ENERGY SOLUTIONS

Hydrogen Replacing Oil in Maritime

A presentation to Vesinikupäev 2021, Keemia Instituut in Tartu

15.10.2021 Berndt Schalin

Advanced project development rooted in research

With a society scale demonstration as reference

Background in strategic research, Tekes SHOK programs:
2010-2015 Smart Grids and Energy Markets
2010-2014 Future Combustion Engine Power Plants
2012-2016 Efficient Energy Use
2015-2016 Future Flexible Energy Systems

SMART ENERGY ÅLAND

2014
–”Aloitetaan energiakäänne Ahvenanmaalta”

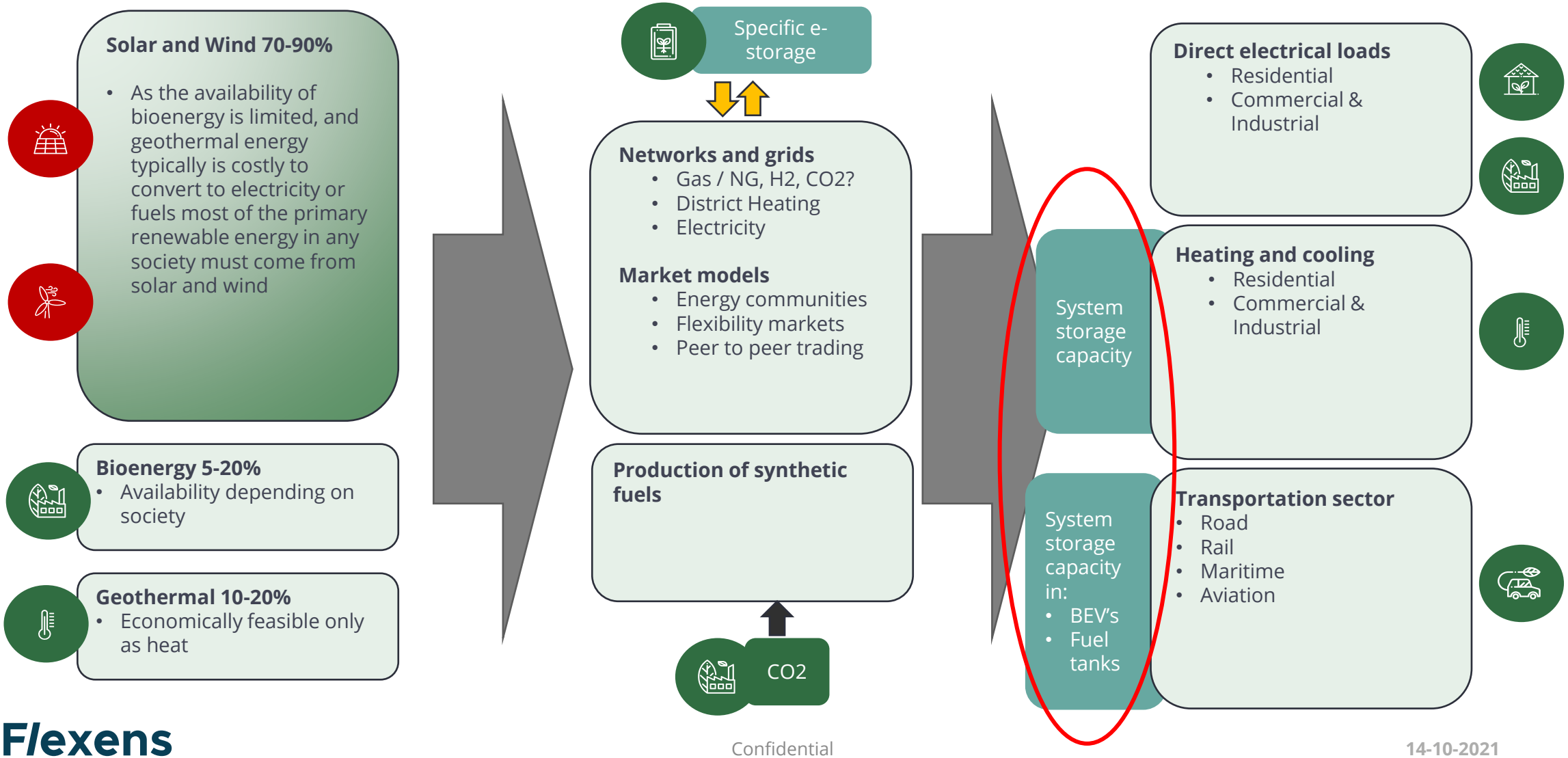
2015- 2018
–FlexE demo and creation of ecosystem

2018
– Flexens founded

2019
– Growth engine finance secured

AIMING AT BUSINESS ACTIVITIES AMOUNTING TO BILLIONS OF EUROS

Key findings and concept



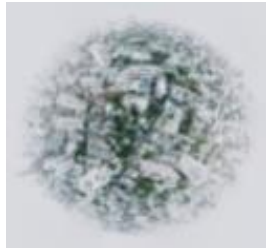
Examples of demo projects

SMART ENERGY ÅLAND

Hydrogen ferry running on locally produced green hydrogen

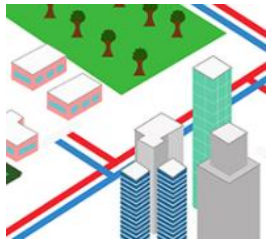
Energy storage integrated in wind farm

Pumped hydro energy storage



Flexibility market

Energy Island community



Energy portal

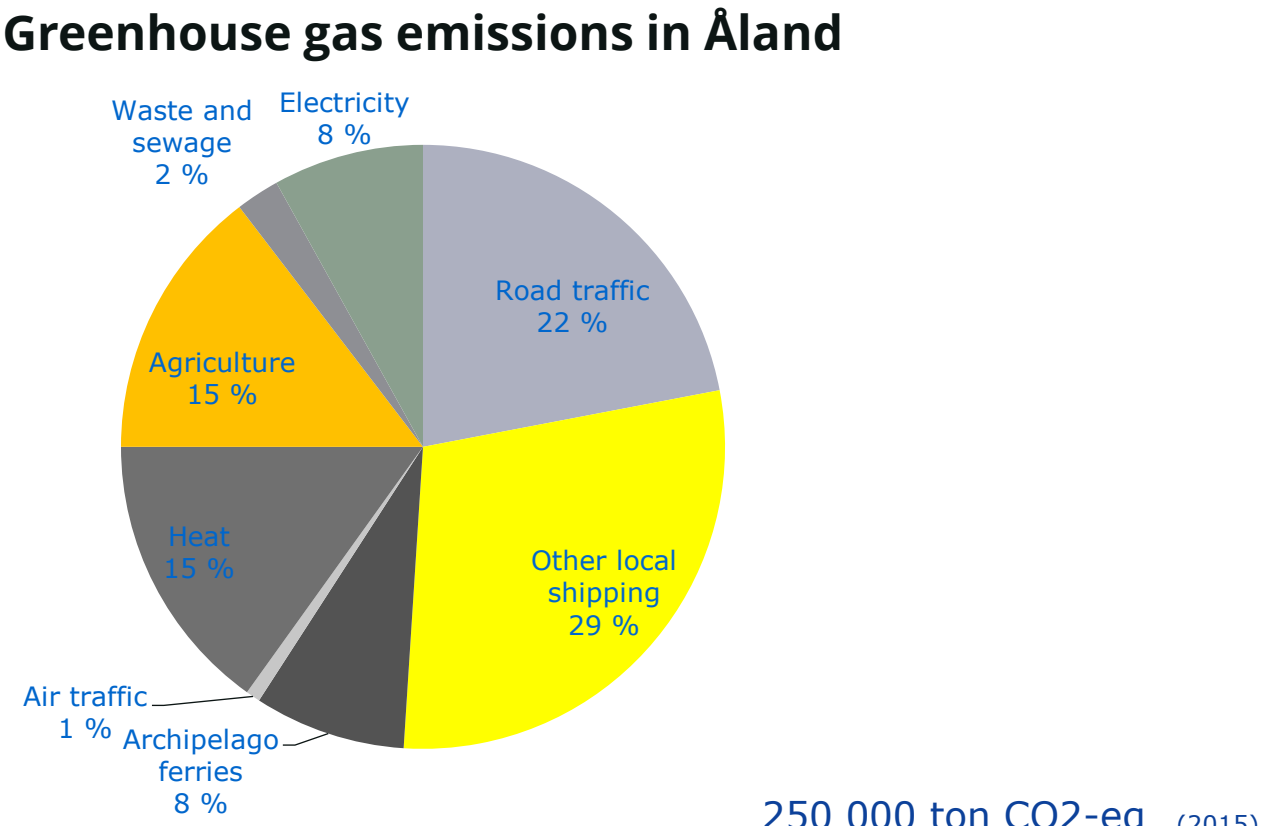
LocalRES

This project has received funding from the European Union's Horizon 2020 Programme under the Grant Agreement no. 957819

Flexens

A CO2 free energy system

The Åland view

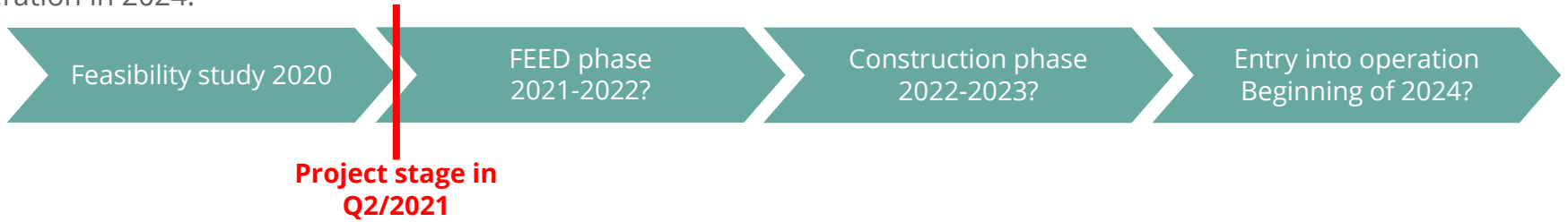


250 000 ton CO2-eq (2015)

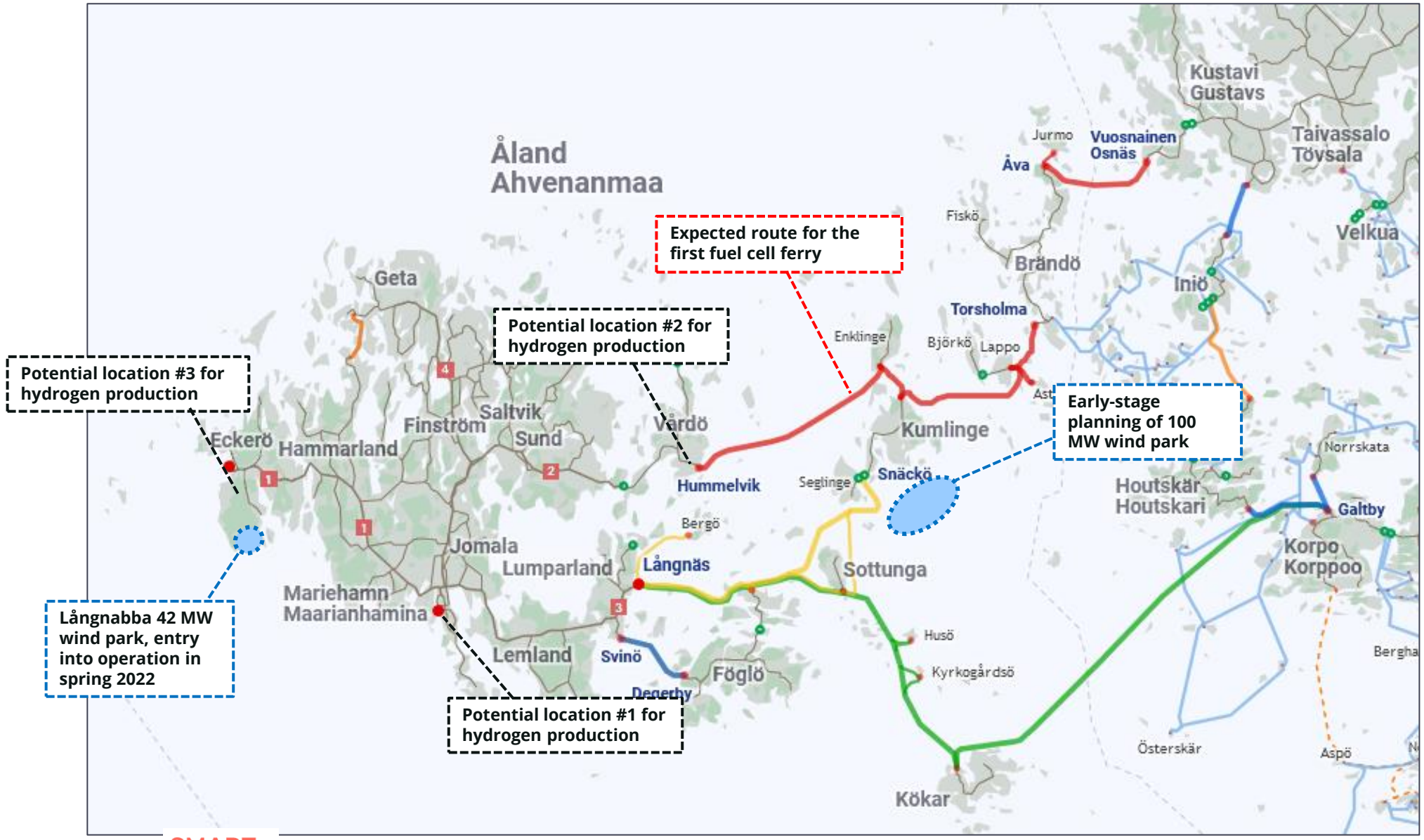
Power2AX PROJECT

LOCAL GREEN HYDROGEN PRODUCTION FOR A FUEL CELL FERRY IN ÅLAND, FINLAND

The feasibility study of Power2AX project was delivered by two engineering offices, Deltamarin and Elomatic in November 2020. In the best-case scenario, if the project would be advanced full-speed, hydrogen ferries could be expected to enter operation in 2024:

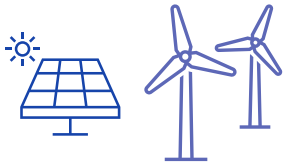


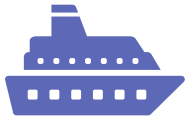
(Archipelago ferry routes as coloured lines)



Expanding the Hydrogen ferry concept

Matching optimal hydrogen production costs with high value transport use





Wind power Solar power

Production cost of solar power and wind power is expected to keep decreasing in 2020-2030, especially in off-shore wind parks. New off-shore wind parks are planned around Baltic Sea.

Hydrogen production in electrolyser

Hydrogen production cost is in majority dependent on the cost of used electricity.

Hydrogen production cost should be minimised by,

1. avoiding power transmission fees by direct integration with electricity production
2. recovering heat produced in the electrolyser
3. using electrolyser for balancing power and frequency control

(optional: processing further to other P2X fuels or chemicals)

Hydrogen can be used as a raw material for chemicals or further P2X fuels:

- e-methane CH4
- e-ammonia NH3
- e-methanol CH3OH

Logistics (Ports!)

Logistics of hydrogen (or other P2X fuels) can be minimised when electrolyser is located close to end-users, e.g. at **ports**. Sea connections enable efficient tanker/bunker logistics.

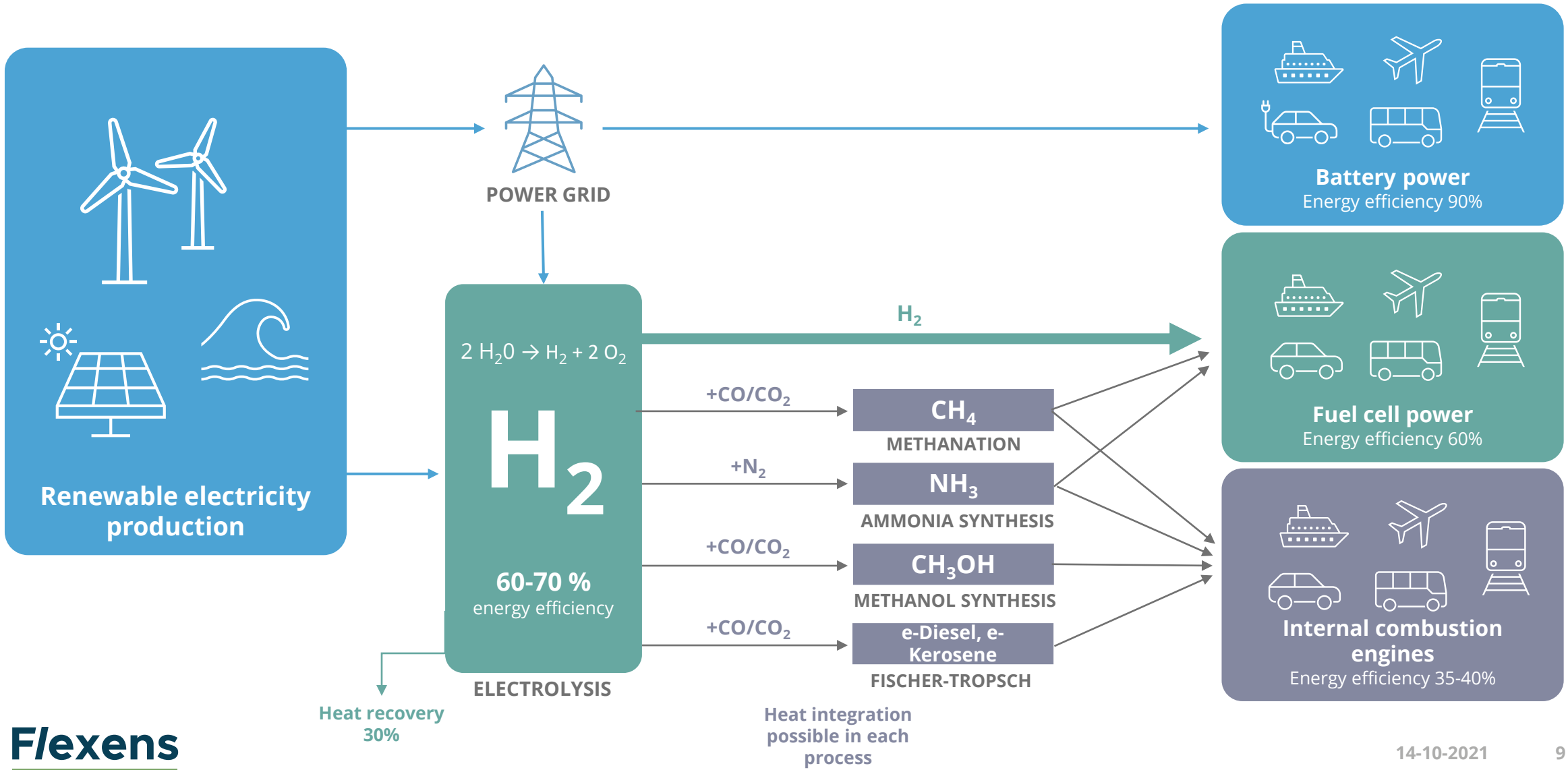
Maritime use and delivery

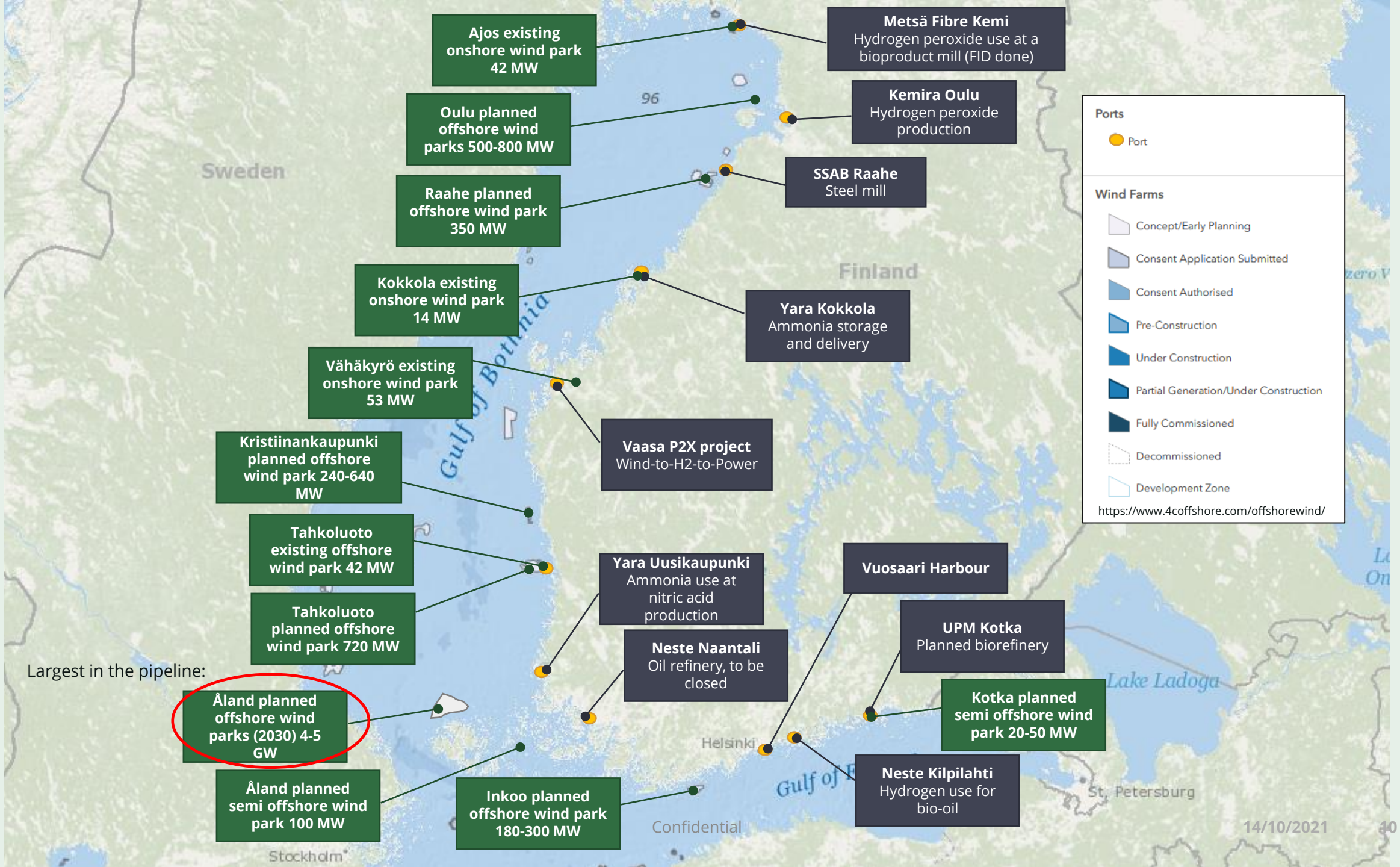
Renewable power sources for maritime applications are limited.

Short distance ferries can operate with batteries but fuels are needed for sail times longer than one hour. Availability of biofuels is limited which sets high hopes on e-fuels.

Power sector will run future logistics

Availability of biofuels is limited; E-fuel will be needed.





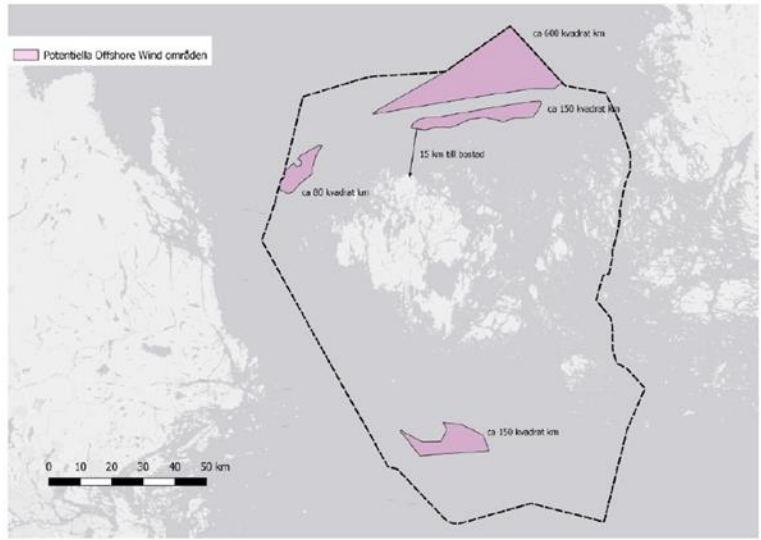
Largest in the pipeline:

Opportunity on Åland

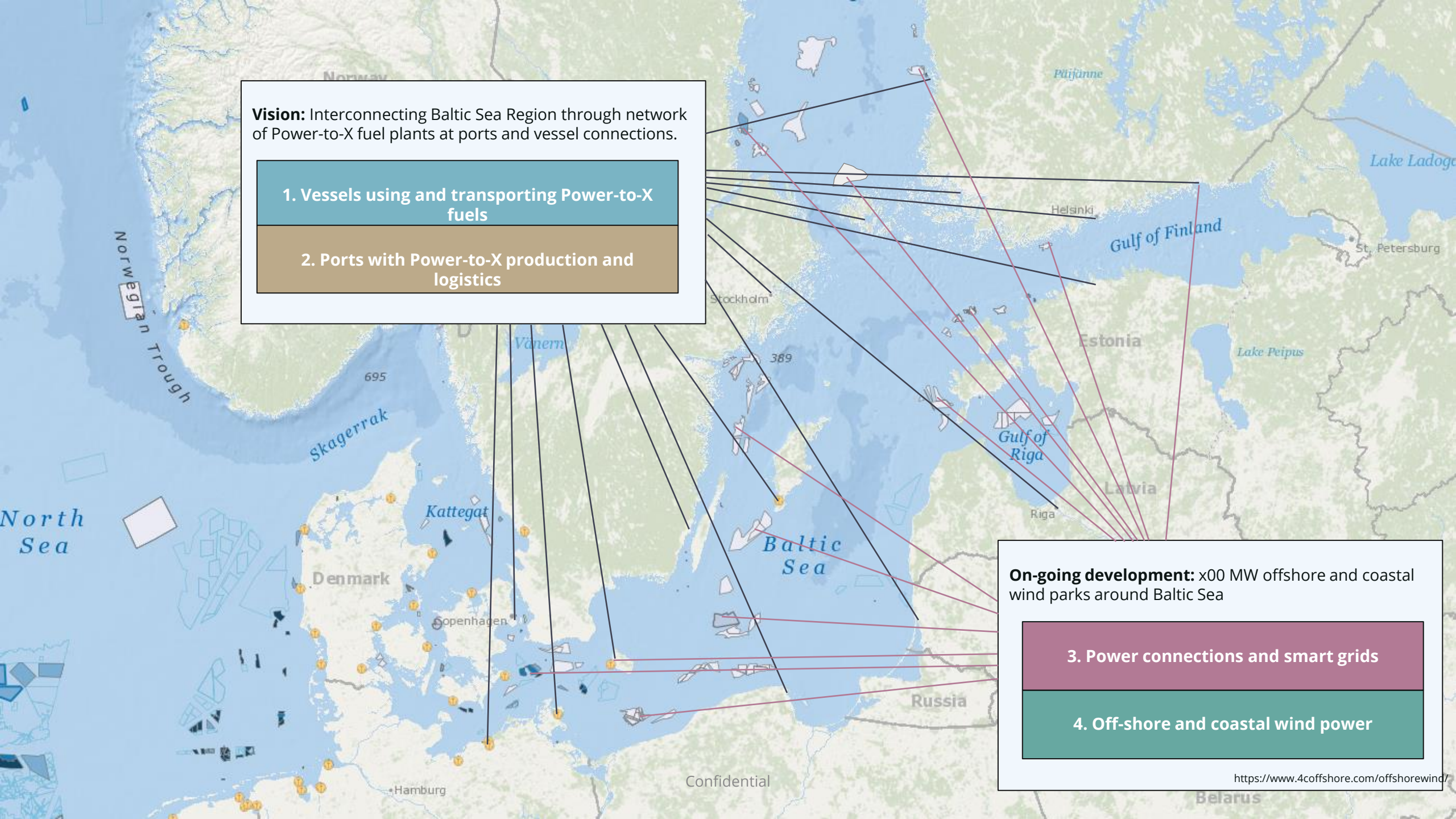
The potential is identified in the Maritime Spatial Plan for Åland territory

- The identified areas provide space for up to 6 GW of wind power
- This corresponds to e.g. 45% of the current electricity consumption in Finland
- Discussions on ministerial level with both Finland and Sweden initiated
- A target for the local government is to utilise the opportunity for developing local added value on top of the potential lease income for the seabed

Havsplansförslagets energiområden



Ålands landskapsregering



Vision: Interconnecting Baltic Sea Region through network of Power-to-X fuel plants at ports and vessel connections.

1. Vessels using and transporting Power-to-X fuels
2. Ports with Power-to-X production and logistics

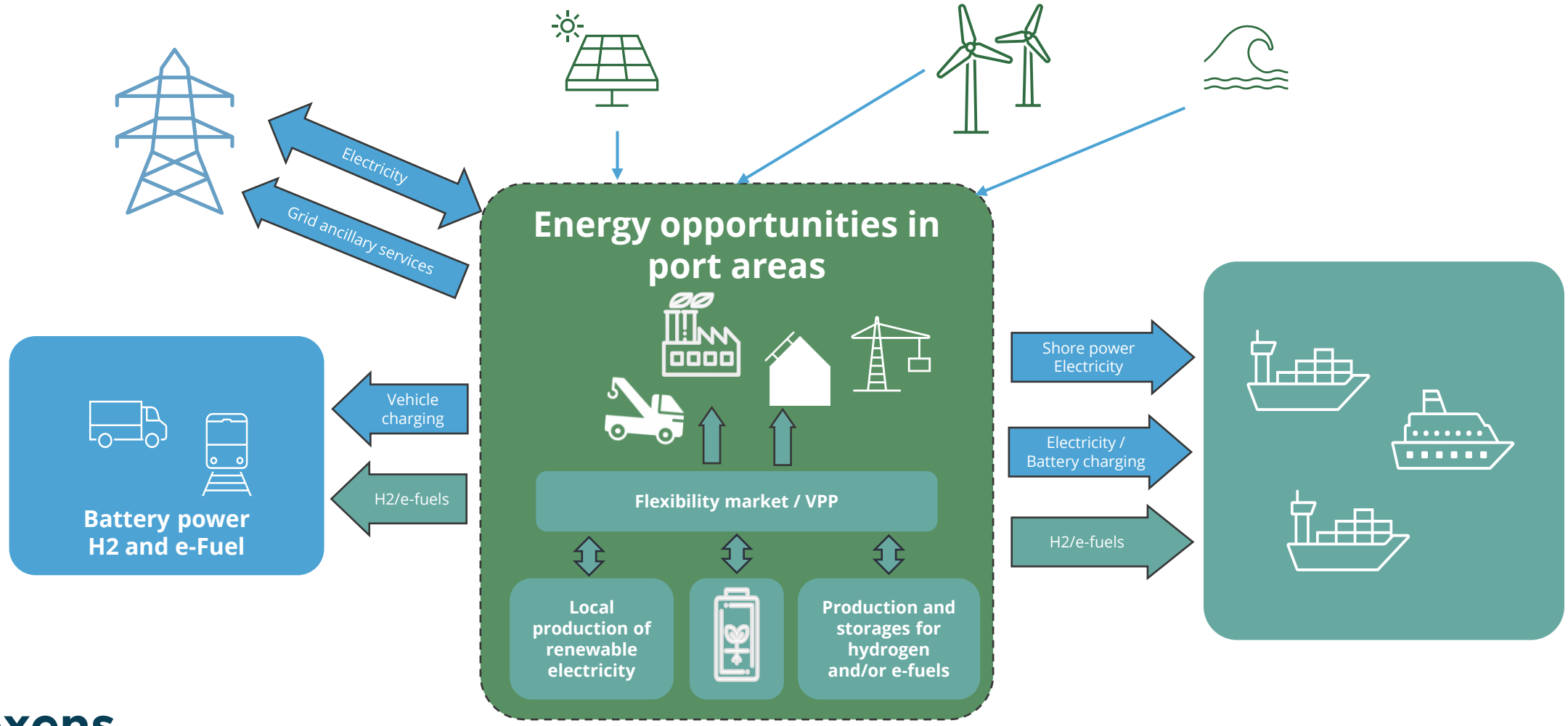
On-going development: x00 MW offshore and coastal wind parks around Baltic Sea

3. Power connections and smart grids
4. Off-shore and coastal wind power

https://www.4coffshore.com/offshorewind/

Hydrogen and the energy transition in port areas

An opportunity to rethink the energy system in ports



Flexens

FLEXIBLE ENERGY SOLUTIONS

Thank you