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POWER-TO-X IN FINLAND: ENERGY, ECONOMY AND SECURITY

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PROJECT MANAGER

EEVA LÄHDESMÄKI

- >> Green electrification
- >> Power-to-X Economy and ecosystems
- >> Sustainable energy investments and competitiveness

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POWER-TO-X IN FINLAND: ENERGY, ECONOMY AND SECURITY

What this talk will cover:

- PtX economy: Energy, economy and security
- Strategic research agenda for finnish hydrogen research



EU UNDER PRESSURE: DEFENCE, ENERGY & ECONOMY

SECURITY & STRATEGIC RISKS

- EU/NATO border from Norway to the Black Sea = new frontline
- Full EU under strategic threat not just border areas
- Military restrictions hinder renewable energy (e.g. wind power)
- >> Centralized energy (e.g. nuclear) = high-risk targets
- Surveillance, intelligence & rapid decision-making needed



SECURITY ENERGY ECONOMY

ENERGY & ECONOMIC PRESSURE

- EU electricity demand to increase 3-4× (fossil phase-out + electrification)
- >> Wind & solar = essential for green transition
- In Central Europe the demand is higher than the capability to produce renewable energy
- Border regions face economic decline & social dissatisfaction
- Finland & Nordics = major potential for producing clean energy

Source: Accelerating the European Renewable Energy Transition, 2022 <u>https://www.greens-efa.eu/en/article/study/accelerating-the-european-renewable-energy-transition</u>





THE ROLE OF EASTERN FINLAND



Refining of carbon dioxide into methanol (MeOH)

- The annual new, industrial turnover would be EUR 11 billion/a, assuming that the price of a tonne of methanol would be EUR 1000
- The energy content exceeds the annual fuel consumption of Finnish land transport.
- Own fuel production resilience
- Solving the radar problem would cost EUR 0.6 0.9 billion¹⁾
- The repayment period would be about one month.

Sources:

- South-East Finland Hydrogen Valley Research report <u>https://lutpub.lut.fi/handle/10024/164642</u>
- Hydrogen and Carbon Value Chains in Green Electrification (HYGCEL)
 <u>https://www.lut.fi/en/hygcel/results/key-messages</u>
- Final report of the working group on wind power construction in Eastern Finland <u>https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/165725/TEM_2024_28.pdf?sequence=</u> <u>1&isAllowed=y</u>





PROJECTS AND CONCRETE ACTIONS

GREEN HYDROGEN AND CARBON DIOXIDE – POWERING SOUTHEAST FINLAND

WIND POWER AS A SENSOR PLATFORM

PROJECT RESILEAST – EASTERN SHIELD







Sensor & Data Technology Piloting Renewable Energy as Dual-Use Infrastructure Strategic Security & Energy Resilience



STRATEGIC RESEARCH AGENDA FOR FINNISH HYDROGEN RESEARCH



STRATEGIC RESEARCH AGENDA FOR FINNISH HYDROGEN RESEARCH: Insights from the Hydrogen research forum Finland

Participating organizations: Hydrogen research forum Finland -12 Finnish universities and research institutes

Selection of research topics: 24 out of 83 research topics were chosen as the most important for Finland's competitiveness

Value chain research: Seamless functioning of the entire hydrogen value chain is essential, which requires studying its different components



Key research areas pertaining to hydrogen economy



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Eastern Finland faces unprecedented risks with minimal preparation.

The vision creates unique value through:

- >> Defence infrastructure powered by resilient energy grid
- >> Crisis-ready innovative solutions
- >> Economic advantages from cross-sector integration

Target: 5% of Europe's clean energy by 2040

Key Elements of Program Implementation

- >> Economic self-sufficiency with improved defence at lower cost
- >> Develop the concept in Finland and scale it to other EU regions
- >> ResilEast concretises the EU Defence White Paper and the Eastern Finland programme.
- >> Defence-related structures rely on civilian infrastructure.
- Robust infrastructure (roads, backup systems, buildings, data connections) is built for triple-use: Defence, Economic Vitality, and Resilience.



Implementation

Source, **ResilEast- Ohjelma:** Jari Sistonen, Petteri Laaksonen, Markku Keinänen, Jami Holtari, Harriet Lonka, Joonas Hänninen,





MISSION: MORE POWER, MOREPOWERFUL SENSORS WITH A COINVESTMENT CONCEPT

BREAKING THE STALEMATE: UNLOCKING WIND POWER AT FINLAND'S EASTERN BORDER

- Wind power development in Eastern Finland has stalled due to radar interference with defence operations. A traditional radar solution would cost €600-900 millionwithout even addressing border security.
- **POWERSENSE** offers a cost-effective alternative through public-private co-investment, delivering:
- Improved border surveillance and intelligence
- Unlocking vast wind power potential and industrial growth in Eastern Finland
- Enabling P2X value chains: wind + CO_2 from forestry \rightarrow e-fuels & energy resilience
- Lower environmental impact, supporting climate goals
- Boost to national economy, RDI, business, and exports
- Stronger socio-economic development in Eastern Finland
- Alignment with ResilEast (from 05/2025) and EU's Eastern Border Shield (from 03/2025)





HIGHLY DISRUPTIVE DUAL-USE **CONCEPT FOR WIND POWER &** P2X, WITH 24/7 BORDER SURVEILLANCE

Modular, scalable, cost-effective & easy-to-install sensor package wit multiple signal passive sensors Integration into wind power or oth



CURITY BENEFITS ONOMIC & BUSINESS

NEFITS

initiative

Difficult-to-destroy upgrade to

border security, applicable to grey zone & war time conditions Strong Finnish contribution to EU & NATO early warning & Eastern Border Shield initiative

Cost-efficient co-investment in

wind power, P2X & surveillance

New business cases for several

industries via a new technology

Enables besides wind power &

investments to Eastern Finland

Supports the region's ResilEast

testing & piloting platform

CIO-EC. & REGIONAL

P2X, also other industrial

SILIENCE BENEFITS

NEW START-UPS

& BUSINESS

A NEW ECOSYSTEM: LINKING ENERGY, **IT & DEFENCE INDUSTRIES WITH** THE PUBLIC SECTOR INCL. THE ARMED FORCES

P2X INVESTMENTS & EXPORTS

ACHIEVING CLIMATE GOALS

infrastructure & deployed in a

decentralised sensor network





GREEN HYDROGEN AND CARBON DIOXIDE – POWERING SOUTHEAST FINLAND

- This initiative map and pilot technologies that enable wind energy to coexist with critical air surveillance systems along Finland's eastern border.
- >> The project have partnered with Exilion Oy at the Muukko wind farm, secured six defence technology partners, and completed initial environmental analyses.
- Advanced sensor testing, including measurement and data analyses will start in 2025, moving towards defence suitability assessments by 2026.



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