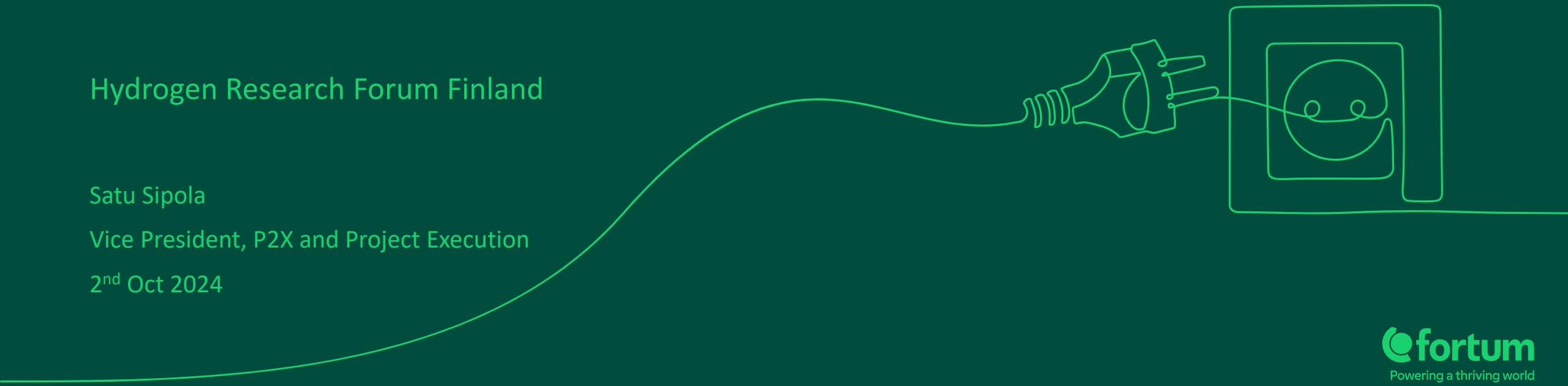
Hydrogen and P2X at Fortum



Hydrogen Research Forum Finland

Satu Sipola

Vice President, P2X and Project Execution

2nd Oct 2024

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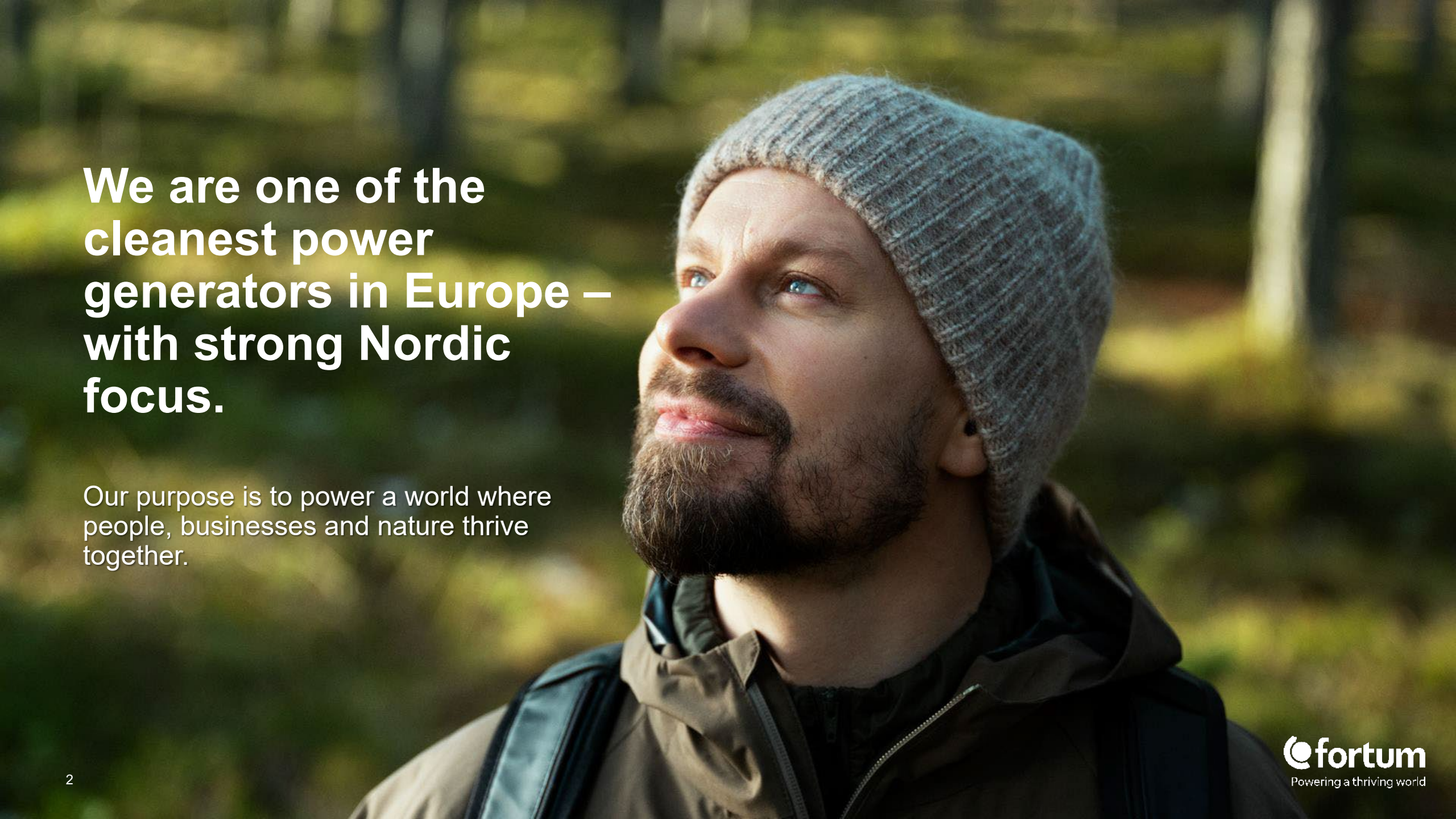

We are one of the cleanest power generators in Europe – with strong Nordic focus.

Our purpose is to power a world where people, businesses and nature thrive together.

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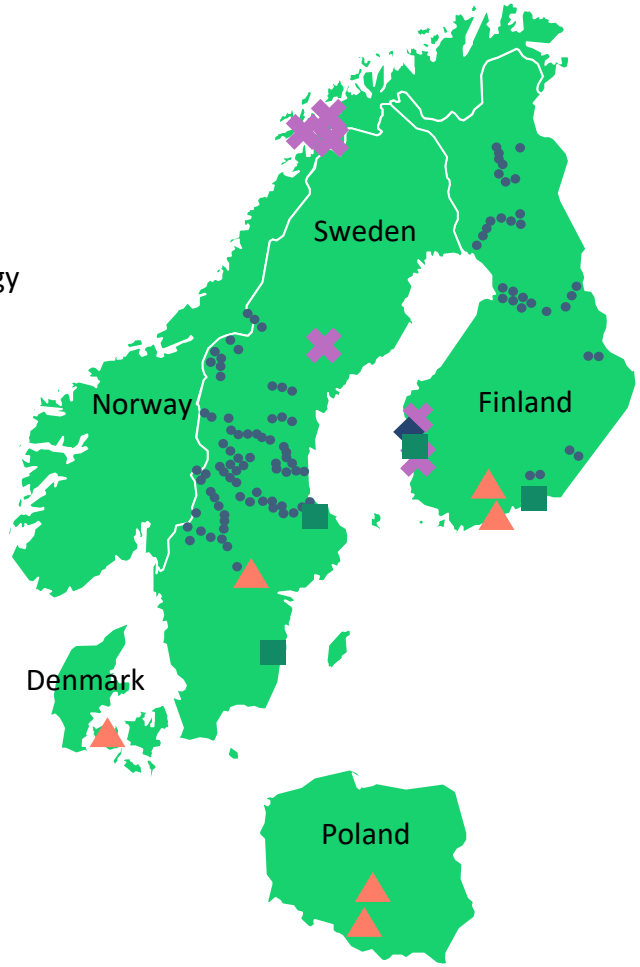
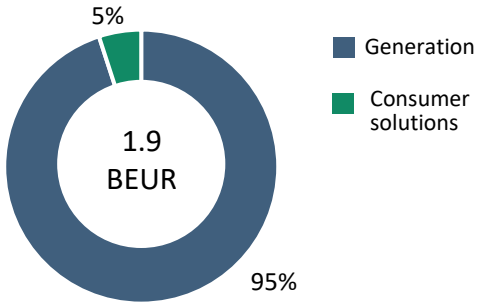
Fortum today: We are one of the cleanest power generators in Europe – with a strong Nordic focus

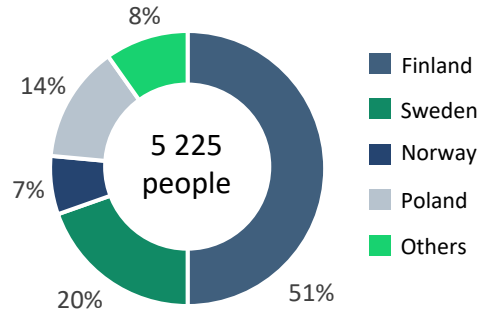
- Hydro
- Nuclear
- CHP and Waste-to-Energy
- Coal-fired power plant
- Wind



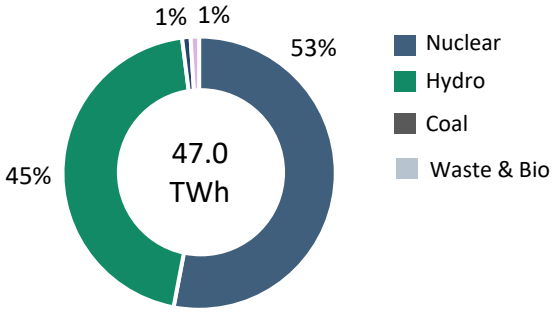
Comparable EBITDA



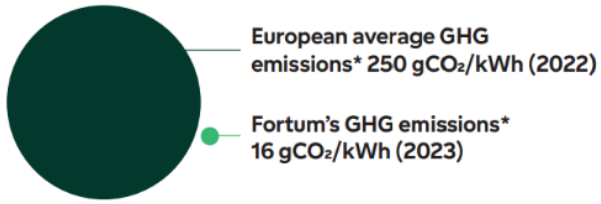
Personnel



Power generation



Specific emissions



* Specific emissions from power generation

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Fortum is uniquely positioned for driving electrification and decarbonisation in the Nordics

Our strategy – designed to deliver our purpose

STRATEGIC PRIORITIES

Deliver reliable clean energy

- Develop our best-in-class operations for efficiency, flexibility and optimization
- Continue to decarbonise and modernise operations

Drive decarbonisation in industries

- Partner with strategic customers
- Prepare ready-to-build pipeline of renewable energy to serve customer demand

Transform and develop

- New business structure, operating model, leadership team and organisation
- Transform to a customer-oriented company
- Managing and reducing business risks
- Strengthen our culture

Our business portfolio

FORTUM CORE

Strengthen and selectively grow areas of core competence, while capitalising volatile markets.

- Hydro
- Nuclear
- Flexibility and optimisation
- Customer business
- Heating and Cooling

DEMAND-DRIVEN RENEWABLES

Prepare ready-to-build pipeline to serve customer demand growth with long-term contracts.

- Onshore wind
- Solar

EXPLORE

Future-shaping by studying, validating, and developing future opportunities.

- Clean hydrogen
- Innovation & Venturing

NON-CORE

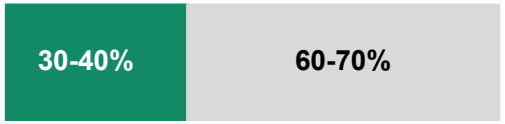
Businesses not in the core of the strategy. Strategic review.

- Circular Solutions

Power-to-X (P2X) and clean hydrogen will play a key role in the future Nordic energy system

Critical decarbonization lever for industrials to reach net zero

Share of Nordic energy-related CO2 emissions, 2021



30-40% of Nordic CO2 emissions stem from hard-to-abate segments, where indirect electrification plays a key role*

New profit pools will emerge built off clean H2

Examples of new market opportunities and value chains shifting profit pools from fossil fuels to renewable power and H2

H2 will require significant new renewable power

150-200 TWh

… of **new renewable power** required to meet potential Nordic clean H2 production in 2040

H2 will act as critical demand response and system integration mechanism

>50%

… of **Nordic power production** in 2040 expected to come from **intermittent sources** (vs. ~20% today)

*Hard-to-abate segments represent the bulk of additional electricity need expected in Nordics

Source: Energy Quantified; Eurostat; Nordpool; Bain&Co analysis

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Fortum is exploring the opportunities around P2X together with customers and partners

Fortum plans to pilot hydrogen production in Finland

15.6.2023

Fortum explores prerequisites for fossil-free hydrogen production at SSAB's site in Raahe

05 June 2023, 10:00 EEST

Fortum and Metsä Group to jointly explore processing wood-based carbon dioxide with green hydrogen

27 March 2023, 14:00 EEST

Fortum and ZeroAvia to explore developing hydrogen production and refuelling infra-structure at airports

20 March 2023, 15:39 EET

Fortum's and Fjernvarme Fyn's joint carbon storage project to receive Danish Business Promotion Board funding

05 January 2023, 13:00 EET

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Fortum P2X strategic priorities

Fortum can become a trustworthy, one-stop-shop type of player in the Nordic P2X ecosystem in 2030s

Why Fortum?

1. **Electricity supply portfolio**
2. **Flexibility engine**
3. **Waste heat utilization capabilities**
4. **Strong safety- and operational efficiency culture**
5. **Trusted partner in the Nordics**

Kalla test facility

- Prove safety and technical operations
- Project development and –integration experience

First commercial project

- Prove profitability in P2X projects and validate customer demand
- Prove the small-scale technical concept based on Kalla learnings

Leverage H2 flexibility

- Build new flexibility services through our existing flexibility capabilities
- Test electrolyser flexibility at Kalla

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Kalla test center in Loviisa will provide learnings in hydrogen production

Kalla site 9.8.2024

Hystar PEM electrolyser container in Equinor's site in Norway

What

- First step of our gradual approach and reference for future projects
- Hydrogen test center with 2 different electrolyzer technologies
- Investment of 17 MEUR including construction and operations

Why

- To pilot hydrogen production and to get a proof-of-concept for potential future scale-up
- To understand features of different technologies (Alkaline and PEM)
- To understand operational safety, technical performance and maintenance related issues
- To understand and test the flexibility potential

What's next

- Construction work started, expected commissioning in late 2025
- Limited operational period of approximately two years between 2025-2028

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Stargate alkaline and Hystar PEM electrolysers at Kalla

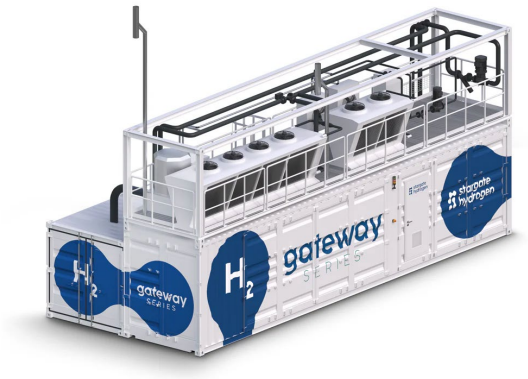
stargate hydrogen

Electrolysers Stacks Case Studies Why us News Resources

17.06.2024

Fortum chooses Stargate's Hydrogen Alkaline Electrolyser System for hydrogen production in Finland.

Helsinki, Finland, 10/06/2024 - Fortum will build a hydrogen production plant in Loviisa, 90km east of Finland's capital, Helsinki. The plant will be equipped with Stargate's novel electrolyser and will be located near Fortum's Loviisa nuclear power plant, at Kalla test center. The construction is set to begin in the summer of 2024, and the plant is scheduled to be commissioned in late 2025.



hystar about solutions contact news careers

Written by Donata Marciulionyte

Finland, PEM, project

Hystar signs contract with Finnish company Fortum to supply a 0.75 MW electrolyser

Hystar AS has signed an agreement with Finnish mostly state-owned energy company **Fortum** (www.fortum.com) to supply a 0.75 MW electrolyser for Fortum's hydrogen pilot plant in Källa, Loviisa, Finland.

Fortum's hydrogen pilot plant, located east of Helsinki, is set to be commissioned in late 2025. Hydrogen will be produced by electrolysis, by using electricity to split water into hydrogen and oxygen. A filling station will be built in connection with the plant for the delivery of hydrogen to industrial customers. Hystar will supply a 0.75 MW containerised PEM electrolyser system.

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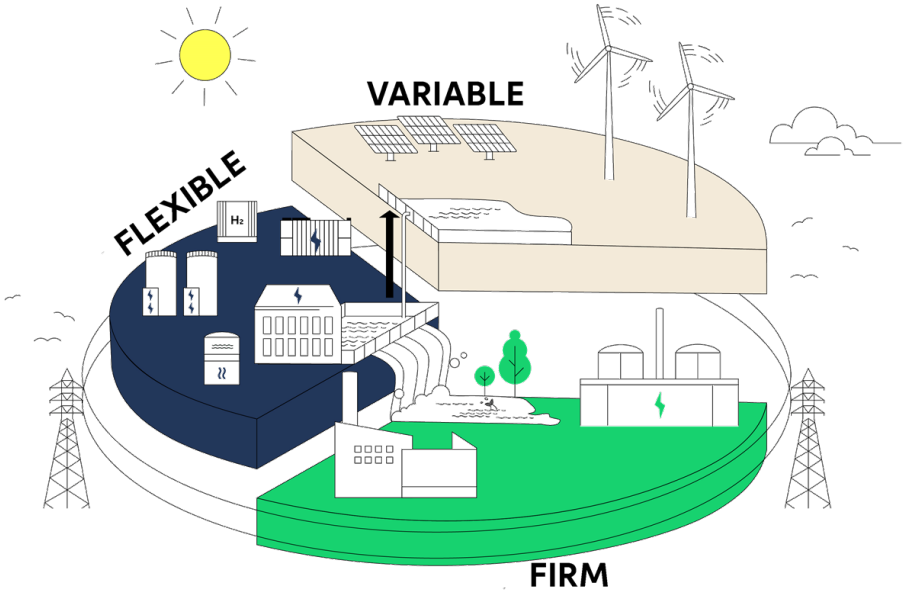
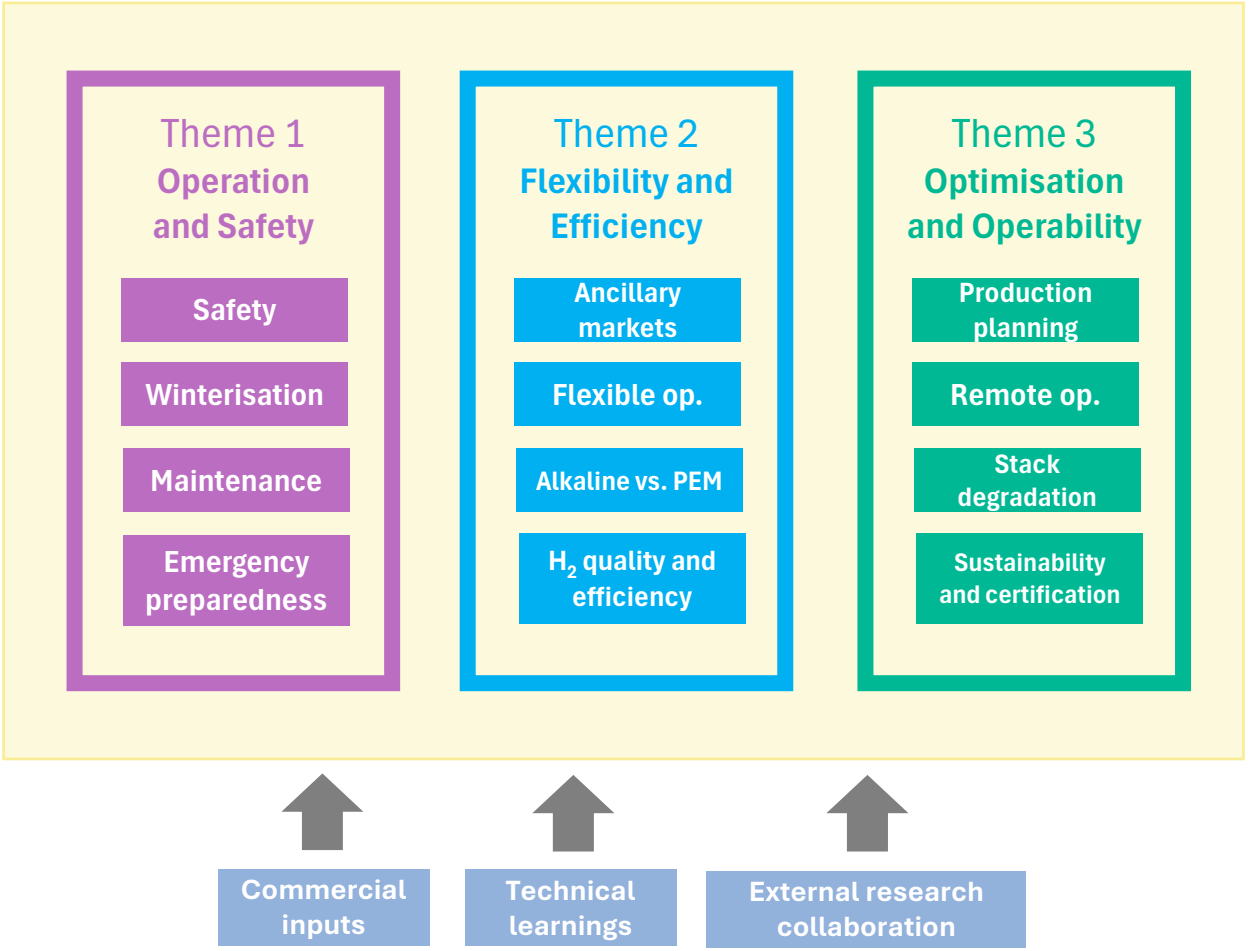
Key priority of the Kalla R&D program
– fully reflecting our strategic priorities

- **Exploring and building Fortum's competitive edge in the hydrogen production value chain**
  - Project integration and execution learnings
  - Safety and operation experience
  - Hydrogen flexibility
  - Understanding differences between alkaline and PEM
  - Value chain exploration
  - External research collaboration





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We are open for collaboration in the following topics

- Hydrogen production plant operational safety and operational excellence in the Nordics
- Integration and dynamic modelling of hybrid energy plant that includes hydrogen production
- Artificial intelligence and data literacy in hydrogen production plant
- Flexibility of a hydrogen production plant and optimisation
- Heat recovery and oxygen utilisation
- Life cycle analysis and sustainability topics

Reach out for further discussions!

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+358 50 453 2089

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