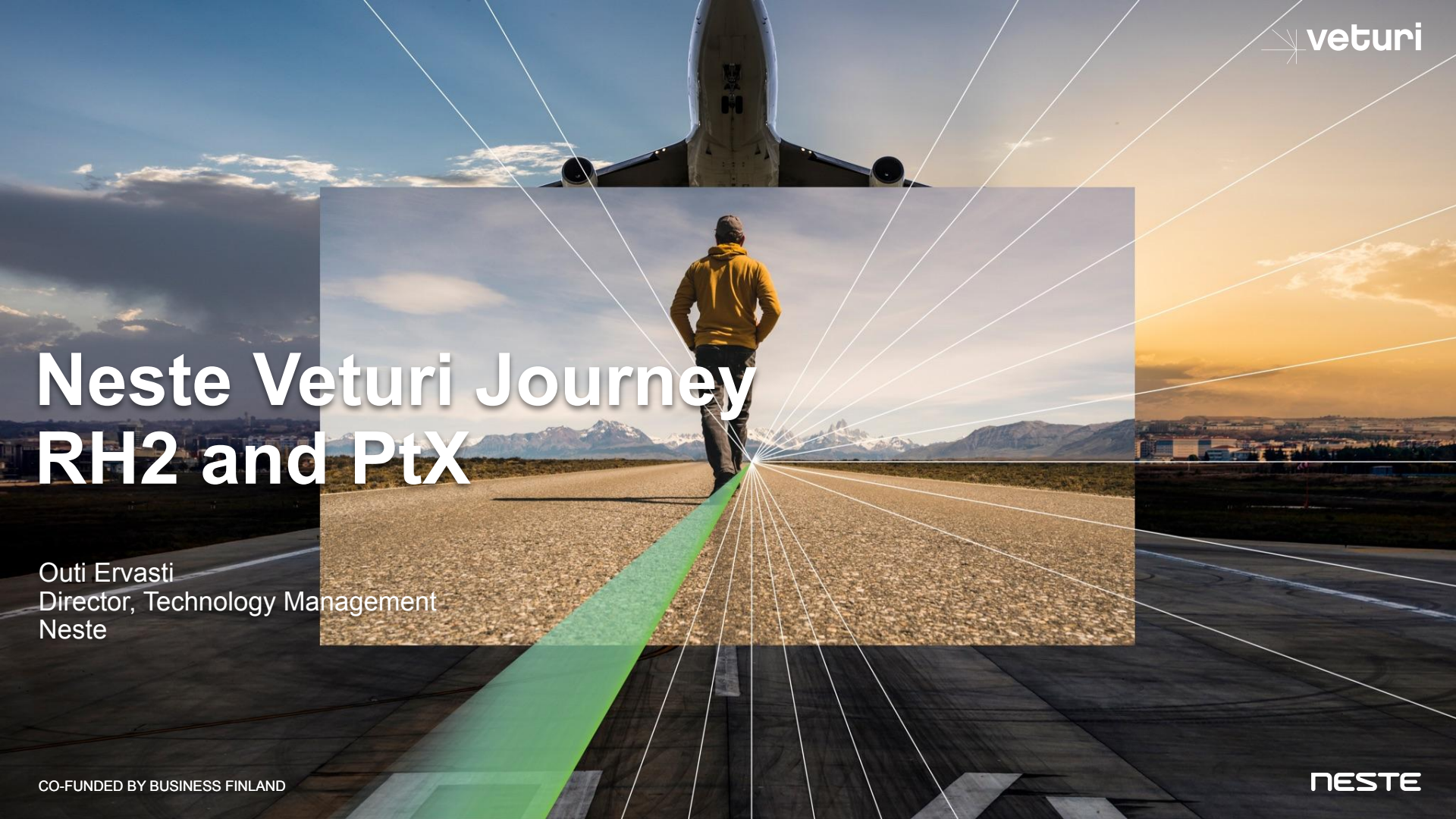

Neste Veturi Journey RH2 and PtX

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CO-FUNDED BY BUSINESS FINLAND

Scope of Veturi research along the RH2 and PtX value chain

In total 24 internal projects and 7 consortium projects

CCS/U

- Carbon capture technologies
- Forest industry carbon capture
- Carbon utilisation opportunities along various end uses

Hydrogen

- Technology evaluations
- Safety
- Hydrogen Storages
- Electrolyser heat utilisation
- Market opportunities

PtX and e-fuels

- Different e-fuel pathways and related technology development
- Concept studies for e-fuel plants
- Integrated e-fuel project

Electricity-related

- Renewable electricity sourcing
- Power transmission capacity expansion to Kilpilahti

Significant amount of partners participated in Neste Veturi RH2 and PtX projects

We worked with 63 different organisations

Highlight:
Integration of value chain was proofed in the E-Fuel Project

"The results were excellent both what regards emission reductions and drivability. The e-fuel developed in this project is one of the most promising future energy solutions for machinery". Kari Aaltonen, product development director, AGCO Power

- Consortium of 15 companies along the entire e-fuel value chain
- A production chain covering carbon capture, renewable hydrogen and liquid e-fuel production was constructed
- Hundreds of kilos of e-fuels were produced
- During the project, technologies of project participants were developed further
- The end product, e-diesel, was refined at Neste Porvoo refinery and tested in AGCO Power's Tractors.

External factors impacted strongly our R&D&I focus

Euphoria at the beginning, followed by COVID

2019 - 2021

“Riding on multiple horses”

Broad spectrum of research topics throughout the value chain

Both renewable hydrogen and CCS in focus in Porvoo

Russian attack to Ukraine, energy crisis and inflation

2022 - 2023

Avoid dependency on fossil fuels

Focus on self-sufficiency and electrification

Stop CCS studies in Porvoo

Inflation escalated investment costs

RED III and reduction of renewable fuel mandates

2023-2024

Reality check

Small mandates for intermediary use of hydrogen in refineries were a disappointment -> revisit Neste’s green hydrogen project concept

“Guns instead of butter” - huge investment in defense at cost of clean transition?

2025 -

Cost-efficiency in focus

E-fuels are still too expensive -> put on hold at Neste.

Cost-efficiency has to be the priority for players in the hydrogen landscape.

Key learnings

1. Valuable insights from multiple projects have helped us to define our role in the hydrogen value chain and prioritize.
2. Accepting not so promising results as valuable information.
3. Hydrogen economy requires collaboration along the value chain – we were able to demonstrate successful technical integration.
4. Cost assumptions for RH2 and PtX were misleadingly low five years ago. Likewise, technology readiness was lower than claimed.
5. Significantly improved cost efficiency is critical for the future success of hydrogen economy.

Thank you!

We thank Business Finland and our Veturi partners
for enabling us to gain world-class knowledge
on the RH2 and PtX value chain!