Panel 5: Airports as an Enabler of Greener Aviation

Annual Safety Conference 2022

EASA Airport Safety & Environmental Sustainability through Innovation

EU2022.CZ | EASA
Your safety is our mission
European Aviation Environment Report (EAER) 2022

- Independent, objective and accurate source of information
- Support to evidence-based policy-making
- Recommendations on how to further improve the level of environmental protection

What is the environmental performance of the European aviation sector?

How might the sector's performance evolve in the future?

What measures are reducing climate change, noise and air quality impacts?

How can the sector further improve its level of environmental protection?
Fostering green airport operations and infrastructure

EAER 2022 – Airport recommendations #2

“To incentivise and enable the development and implementation of necessary green airport infrastructure and operations (e.g. standards on supply of SAF / hydrogen / electrification)”

IMAGINING THE SUSTAINABLE OF TOMORROW
FACILITING THE SUPPLY OF « CLEAN » ENERGY

EASA ANNUAL SAFETY CONFERENCE 2022
OUR CONVICTION

The future and development of our business depends on an **ACCELERATED ENVIRONMENTAL TRANSFORMATION**
BE A PIONEER IN THE IMPLEMENTATION OF NEW ENERGIES

TOWARDS INTENSIVE ELECTRIFICATION

Electricity (400 Hz) and Air Condition Unit to limit APU use

GSE Electrification

Electric Taxi

Electric and Hybrid Aircraft

→ RENEWABLE ELECTRICITY

Guarantee of origin

Corporate Power Purchase Agreement
BE A PIONEER IN THE IMPLEMENTATION OF NEW ENERGIES

SUSTAINABLE AVIATION FUELS

Sustainable Aviation Fuel chains certified to date, others to come

Infrastructures already able to operate with Sustainable Aviation Fuels in CDG and ORY

Sustainable Aviation Fuel used on a continuous basis in LBG since mid-2021

GMR:
Development of a project in India of sustainable aviation fuel production (FASEP project)

Demonstration of SAF integration

May 18th, 2021
CDG - Montreal

7 t SAF
Used Cooking Oils
-15% CO2 emissions
Blend 16%

“2025 Pioneers” strategic roadmap
IN PARTNERSHIP with Airbus and Air Liquide, Group ADP investigates the feasibility to deploy hydrogen infrastructure to refuel future liquid hydrogen aircraft.

1. HYDROGEN TERRITORIAL ECOSYSTEMS

PREPARING THE ARRIVAL OF THE LIQUID HYDROGEN AIRCRAFT

PARIS: preparation of ecosystems on the 3 platforms

NUEVO PUDAHUEL: launching studies (April 2022) for a hydrogen territorial ecosystem

“2025 Pioneers” strategic roadmap
A TRIPARTITE COOPERATION TO PREPARE THE LH2 AIRPORT INFRASTRUCTURES

A MOU between Airbus, Groupe ADP et Air Liquide officially signed and publicly announced in June 2021 at the Paris Air Forum and completed in Q1 2022.

International panel study – LH2 supply chain study for airports:
- Patterns of hydrogen supply: cost, footprint, energy requirements, timeline

Paris Case study for making CDG and Orly “hydrogen-ready”:
- LH2 volumes assessment
- Definition of the LH2 supply chain and characterization of the associated issues at the territorial and national levels
- LH2 storage and distribution configurations at airport
- Pre-sizing and implementation studies of LH2 infrastructures
- Evaluation of COSTS

A TRIPARTITE COOPERATION TO PREPARE THE LH2 AIRPORT INFRASTRUCTURES
STRATEGIC KEY LEARNING
ABOUT LH2 INTEGRATION AT AIRPORTS

Supply chain patterns

• A clear list of possible supply chains has been defined, that includes LH2 trailers, pipelines, and on- and off-site production and liquefaction.

• The threshold effects among these options and their variations depending on the type of airports are understood.

Infrastructure feasibility at airports

• The integration of the infrastructure in most airports seems feasible.

• Integration challenges identified in few airports: large airports in an urban environment and little spare surfaces available (10% of the 30 airports studied).

Cost assessments

• A first high-level assessment shows a very high degree of cost variability, depending on LH2 demand volumes during ramp-up phase and electricity costs.

• Understanding the drivers of this variability and how to mitigate them will be crucial for the development of hydrogen aviation.
A TYPICAL H2 ROADMAP FOR A LARGE AIRPORT

Traffic maturity

High traffic ramp-up

Larger aircraft enter service

2035 - 2040

2040 - 2045

2045 - 2050

2050 - 2060

Service introduction

Dedicated LH2 infrastructure when truck traffic is becoming too important

Several phases of infrastructure building required on ~ 30 years

CDG

Up to

600 flights LH2
700 LH2 Tons

Per day at maturity (hyp. 2060)

High-temperatures from demand market model

ORY

Up to

300 flights LH2
350 LH2 Tons

Per day at maturity (hyp. 2060)

High-temperatures from demand market model

Electric power & energy needed at maturity (hyp. 2060)

Estimate of electricity needs for electrolysis & liquefaction

Electrolysis represents 1.5 GW and 12 TWh/year

0.8 GW TWh/year

Electricity represents 0.7 GW and 12 TWh/year

LH2 truck import

LH2 infrastructure in operation at the airport
HYDROGEN LARGE AIRPORT LH2 FARM LAYOUT

- Electrolyser module
- LH2 tank farm + departure of cryo-pipes
- Liquefier module
- Electrical Transformers & Electrical rooms module
- Truck loading bay
Peter Esteie
Head of Ground Operations & Airport Safety, Airbus

Annual Safety Conference 2022
EASA Airport Safety & Environmental Sustainability through Innovation
ZEROe
Towards the world’s first zero-emission commercial aircraft

Peter Esteie, Head of Ground Operations & Airport Safety, Airbus
Ecosystem Partnerships Strategy

Airbus acts as facilitator and catalyst, bringing together all major players across the Ecosystem.

Timeline

2021

Understand

Engage with leading airlines, energy providers, infrastructure & airports, non aviation sector, etc.

2023

Partner

Develop partnerships & projects in strategic regions with high market potential

2025

Prepare EIS

Deploy hydrogen hubs at airports globally

2028

Global deployment phase

Deploy hydrogen infrastructure globally

- Airport Ecosystem
- Energy Providers
- Airlines
- Regulatory Bodies
- Non-aviation
- H2 Alliances
- Investment Funds

Images: ICAO, Lufthansa Group, Daimler trucks
Main topics studied by these partnerships:

- Local and global H₂ supply chain studies
- Adaptation of airport infrastructure for H₂
- Hydrogen Hub @Airport
- Airline network studies
- H₂ aircraft operations
- Communication/advocacy

Ambitious partnership strategy with hydrogen industry, airports and airlines to jointly build a roadmap of hydrogen supply for aviation
Hydrogen Hubs at Airports

Why Airports as Hydrogen Hubs?

- Airports are heavy goods transport hubs (machinery, buses, trucks, … and aircraft)
- Heavy transport requires hydrogen for decarbonisation
- Airports hydrogen hubs which will also prepare for zero emission aviation

Airport hydrogen hubs will:

- Prepare regulations and standards for the handling of hydrogen at airports
- Ensure that a large number of airports worldwide are supplied with LH$_2$ by 2035
- Foster efficiency improvements and cost reductions in hydrogen liquefaction, storage and distribution
Thank you
Mikko Viinikainen
VP Sustainability & Environment
Finavia Corporation

Annual Safety Conference 2022
EASA Airport Safety & Environmental
Sustainability through Innovation

Your safety is our mission
FINAVIA
for smooth travelling
Net Zero Carbon Finavia Roadmap

Mikko Viinikainen, VP Sustainability and Environment, Finavia Corporation
Finavia is an airport company that leads and develops 20 airports in Finland.

We work to improve Finland’s connectivity.
At Helsinki Airport, we are part of global competition.

Our customers consist of airlines and passengers.
We develop the customer experience at our airports to ensure smooth travel.

Sustainability is important to us.
Finavia’s airports are carbon neutral.
Use of energy in Finavia’s operations at its airports

Consumption of energy in Finavia’s operations
• Vehicles and machinery, 25GWh
  – Passanger cars, vans, buses, trucks, snow removing and other machinery
• Heating, local or district heating, 55GWh
  – Terminals, machinery shelters etc.
• Electricity, 80GWh
  – Lighting, air conditioning, machinery etc.
• Other use
  – Emergency power generators

Energy efficiency is prioritized in investments
Improving energy efficiency is paramount

Environmental Management Systems Helping Airports

**Environmental Management System ISO14001**
- Commitment by top management
- Creates the platform for the “Monitoring and measuring engine” to gather data for evaluation of performance and improvements
- EMS is a tool, not a proof of performance

**Airport Carbon Accreditation ACA**
- Industry-specific guidance on measuring and reducing CO₂ emissions
- Practical means for engaging stakeholders
- Forms a basis to voluntarily exceed the air transport industry’s general goals regarding CO₂

**Sustainability Assessment of Buildings BREEAM (LEED)**
- Major steps in energy efficiency can only be made cost-efficiently in new infrastructure projects
- Airport’s goal-setting on certification pushes designers to apply ambitious technical criteria instead of business-as-usual standards
Kittilä
Lapland illuminated by the Northern Lights

Rovaniemi
Official airport of Santa Claus

Oulu
The capital of Northern Scandinavia

Vaasa
A gem of Northern Ostrobothnia

Turku
A medieval city along the River Aura

Helsinki
The shortest route between Asia and Europe

Helsinki and four airports in Lapland are on Airport Carbon Accreditation (ACA) Level 4+

Finavia’s operations at all of its airports are carbon neutral.

But we are aiming at Net Zero Carbon emissions.
Further CO₂ reduction measures

• Vehicles and machinery, 25GWh
  – Switching to electric machinery, when feasible
  – Switching to renewable fuels only (others)
• Heating, local or district heating, 55GWh
  – Switching to geothermal power
  – Sourcing green district thermal energy where available
• Electricity, 80GWh
  – Increased production of solar electricity
  – Continuing the sourcing of wind power for the rest of the consumption
• Other use (e.g. emergency power)
  – Use of renewable fuels only
• The remaining emissions: carbon removals (elimination credits)
Carbon Neutral Today – Net Zero Carbon Tomorrow

Gradually, in 2023–2025 Finavia will switch to using of renewable energy only and will eliminate the residual CO₂ emissions by carbon capturing measures.

- Lapland Airports in 2023
- Helsinki Airport in 2024
- The whole airport network in 2025

Finavia will be a Net Zero Carbon airport operator in three years.
Thank you!

www.finavia.fi
Mikko.Viinikainen@finavia.fi
Jan Petter Steinland
Director Strategic Analysis & Transformation, CAA Norway

Annual Safety Conference 2022
EASA Airport Safety & Environmental Sustainability through Innovation
Airports as Enablers for Greener Aviation

Jan Petter Steinland
Director Strategic Analysis & Transformation
CAA NO mission – aviation should be safe, of benefit to society and sustainable

56 airports
45 heliports
69 airworthiness and maintenance organisations
24 AOC holders
Ministry of Transport

- New Aviation Strategy in the making – social, economic and environmental sustainability
- Aviation is key to maintain the societal structure in Norway
- New zero- and low emission technologies in demand for commuter/regional aviation
- Financial bodies for research & innovation to support phasing in of new technologies
- Public Service Obligations routes and possible climate criteria
- CAA Norway & state-owned Avinor have missions to support this work
A full eco-system in transformation

Infrastructure

Airspace

Aircraft & systems

Training

Operations

Fuels/energy

Rules

EASA

European Aviation Safety Agency
• Triple helix – government, industry, science
• Join forces nationally to succeed internationally
• Coordination & facilitation
• Open, including, cross-sectorial
• Mobilising key stakeholders

GREEN AVIATION NORWAY
Faster emission reductions, green jobs, better mobility
Why the collaborative approach?

Level 3
The mobility system & society

Level 2
The aviation eco-system

Level 1
New technology & concepts development

CAA NORWAY
Fossil-free airport operations by 2030 (Avinor)
Future electricity supply to airports

- First mapping carried out in 2020 - will be updated regularly
- 25+ utility companies serving Avinor’s 40+ airports
- Possible to deliver adequate charging for aircraft at all airports (based on a set of consumptions)
- Charging directly from grid most economically favourable at (almost) all airports
- Stationary batteries/energy storage relevant at some airports. Expect this market to develop
- Costs not insignificant!
- Exploring financing and business models
Planning for increasing charging needs

Utility company

Transformer

Landside
- Cars incl rental cars
- Taxi
- Buses

AVINOR (own consumption)

Tenants

Electricity production

Energy storage

Hydrogen production?

Airside
- Airport operations
- Handling companies
- Electrified aircraft
- eVTOLs

Energy management incl peak shaving
LOGISTICS AND MARKET PREFEASIBILITY STUDY
Hydrogen supply to Norwegian airports
Avinor AS

Report No.: 2023-0483
Date: 4/22/2023

Hydrogen production and/or distribution projects throughout Norway
Sustainable Aviation Fuels (SAF)

- 2014: First jet biofuel flights in Norway
- 2016: OSL #1 hub in the world to drop in SAF in main fuel farm and distribute in hydrant and dispenser system.
- 2020: Norway introduced drop-in mandate (0.5% advanced jet biofuel)
- Today
  - both e-fuels and advanced biojetfuel factories in the pipeline
  - possible increase blending mandate
As an EASA Member State:

- Safe development, testing and integration of new technologies – possibly in a sandbox format
- Provide guidance & develop own competency
- 🔄 A driver for international collaboration
- Analysis & input to regulatory development
Thank you for your time.
Sustainable Aviation Fuel as a Today solution for aviation's emissions

EASA, December 2022
SAF can reduce the GHG emissions up to 80%* over the lifecycle compared to fossil jet fuel.

* According CORSIA LCA methodology

Production of feedstock, transports, refining

SAF can reduce the GHG emissions up to 80%* over the lifecycle compared to fossil jet fuel.

**Non CO2 benefits:**

50-70% less particulates

Made from

100% waste and residues, eg used cooking oil

Drop-in solution requiring zero additional investment in infrastructure

The fuel lifecycle extends from raw material extraction to the consumption of the fuel.

* According CORSIA LCA methodology

**Production of feedstock, transports, refining
SAF can be supplied using existing Jet supply chain infrastructure
Neste’s SAF is available globally, both through Neste’s own network of airports and through distributors.
Continuing growth of the SAF market will require policy support to create demand certainty for investments

**AMERICAS**
Opt-ins continue to drive market growth
- CFS SAF opt-in
- IRA SAF BTC
- Washington
- Oregon
- California
- Opt-in schemes

**EUROPE**
Regulation and commitments are progressing
- Norway 0.5%
- Sweden 1.7%
- Netherlands opt-in 14%
- UK opt-in 10%
- France 1%
- ReFuelEU Mandated 2% by 2025

**ASIA**
Targets being set and policies explored for SAF use particularly in New Zealand, Singapore and Japan
- Brazil Mandated policies in development

Proposal for SAF % of aviation fuel at EU airports

**2022** 2%
**2030** 6%
Neste’s Sustainable Aviation Fuel capacity will reach 1.5 Mt by end of 2023, and 2.2 Mt by H1 2026

2019
100,000 tons, sustainable aviation fuel capacity

2023
1.5 Mt of SAF capacity through investments in Rotterdam and Singapore

H1 2026
Additional 0.7 Mt of SAF capacity through further investments in Rotterdam

Beyond
Continuing growth with current and new technologies

Note: 300 Mt of fossil fuels are burned every year to fuel airplanes (in 2019)
Realization of full potential will requires scale up of new technologies (3-stage roadmap)

1. Up to 10% of global jet fuel use

2. Potential exceeds global jet fuel use

3. Technical potential “unlimited”

POWER-TO-LIQUIDS (CO2 capture)

TECHNOLOGIES NEAR COMMERCIALIZATION
(Gasification/Fischer-Tropsch, Alcohol to Jet - municipal solid waste, lignocellulosic, etc.)

HEFA¹ (waste and residue oils and fats as raw materials)

Neste SAF scale up
- Current: 100 kton/a in Porvoo
- 2023: 1 Mton/a in Singapore (under construction)
- 2023: 450 kton/a in Rotterdam (feasibility study on-going)
- SAF capacity included in future renewable refineries

Source: Neste estimates
¹ HEFA = Hydroprocessed Esters and Fatty Acids
Neste has developed a solution to enable aviation’s end customers to reduce their emissions by paying for SAF. We can apply this model to drive additional emission reductions over and above regulatory requirements.
Airports have taken initiative to accelerate SAF uptake through SAF incentive schemes

- Purpose to “stimulate production and use of SAF”
- Total value €15m over 2022-2024 (€2.5m in 2022, €5m in 2023, €7.5m in 2024)
- Incentive 500 €/t for biofuel €1000/t for e-fuel
- Payable to applying airlines
- Funding through airport charges (e.g. noise, pollution, NOX levy, night time take off/landing)

- Aim to support goal of becoming “leading hub for the development and deployment of SAF”
- Total value 10 MGBP in 2022, SAF share to rise from 0.5% in 2022 to 2% in 2024
- Incentive intended to cover half the net SAF premium vs fossil jet (ca 600 $/t)
- Payable to applying airlines, allocation based on ASK
- Funding through NOX charge

- Airlines can invest in SAF to lower their CO2 emission charge (introduced in Jan 2022)
- Reduced offtake and landing fees with use of SAF
- Incentive program to cover up to 50% of cost of SAF (total funds available amount to 20 MSEK in 2022)
Thank you