

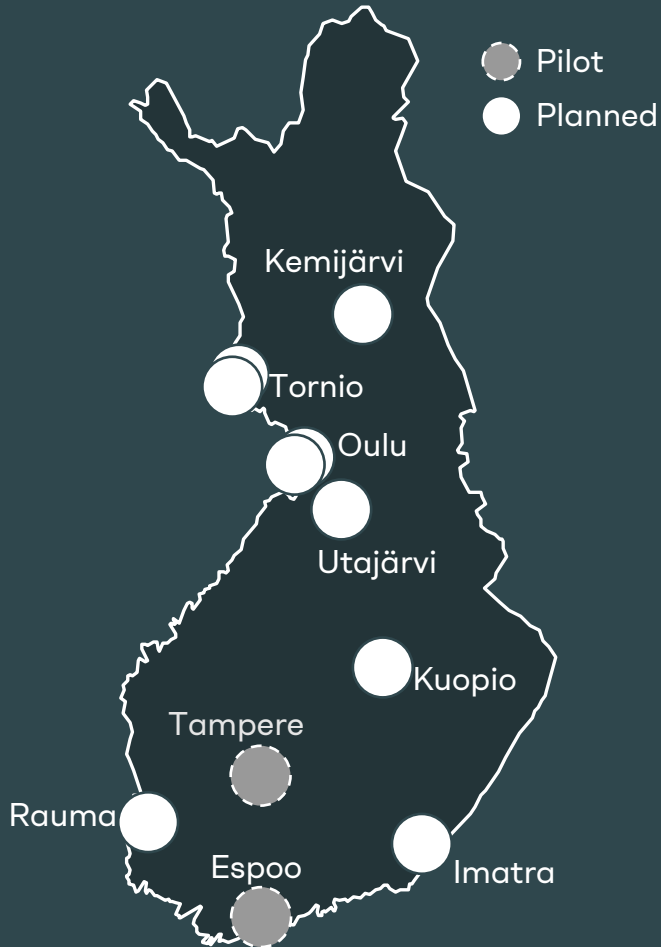
The Potential of eSAF in Finland

Webinar

10. June 2026



Scaling eSAF in Finland is a strategic opportunity to create a new export industry, generating jobs and economic value



eSAF builds on **EU-driven demand** and offers Finland a pathway to **scale its hydrogen economy**, strengthen **energy security**, and **capture value** from new clean fuel markets



Finland is **uniquely positioned** to produce eSAF due to its potential for expanding electricity capacity, low-emission grid, biogenic CO₂, and high-quality power grid

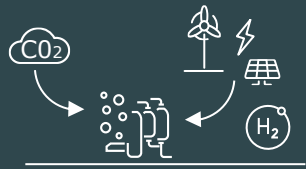


To turn its competitive position into real economic value, Finland should aim to **act early in eSAF** requiring targeted national support



Hydrogen Cluster Finland has outlined **domestic eSAF production target** of 250 000 ton/a by 2035 positioning Finland for **export-driven growth** through book-and-claim

eSAF is a necessary solution for aviation decarbonization, produced from renewable electricity and biogenic CO₂



In this study, eSAF refers to a drop-in sustainable aviation fuel (SAF) produced from renewable electricity and biogenic CO₂, capable of replacing conventional fossil jet fuels

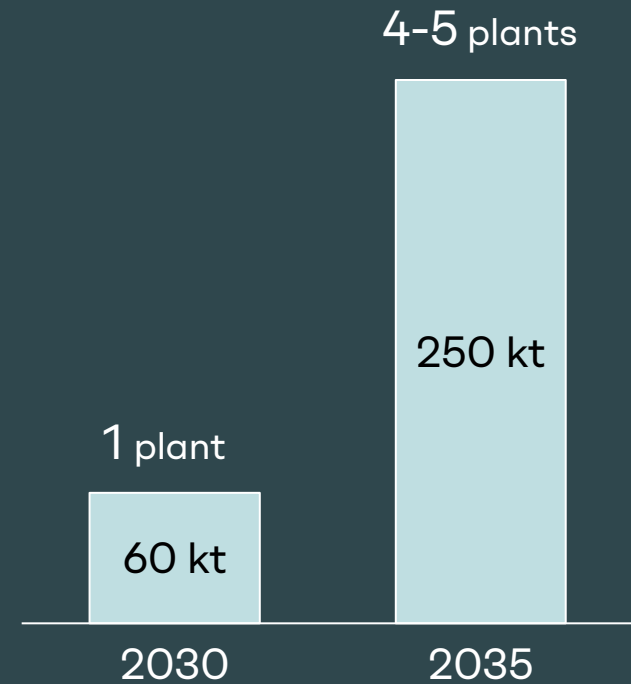
eSAF production goal as part of the Hydrogen Cluster Roadmap for Finland



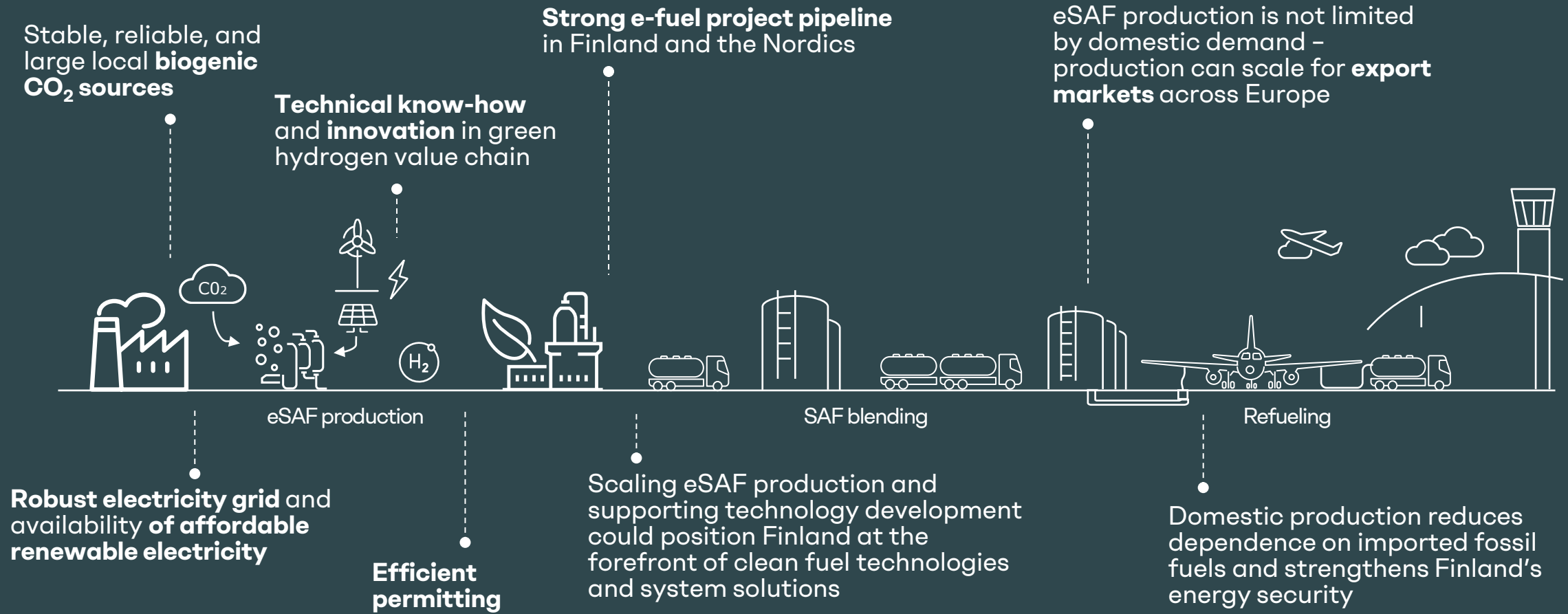
Aviation is a hard-to-abate, hard-to-electrify sector where liquid fuels are needed. This transition is reinforced by the EU's binding ReFuelEU mandate, which is driving eSAF demand from 2030 onwards



Today SAF is produced primarily from waste oils and fats – which are running out. Long-term decarbonization of the aviation sector will require eSAF to ensure global mobility



Unique availability of production factors make Finland one of Europe's most competitive locations for eSAF production



eSAF production creates value across the value chain, contributing to industrial growth and employment

Annual impacts of 250 kt eSAF production in Finland

eSAF production **multiplies the value** of renewable electricity generation and biogenic CO₂ capture:



Employment



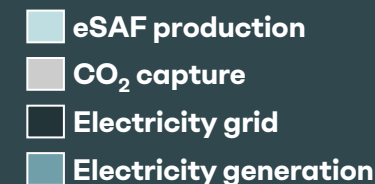
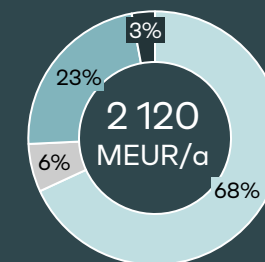
2 230 FTE^{1/a}

Tax revenue



80 MEUR/a

Value added



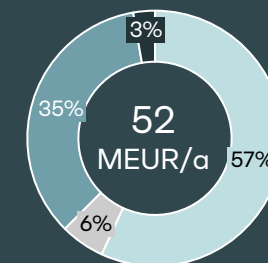
Impacts during investments, 2027-2035

Total investments:



5 110 FTE^{1/a}

90 MEUR/a



1. FTE – Full-Time Equivalent

Increasing domestic share of eSAF technology development could grow value added and create export opportunities

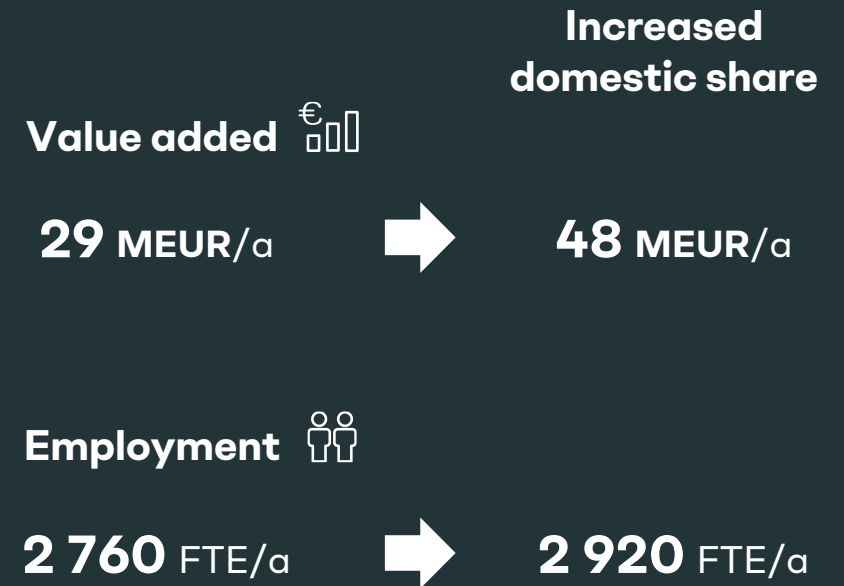
Value added during the investment phase is primarily dependent on domestic share of technologies and materials in the value chain

For the first eSAF investments, a 45% domestic share is estimated; mostly reliant on design and engineering, civil works, electric components and installation, while needed specialized machinery is estimated as imported

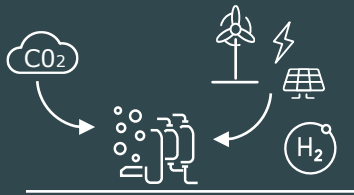
If the domestic share of specialized machinery for eSAF production and CO₂ capture investments were increased to more than 30%, the value added could nearly double, raising the overall domestic share of eSAF investments to approx. 60%

Finland will need accelerated RDI program to accelerate the development and market share of Finnish based technologies to capture this domestic and export market by 2035

Impact of one eSAF investment



Unlocking eSAF potential requires parallel development along the value chain



eSAF production



SAF blending



SAF consumption



Regulation

Project-on-project risk

- Parallel development of new value and supply chains since CO₂ capture and utilization is also under development

High production costs

- Capital-intensive production investments with long learning curves

SAF blending

- There is still a need to develop neat (e)SAF blending with fossil jet fuel in Finland
- Access to Helsinki-Vantaa fuel supply is currently only through Kilpilahti oil terminal

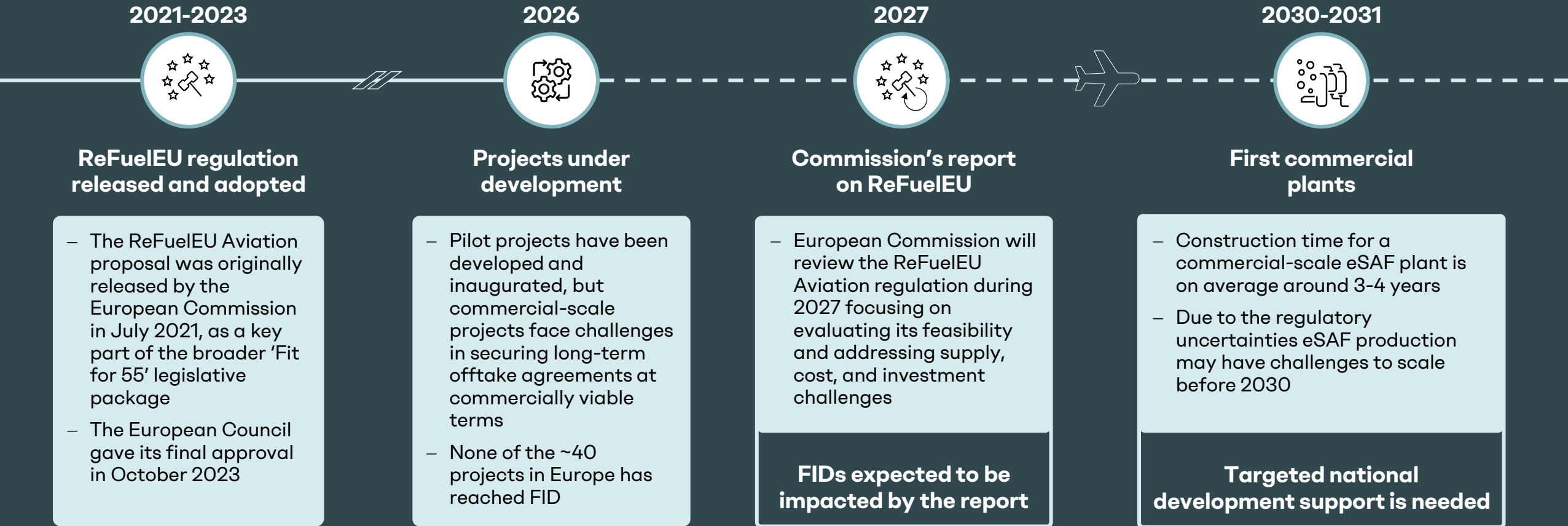
Book-and-claim system

- Small volumes are not viable for exporting. Thus, a book-and-claim system needs to be established to enable virtual eSAF exports

Regulatory framework

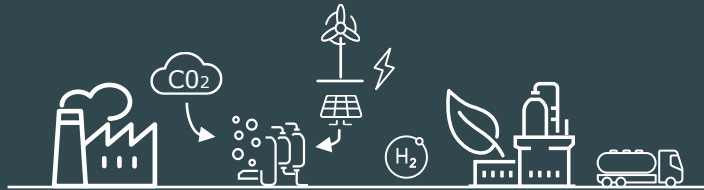
- While the implementation and evolution of ReFuelEU has been rapid, it still carries uncertainty due to upcoming revision
- Policy revisions tend to impact investment decisions and increase risk across the eSAF value chain

Policy uncertainty impacts investment environment, underscoring the need for predictable frameworks



Launching eSAF production requires support across the full value chain from technology development to market creation

Production support



Offtake creation



Existing measures

- Tax credits for large clean transition investments
- Energy Aid (CAPEX support, Business Finland)
- EU Innovation Fund (investment/CAPEX support)
- European Hydrogen Bank (EUR/kg premium for renewable H₂)

- EU ETS Allowances**
- ReFuelEU Aviation regulation; penalties related to blending mandate
- Early Mover Coalition; double-sided auctions
- Sustainable Aviation Buyers Alliance
- International Civil Aviation Organization

Potential, NEW measures

- Redirecting tax revenue from eSAF production to subsidies as a national extension of the European Hydrogen Bank's auction
- State loan guarantees for new technology suppliers
- Non-monetary support in permitting process and public-private partnerships**

- Allocation of ETS auction proceeds to support offtake, e.g., through Contracts for Difference scheme**
 - E.g., two-sided, one-sided net, or state guaranteed floor price
- Continuation and strengthening of EU ETS Allowances**
- Book-and-claim system for SAF**
- EU-wide and national Contract-for-Difference systems

Nordics are seen most competitive region in Europe for eSAF that can materialise only with strong public support

Finland (and the Nordics) are one of Europe's most competitive locations for eSAF production



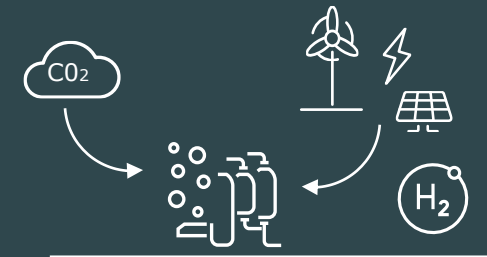
Finnish government needs to **promote critical policies together with Nordic peers** to unlock the economic potential of eSAF and to remain as most attractive region for investments

European airlines compete in global markets and need **market mechanisms to enable bankable off-take contracts for eSAF**



Investment and production cost support is critical to derisk first wave of new technologies while **end-users need also support mechanisms to mitigate the high additional costs of eSAF** through contract for difference schemes and inclusion of book-and-claim in ReFuel EU regulation

Share of Finnish and Nordic based eSAF technologies is today very small and thus the invested capital is not creating the best economic impacts nationally and locally



If investments in Finnish and Nordic eSAF technology RDI could enable 1/3 market share for Finnish or Nordic technology suppliers, it would have the potential to **double the value added in each eSAF plant** while also creating new indirect jobs and tax revenues

Annex: Socioeconomic impact assessment

2030 – one eSAF plant built and operational

Annual eSAF production phase impacts

Total

| | | | | | | | | | | |
|----------------------|-----|--------|-----|--------|----|--------|-----|--------|-----|--------|
| Domestic value added | 255 | MEUR/a | 115 | MEUR/a | 27 | MEUR/a | 13 | MEUR/a | 410 | MEUR/a |
| Domestic employment | 355 | FTE/a | 100 | FTE/a | 50 | FTE/a | 5 | FTE/a | 510 | FTE/a |
| Tax revenue | 9.5 | MEUR/a | 6 | MEUR/a | 1 | MEUR/a | 0.5 | MEUR/a | 17 | MEUR/a |



eSAF production



Electricity production



CO₂ capture



Electricity network

Annual average investment phase impacts during 2027-2030

Total

| | | | | | | | | | | |
|----------------------|------|--------|-----|--------|-----|--------|----|--------|------|--------|
| Domestic value added | 15 | MEUR/a | 11 | MEUR/a | 2 | MEUR/a | 1 | MEUR/a | 29 | MEUR/a |
| Domestic employment | 1585 | FTE/a | 900 | FTE/a | 230 | FTE/a | 45 | FTE/a | 2760 | FTE/a |
| Tax revenue | 28 | MEUR/a | 17 | MEUR/a | 5 | MEUR/a | 1 | MEUR/a | 51 | MEUR/a |

2035 – four eSAF plants built and operational

Annual eSAF production phase impacts

Total

| | | | | | | | | | | |
|-----------------------------|--------------|---------------|------------|---------------|------------|---------------|-----------|---------------|--------------|---------------|
| Domestic value added | 1 440 | MEUR/a | 480 | MEUR/a | 140 | MEUR/a | 60 | MEUR/a | 2 120 | MEUR/a |
| Domestic employment | 1 590 | FTE/a | 420 | FTE/a | 200 | FTE/a | 20 | FTE/a | 2 230 | FTE/a |
| Tax revenue | 43 | MEUR/a | 30 | MEUR/a | 4 | MEUR/a | 3 | MEUR/a | 80 | MEUR/a |


eSAF production

Electricity production

CO₂ capture

Electricity network

Annual average investment phase impacts during 2027-2035

Total

| | | | | | | | | | | |
|-----------------------------|--------------|---------------|--------------|---------------|------------|---------------|-----------|---------------|--------------|---------------|
| Domestic value added | 28 | MEUR/a | 20 | MEUR/a | 3 | MEUR/a | 1 | MEUR/a | 52 | MEUR/a |
| Domestic employment | 2 940 | FTE/a | 1 655 | FTE/a | 425 | FTE/a | 90 | FTE/a | 5 110 | FTE/a |
| Tax revenue | 51 | MEUR/a | 30 | MEUR/a | 8 | MEUR/a | 1 | MEUR/a | 90 | MEUR/a |

Underlying assumptions

| CAPEX breakdown | eSAF production | Electricity generation | CO ₂ capture | Electricity networks |
|---|-----------------|------------------------|-------------------------|----------------------|
| Machinery (e.g., specialised equipment such as electrolysers or wind turbines) | 42% | 59% | 40% | - |
| Installation | 6% | 7% | 15% | 8% |
| Civil works | 30% | 15% | 21% | 40% |
| Engineering and design (incl. project development) | 15% | 8% | 15% | 10% |
| Electric components and works | 7% | 11% | 9% | 42% |

All installation and construction phase employment and operation phase employment are considered domestic

Electricity generation includes both onshore wind and solar

| | % of labour costs from full cost | | | % of domestic materials | | |
|---|----------------------------------|------------------------|----------------------|----------------------------------|------------------------|----------------------|
| | eSAF and CO ₂ capture | Electricity generation | Electricity networks | eSAF and CO ₂ capture | Electricity generation | Electricity networks |
| Machinery | - | - | - | 3% | 5% | - |
| Installation | 100% | 100% | 100% | - | - | - |
| Civil works | 50% | 50% | 50% | 75% | 75% | 75% |
| Engineering and design (incl. project development) | 100% | 100% | 100% | - | - | - |
| Electric components and works | 40% | 40% | 40% | 35% | 35% | 35% |

In the base case the total domestic share of CAPEX is ~ 45% for eSAF production and CO₂ capture

If domestic share of eSAF production and CO₂ capture machinery would be increased to 33% and electric components to 70%, total domestic share would increase to ~60%

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