Boosting the use of SAF - Sustainable Aviation Fuel

Thorsten Lange | Executive Vice President Renewable Aviation
14.04.2021 | EP TRAN Committee
Neste’s transformation

From a local oil refiner towards a global leader in renewable and circular solutions, with limitless curiosity
Driven by our purpose

We are #1
Producer of Renewable Diesel & Sustainable Aviation Fuel from waste and residue

In 2020, our customers reduced 10.0 Mt greenhouse gas emissions with our renewable products

In 2020, renewables contributed 94% to Neste’s total comparable operating profit of 1,416 m€
Our climate commitments

**HANDPRINT**

Neste to reduce customers’ greenhouse gas emissions with its renewable and circular solutions by at least 20 million tons CO$_2$e annually by 2030

**FOOTPRINT**

Neste to reach carbon neutral production* by 2035

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* Scope 1 & 2
SAF Potential

- SAF technical feasibility proven
- Reducing both CO2 and non-CO2 climate effects
- Production capacity existing and ramping up
- Sustainable feedstocks available

Reducing both CO2 and non-CO2 climate effects
SAF: Technical feasibility is proven
A drop-in solution to the existing fuel supply chain and infrastructure
### Neste MY Sustainable Aviation Fuel

#### Available Drop-in solution
- Compatible with existing jet engines and fuel supply infrastructure
- Commercially available and in use
- Used in blends up to 50%

#### Greenhouse gas emission reduction
- In neat form, reducing GHG emissions up to 80% compared to fossil fuels over the life-cycle
- Produced 100% from renewable waste and residue raw materials
- In-sector emission reduction, unlike offsets

#### Reduction of Non-CO2 effects
- Burns clean, reducing local emissions
- Additional climate benefits through reduced particulate emissions (non-CO2 effects of aviation may have equal or higher climate impact than carbon emissions¹)

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¹ EASA Final Report: *Updated analysis of the non-CO2 climate impacts of aviation and potential policy measures pursuant to the EU Emissions Trading System Directive Article 30(4)*, November 2020
SAF helps to stay within the Carbon Budget

Mathematics of climate protection

Global CO₂ emission budget (1.5-degree target) from Jan. 2021: **300 Gt CO₂**
Current global level of CO₂ emissions: **40 Gt CO₂ per year**

<table>
<thead>
<tr>
<th>Year</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
<th>2040</th>
<th>2045</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂ emissions in Gt/a</td>
<td>40</td>
<td>35</td>
<td>30</td>
<td>25</td>
<td>20</td>
<td>15</td>
<td>10</td>
</tr>
</tbody>
</table>

**Budget 300 Gt CO₂**

- **no action:** 7.5 years left
- **correct action:** 15 years left

Source: IPCC (2018) Special Report on Global Warming of 1.5°C, October 2018

Faculty of Life Sciences, Department of Process Engineering
Prof. Dr.-Ing. Thomas Wilbrer
Departing flights & CO2 Emissions (2020)
Neste’s SAF capacity will grow to 1.5 million tonnes in 2023, and will continue to expand with new technologies.

1. **Up to 10% of global jet fuel use (35 Mton)**
   - HEFA\(^1\) (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

2. **Potential exceeds global jet fuel use**
   - TECHNOLOGIES CLOSE TO COMMERCIALIZATION
     - (municipal solid waste, lignocellulosic, etc.)

3. **Technical potential “unlimited”**
   - POWER-TO-LIQUIDS (CO\(_2\) capture)

Source: Neste estimates

\(^1\) HEFA = Hydroprocessed Esters and Fatty Acids
Sufficient Bio-feedstock potential sufficient for substituting fossil jet fuel
Power-to-Liquids will bring unlimited additional potential as the technology matures

<table>
<thead>
<tr>
<th>Feedstock Type</th>
<th>Practical availability in 2030, Mt/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste &amp; residue lipids</td>
<td>40</td>
</tr>
<tr>
<td>Oil trees on degraded land</td>
<td>85</td>
</tr>
<tr>
<td>Oil-cover crops</td>
<td>70</td>
</tr>
<tr>
<td>Cellulosic cover crops</td>
<td>1100</td>
</tr>
<tr>
<td>Agricultural residues</td>
<td>660</td>
</tr>
<tr>
<td>Forestry residues</td>
<td>580</td>
</tr>
<tr>
<td>Wood-processing waste</td>
<td>320</td>
</tr>
<tr>
<td>Municipal solid waste</td>
<td>960</td>
</tr>
</tbody>
</table>

Immediately available HEFA technology based on zero ILUC lipids can replace 20% of jet fuel

In mid 2020's, Gasification+synthesis and ATJ technologies will mature. Together with HEFA, they have the potential of substituting all fossil jet fuel

Up to 120% of estimated global jet fuel demand of 410 Mt in 2030

Estimated SAF potential 490 Mt in total in 2030

Starting around 2030, industrial volumes of PtL can become available

SAF will remain more expensive than fossil Jet Fuel. Prices will come down as technologies mature.

Development of production costs of SAF and comparison to fossil Jet Fuel

Near term Sustainable Aviation Fuel capacity is almost all HEFA, dependent on lipid feedstocks.

Global SAF production capacity outlook, Mt

Demand certainty for SAF can drive new investments for additional capacity in addition to pipeline in place.
## Regulatory treatment and availability of the HEFA feedstocks

<table>
<thead>
<tr>
<th>Category (Ref. to Figure 1 above)</th>
<th>RED II (Availability: WEF and Neste estimates)</th>
<th>CORSIA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong> Waste and residue lipids 40 Mt/a</td>
<td>Annex IX Part A 2.7 Mt/a</td>
<td>Partly specifically included. None are excluded and individual LCA values allowed since zero ILUC</td>
</tr>
<tr>
<td></td>
<td>Annex IX Part B 10.3 Mt/a</td>
<td>Specifically included. Zero ILUC assigned</td>
</tr>
<tr>
<td></td>
<td>Outside of Annex IX 29.2 Mt/a</td>
<td>Partly specifically included. None are excluded and individual LCA values allowed since zero ILUC</td>
</tr>
<tr>
<td><strong>2</strong> Oil trees on degraded land 85 Mt/a</td>
<td>Not included in any category, but similar with “Low ILUC Risk Biofuels” definition RED II Art. 2(37)</td>
<td>Included in the “Low land use change (LUC) risk practices” category. Zero ILUC assigned. (Temporary rules, to be updated)</td>
</tr>
<tr>
<td><strong>3</strong> Oil Cover Crops 70 Mt/a</td>
<td>Included in the “Intermediate Crops” definition RED II Art. 2(40) 70 Mt/a</td>
<td>Included in the “Low land use change (LUC) risk practices” category. Zero ILUC assigned. (Temporary rules, to be updated)</td>
</tr>
</tbody>
</table>
Wide feedstock acceptance is critical for ensuring that ambitious SAF scale up targets are achievable.

Global wastes and residues (suitable for biofuel production) potential in 2030, Mt
Source: Neste estimates

2 = Oil trees on degraded land (85) and
3 = Oil Cover crops (70) Mt in 2030
Source: World Economic Forum estimates
Moderate effect on ticket prices

The influence on ticket prices is moderate. Examples for 5%, 14% or 30% SAF blending, respectively:

- For Helsinki - Singapore 12 €, 33 € or 71 €
- For Helsinki - Munich 3 €, 9 € or 20 €
- For Helsinki - Stockholm 1 €, 4 € or 8 €

CONCLUSIONS

| Urgency to act. SAF will remain more expensive than fossil fuel, making regulatory measures necessary |
| HEFA based SAF is commercially immediately available. Eligibility of all sustainable feedstocks is crucial |

| For the climate, biofuels are most effective when used in aviation due to the reduction of also the non-CO2 effects |
| Ticket price increase is reasonable. Aviation will continue to contribute to connectivity and productivity |