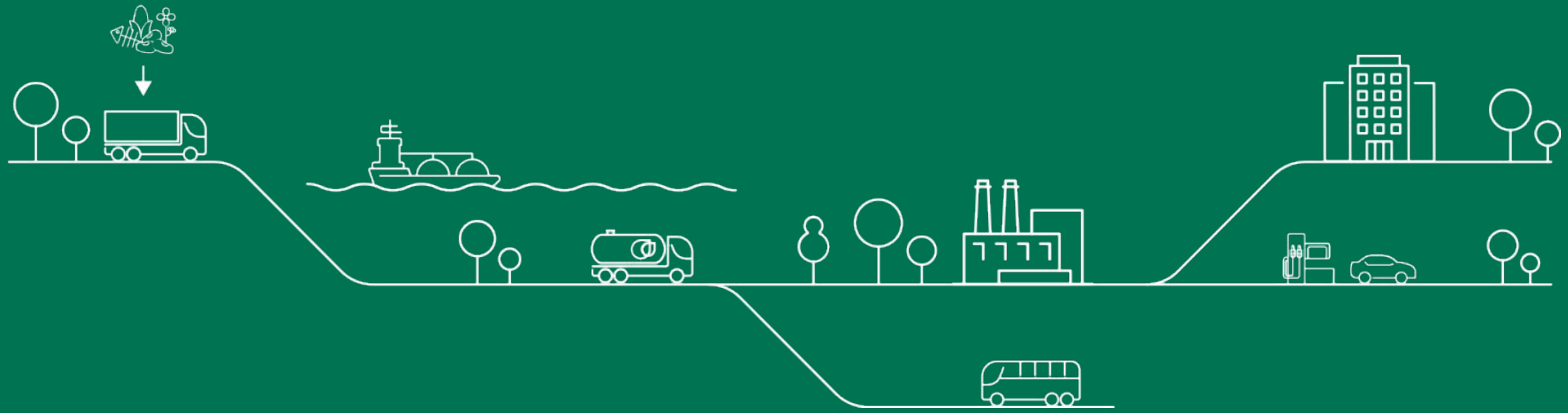
Renewable materials for aviation and marine fuels

BL2F Final Event, 06.03.2024
Ekaterina Sermyagina, Neste

BL2F
Transforming Black Liquor to Biofuel

This project has received funding from the European Union Grant Number 884111

Turning renewable raw materials into a variety of renewable products with NEXBTL technology



Raw materials

More than 10 different renewable raw materials are sourced around the world

Neste's renewables refineries technically capable of running on 100% waste and residues

Pre-treatment

Pre-treatment of the renewable raw materials ensures impurities are removed before refining

NEXBTL process

Pre-treated renewable raw materials are processed with Neste's proprietary NEXBTL technology at Neste's refineries globally.

Hydrogen added to remove oxygen. CO_2 and renewable propane can be recovered for commercial use

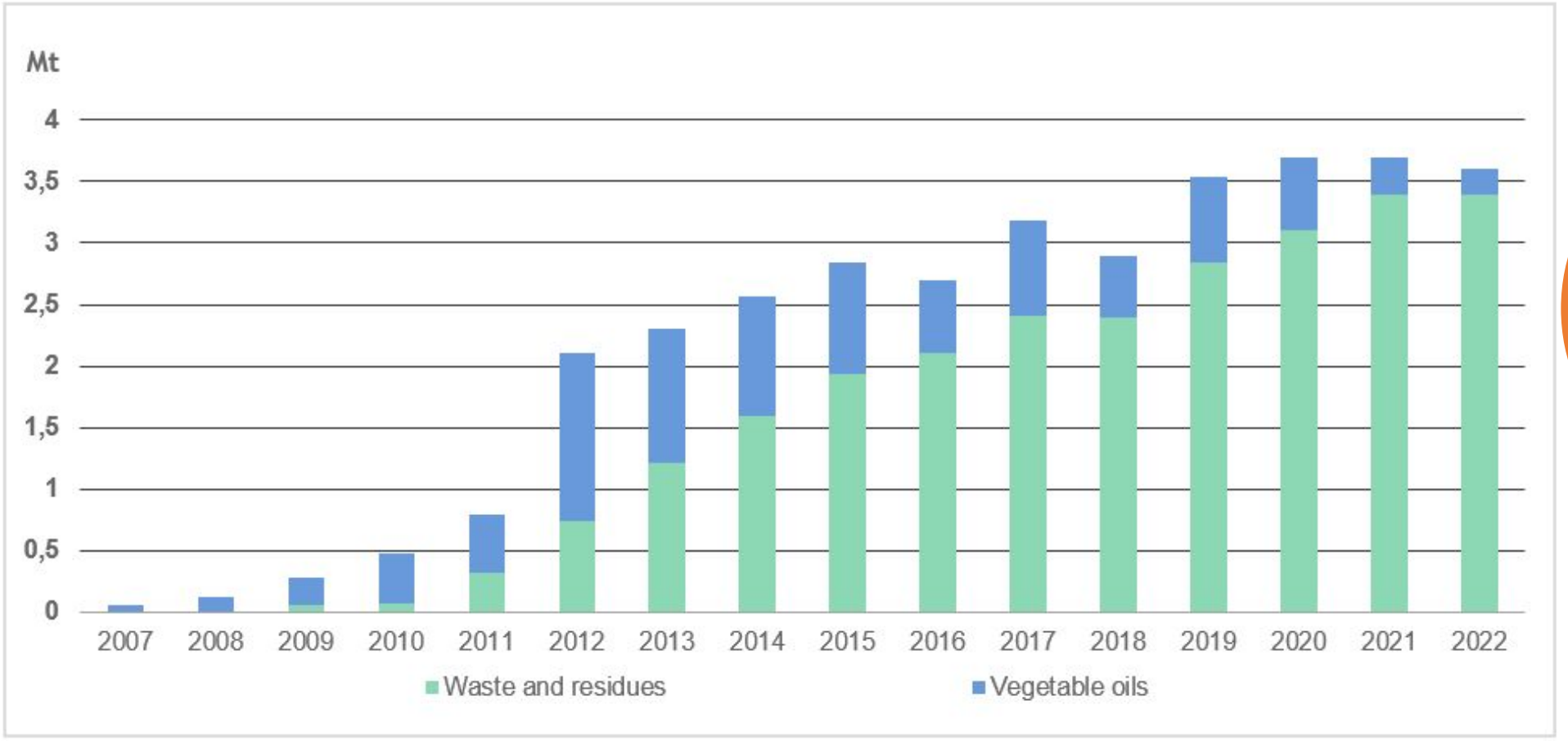
Output

3.3 million tons of Neste renewables per year

→ 5.5 million tons by 2024

NESTE

Neste's raw material journey:
Focus on waste and residues



over
90%
waste and residues

All our units producing renewables have technical capability to run on W&R

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Extensive portfolio of globally-sourced sustainable raw materials

Animal fat from food industry waste

Used cooking oil

Vegetable oil processing waste and residues
(e.g. PFAD, POME, SBEO)

Fish fat from fish processing waste

Technical corn oil

Tall oil based raw materials

Palm oil
(0% by end of 2023)

Soybean oil

Rapeseed oil

Camelina oil
in specific projects only

PFAD: Palm fatty acid distillate; POME: palm oil mill effluent; SBEO: spent bleaching earth oil

Vegetable oil processing sources

Many vegetable oil processing wastes and residues can be used as raw materials to produce Neste's renewable products. Of these types of wastes and residues, Neste uses, for example:

PFAD (palm fatty acid distillate) is a processing residue derived from the final stages of refining food-grade palm oil. It consists of degraded fats, free fatty acids, that need to be removed before palm oil meets the food industry's quality standards in terms of taste, smell, color and shelf life.

SBEO (spent bleaching earth oil) consists of oil waste recovered from spent bleaching earth that is used in the refining processes of various vegetable oils.

POME (palm oil mill effluent) is usually released to a system of ponds to remove solids, oil and grease before discharging the water into waterways. Oil settles on top of the pond and can be recovered (skimmed off).

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Tall oil based raw materials

Crude tall oil is a residue generated at pulp mills when pulp is produced from pine wood.

Crude tall oil is further processed at tall oil refineries. Distillation process yields different fractions such as tall oil fatty acids, tall oil rosins and tall oil pitch.

Crude tall oil and some of its derivatives, e.g. crude fatty acids and tall oil fatty acids, can be used as raw material for renewable products, such as fuels. Tall oil derivatives are also used for various chemical applications.

Neste can use crude tall oil based fatty acids as raw material.

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Neste’s renewable raw materials supply growth driven by strategic development program

Global raw material supply growth

- A series of acquisitions and partnerships and continuously strengthened sourcing capability will ensure the future availability of raw materials.
- We are also growing our global aggregation network by creating regional aggregation hubs and expanding our terminal network globally.

The availability of waste and residue oils and fats suitable for Neste’s current NEXBTL refining technology expected to grow to **40 Mt/a by 2030** (source WEF/McKinsey)

We are exploring **several technologies** to tap into new types of raw material sources to grow the availability of raw materials

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Ways to ensure sustainability in renewable raw material supply chain

Which raw materials? Raw material evaluation	We ensure that all of our raw materials meet our sustainability criteria. 1. Technical suitability 2. Refinery evaluation 3. Sustainability evaluation
Who? Supplier selection	We only buy from suppliers that meet our sustainability criteria. 1. Credit review 2. Compliance review 3. Health, safety, environment & sustainability evaluation
Where? Traceability	We know the exact location of production sites and estates.
How? Engagement	We expect all of our suppliers to uphold Neste's policies and principles and the minimum requirements in our Supplier Code of Conduct. We engage to ensure that our suppliers are committed to our sustainability criteria.
How do we verify? Certification & audit	Certification and audits are used to verify our supply chains and raw materials meet our sustainability criteria and those provided by legislation.

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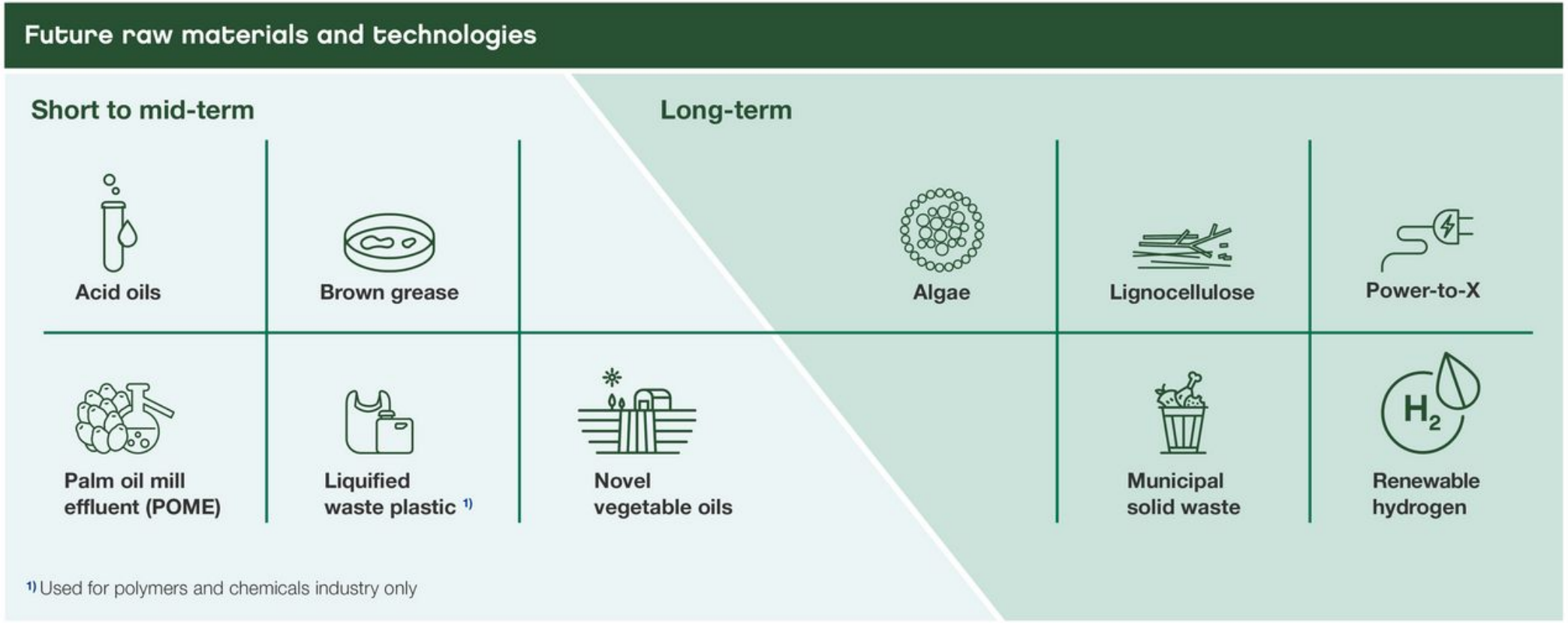
Future raw materials



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Lignocellulose offers excellent replacement for fossil raw materials for making fuels, chemicals and materials

Lignocellulose is the **most abundant natural polymers on earth**. It is a biopolymer containing cellulose, hemicellulose, and lignin, and it is the main material in all plants. By converting waste and residues front those plants into energy, for example in the form of biofuels, we can **reduce our reliance on fossil fuels**.

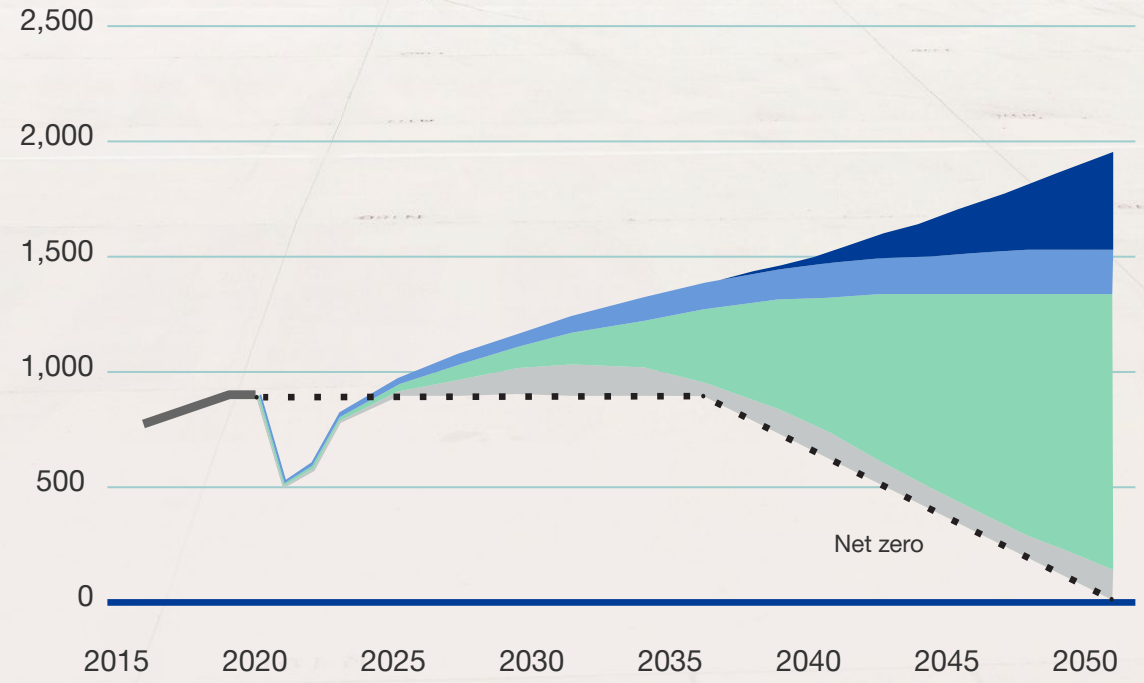
Large amounts of waste and residues from existing forestry and agricultural production remain underutilized and could be transformed into valuable and highly sustainable new raw materials.

The most sustainable way of lignocellulose utilization is via biomass residues, which refers to the waste and residues of commercial and industrial processes like agriculture, forestry, and food production.

At Neste, we focus on resources that are currently underutilized. Our plan is to utilize waste and residue streams from forestry, such as tree tops and branches, and pre-commercial thinning and residues from forest industry, such as bark and sawdust.

Aviation needs growing volumes of sustainable aviation fuels to cut emissions

Aviation CO_2 emissions trajectory and reductions by measure (Mt CO_2e)



- Technology (incl. Electric and hybrid aircraft)
- Operations and infrastructure
- Sustainable aviation fuel
- Offsets (or other carbon mitigation measures)

Aviation continues to rely heavily on liquid jet fuel, even with efficiency improvements and emergence of (short-haul) electric planes in the future.

Sustainable Aviation Fuels will be the most important tool in the aviation sector's transition towards net zero by 2050.

Source: ATAG Waypoint 2050

NESTE

Neste has a strong foundation for value creation in the growing SAF market

Leading global SAF production platform and global supply capability

Integrated and flexible position to efficiently serve diverse customer segments

Sustainability know-how to create credible offerings for the regulatory and voluntary markets

Delivering on our promise of making SAF available

1.5 Mt/a

SAF capability

Capability in 2024 with completed Singapore refinery expansion and ongoing investments in the Rotterdam refinery

>70

Customers

Direct customers across the aviation supply chain, i.e. fuel suppliers, airlines, corporates and travel & cargo companies

21

Countries

Neste's SAF is used in a growing list of countries across Europe, Americas, Middle East and Asia-Pacific

>25

Key airports[1]

Neste MY Sustainable Aviation Fuel is available either directly from Neste or via a channel partner at key aviation hubs around the world

1) Including airports with over 1 million passengers where branded Neste MY Sustainable Aviation Fuel is available to airline customers, either directly from Neste or via a channel partner; Neste MY SAF is also available at several smaller and general aviation airports

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Global supply chain capabilities and channel partners enable managing growth and serving diverse customer segments

Global supply chain has been expanded...

Network of key airports where Neste MY SAF is available[1]

2021	2023
7	>25

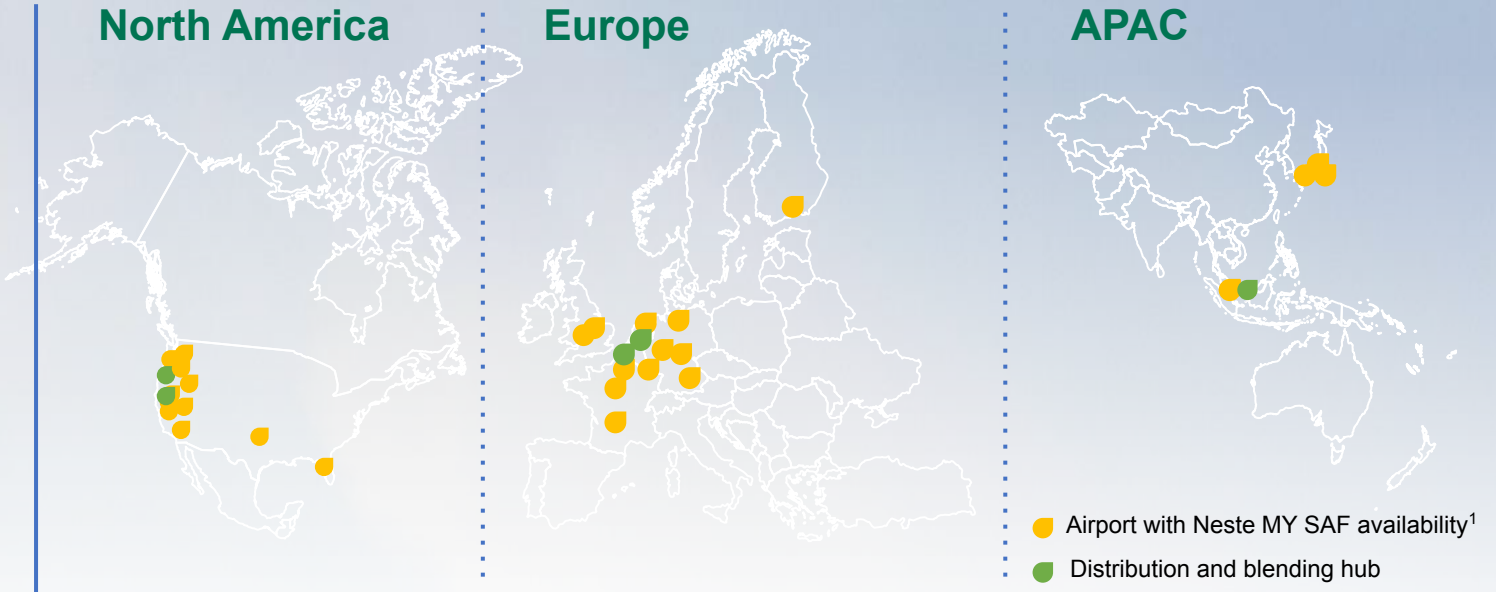
Distribution and blending hubs

2021	2023
2	5

Pipeline deliveries

US: Colonial and Buckeye Pipeline, SFPP
Europe: CEPS, CIM, Exolum UK

…to serve global customers across the key regions



Selected customers and channel partners:

American Airlines, Delta, Air France KLM, ANA, World Fuel Services, Air New Zealand, United, Lufthansa, IAG, Singapore Airlines, Signature Aviation, Itochu

1) Including airports with over 1 million passengers where branded Neste MY Sustainable Aviation Fuel is available to airline customers, either directly from Neste or via a channel partner; Neste MY SAF is also available at several smaller and general aviation airports.

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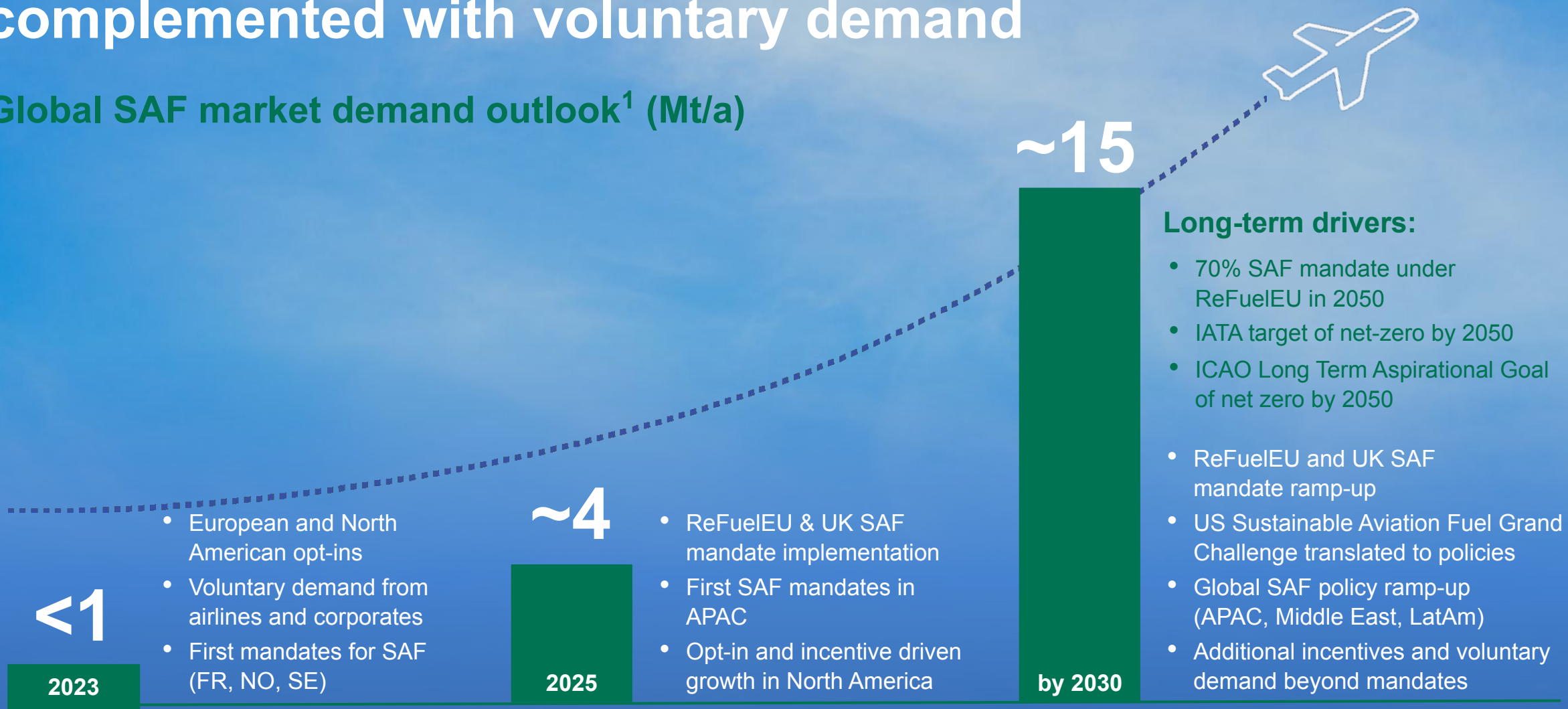
Accelerating SAF market growth is driven by regulations, complemented with voluntary demand

Global SAF market demand outlook[1] (Mt/a)



1) Including opt-in into road mandates and voluntary demand. Source: Neste estimates.

New co-processed marine fuel

Solution for the maritime sector enabling up to 80% reduction of greenhouse gas emissions

Up to 80% lower GHG emissions

Emission reduction compared to fossil fuels over the lifecycle. ISCC PLUS certified renewable raw materials reducing dependency on fossil resources.

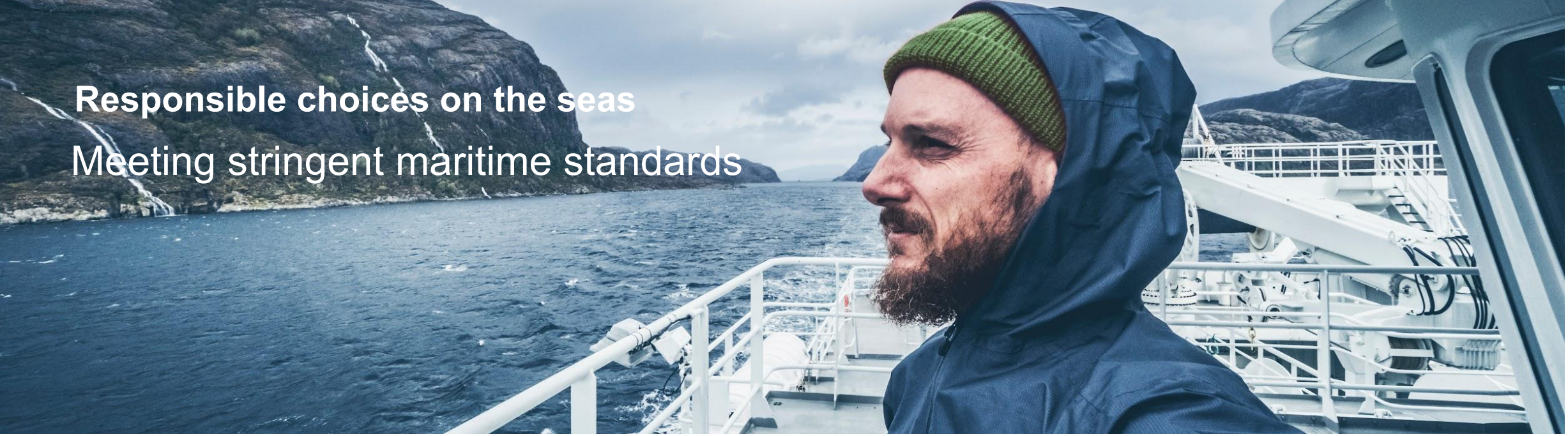
Easy to switch

Good compatibility and a composition similar to conventional marine fuels. No modifications or investments in infrastructure needed. Increase lifespan for existing assets.

"With the co-processed marine fuel, Nordic Marine Oil is enabling the shipping industry to reduce its GHG emissions. For cargo owners and charterers, the product is an effortless and cost-efficient opportunity to reduce CO_2 emissions in transportation. The emission reduction is immediate and the solution is easy to implement as the shipowners are not forced to make any investments or changes to the vessel engines. Together with Neste, we supply tomorrow's fuels for the maritime industry already today."

STEEN MØLLER, CEO, NORDIC MARINE OIL A/S

The method used to calculate life cycle emissions and emission reduction is guided by the EU Renewable Energy Directive II (EU)2018/2001.



Responsible choices on the seas

Meeting stringent maritime standards

Neste Marine 0.5™ bunker fuel

< 0.5%

sulfur reducing significantly marine emissions

High-quality fuel for shipping companies operating in global waters

German BMT Bunker und Mineralöltransport GmbH is offering Neste Marine 0.5™ bunker fuel in the Northwestern Europe. Thereby, shipping companies operating in global waters are offered a solution that ensures instant IMO2020 compliance and meet stringent technical and performance standards.

"We are proud to bring our BMT expertise and Neste's high-quality marine fuels together. We value cooperation with Neste. BMT is committed to building strong partnerships, which is also our key driver with Neste."

ANDREAS MESTERMANN, CEO, BMT

Responsible choices on the seas

Bringing value with low-sulphur marine fuel

ESL Shipping, the leading dry bulk sea transport company on the Baltic Sea, is using Neste's premium, low-sulfur marine fuel (Neste MDODMB). Shift to marine fuel containing less than 0.1% of sulphur was easy and no high maintenance nor investments were needed.

< 0.1%

sulfur in our low-sulfur marine fuels

"Performance and quality of Neste Marine 0.1 fuel has met our stringent standards. In addition to meeting the EU Sulphur Directive requirements, we are very pleased to improve the sustainability of our fleet."

KIRSI YLÄRINNE, BUSINESS UNIT MANAGER, ESL SHIPPING LTD.

BL2F Partners:

Tampere University

Brunel University London

KIT Karlsruhe Institute of Technology

SINTEF

PAUL SCHERRER INSTITUT PSI

VTT

THE NAVIGATOR COMPANY

Valmet

NESTE

Ranido

LGi sustainable innovation

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Thank you!

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