The Neste Oil process: Biofuels for road transport and aviation

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NESTE OIL

Neste Oil in brief

LARGEST PRODUCER

A refining and marketing company focused on premium-quality traffic fuels

Refining capacity: 15 million t/a of petroleum products and 2 million t/a of renewable diesel

Net sales: €15 billion (2014)

Operations in 15 countries; employs approx. 5,000 people

Listed on the Helsinki Stock Exchange

Largest owner: the Finnish State (50.1%)

Annual production capacity of 2 Mt

All Neste Oil's NEXBTL plants are ISCC-EU and EPA-approved

Unit	Capacity	Year	Investment
Finland #1	190 000 t/a	2007	EUR 100 million
Finland #2	190 000 t/a	2009	EUR > 100 million
Singapore	800 000 t/a	2010	EUR 550 million
Rotterdam	800 000 t/a	2011	EUR 670 million

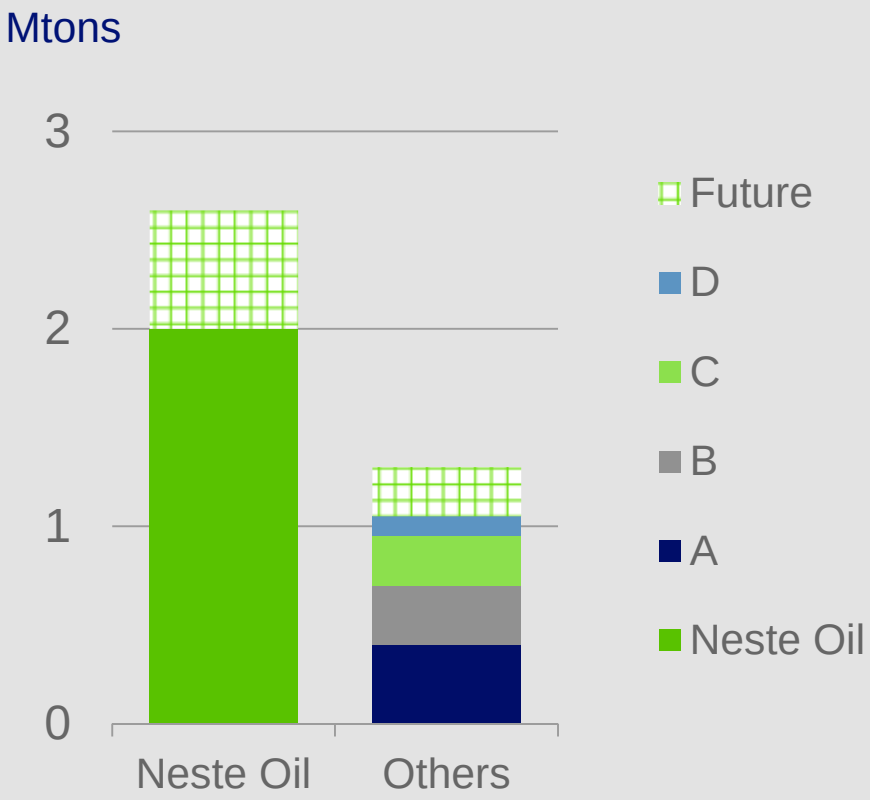
Neste Oil's aim is to increase production capacity by 15% to 2.3 million t/a by 2015.

ISCC-EU= International Sustainability & Carbon Certification; production volumes eligible for the EU biofuel market

EPA= Environmental Protection Agency; production volumes eligible for the US biofuel market

Renewable diesel capacity growing as demand for advanced drop-in solutions increases

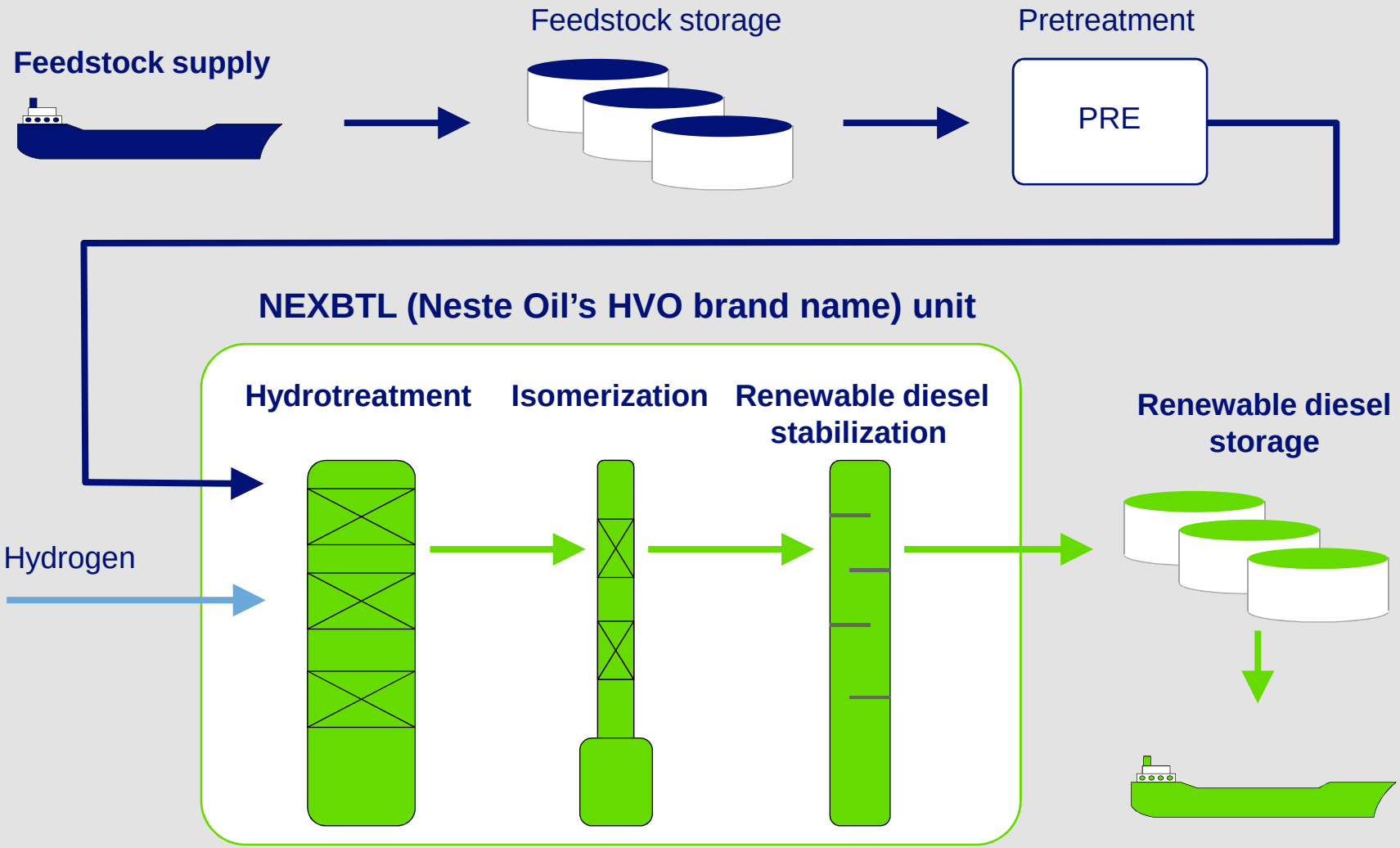
Global HVO capacity



NEXBTL is preferred solution for global renewable feedstock-based markets

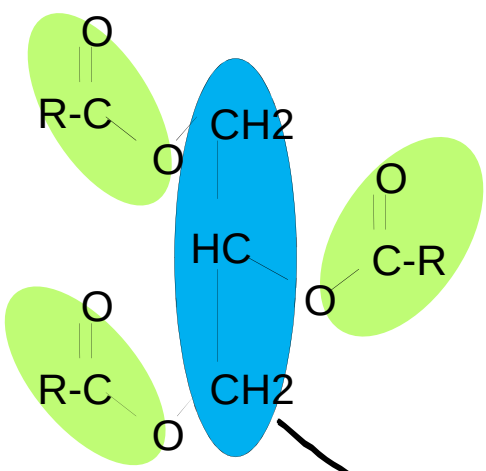
- Drop-in solution replacing fossil alternative as fuel or feedstock
- Flexible technology maximizing use of waste and residue
- Global supply chain and industrial scale

NEXBTL production process



Main product NEXBTL Diesel
Other product Biopropane

Feedstock



Triglyceride, R = n x (CH2)

Reaktions & Products

H2

Catalyst

R'-CH2-CH3 + 2 H2O (A)

R'-CH3 + CO2 (B)

R'-CH3 + CO (C)

NExBTL renewable diesel, R' = (n-1)C

H2

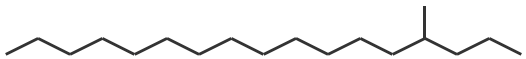
Catalyst

CH3-CH2-CH3

Propane

What makes the HVO drop-in quality

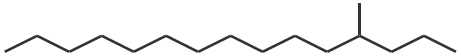
HVO



isoparaffins

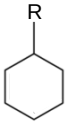
normal paraffins

DIESEL

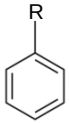


isoparaffins

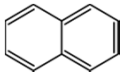
normal paraffins



naphthenes

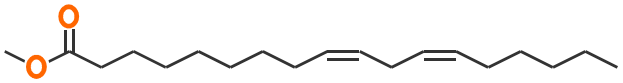


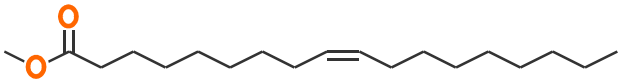
aromatics



polyaromatics

FAME



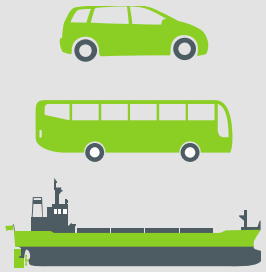


fatty acid methyl esters

NEXBTL product family – 100% bio-based

NEXBTL

- NEXBTL renewable **diesel**
- NEXBTL renewable **propane**
- NEXBTL renewable **aviation fuel**
- NEXBTL for bio-based **chemicals**



NEXBTL renewable diesel

- The highest quality diesel in the world.
- Produced from vegetable oils and waste fats
- Using NEXBTL renewable diesel reduces greenhouse gas and tailpipe emissions significantly
- Compatible with existing distribution systems and engines
- Meets even the toughest manufacturer requirements

NEXBTL renewable aviation fuel

- Offers airlines an easy way to cut their emissions
- Compatible with existing jet engines
- High energy content (MJ/kg), no aromatics, reduces CO_2 and sulphur emissions
- Complies with ASTM D7566 specification
- Already available at commercial scale

- Proven performance – the BurnFAIR project of Lufthansa
  - 1187 scheduled flights
  - 800 tonnes of biofuel
  - 1500 tonnes of CO2 reduction
- Now also soon low blend of on-road diesel quality

Applications for chemical industry

NEXBTL renewable naphtha

- Can be used e.g. as a bio-based gasoline component in blending gasoline, and in bioplastics production.
- Produced as part of the refining of NEXBTL diesel

NEXBTL renewable isoalkane

- Renewable alternative to traditional mineral oils and ideal for a wide range of chemical applications (paints, coatings, TPE additives, lubricants)
- Produced as part of the refining of NEXBTL diesel

…soon also biopropane

Hintergrundwissen zum künftigen Bio-Kraftstoff im Autogas

Statt Tulpen aus Amsterdam bald Biopropan aus Rotterdam

Drop-in solutions – Added value to key target groups

SOCIETY

- Significant GHG reduction
- Reduced exhaust gas emissions
- Improved air quality
- An easy way to increase the use of biofuels in traffic

DISTRIBUTION

- Excellent blending properties; improves fuel quality as a biocomponent
- Compatible with existing distribution systems
- Stable product with no “best before” date
- Means to fulfil biomandate

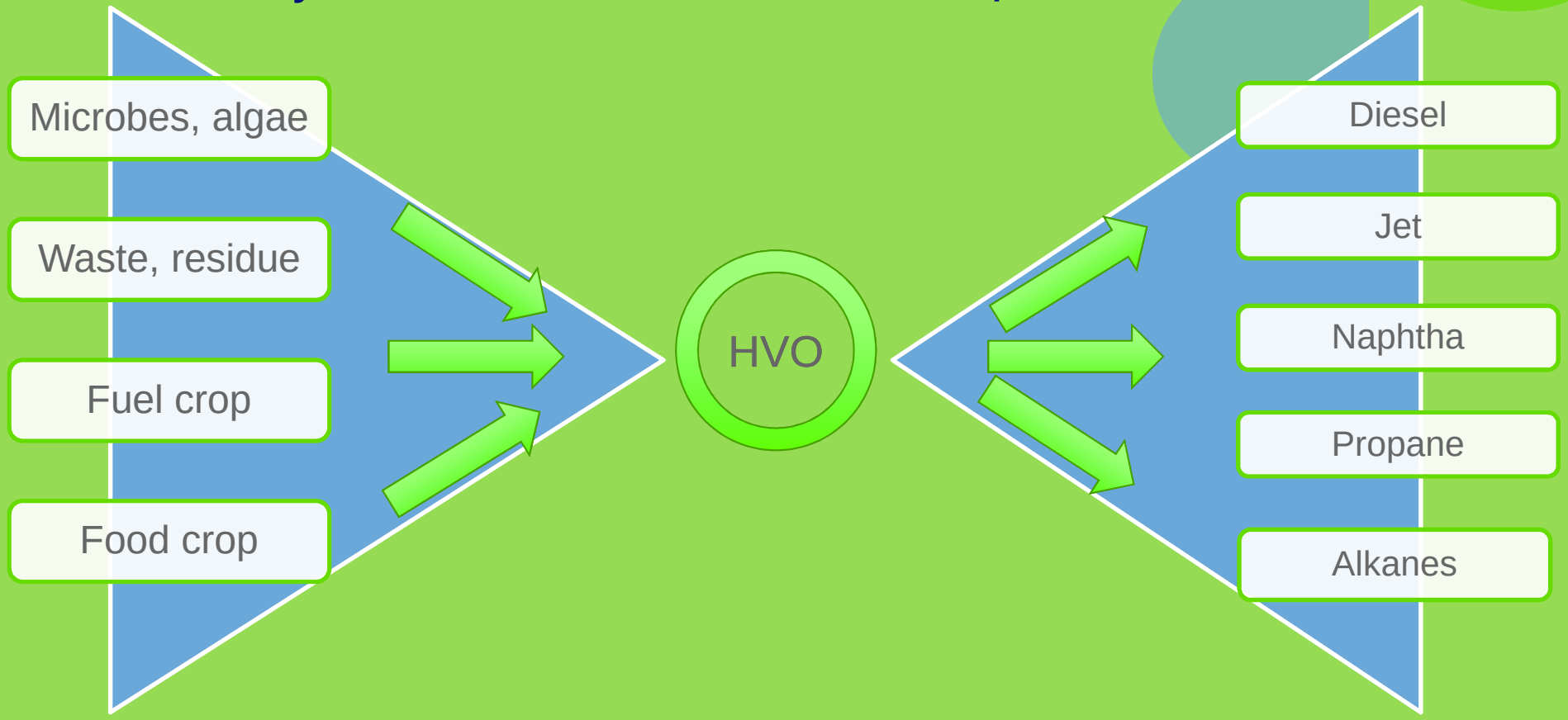
CONSUMER

- Compatible with all modern diesel engines; requires no modifications (cars, buses, trucks, etc.)
- Superior quality compared to conventional biodiesel and fossil diesel
- Excellent cold properties (reliability during the winter)

HVO technology – a pivotal enabler

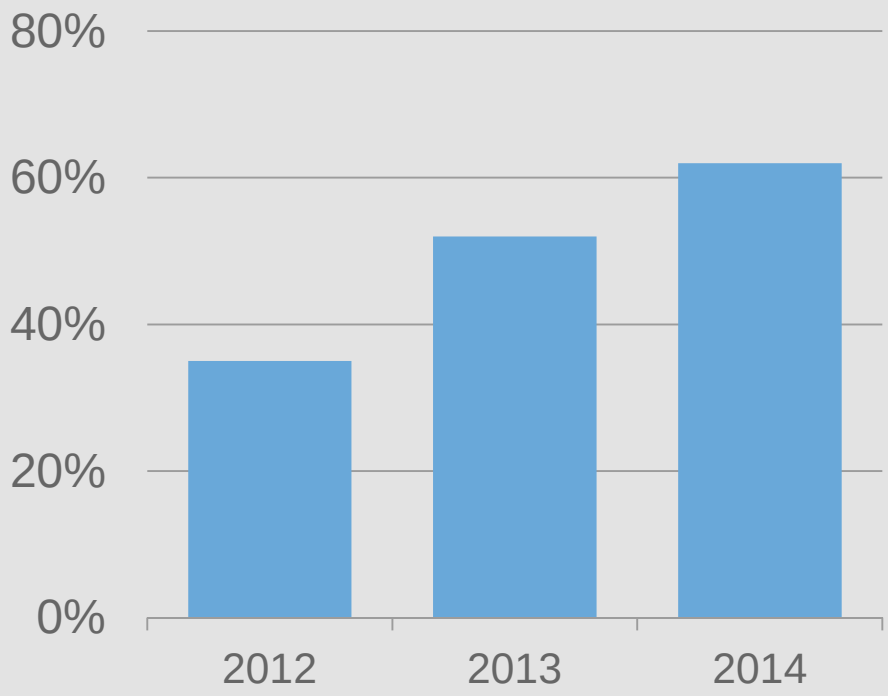
Enabling feedstock flexibility and R&D

Enabling full compatibility with past and future uses



Targeting 100% waste and residue processing capability by 2017

Share of waste and residue feedstock



Actions to reach 100% capability

- Further development of global supply chain
- Continuous R&D to evaluate new lower-quality feedstock
- Successful test runs with 100% waste and residue blends
- Debottlenecking processing constraints

Broad range of renewable raw materials

Waste animal fat from the food processing industry

Waste fat from the fish processing industry

Vegetable oil residues PFAD and spent bleaching earth oil

Technical corn oil

Used cooking oil

Tall oil pitch

Crude palm oil

Camelina oil

Jatropha oil

Rapeseed oil

Soybean oil

Neste Oil also procures bio-based ethanol from the global market to be used as a bio-component in 95 E10 and 98 E5 gasoline.

Cutting-edge research

- Continuous research to expand renewable raw material base and further develop NEXBTL technology
  - 70% of R&D costs
- Cooperation with over 20 research institutions around the world
- Approx. 1,000 people working with research

NESTE OIL

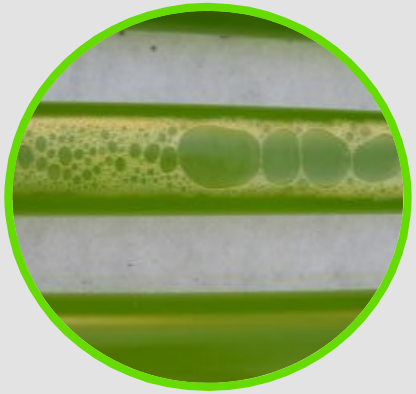
Expanding the feedstock base

SHORT-TERM

Waste animal fats, waste oils, residue and side streams

Non-food vegetable oils

LONG-TERM



Algae oil

Harvesting residue and biomass

Global leader in renewable products

Flexible feedstock supply

Global supply chain

Drop-in solutions for customers

Kiitos.

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