

Renewable diesel - Advanced biofuel

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NESTE OIL

refining the future

Neste Oil ...

- ... aims to be the world's leading renewable diesel producer
- ... continues to invest in new conversion capacity at current refineries
- ... invests several billion euros in growth projects over the next 10 years

... to maximize shareholder value

We will reinforce the key elements of our strategy...

**Delivering high-quality
products for cleaner
traffic**

**Increasing the
range of
feedstocks**

**Leveraging
refining
excellence**

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NExBTL Capacity Outlook



1. Finland #1	170 000 tons	2007
2. Finland #2	170 000 tons	2009
3. Austria	200 000 tons	2010/11 (JV with OMV, pending)
4. Singapore	800 000 tons	2011
5. Rotterdam	800 000 tons	2011
Undisclosed projects	millions of tons	by 2015

Investment Projects 2008 – 2011

Division	Location	Capacity	Budget	Schedule	Other
Oil Refining					
➤ New diesel line (mild hydrocracker)	Naantali	Open	Open	Open	No investment decision made. Could use VGO as feedstock.
➤ Isomerization unit	Porvoo	600,000 t/a	80 Meur	2011	Processes 600,000 t/a of low-value gasoline into high-quality gasoline. Increases refinery's total gasoline output by 200,000 t/a
Renewable Fuels					
➤ NExBTL plant	Porvoo	170,000 t/a	> 100 Meur	2009	Under construction
➤ NExBTL plant	Singapore	800,000 t/a	550 Meur	2010	Under construction
➤ NExBTL plant	Rotterdam	800,000 t/a	670 Meur	2011	Under construction
Specialty Products					
➤ Base oil plant	Bahrain	400,000 t/a	115–135 Meur	2011	JV: Neste share is 45% → 180,000 t/a
➤ Base oil plant	Abu Dhabi	500,000 t/a	Open	Open	JV: Neste share is 20% → 100,000 t/a No final investment decision made



Drivers for uptake of renewable fuels

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Rationale for stimulating the development of strong biofuels markets is compelling, notably to Western Governments

GHG and Security of Supply

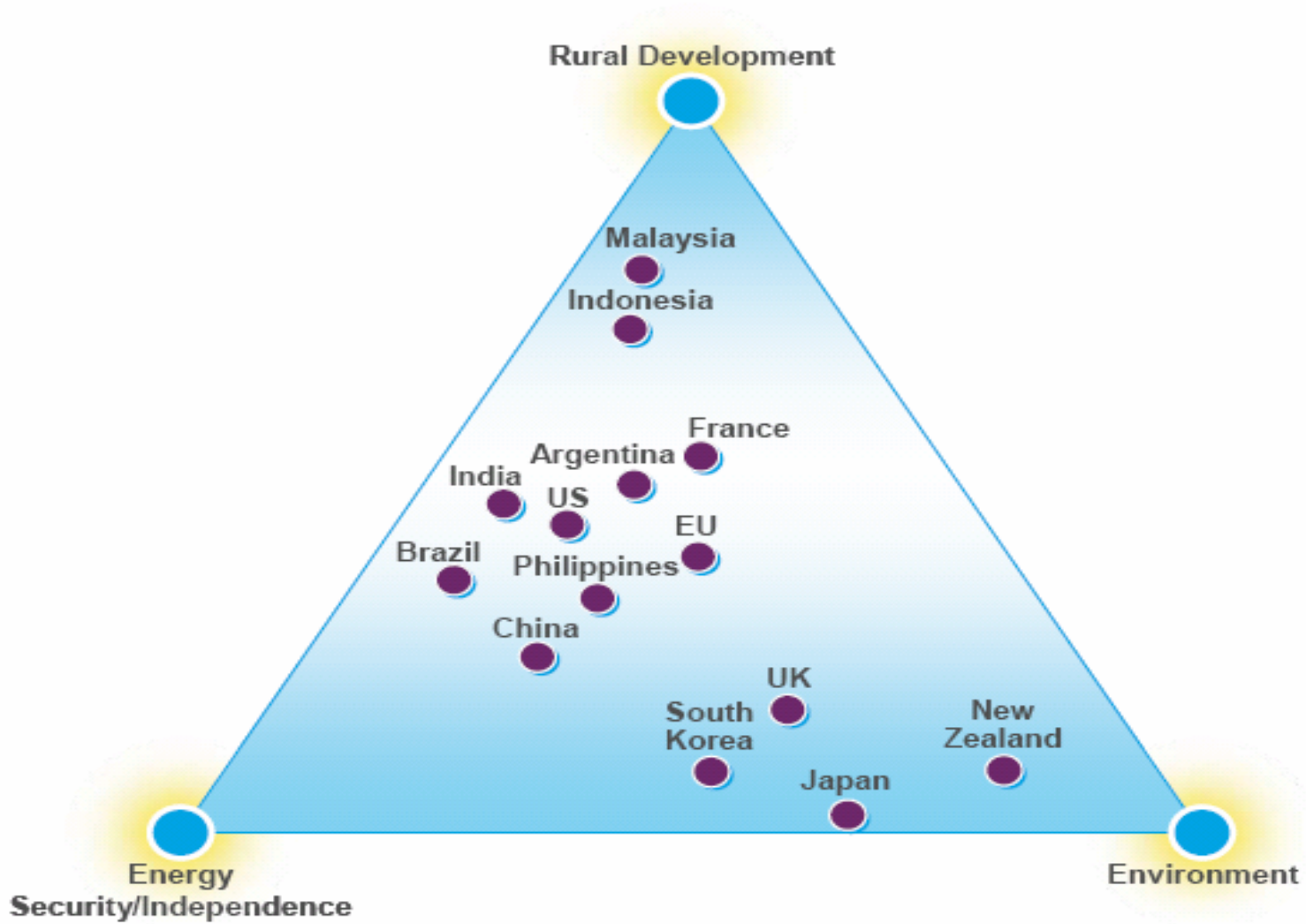
Rural economies

Oil bills

Technology development

- **Only viable supply side option to tackle GHG and Security of Supply**
 - Compatibility with current pools
 - Relatively high energy content
 - Economically more attractive than alternatives (LNG, LPG, Fuel Cells, etc)
- EU short diesel / US short gasoline
- **Convenient way to support/maintain domestic rural economies**
 - Rapeseed-based biodiesel in WE
 - Corn-based ethanol in US
- **Opportunity for emerging countries to reduce oil import bills**
- **Promising technology development**
 - Biomass Gasification to Biodiesel
 - Ligno-Cellulosic fermentation to Ethanol

Biofuels Policy Drivers in Key Countries



Alternatives to make renewable fuel

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Technology Options

Feedstocks

Annual Crops

vegetable oils

- palm, rape, soya

cereals

- wheat, barley, corn

sugar crops

- sugarbeet, sugar cane

Wastes

animal fats

pine oil

straw, corn stover

MSW / RDF

black liquor

sawmill wastes

forestry residues

Energy Crops

reed canary grass

switch grass

algae

microbes

Process

Pressing/
Esterification

Hydrotreating/
Isomerization

Fermentation

Gasification/
Catalysis

Fuel

FAME, RME

Hydrocarbons

NExBTL

F-T Diesel

Ethanol / ETBE

TAME, TAAE

MeOH / MTBE

Dimethylether (DME)



FAME = BIODIESEL



RENEWABLE DIESELS

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Alternative Fuel Options

In	Mineral Oil	Natural gas Coal	Vegetable oils Animal fats	Vegetable oils Animal fats	Biomass
	Refining	Gasification Fischer-Tropsch	Esterification	Hydrotreating	Gasification Fischer-Tropsch
Out	Gasoline	Gasoline	FAME = Biodiesel	Renewable: Gasoline	Renewable: Gasoline
	Jet	Jet		Jet	Jet
	Diesel	Diesel		Diesel	Diesel
	C_nH_{2n+2}	C_nH_{2n+2}	$H_3C-O-C(=O)-R$	C_nH_{2n+2}	C_nH_{2n+2}
	C_nH_{2n}				
	Isoparaffins Aromatics Polyaromatics	Isoparaffins	Esters	Isoparaffins	Isoparaffins
	Commercial	Commercial	Commercial	Commercial by Neste Oil	Development phase (Choren, Neste Oil- StoraEnso etc.)

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NExBTL Plant



Bio oils

Feed tank

Pretreatment
Impurities
removal

Solids

Hydrogen

NExBTL Process
Conversion
of fatty acids
to diesel fuel

Stabilization

Bio fuel gas

Water

Biogasoline

1st unit in Finland
running 2007
170 000 t/a

NExBTL
tank

NExBTL for
blending and sales



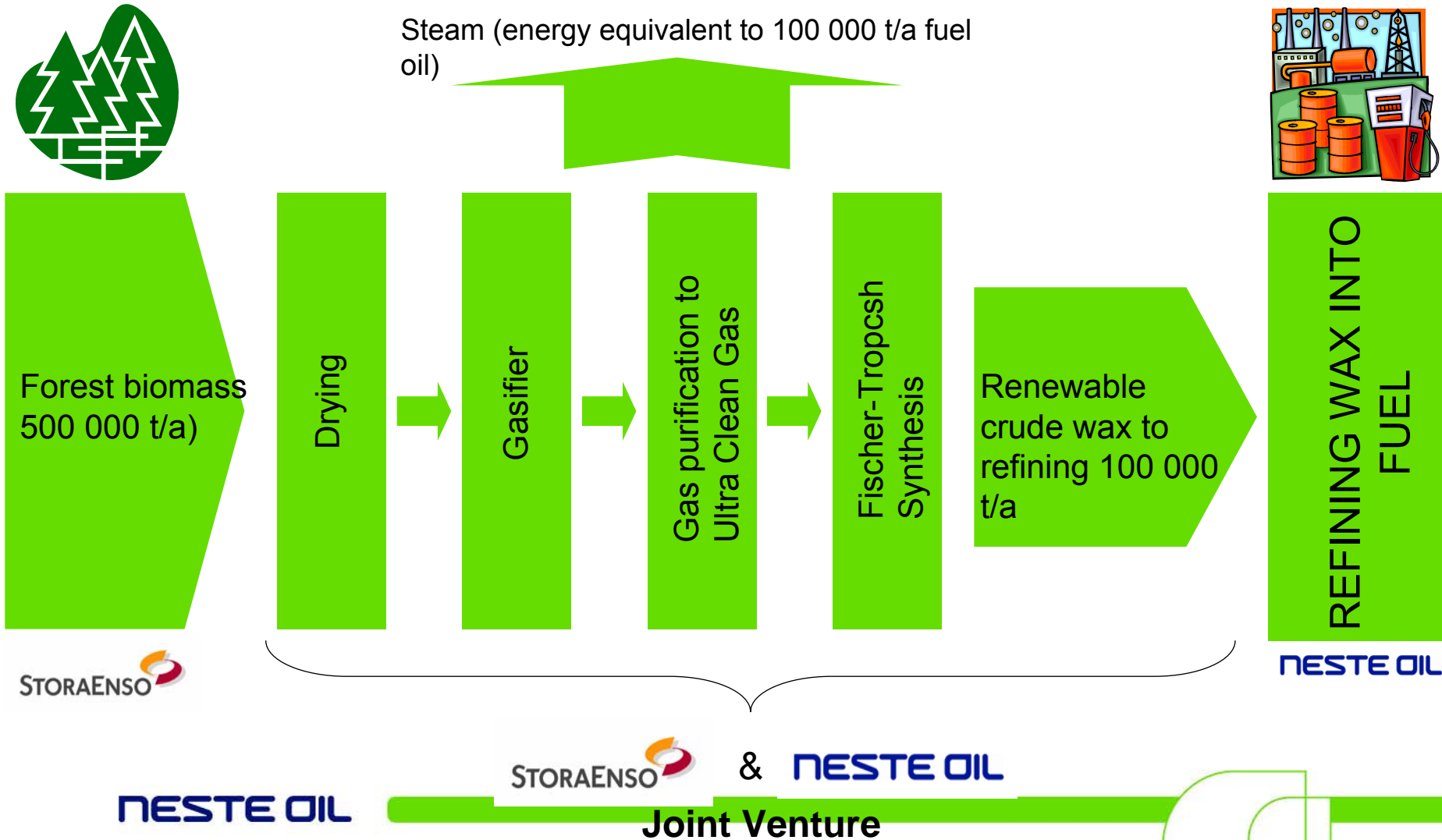
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JV with Stora Enso to develop renewable diesel from wood-based raw materials



- Aiming to produce renewable diesel from forest chip raw materials
- Demonstration plant at Stora Enso's Varkaus Mill in Finland
 - develop technology for purification of syngas to be used in Fischer Tropsch process
 - start up in 2009
- Commercial plant development in the second phase
 - after successful testing period
- Combines expertise of Neste Oil, Stora Enso, and VTT (the Technical Research Centre of Finland)

JV with Stora Enso to develop renewable diesel from wood-based raw materials



Alternative Fuel Options

Focusing in diesel capacity

In

Mineral Oil

Natural gas

Coal

Vegetable oils

Animal fats

Vegetable oils

Animal fats

Biomass

Refining

Gasification

Fischer-Tropsch

Esterification

Hydrotreating

Gasification

Fischer-Tropsch

Out

Gasoline

Gasoline

FAME =

Gasoline

Gasoline

Jet

Jet

Biodiesel

Jet

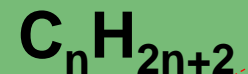
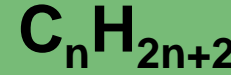
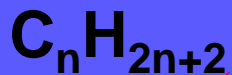
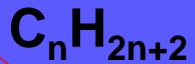
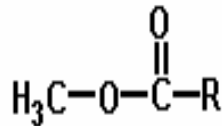
Jet

Diesel

Diesel

Diesel

Diesel



Isoparaffins
Aromatics
Polyaromatics

Isoparaffins

Esters

Isoparaffins

Isoparaffins

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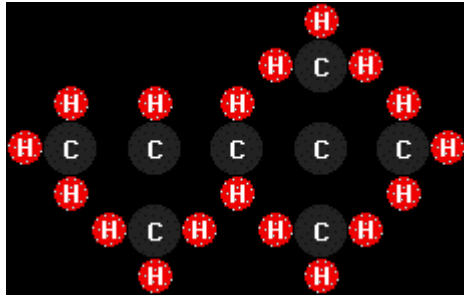
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CAPEX intensity

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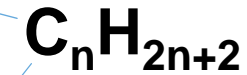
Pure hydrocarbon fuels



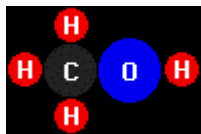
isooctane (C₈H₁₈), gasoline



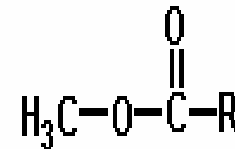
cetane (C₁₆H₃₄), diesel



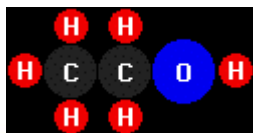
Fuels with oxygen atoms



methanol
(CH₃OH)



FAME
biodiesel



ethanol
(C₂H₅OH)

Butanol
(C₄H₇OH)

DME
(C₂H₆O)

Alternative Fuel Options

In

Out

<p>Lignocellulosic biomass</p> <p>Pyrolysis Hydrogenation</p> <p>Gasoline Jet Diesel</p> <p>C_nH_{2n+2} C_nH_{2n}</p> <p>Isoparaffins Aromatics Polyaromatics</p>	<p>Carbohydrates</p> <p>Biochemical or catalytic conversion</p> <p>Gasoline Jet Diesel</p> <p>C_nH_{2n+2}</p> <p>Isoparaffins</p>	<p>Black liquor</p> <p>Gasification Catalytic conversion</p> <p>DME MeOH</p> <p>Isoparaffins</p> <p>Ether Alcohol</p>	<p>Algae Microbes</p> <p>Hydrotreating</p> <p>Renewable: Gasoline Jet Diesel</p> <p>C_nH_{2n+2}</p> <p>Isoparaffins</p>	<p>Lignocellulosic biomass</p> <p>Biochemical conversion</p> <p>Bioalcohols</p> <p>EtOH BuOH Alcohols</p>
<p>Development phase</p>	<p>Development phase</p>	<p>Development phase</p>	<p>Development phase</p>	<p>Development phase</p>

Feedstock Availability / Plant Oils and Fats

	World / EU-27 production exports*/imports kt/a	World trade** kt/a	EU-27 kt/a
Palm oil	37,156 / -	29,979	158 / 4731
Soybean oil	35,314 / 2,591	10,384	253 / 934
Rapeseed oil	18,449/ 6,317	2,088	63 / 696
Tallow and greases	8,450 / 1,107	2,154	43 / 74

Jan-Dec 2006

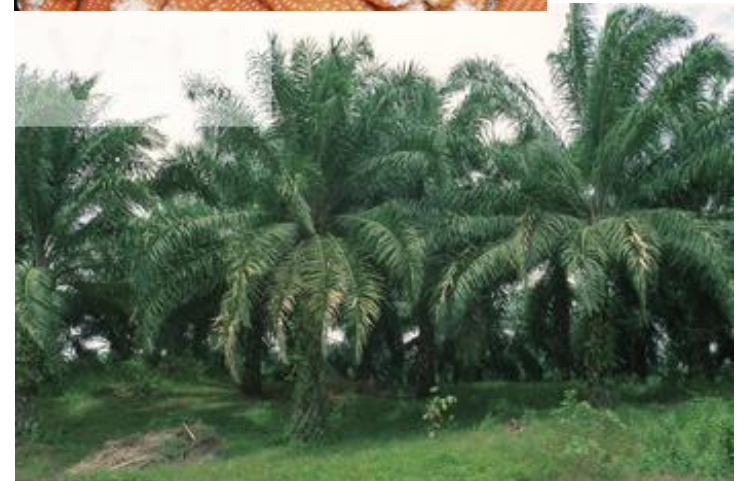
*Intra EU trade excluded

** Includes world export

Source: ISTA Mielke GmbH, OIL WORLD June 2007

In existing crops palm oil yield is superior (in crude oil equivalent)

	End product:	Yield (ton/hectare) as crude oil equivalent:
rapeseed oil (EU)	NExBTL / (FAME)	0.9
soya oil (US)	NExBTL / (FAME)	0.54
palm oil (Malaysia)	NExBTL / (FAME)	4.2
wheat (EU)	EtOH	1.1
barley (Finland)	EtOH	0.6
corn (US)	EtOH	1.2
sugar beet (EU)	EtOH	3.1
sugar cane (Brazil)	EtOH	3



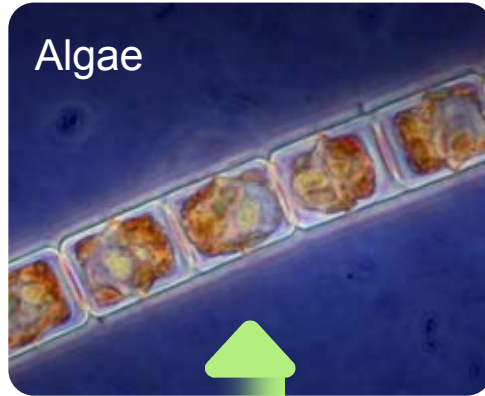
Global biomass potential

	Million hectares globally	Ton/hectare yield	Million tons crude oil equivalent production 2007
1. existing crops (sugar cane, sugar beet, oil crops, wheat, maize, palm)	100-200	5-20	250-500
2. energy crops (Miscanthus, Reed canary grass, eucalyptus etc.)	200-400	15-20	1000-2000
3. agricultural wastes (straw, cornstover, bagasse, rice hulls, palm wastes)	300-600	5-15	700-2000
4. forestry wastes (sawdust, logging residues, black liquor)	100-200	10-20	500-800

Conclusion: Many studies put potential at 2000-5000 Mtoe/a

Compare: Current global traffic fuel need ~ 2000 Million ton crude oil equivalent / year

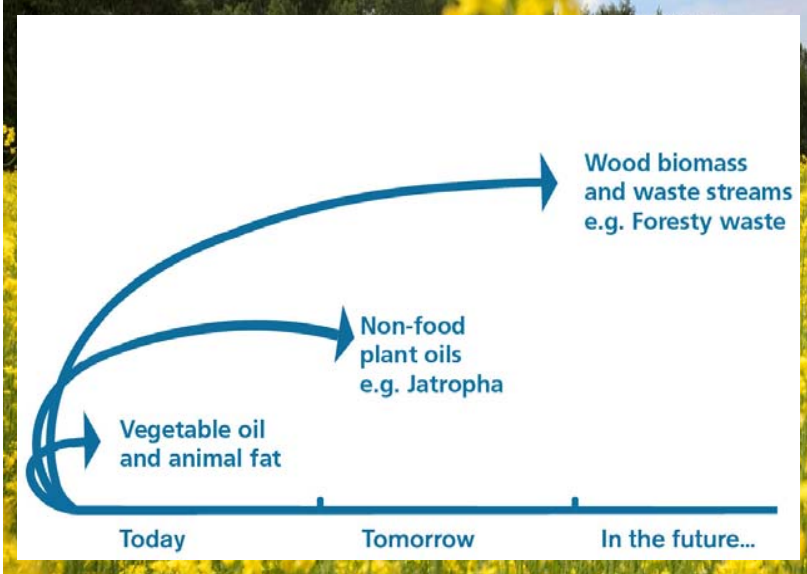
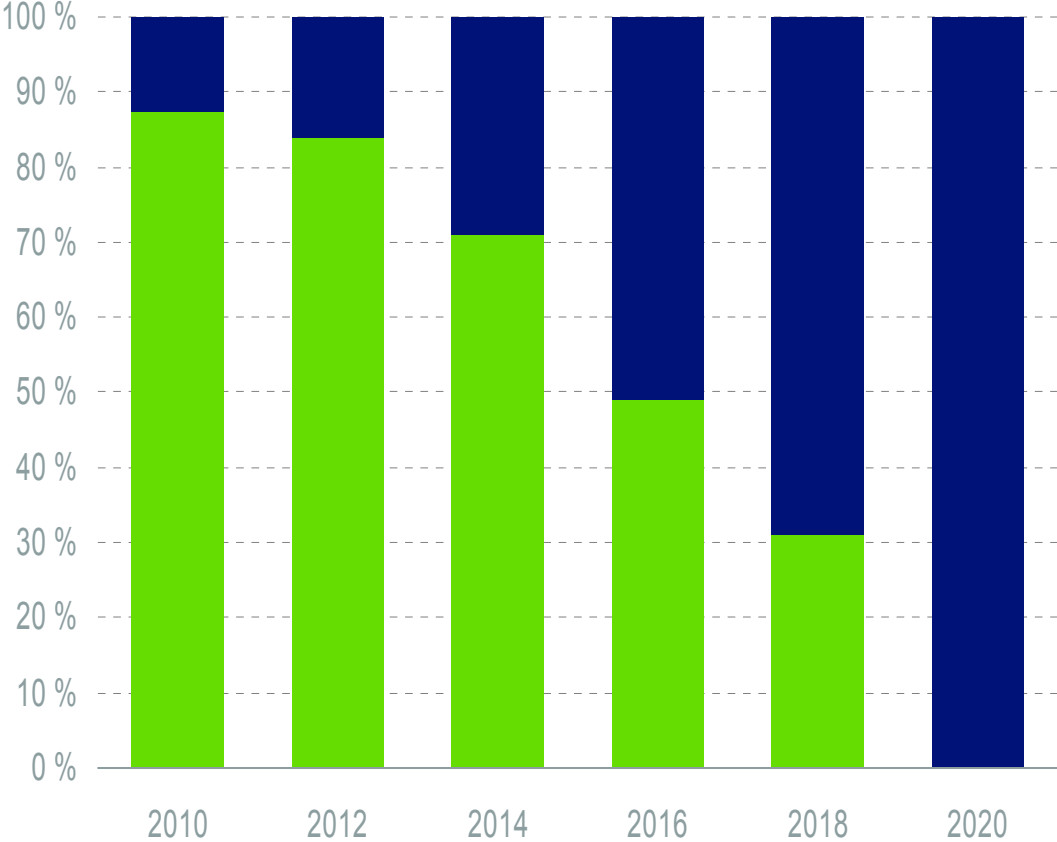
Neste Oil's six research initiatives



Neste Oil's use of edible and nonfood raw materials

Target to exit the traditional food chain by 2020

Edible Nonfood



NExBTL renewable diesel has superior product qualities

NExBTL renewable diesel

- **No restrictions on blending proportions**
- **No need to relax specifications to achieve high bio-content**
- **Reduces emissions**
- **Excellent storability**
- **No vehicle modifications needed**

Conventional biodiesel

- **Maximum blending limit 5%***
- **Bio targets not achievable without specification changes**
- **Higher NOx emissions**
- **Must be used by its “sell by” date**
- **May cause problems with engines**

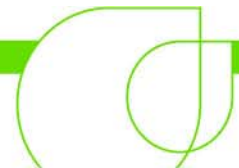
* Maximum permitted level under European diesel standards

NExBTL Process is Feedstock Flexible

The quality of the fuel is independent of feedstock

- Currently only some vegetable oils (palm, rapeseed, soy) and animal fats are available in large volumes.
- Non-food oils like Jatropha are emerging.
- Algae oils have large potential further in future.

Sustainable and GHG efficient feedstocks are essential



NExBTL Benefits to Consumer

High engine efficiency

- high cetane, clean nozzles, 5 % more energy than FAME

Standard service intervals

- with FAME shorter service intervals

No water or cold operability issues

- no filter blockages

Clean engine, no power losses or consumption increase

NExBTL Value Added to Distributor

Logistics fully compatible with diesel logistics

- materials, additives, storage time

Doesn't attract water like FAME (conventional biodiesel)

Blending value

- density, energy content, cetane, sulphur, aromatics

Cold properties

Comparing key fuel properties

Fuel properties	RME	Sulphur-free Diesel fuel ⁽¹⁾	NExBTL
Density at +15°C (kg/m ³)	≈ 885	≈ 835	775 ... 785
Cetane number	≈ 51	≈ 53	≈ 84 ... 99 ⁽²⁾
Cloud point (°C)	≈ - 5	≈ - 5	≈ - 5 ... - 30
Heating value (lower) (MJ/kg)	≈ 38	≈ 43	≈ 44
Sulfur content (mg/kg)	< 10	< 10	≈ 0
Product stability	Unstable	Stable	Stable

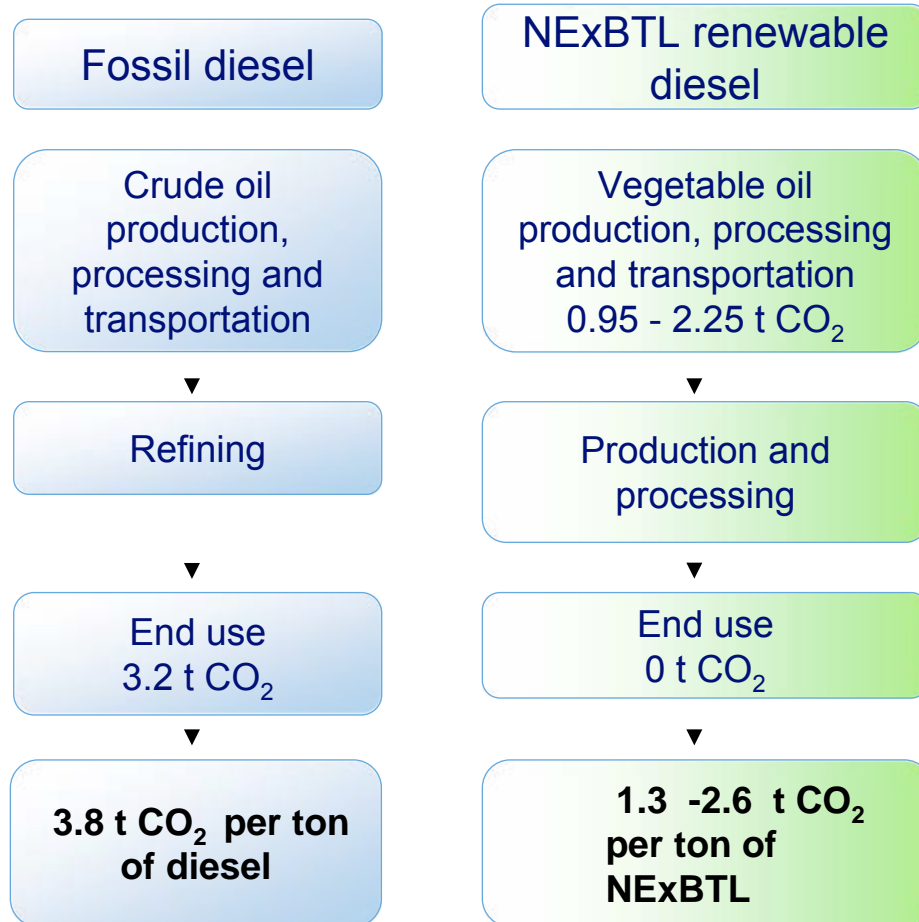
NExBTL characteristics

- CO₂ reduction
- Cleaner emissions
- No implications for existing car pool
- No need to relax specifications to achieve high bio content
- Distribution within existing oil refinery logistics
- No need to compromise fuel quality

(1) EN590/2005

(2) Blending cetane number

Significant reduction of GHG emissions



Annual production of the first Porvoo NExBTL-plant (170 Kton) can supply diesel needed for around 42,000 cars driving one time around the world

NExBTL's GHG emissions over entire lifecycle are 40-60% lower than fossil diesel

Majority of emissions generated on raw material production

Potential to reduce GHG emissions in raw material production

- optimizing fertilizer use
- waste water treatment
- use of waste

Source: Concawe/Eucar WTW 2004, IFEU

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Significant reduction in tailpipe emissions

- Engine tests have proved that NExBTL renewable diesel reduces tailpipe emissions significantly compared to fossil diesel fuel:
 - ✓ 10% less nitrogen oxides
 - ✓ 28% less small particle emissions
 - ✓ 50% less hydrocarbons
 - ✓ 28% less carbon monoxide
 - ✓ 40 - 45% less aldehydes
 - ✓ 40 - 45% less benzene

Future

Future fuel is in production today

- NExBTL renewable diesel is like BTL/GTL - diesel

Production of NExBTL will increase, target to be worlds leading producer

New non-food feedstocks (sustainable)

- Jathropa, Algae, etc

We want to be the leading provider of cleaner transport fuels

Our technology is flexible in terms of feedstock

NExBTL diesel has significant reduction in tailpipe emissions and ensures good engine performance and operability

Key drivers are sustainability and GHG reduction

We have intensive R&D - Our technology is available today, the feedstock is developing

JV with Stora Enso to develop renewable diesel from wood-based raw materials

Conclusions

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- Growing demand for traffic fuels
 - US as a growth engine for fuels business slowing down and probably becoming a decreasing market
- Renewable fuel demand growth on all continents
- Diesel and jet applications grow fastest
- A wide range in CAPEX intensity of alternative value chains
- A wide range in primary energy supply and price
- Sustainability is a major new issue in business
- Market creation is a political process – so political risk is always included
- In order to create shareholder value – look for contingency plans

Biodiesel - new ??

Rudolf Diesel (1858-1913) developed the first peanut-oil dieselmotor to Paris world exhibition 1900



renewable

"Use of vegetable oils will stay marginal, but some day these will be as important as crude oil and coal" Rudolph Diesel, 1912

THANK YOU
for your attention

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