

Renewable Diesel: Sustainable Hydrocarbon Fuel

Detroit Advisory Panel Forum
17 April 2018

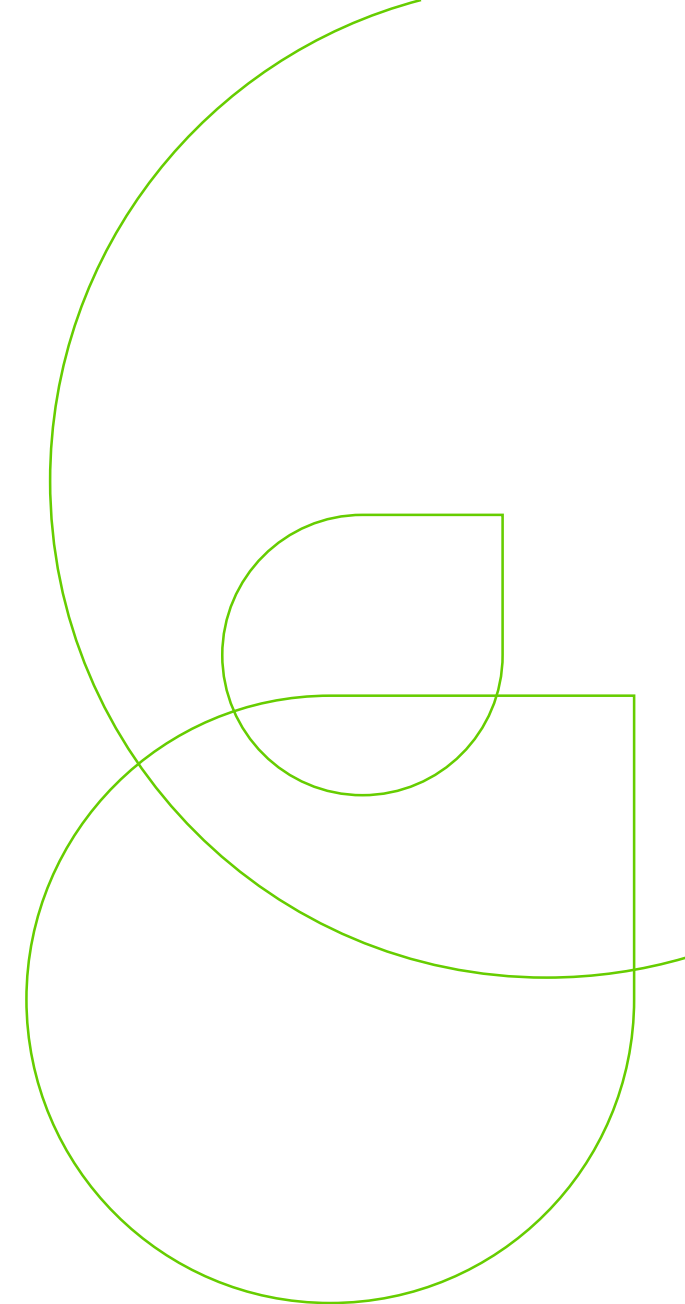
Chris Castanien
Technical Services Manager - Americas



NESTE MY

Agenda

- Neste in Brief
- Premium hydrocarbon diesel fuel - not biodiesel
- Sustainability
- Production
- Performance
- Renewable Technology Growth





Neste has been ranked the 2nd most
sustainable company in the world

2018 Global 100 Most
Sustainable Corporations
in the World, Jan. 2018

Neste in brief...



The world's
largest
producer of
**renewable
diesel**

**880M
gallons**
Annual
production

Total capacity
increased to
1.3B gallons
by 2022

Major
Supplier of
Group III Base
Oils

**\$13.9
billion**
In revenue

Renewable Diesel Premium Diesel Fuel



RENEWABLE DIESEL

Every molecule in Renewable Diesel is in
Petroleum Diesel

NOT BIODIESEL

No molecules in Biodiesel are in
Petroleum Diesel (Fatty Acid Methyl Ester)

“Renewable diesel should be treated the same as conventional CARB diesel for all purposes...”

“Renewable diesel should be treated the same as conventional CARB diesel for all purposes, including storage in underground storage tanks.

For purposes of this statement, conventional CARB diesel is petroleum-based diesel that meets specified aromatics, sulfur content, and lubricity standards, as well as ASTM international standard specification, ASTM D975-12a. Similarly, renewable diesel meets the definition of ‘hydrocarbon oil’ and the physical and chemical properties specified in ASTM D975-12a.

The renewable diesel samples tested well within the ASTM D975-12a specifications.”

Renewable Diesel is Diesel Fuel ... by definition



What is renewable diesel?

- A premium quality diesel that is a colorless, odorless, high cetane, cleaner burning, stable, diesel fuel
- Produced from 100% renewable and sustainable raw materials
- Pre-treatment of raw materials ensures near zero contaminants





Renewable Diesel Sustainability



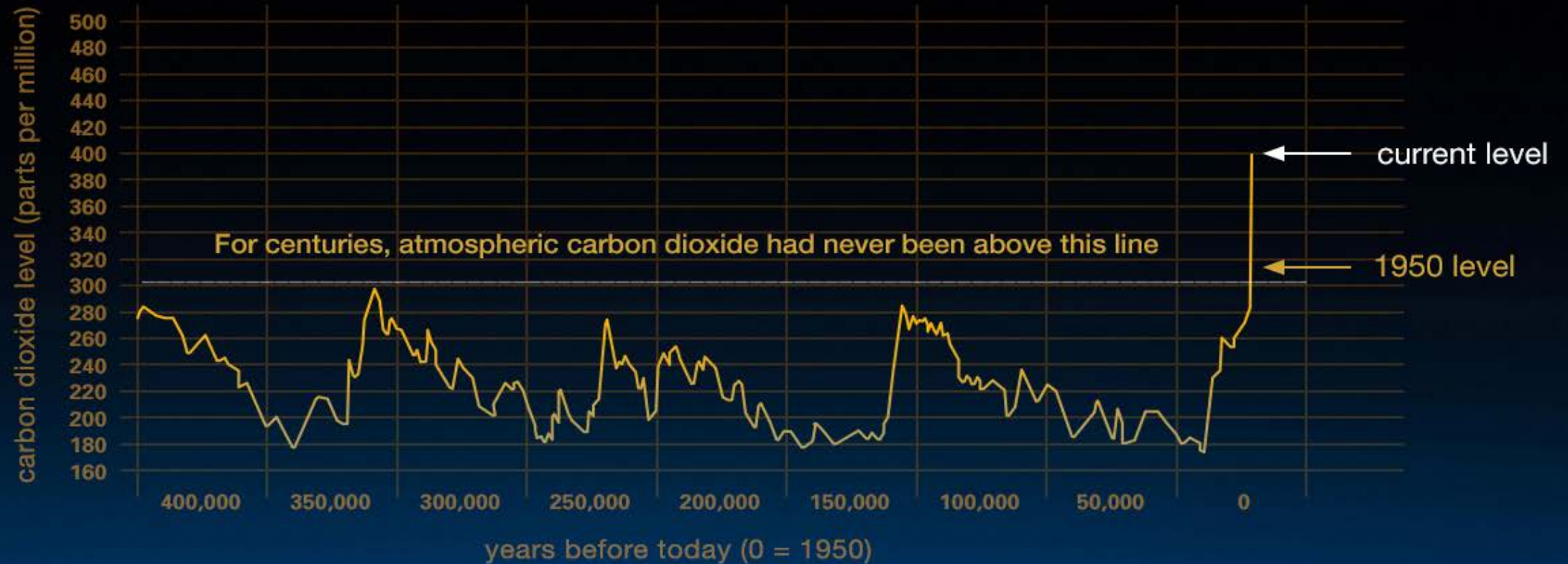


Liquid Fuels & the Internal Combustion Engine: Revolutionary!

Exponential improvements in:

- Global Trade
- Public Health
- Living Standards
- Wealth & reduced poverty
- An effectively smaller world

Atmospheric CO₂ has also Grown Exponentially



Burning Fossil Fuel Reintroduces Sequestered Carbon to the Biosphere



- Fossil Fuels are the sun's energy from millions of years ago transformed into hydrocarbons below ground
- Extracting and burning those hydrocarbons returns that ancient carbon to the biosphere as CO₂
- There's a lot of old carbon going back into the atmosphere and we really don't know the impact

Clearly it would be better, and more sustainable,
to recycle solar energy with today's CO₂

-Renewable Diesel-

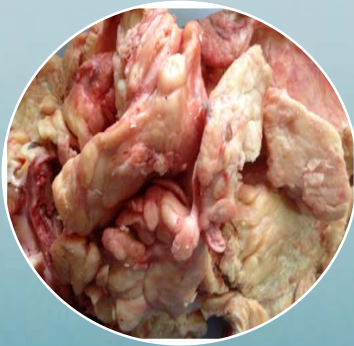
Renewable Diesel Production



Neste MY is refined from a mix of more than 10 different triglyceride wastes & residues and various vegetable oils



Used cooking oil



Waste animal fat



Waste fish fat



Vegetable oils

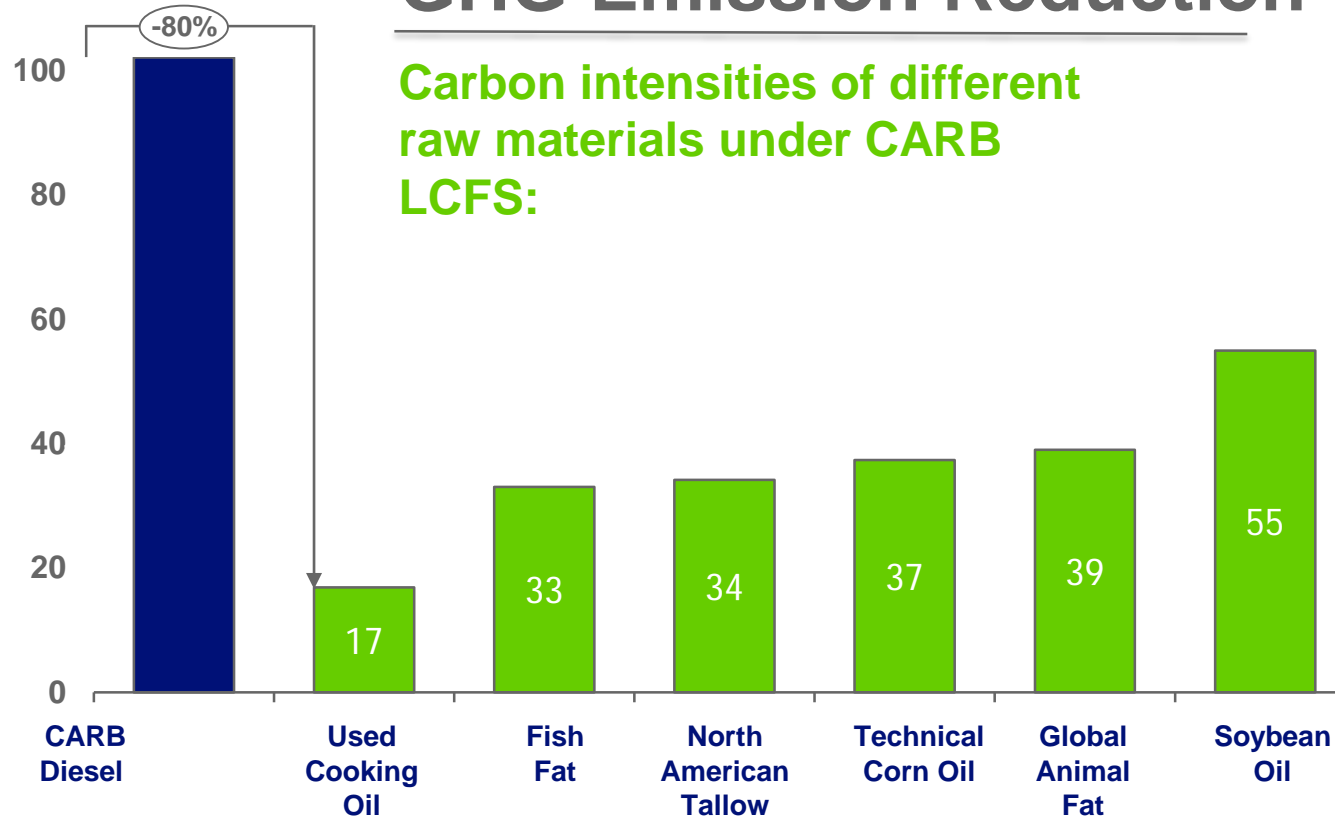


Residue oils



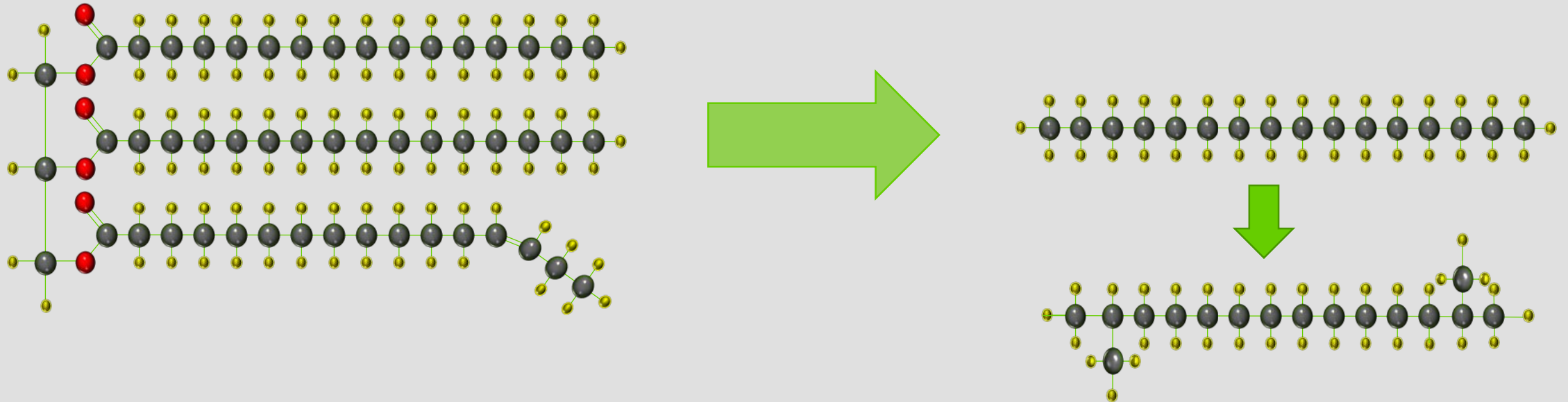
Renewable raw materials provide up to 80% Carbon Intensity reductions

GHG Emission Reduction



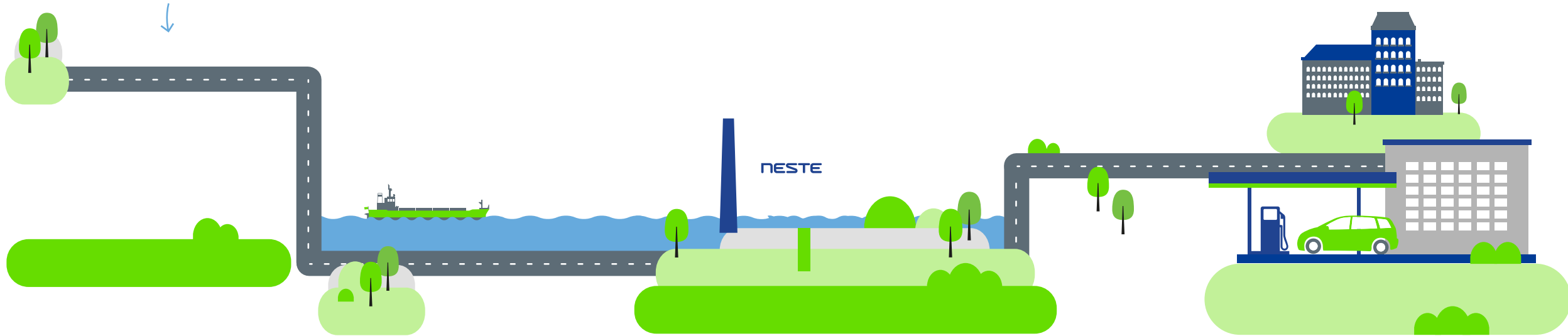
Units are all gCO2e/MJ

Triglycerides are Hydrogenated and Isomerized



Renewable Diesel is frequently called Hydrogenated Vegetable Oil (HVO)

NEXBTL Process



Inputs

Hydrogen and
renewable feedstocks

Pretreatment

Renewable raw materials are
sent through a pre-treatment
unit for purification and
removal of all metals and
contaminants prior to the
Neste MY production process
to protect the catalyst

Purity

Hydrotreatment Unit (HDO)

is used to remove oxygen and break
the feedstock into hydrocarbons

Isomerization Unit

allows for precise adjustment of cold
properties down to arctic grade diesel
fuel grades

Distillation

is used to separate diesel, gasses,
and naptha

Outputs:

- Neste My Renewable Diesel
- Renewable Propane
- Renewable Naptha



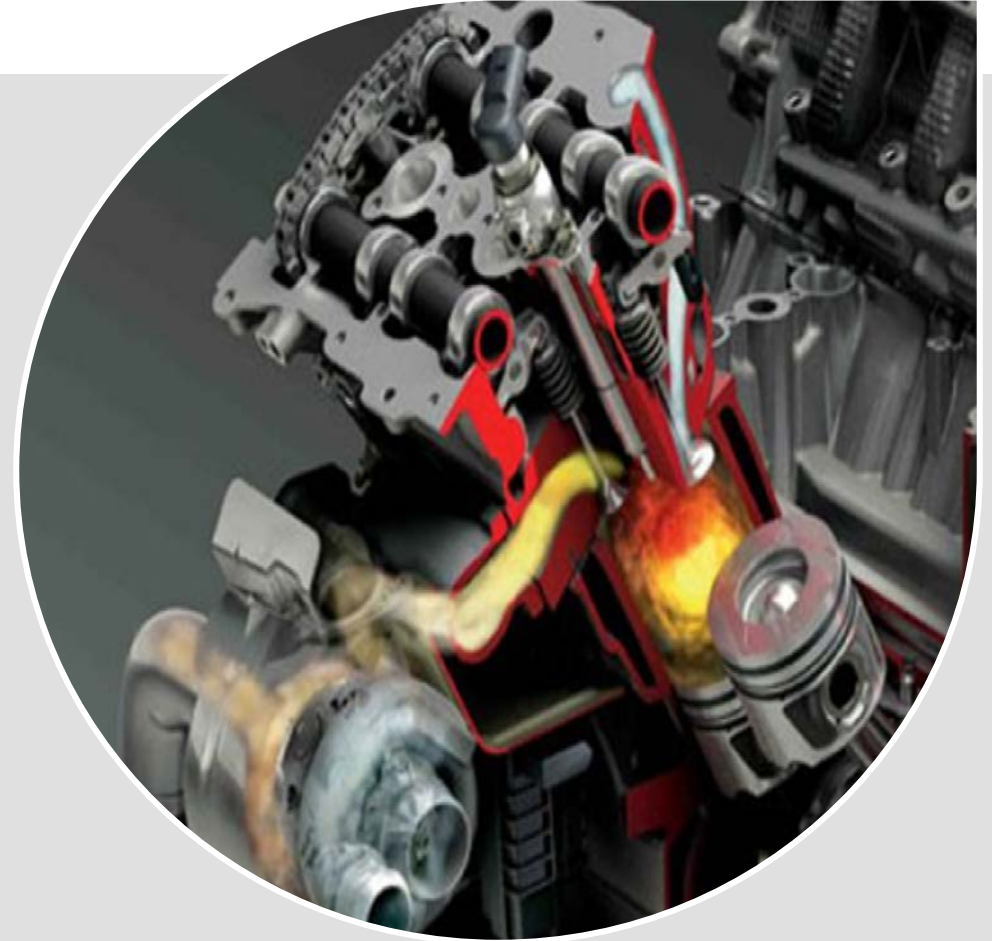
Renewable Diesel Performance



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Powertrain benefits

- High cetane (75-80) for greater pick up and improved cold start
- Less soot meaning fewer DPF regenerations and lower backpressure
- Near zero ash-forming components reduce ash accumulation and extend cleaning intervals
- Outstanding thermal stability reducing maintenance issues from deposits
- Quieter combustion



Fueling benefits

- Almost zero risk of water absorption or microbial growth
- Cold flow properties equal or better than petroleum diesel
- Non-polar, will not clear out debris in older fuel tanks
- Aromatic-free is less harmful to employees, handlers & environment
- Absolutely no changes to infrastructure, storage or handling required



“We have been using renewable diesel for some time now and we are thrilled with it. The best news is that there is no difference between traditional diesel and renewable diesel. From a performance standpoint it’s amazing.”

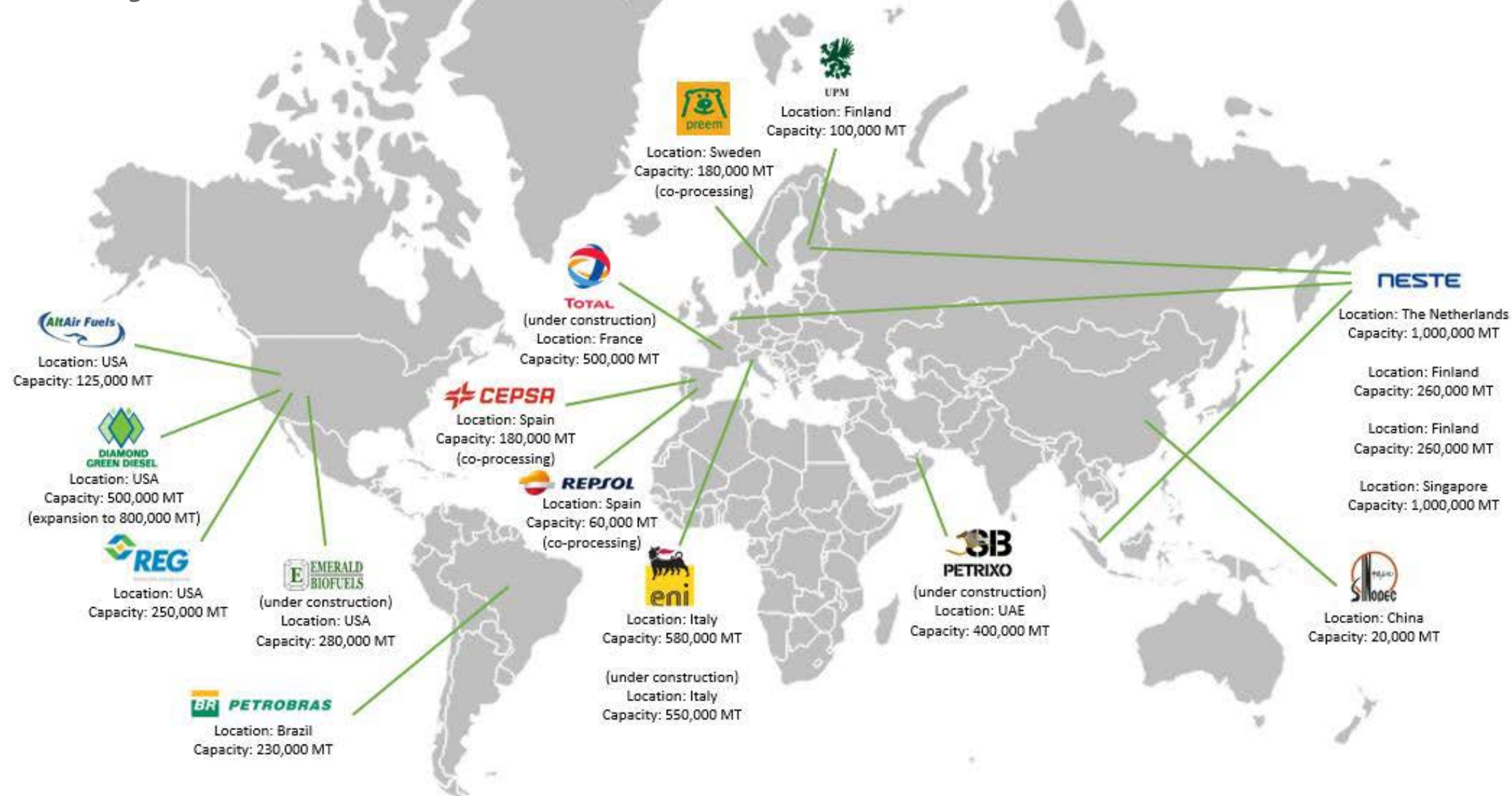
**- Deborah Raphael, Director,
San Francisco Department of the Environment**



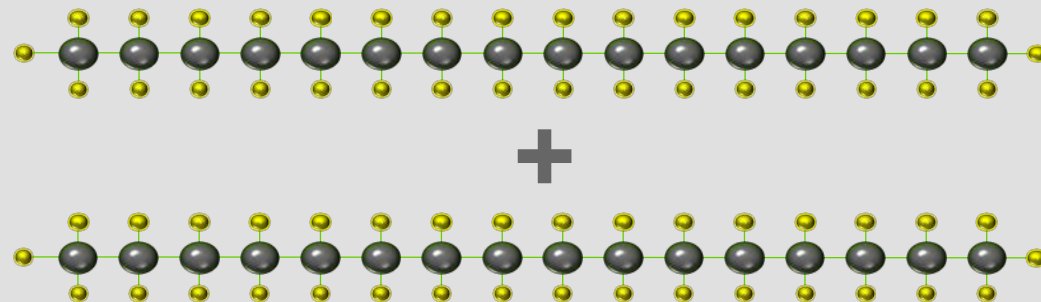
Renewable Technology A Growing Opportunity



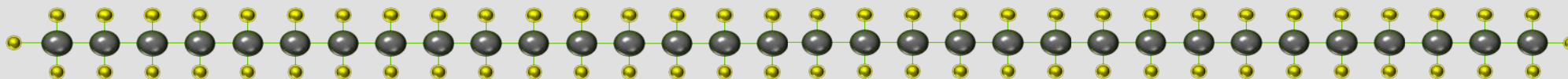
New Players Join the HVO Game



Renewable Base Oil



Patented New Technology



C₃₁ 4.3 cSt

C₃₃ 5.2 cSt

C₃₅ 6.0 cSt

All products are isomerized for cold properties

An aerial photograph of a coastline, showing a mix of green land, blue water, and white clouds. A large, semi-transparent light blue circle is overlaid on the left side of the image, containing text. The right side of the image shows the white wing and engine of an airplane in flight against a clear blue sky.

Neste Renewable Jet Fuel

- ✓ Offers airlines an easy way to lower their carbon footprint and cut their emissions
- ✓ Meets ASTM D7566 specification
- ✓ High energy density
- ✓ Already available at scale
 - ✓ Over a thousand commercial flights on Lufthansa
 - ✓ Introduced to Oslo airport for ITAKA project



www.nesteMY.com



NESTE



A side-by-side comparison of two flames. On the left, a flame from Neste MY Renewable Diesel is shown, which is tall, smooth, and has a clean, blue-tinted base. On the right, a flame from CARB Petroleum Diesel is shown, which is shorter, more irregular and flickering, and produces a thick, dark plume of smoke that rises into the air. Both flames are contained within glass vessels on a reflective surface.

Neste MY
Renewable Diesel

CARB
Petroleum
Diesel

NESTE