Transportation and climate change

- Transportation is the #1 source of GHG emissions in the U.S.
- Between 1990 and 2015, GHG emissions in the transportation sector increased more in absolute terms than any other sector.
- 78% of commercial vehicles are powered by diesel engines
- In California medium and heavy duty trucks only make up 4% of the 28.2 million vehicles, but account for 20% of the GHG emissions in the transportation sector and 8% of statewide GHG emissions.
Alternative transportation fuel carbon intensities per mile

Renewable diesel, Petroleum diesel, Electricity (for transportation), Hydrogen, CNG, LNG

The fossil cycle takes carbon that has been sequestered underground for millions of years and releases it into the atmosphere

The biogenic cycle reuses carbon already in the atmosphere and does not increase atmospheric carbon levels
Neste MY is refined from a mix of more than 10 different wastes & residues and various vegetable oils

- Used cooking oil
- Waste animal fat
- Waste fish fat
- Vegetable oils
- Residue oils

Consistency

- Clear and bright every time
- D975 still has variability
- Neste MY is consistent

10 random fossil diesel samples from CA
Fleet maintenance costs

- The systems affected by fuels combine to be the second largest cost, behind tire related expenses
- Switching to Neste MY can lead to savings in those areas

What is renewable diesel?

- It is ULSD and CARB diesel and is certified as a drop-in fuel by CARB
- Produced from 100% renewable and sustainable raw materials
- Pre-treatment of raw materials ensures near zero contaminants
- A premium quality, high cetane diesel fuel that is colorless, odorless, cleaner burning, and very stable
- **Renewable diesel is NOT biodiesel**
What is diesel fuel?

The first diesel engines were designed to run on peanut oil and coal dust.

This box represents everything that could potentially fuel a diesel engine.

Within the US the diesel fuel specification is managed by ASTM International (formerly the American Society for Testing and Materials).

The hydrocarbon diesel spec is called ASTM D975.

Every gallon of hydrocarbon diesel fuel sold must meet this spec.
What is diesel fuel?

In 2007 the allowable sulfur limit in US diesel fuel was reduced from 500 ppm to just 15 ppm.

This allowed engine manufacturers to begin implementing advanced emissions reduction technology that would otherwise be poisoned by high sulfur content.

What is diesel fuel?

Because the California Air Resources Board was formed before the US EPA they have the ability to make regulations more stringent than other states.

California chose to limit the aromatics content of their diesel fuel to 10%.
What is diesel fuel?

Biodiesel is not a hydrocarbon fuel, so it is controlled by a different spec - ASTM D6751.

In 2008 a change was made to D975 which allowed for up to 5% biodiesel to be blended in (B5).

Deeper within the tightening circles of cleaner fuel are paraffinic fuels. These are synthetic fuels that consist of only paraffinic molecules, with no aromatics.

Paraffinic fuels are hydrocarbons, so they are governed by D975 and are allowed to have 5% biodiesel blended in.
What is diesel fuel?

This is where Neste MY is unique and differentiated.

Neste sells pure renewable diesel without any blending of biodiesel into the finished product.

This ensures complete control of every fuel molecule from production through consumption.

Neste MY benefits

**Appearance**
- Clear and bright every time
- Product not variable like petroleum based fuels

**Fueling**
- Aromatic-free means Neste MY is less harmful to employees, handlers & environment
- High flash point improves safety for emergency vehicles, school buses other and mission-critical applications
- Flash point guaranteed >60°C

**Handling and storage**
- Almost zero risk of water absorption or microbial growth
- Great oxidative stability = long shelf life
- Minimal to zero risk of filter blocking
- Non-polar, will not clean out debris in older fuel tanks
- Neste R&D has fuel from the first production in 2005. This fuel is tested annually, and in 14 years the oxidative stability has not changed.
Neste MY benefits

Combustion
- High cetane (70+) for greater pick up, quicker cold start, and quieter operation
- 33% less soot to plug DPFs and reduce fuel economy
- Better lubricity than CARB ULSD - 460 μm HFRR (EN590), compared to 520 HFRR for D975
- Maintenance intervals & costs can be reduced (high pressure pumps, fuel injectors, after-treatment systems)

Fuel injectors
- Example from Detroit Diesel engine testing
- Test artificially aged fuel similar to real-world, longer term storage applications
- Demonstrated much lower risk of deposits in injectors which lead to failures
- Purity and lack of oxygen in RD showed no injector failures on Neste test where others failed

Exhaust system
- Burns cleaner due to high cetane number and zero aromatics
- 33% less soot can lead to fewer regenerations and lower backpressure, improving fuel economy
- Improved DPF safety due to reduced soot load and less risk of over-temp
- Near zero ash-forming components reduce ash accumulation extend cleanout intervals

By reducing emissions, we’re improving the environment

Average **30%** lower hydrocarbons (HC), which can cause eye and lung irritation

Average **24%** lower carbon monoxide (CO)

**Near-zero polyaromatic hydrocarbons (PAH)**, which cause health problems

Up to **80%** reduction in life cycle greenhouse gas (CO₂) emissions
The impact of switching to renewable diesel

• There are 3.24 million truck drivers in the United States, according to the U.S. Dept. of Labor.

• Most long-haul, over-the-road trucks drive on average 110,000 miles per year.

• If you switched 100 trucks, each averaging 110,000 miles at 6 miles per gallon, your CO₂ savings would be the equivalent of taking 2,981 cars off the road for a year.

• The 80% carbon intensity reduction for that volume of renewable diesel would also provide the same environmental benefits as 16,396 acres of forests.

What do you need to do to switch to renewable diesel overnight?

NOTHING!

• No change in vehicle purchase price
• No specialized fueling or recharging infrastructure
• No change in maintenance parts stocking
• No retraining and certifying of maintenance personnel
• No compatibility issues with fossil diesel
• No regulatory issues

Compatible with Your Current Infrastructure
Zero change or disruption to your fleet’s operations.

Just Drop-In and Go
Suitable for all diesel engines, requiring absolutely no additional investment.
Neste by the numbers

- The world's largest producer of renewable diesel
- 900M gallons Annual production
- Total capacity increased to 1.4B gallons by 2022
- 5,000+ Professionals in 15 countries
- $16.3 billion in revenue

Sustainability is deeply embedded into Neste’s everyday business

Global 100: Neste is the world’s 3rd most sustainable company.

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Renewable products refineries

Rotterdam, The Netherlands
• The world’s largest renewable diesel refinery alongside Singapore
• Renewable propane will be available on the market during the year 2018
  • ~336MM gallons/yr

Porvoo, Finland
• The world’s first renewable diesel refinery
  • ~153MM gallons/yr

Singapore
• The world’s largest renewable diesel refinery
  • ~336MM gallons/yr
  • Investing $1.6B in refinery expansion
  • Doubling capacity by 2022

Neste MY Renewable Diesel

CARB Diesel
Thank You