

# where public fleet professionals connect

**GOVERNMENT FLEET  
EXPO & CONFERENCE**

June 12-15, 2017

Henry B. Gonzalez Convention Center, San Antonio, TX



# The New Alternative Fuel of Choice

# Renewable Diesel

Richard Battersby | The City of Oakland – Oakland, California

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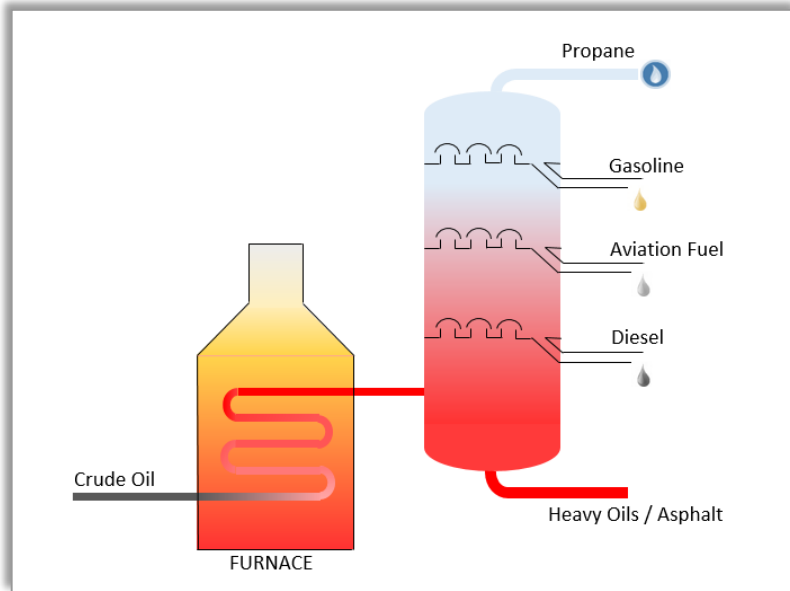


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SAN ANTONIO, TX

# What is Renewable Diesel ?

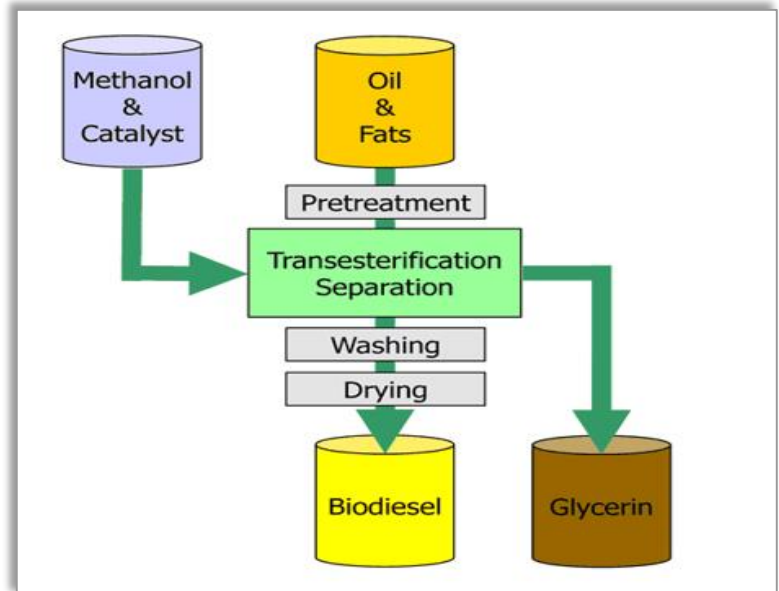
## Petroleum Fuels

Produced by a Fractional Distillation Process

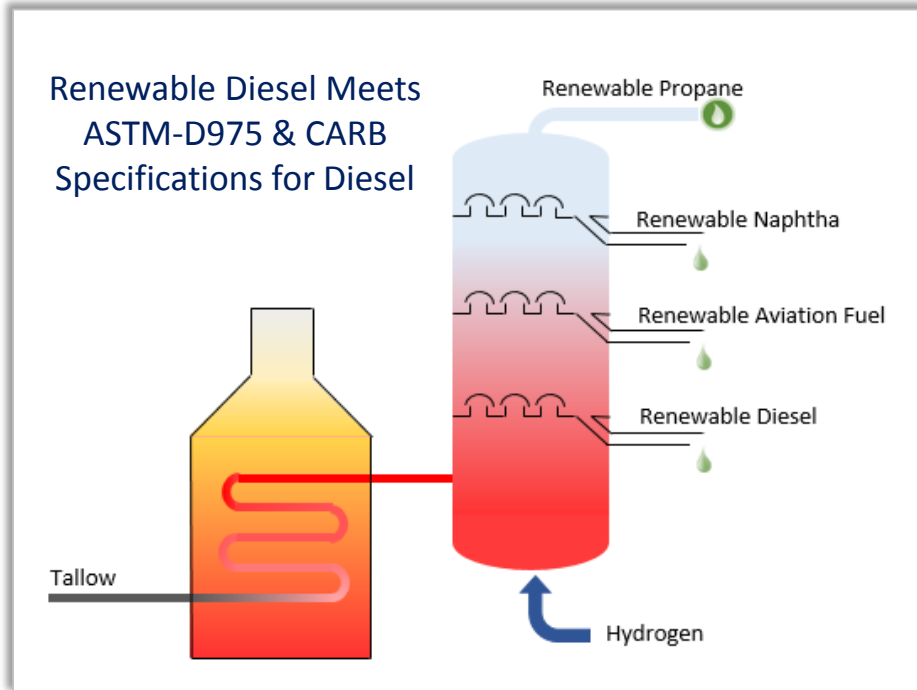


## Bio-Diesel

Utilizes a transesterification process



# Renewable Diesel – is refined by a hydrotreating process



Producing RD involves hydrogenating triglycerides to remove metals and compounds with oxygen and nitrogen using existing refinery infrastructure.

## It's Made by Using Organic Materials

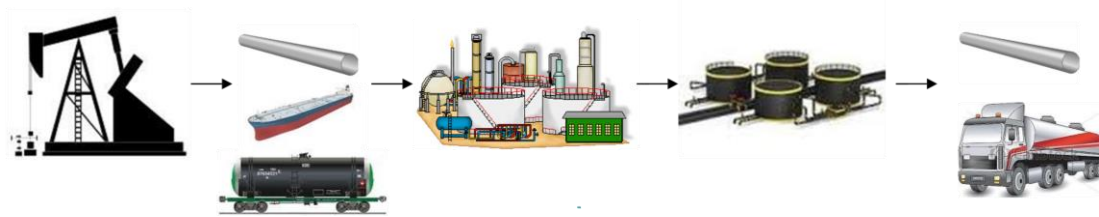
- Waste Animal Fat
- Wasted Fish products
- Vegetable Oil Residues
- Used Cooking Oil
- Technical Corn Oil
- Tall Oil Pitch
- Crude Palm Oil
- Camelina Oil
- Jatropha Oil
- Rapeseed Oil
- Soybean Oil

# Typical Properties of Diesel Fuels

	Petroleum Diesel	Bio-Diesel	Renewable Diesel
Cetane #	40-55	50-65	75-90
Energy Density, MJ/kg	43	38	44
Energy Content, BTU/gal	129K	118K	123K
Sulfur	< 10 ppm	< 5 ppm	< 10 ppm
NOx Emissions	Baseline	10	-10
Cloud Point, C	-5	20	-15
Oxidative Stability	Baseline	Poor	Excellent
Cold Flow Properties	Baseline	Poor	Excellent
Lubricity	Baseline	Excellent	Similar

As you can see from the table above, Renewable Diesel possesses properties that are similar to Petroleum Diesel and thus can be used in any quantity.

# Life-Cycle Carbon Intensity Comparison



Below are Oregon Default Values - Specific Pathways and Locations can Change Values Significantly

lbsCO<sub>2</sub>e in Diesel Gallon Equivalents

**29.02 Ultra-Low Sulfur Diesel (ULSD)**

Feedstock

Bio-Diesel

Renewable Diesel

Used Cooking Oil

5.17 lbsCO<sub>2</sub>e/dge

5.50 lbsCO<sub>2</sub>e/dge

Tallow

10.83 lbsCO<sub>2</sub>e/dge

8.55 lbsCO<sub>2</sub>e/dge

Corn Oil

10.53 lbsCO<sub>2</sub>e/dge

9.60 lbsCO<sub>2</sub>e/dge

Canola

16.51 lbsCO<sub>2</sub>e/dge

14.27 lbsCO<sub>2</sub>e/dge

Tallow

10.83 lbsCO<sub>2</sub>e/dge

**8.55 lbsCO<sub>2</sub>e/dge**

Soy

16.63 lbsCO<sub>2</sub>e/dge

14.92 lbsCO<sub>2</sub>e/dge

# Why are the Carbon Reduction numbers so important?

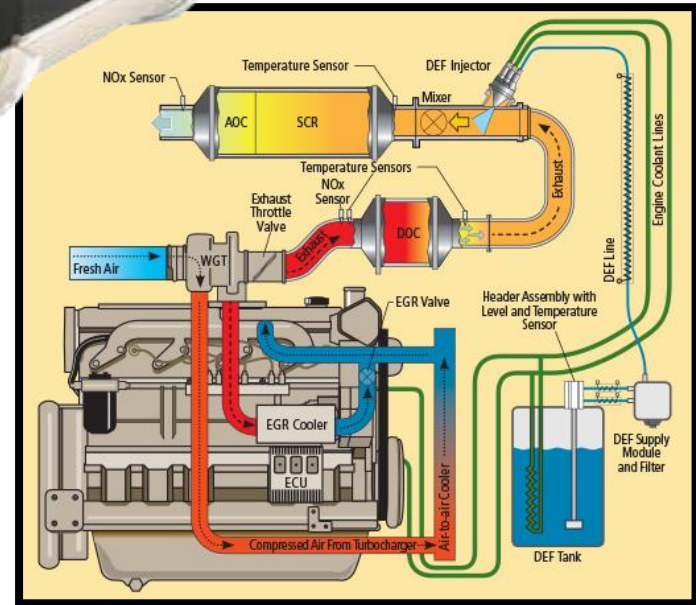
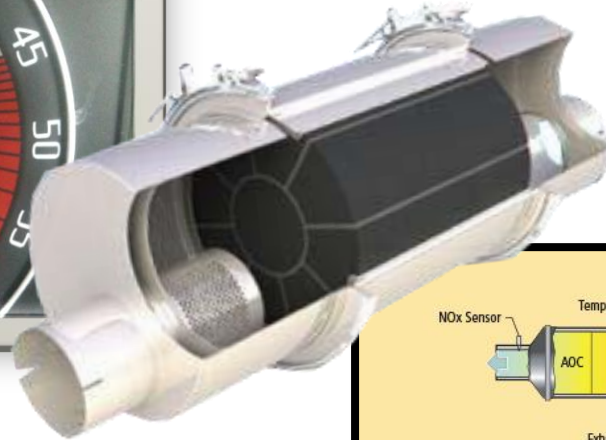


- Renewable Diesel is on the left-side
- Petro-Diesel is on the right-side
- The black soot are the particulates that are going in your exhaust systems
- To watch the full video – go to:

<https://www.youtube.com/watch?v=ww6GY45TgE>



# What does Particulates do to our DPF's





# The Benefits of Renewable Diesel

## As a drop-in biofuel Renewable diesel behaves exactly like fossil diesel -

- Can be used straight or blended
- No need for infrastructure change
- It meets the ASTM-D975 and CARB standards for Diesel Fuel
- Very stable – it can be stored over long periods of time with no deterioration in quality
- Year-around performance, various grades can be produced to reach cloud points -34 °C (-29°F)
- Feedstock flexibility from various sources

## The environmental benefits -

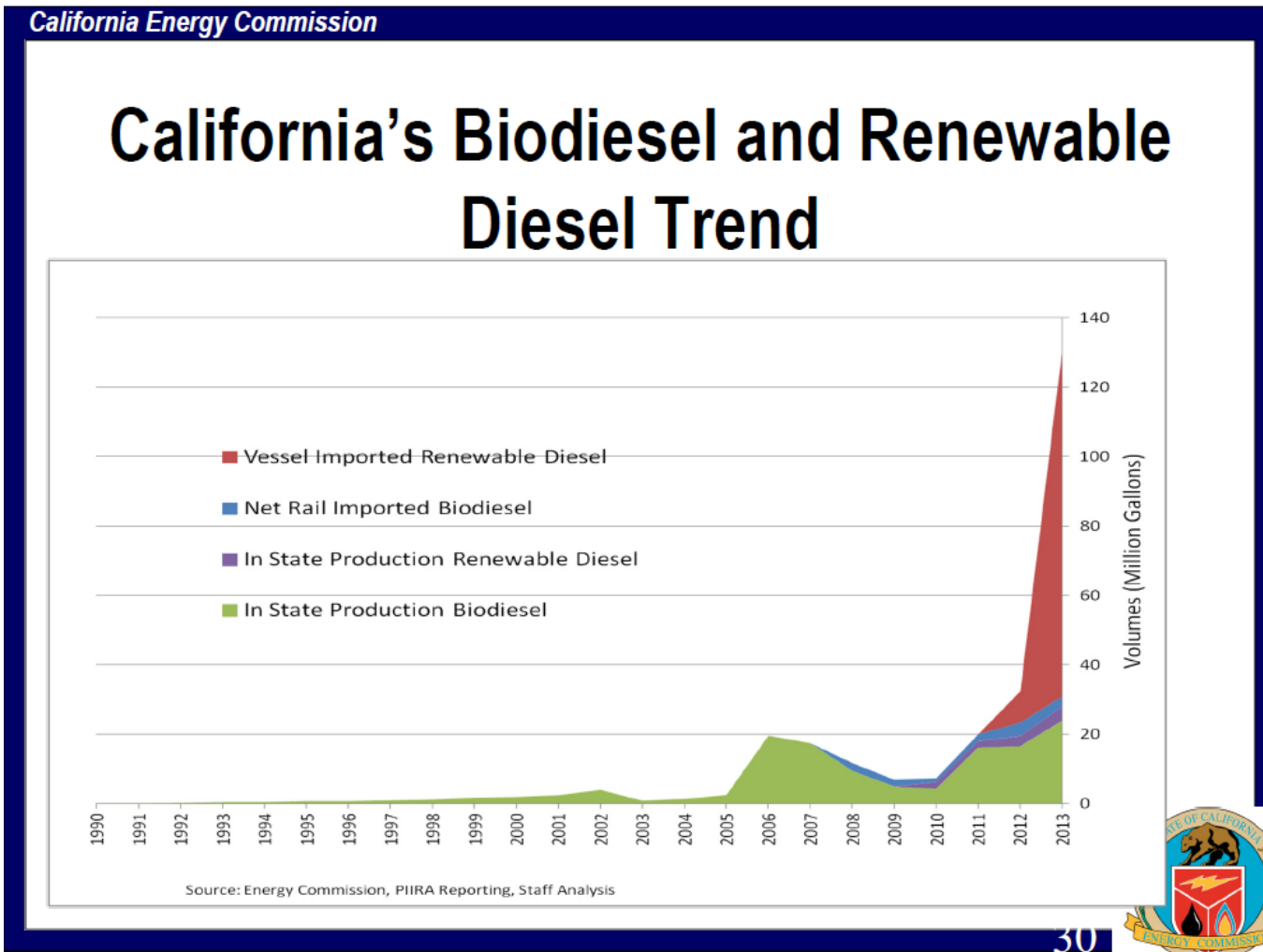
- GHG Emission Reductions
  - NOx - emissions -10%
  - PM - emissions -30%
  - CO - emissions -35%
  - THC - emissions -40%
- Less regeneration cycles
- Can be used in all storage tanks
  
- Renewable Diesel has the potential to make all diesel powered vehicles a AFV (alternative fuel vehicle)

# The Big Questions:

- ✓ What's with this “new” fuel?
- ✓ Where does it come from?
- ✓ How much does it cost?
- ✓ What are the emission benefits?
- ✓ Can I store it in an Underground Storage Tank?
- ✓ How does it fit into sustainability plans?
- ✓ What else am I missing?



# What's with this "new" fuel?

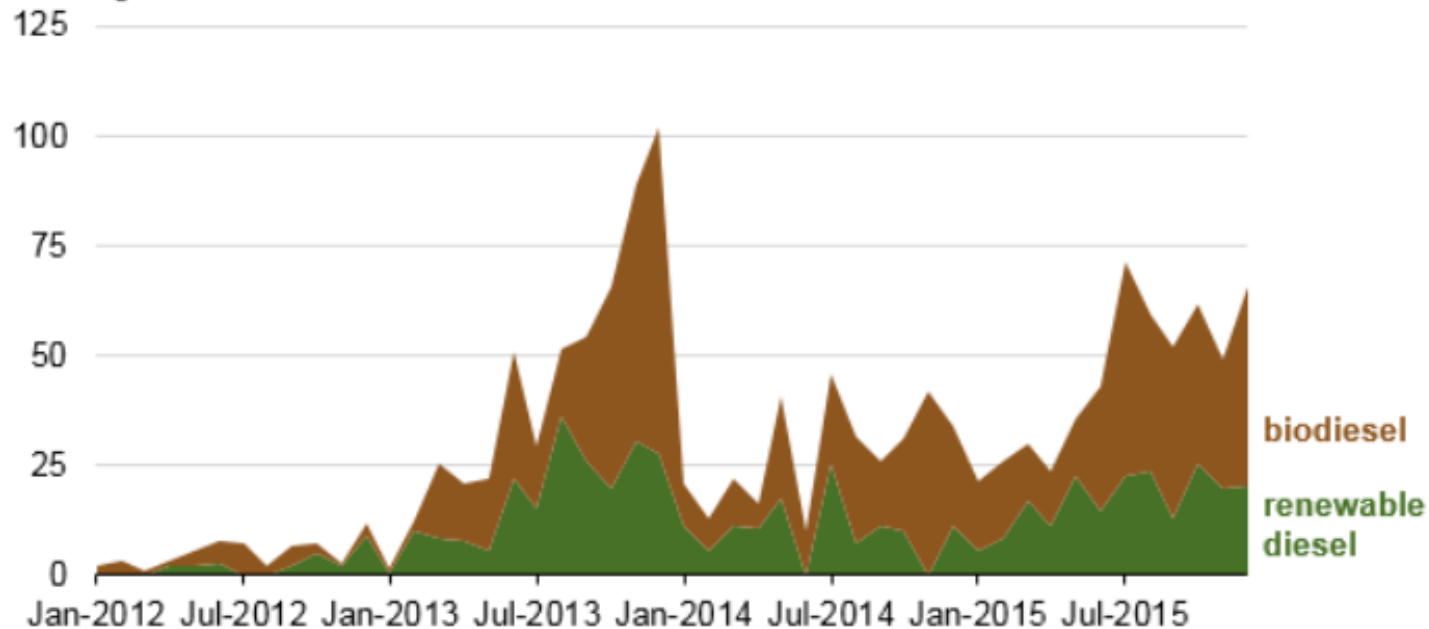


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# What's with this "new" fuel?

Monthly U.S. biodiesel and renewable diesel imports (2012-15)  
million gallons



Source: U.S. Energy Information Administration, *Petroleum Supply Monthly*

# RD Producers and Future Producers

Producer	Annual Production (gal)	Plant Location(s)	Notes
Neste	680 Million	Finland, Rotterdam, Singapore Evaluating potential US location	Finnish Petroleum Refiner
REG	75 Million	Geismer, LA	Large portfolio of biodiesel and renewable chemical plants
Eni S.p.A.	125 Million – 150 million additional in 2016	Italy	Largest petroleum refiner in Italy. Offering RD15 at 3500 stations (UOP process)
Diamond Green	184 Million – expanding to 275 Million start of 2018	Norco, LA	Partnership between Valero and Darling Industries (UOP process)
AltAir Paramount	42 Million (jet and diesel)	Los Angeles, CA	Paramount Petroleum (UOP process)
UPM Biofuels	32 Million (diesel and naphtha)	Lappeenranta, Finland	Feedstock crude tall oil from pulp production
ENVIA Energy	23 Million – in start up phase	Oklahoma City, OK	Landfill methane to RD (JV including Waste Management, Inc.) FT-Process
East Kansas Agri-Energy	3 Million – planned	Garnett, KS	Integrated RD/ethanol plant, under construction
UrbanX Renewables	75 million – in planning	Southern California	ARA/Chevron Lummus “Biofuels Isoconversion” of waste fats and oils

*Full scale operation*

# RD Regulatory Information

- Renewable diesel is a qualified EPA Act fuel
  - For RDxx blends the renewable portion of the fuel is counted as alternative fuel and receives EPA Act credits (treated the same as biodiesel blends)
- RD has multiple approved pathways for Renewable Fuel Standard
- Eligible for blender's tax credit so may actually find RD99 (if tax credit is renewed)



# How much does it cost?

## May 2017 (bulk drop minus fed excise)

- \$1.75- \$1.85 / gallon R99 Renewable Diesel
- \$1.70- \$1.80 / gallon ULSD
- \$1.95- \$2.15 / gallon B20 Bio-Diesel

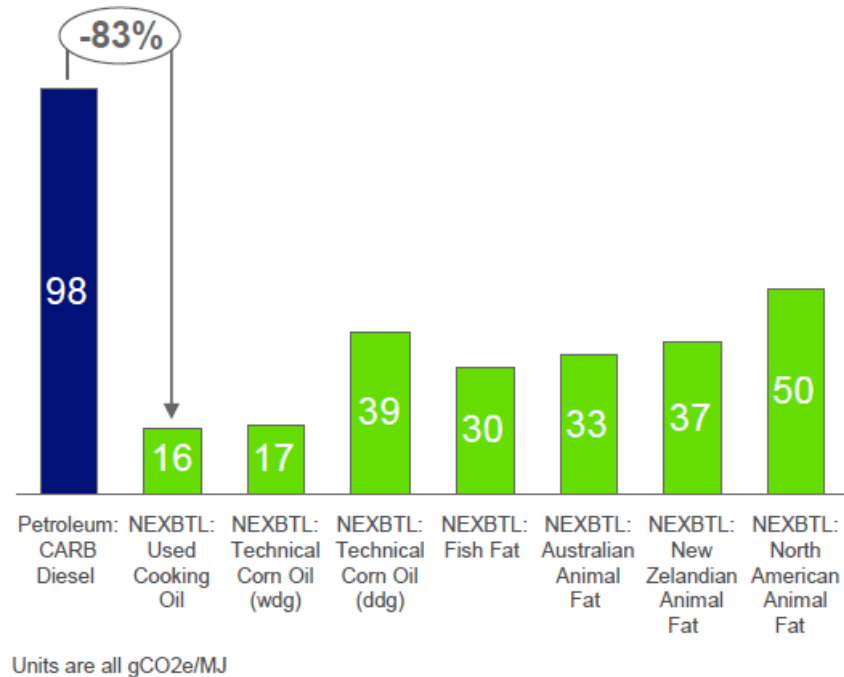
## Sources:

- Spot bid
- RFP/RFQ
- Piggyback/co-op- State General Services, SACOG, City of SF

# What are the emission benefits?

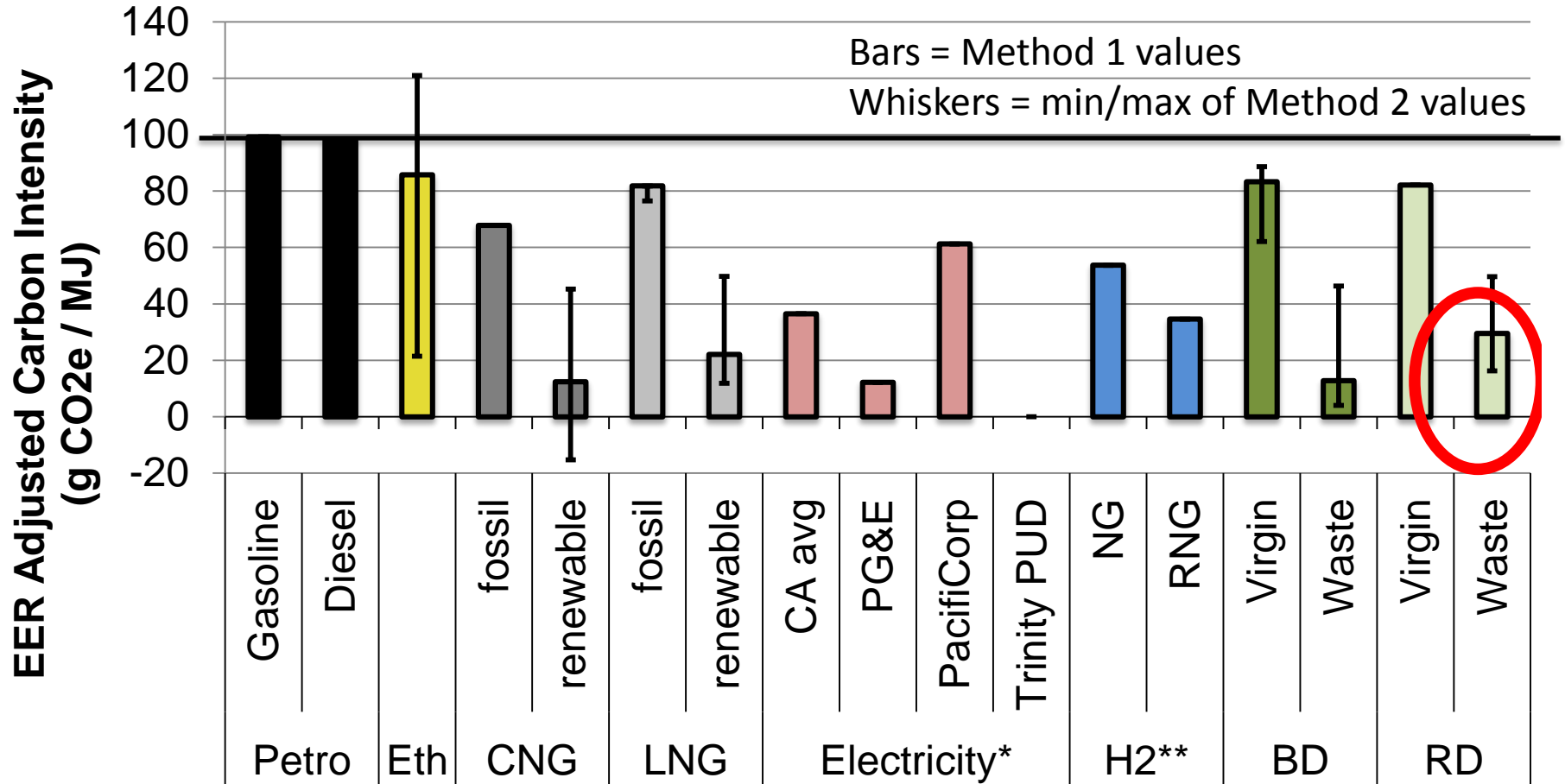
## GHG Emission Reduction

Carbon Intensities of different feedstock under CARB LCFS:



Using Renewable Diesel produced from 100% renewable raw materials can achieve up to 80% reduction in greenhouse gas emissions over its lifecycle compared to fossil diesel. In addition, it can reduce levels of local emissions that have a negative impact on air quality.

# LCFS Carbon Intensities (CI) of fuels



\* Scaled by EER of 3.4. Utility values use utility specific reported carbon intensities.

\*\* Scaled by EER of 2.2.

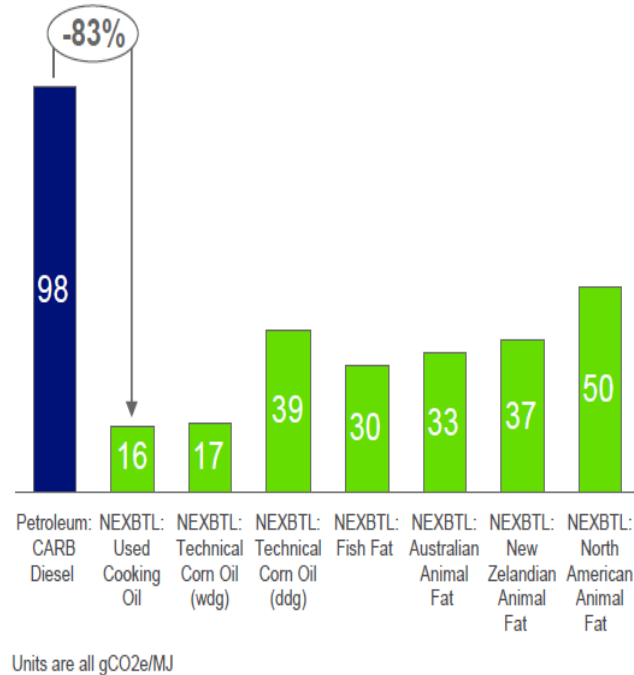
Source: SERC, 2016

Data Source: <http://www.arb.ca.gov/fuels/lcfs/lcfs.htm> (accessed 4/23/16)

# What are the emission benefits?

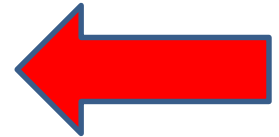
## GHG Emission Reduction

Carbon Intensities of different feedstock under CARB LCFS:



- Average emission reductions with 100% NEXBTL diesel

- NOx-emissions: -10 %
- PM-emissions: -30 %
- CO-emissions: -35 %
- THC-emissions: -40 %
- PAH compounds: reduced significantly



- Standard service interval
- No changes in fuel logistics
- No operability issues with blend or 100 % NEXBTL
- Average daily low temp in 2009 was app. negative (-) 20 °C
- Winter grade NEXBTL had cloud point of negative (-) 25 °C
- There are approximately 1400 urban buses in the Helsinki area

# RD Study, Knoxville, TN



- East Tennessee Clean Fuels Coalition
- 7500 gallon test batch
- \$2.80/gallon delivered vs. \$1.53/gallon
- 8 week testing period
- 5 truck test group, but other vehicles used the fuel
- Operators told a fuel additive was being tested
- Operators were asked to keep a manual regen log

# RD Study, Knoxville, TN



## Before the study:

- Manual regens required frequently
- Forced regens required up to weekly
- Oil dilution, DPF/DOC failures

## During the study:

- No forced regens on any test vehicles
- Reduced manual regens on test vehicles
- No blending issues noted

## After the study:

- 2 test vehicles required forced regens 8 and 10 days later



# Can I store it in an Underground Storage Tank?



**Air Resources Board**  
Mary D. Nichols  
*Chairman*

## State of California

Edmund G. Brown Jr.



**State Water Resources Control Board**  
Felicia Marcus  
*Chair*

### Renewable Diesel Should Be Treated the Same as Conventional Diesel

This is a joint statement by the Air Resources Board (CARB) and the State Water Resources Control Board intended to clarify questions that have been raised regarding the status of renewable diesel. As discussed below, renewable diesel should be treated the same as conventional CARB diesel for all purposes, including storage in underground storage tanks (USTs).

# Mandates

## MANAGEMENT MEMO

SUBJECT:

**DIESEL, BIODIESEL, AND RENEWABLE HYDROCARBON DIESEL BULK FUEL PURCHASES**

REFERENCES: PUBLIC RESOURCES CODE §25722.5 (d) - (f), §25722.8 et seq.; HEALTH AND SAFETY CODE §43870; CALIFORNIA CODE OF REGULATIONS §95480 et seq.; EXECUTIVE ORDERS B-2-11 and B-30-15; ASSEMBLY BILL 692 (QUIRK)

**THIS MANAGEMENT MEMO REPLACES MANAGEMENT MEMO 12-05**

NUMBER:

MM 15-07

DATE ISSUED:

DECEMBER 9, 2015

EXPIRES:

UNTIL RESCINDED

ISSUING AGENCY:

DEPARTMENT OF GENERAL SERVICES

Purpose

This Management Memo establishes requirements for the purchase of bulk diesel, biodiesel, and renewable hydrocarbon diesel (renewable diesel) fuels.

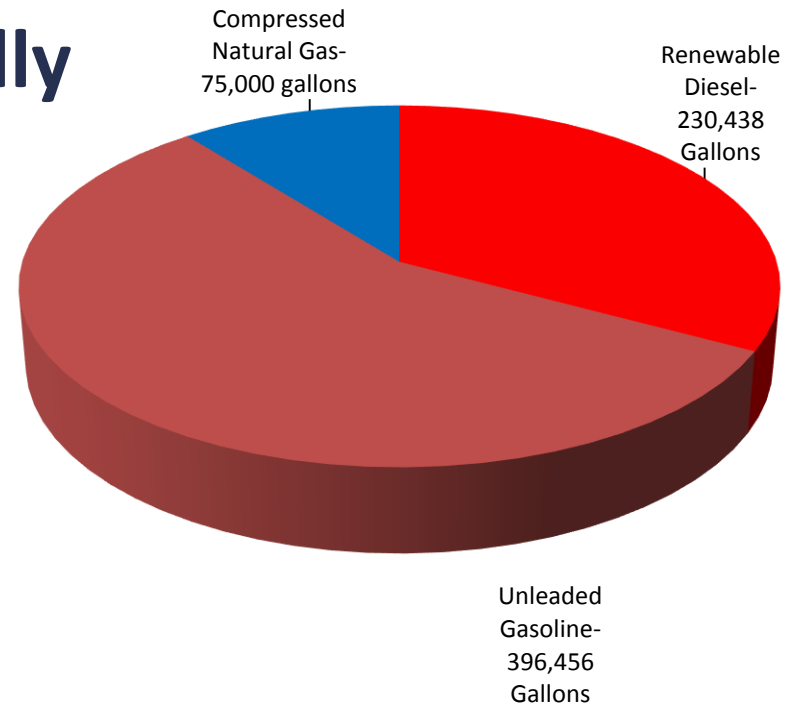
Policy

State agencies shall purchase state-contracted renewable diesel fuel, in lieu of conventional diesel and biodiesel fuels, when making bulk purchases of fuel for diesel powered vehicles and/or equipment. Additional information on this policy can be found in State Administrative Manual (SAM) Section 3627, *Diesel, Biodiesel, and Renewable Diesel Bulk Fuel Purchases*.

Exemptions to this renewable diesel fuel purchasing requirement are processed through the Department of General Services (DGS) Office of Fleet and Asset Management (OFAM) and are outlined under the *Exemptions to Renewable Diesel Purchasing Requirements* section of SAM 3627, which includes provisions for fuel availability, timeliness of delivery in emergency response situations, cost, and operational viability.

# City of Oakland Clean Fuel Fuels

- **700,000 gallons annually**
- Gasoline
  - 396,000 gallons
- Renewable Diesel
  - 230,000 gallons
- Compressed Natural Gas (CNG)
  - 75,000 gasoline gallon equivalents



# City of Oakland Clean Fleet Plan



## Continue:

- Renewable Diesel
- Battery electric and hybrid sedans and trucks
- CNG street sweepers, refuse trucks, cargo vans

## Expand:

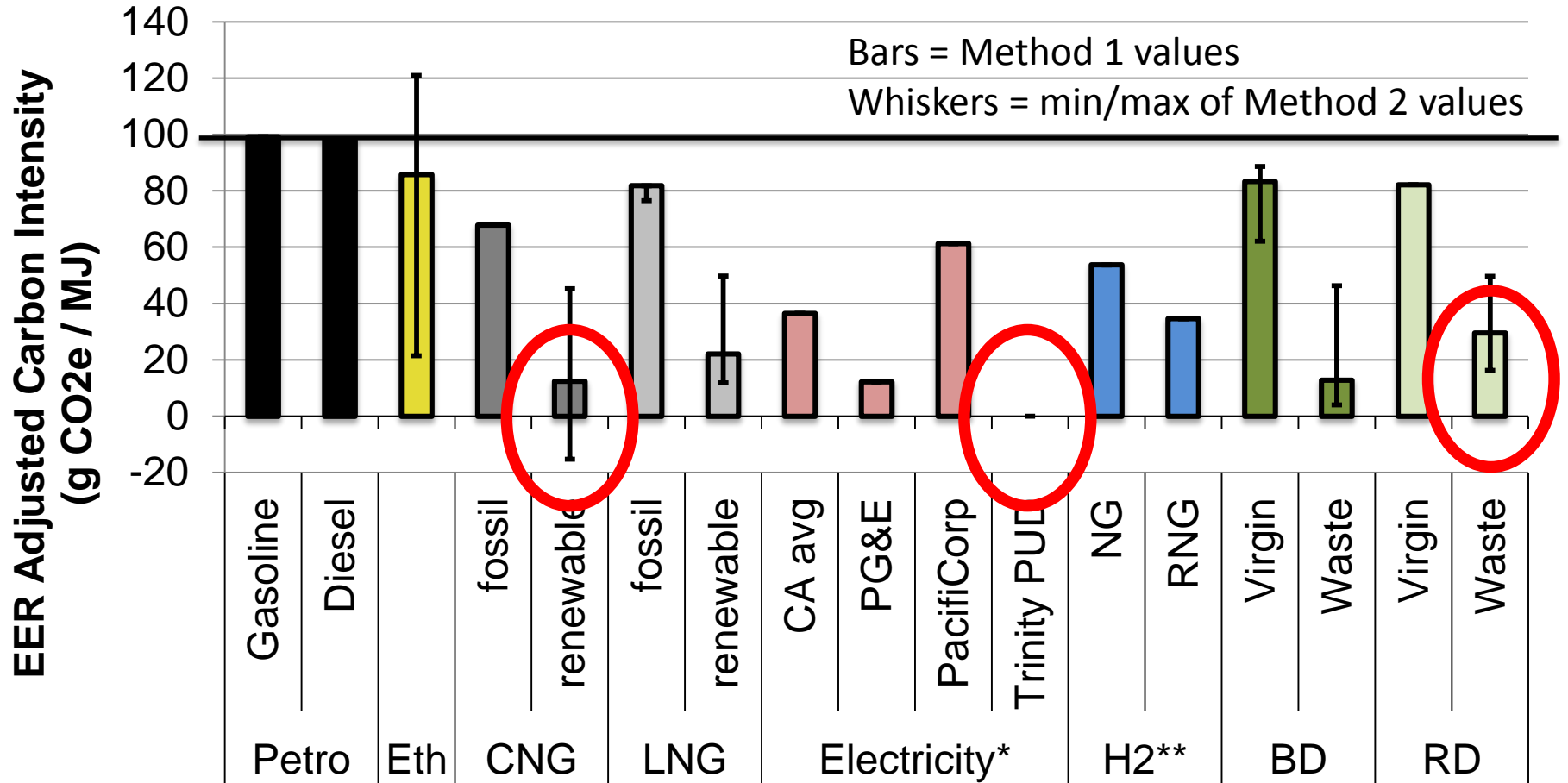
- EV charging infrastructure
- Data capture (utilization, EV, emissions)

## Explore:

- Solar EV charging
- Hydrogen fuel cell sedans
- Renewable diesel sedans



# LCFS Carbon Intensities (CI) of fuels



\* Scaled by EER of 3.4. Utility values use utility specific reported carbon intensities.

\*\* Scaled by EER of 2.2.

Source: SERC, 2016

Data Source: <http://www.arb.ca.gov/fuels/lcfs/lcfs.htm> (accessed 4/23/16)



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# What else are we missing?

- 100% renewable and sustainable
- Smaller environmental footprint
- Lower operating costs than other alternative fuels
- Easy to use
- Superior cold weather performance
- High performance
- No blending limit
- Good storage properties
- Pure hydrocarbon
- Odorless





# Questions.....

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