

Renewable Diesel: The Bridge to Zero-Emission Transportation

Keith Wilson, President, TITAN Freight Systems

Today's Panelists

Keith Wilson, President, TITAN Freight Systems

Jeremy Baines, President, Neste US

Richard Battersby, Assistant Director, Bureau of Maintenance, City of Oakland

Tom Wolf, Senior Government Affairs Manager, US West Coast, BP

TITAN Vision 2020: Reduce Emissions 20% by 2020

Vision 2020	2010	2019	Change
Fleet MPG - Actual	6.46	6.81	5%

Missed Target by Wide Margin Despite Every Available Add-On

Air Deflectors



Trailer Side Skirts



Aerodynamic Wheel Covers



Low Rolling Resistant Tires



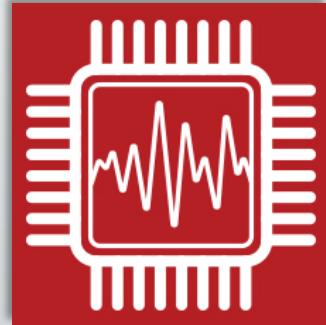
Aerodynamic Mud Flaps



Engine Idle Shutoff



Artificial Intelligence



Alternatives to Petroleum Diesel

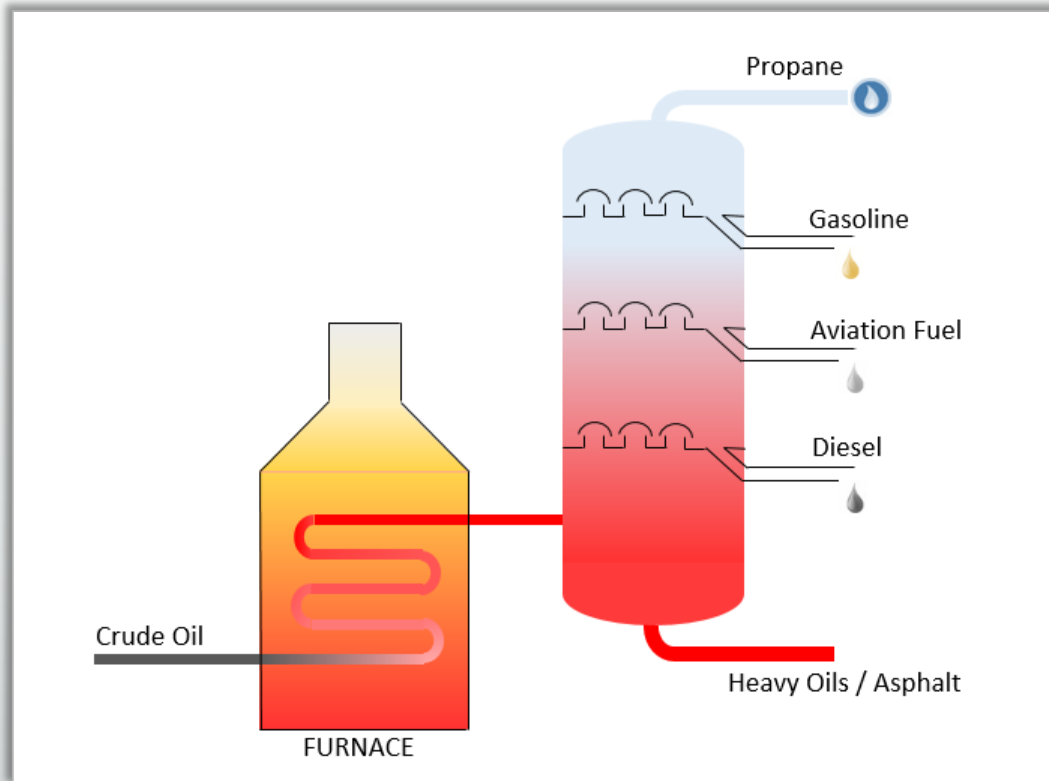
Diesel Application Energy Options	Energy Type	ASTM (American Society for Testing and Standards)	Carbon Intensity [g CO ₂ e / MJ]	CI Reduction vs. Petroleum Diesel
Petroleum Diesel (B5)	Fossil	D975 ←	97.64 ←	---
Natural Gas (Compressed)	Fossil	WK40094	79.98	18%
Natural Gas (Biogas)	Renewable	WK40094	50.00	49%
Biodiesel (B99)	Renewable	D6751	35.40	64%
Electricity (hydro, natural gas, coal, wind)	Oregon Mix		32.15	67%
Renewable Diesel (R99)	Renewable	D975 ←	30.02 ←	69% ←
Electricity (local charging wind & solar)	Renewable		0.00	100%

Oregon Department of Energy; OAR 340-253-8010 (4)

The Petroleum & Renewable Diesel Difference?

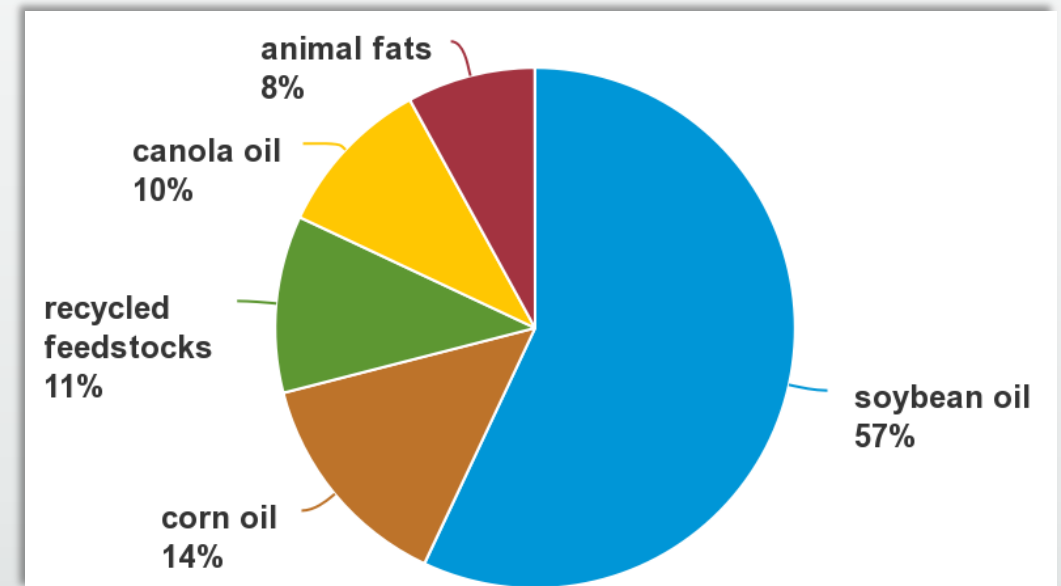
Same Process, Same Chemical

Both use Fractional Distillation in the same existing production facilities



Millions of Years

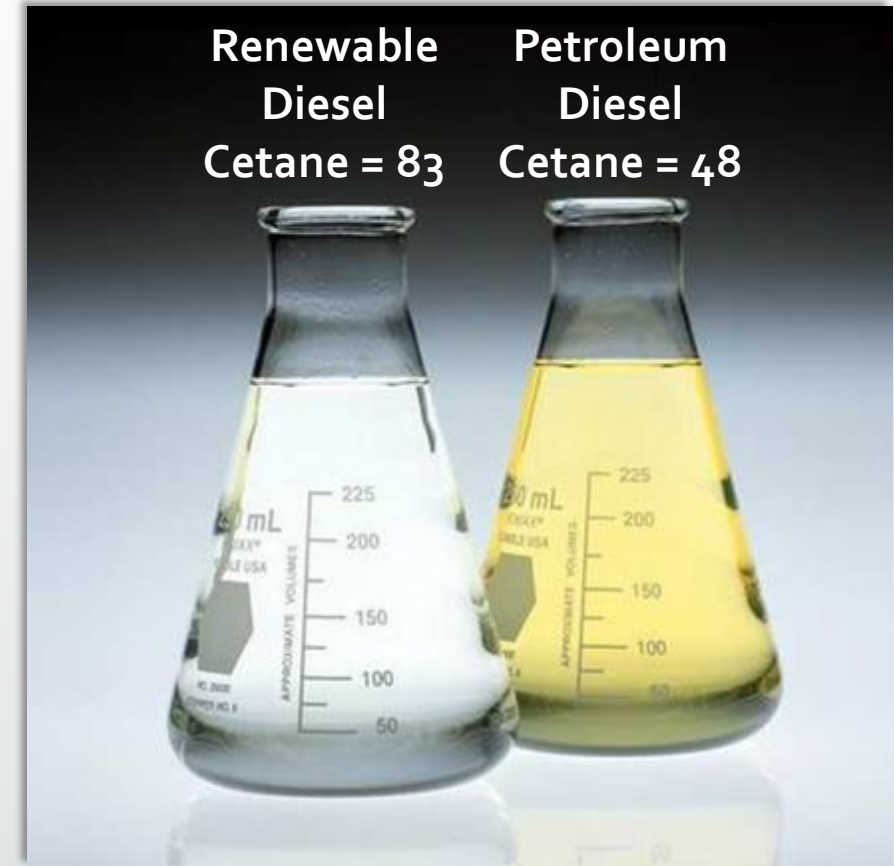
Harvesting today's renewable waste and crop oils in place of carbon intense crude oil



Next Feedstocks

- Used cooking oil
- Municipal garbage & agricultural waste
- Wood scrap waste from forest-rich Oregon

Renewable Diesel is Ultra Clean Burning



The black soot are the particulates that are created by diesel engines

Renewable Diesel Scorecard

Diesel Application Energy Options	Petroleum Diesel (B5)	Renewable Diesel (R99)
ASTM (American Society of Testing Measurement)	D975	D975 "Drop In" replacement
Carbon Intensity (g CO ₂ e / MJ)	97.64	30.02 Bridge to electric
Truck Cost (class 8)	\$130,000	\$130,000
Energy Density (MJ / KG)	43	44
Oxidative Stability (Water content)	Baseline 12 months	Excellent Indefinitely
Cold Flow Properties	Baseline	Excellent
Lubricity	Baseline	Similar
Made in Oregon	0%	100% Planned
Price Per Gallon (3/31/21)	\$2.26	\$2.26 Portland Region

Diesel Engine Makers Support Renewable Diesel

OEM approvals



Renewable Diesel – Lower Operating Costs

Energy Source Worksheet - TITAN Freight

Diesel Type

Petroleum

Renewable

Fuel economy (Class 8) - Miles Per Gallon

6.7

6.7

Fuel Cost - Per Gallon (3/31/21)

\$2.26

\$2.26

Cost Analysis - Per Mile

Petroleum

Renewable

Reductions

Exhaust system maintenance

\$0.022

\$0.007

-\$0.015

Oil change maintenance

\$0.010

\$0.005

-\$0.005

Renewable Diesel Total Cost Per Mile Savings

-\$0.020

Clean Energy Calculator – TITAN Freight

Clean Energy Calculator - TITAN Freight

Diesel Gallons Used - Annual

Total Miles Travelled - Annual (Gallons x MPG)

Savings Calculator

RD Total Miles Travelled

RD Total Cost Per Mile Savings

Total Cost Savings - Annual

Metric Tons of CO₂e (MTCO₂e) Calculator

Renewable Diesel Use - Gallons

MTCO₂ = 2,204.6 pounds of CO₂

MTCO₂e reduced with switch to Renewable Diesel

	Petroleum	Renewable	Totals
Diesel Gallons Used - Annual	119,273	142,279	261,552
Total Miles Travelled - Annual (Gallons x MPG)	842,629	1,005,155	1,847,784

RD Total Miles Travelled	1,005,155
RD Total Cost Per Mile Savings	-\$0.020
Total Cost Savings - Annual	-\$20,286

	Petroleum	Renewable	Totals
Renewable Diesel Use - Gallons		142,279	
MTCO ₂ = 2,204.6 pounds of CO ₂	1,868	574	
MTCO₂e reduced with switch to Renewable Diesel		-1,294	-69%

Clean Energy Calculator – OREGON

Clean Energy Calculator - Oregon

Oregon petroleum diesel use

650,147,179

Diesel MPG estimate (est passenger and commercial)

10

Oregon petroleum diesel miles

6,501,471,790

RD Total Cost Per Mile Savings

-\$0.020

Total Cost Savings - Annual **-\$131,209,830**

Metric Tons of CO2e (MTCO2e) Calculator

MTCO2 = 2,204.6 pounds of CO2

Petroleum

Renewable

Totals

8,537,495

2,624,653

MTCO2e reduced with switch to Renewable Diesel

-5,912,842

-69%

Renewable Diesel – Pollution Scorecard

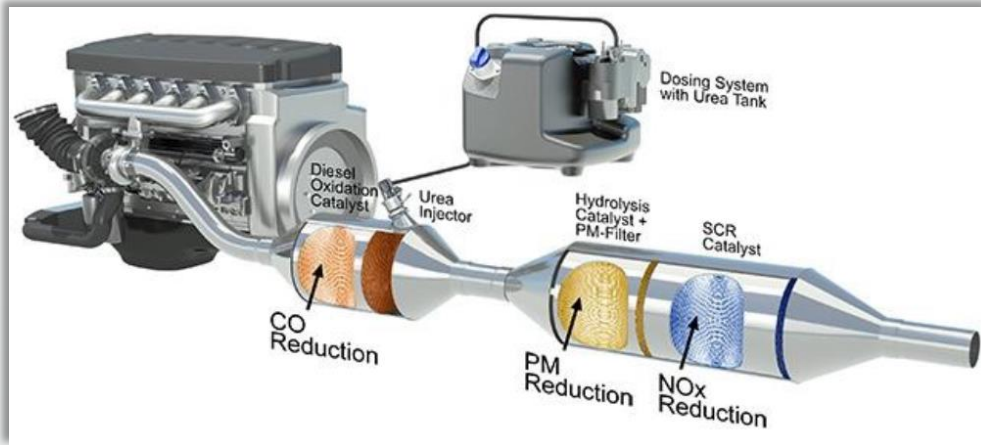
Deadly Diesel Pollution	Why is it Deadly	Petroleum Diesel (B5)	Renewable Diesel (R99)
NOx - Nitrogen Oxides	Causes breathing problems, chronically reduced lung function	Baseline	-10%
PM (2.5 & 10) / Black Carbon	Lung cancer, makes asthma symptoms worse	Baseline	-30%
CO - Carbon Monoxide	Deprives the heart, brain and other vital organs of oxygen	Baseline	-24%
HC - Hydrocarbons	Lung and eye irritation	Baseline	-30%
Average Pollution Reduced:			-24%

Renewable Diesel – We Can Live with That

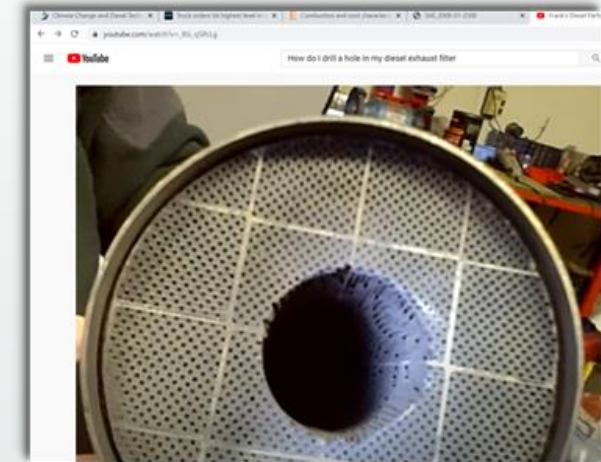
Diesel Pollution Fatalities	Fatalities (DEQ Estimate)	Pollution Reduced	Oregonians Saved
Oregon	460	-24%	108

“EPA confirms widespread emission tampering”

Diesel Exhaust Emission System ...

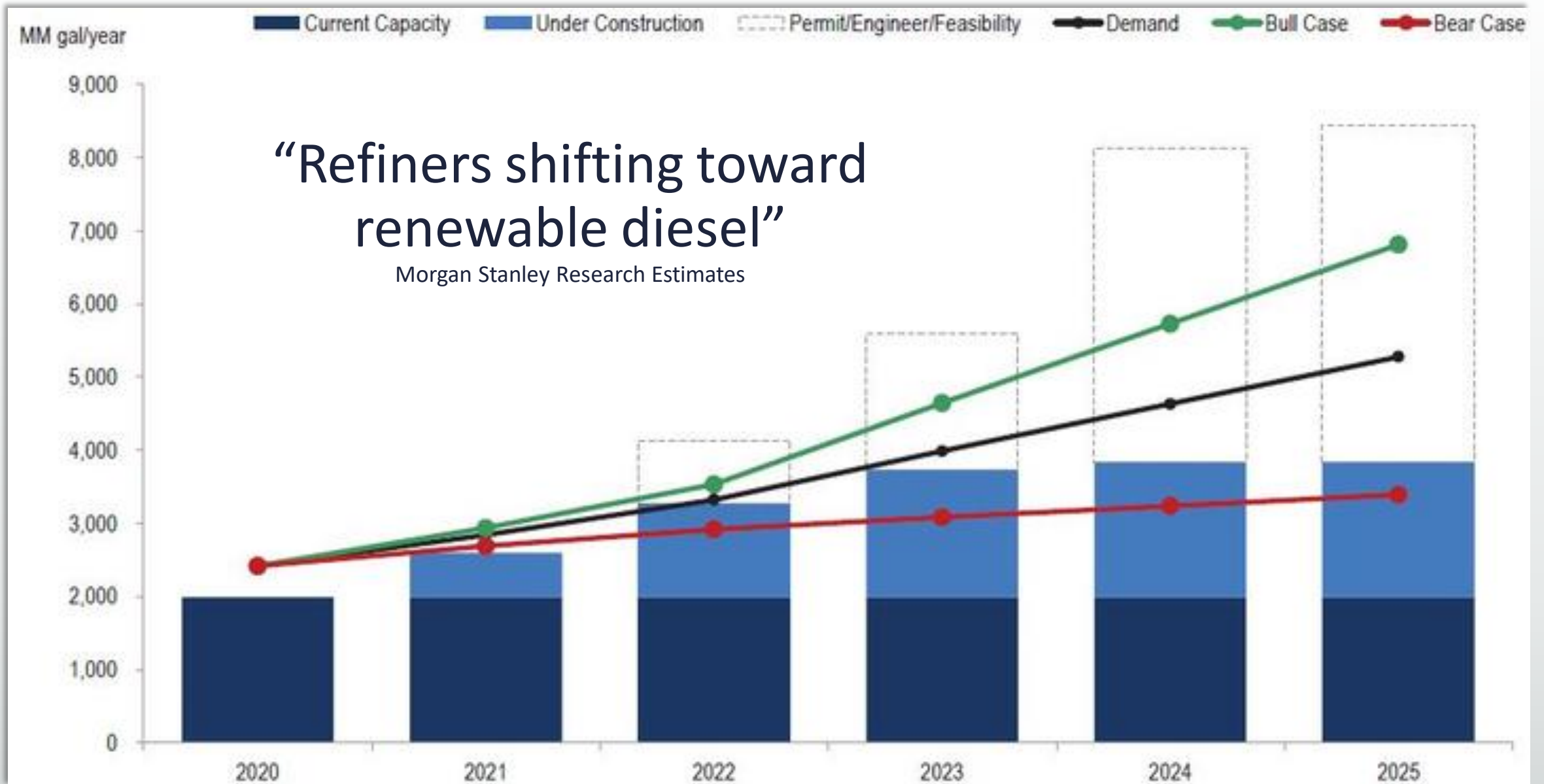


... Removed



More than 17,436 (20%) of Oregon diesel pickup trucks have emission systems completely removed

“Tampered diesel pickup trucks”, EPA report, November 20, 2020



Oregon's Future Potential

Emissions:

5.9 MILLION MTCO₂e REDUCTION

23% less GHG transportation sector emissions

Economics:

\$131 MILLION IN LOWER OPERATING COSTS FOR DIESEL FUEL USERS

Equity:

108 OREGONIANS SAVED EACH YEAR

Energy Independence & Security:

OREGON AS THE NATIONS LEADER IN CLEAN ENERGY FUEL PRODUCTION & JOBS

City of Knoxville - [Renewable Diesel Test - Testing an Alternative Fuel in the City of Knoxville Fleet](#)

“Hearing terms like “**miracle fuel**” & “eliminates DPF issues” did not seem realistic. We are extremely pleased to report that Renewable Diesel exceeded everything that we were told.”

Gary Lentsch, City of Eugene, Eugene Water and Electric, Fleet Manager

“It’s been a miracle fuel. Not one Diesel Particulate Filter has needed cleaning or replacement since 2015 using Renewable Diesel.”

Richard Battersby, City of Oakland, Oakland Public Works, Bureau of Maintenance, Assistant Director - [Fleet Perspective - Renewable Diesel](#)

“Renewable Diesel seems too good to be true but delivers as promised.”

Rob Bennett, Maintenance Supervisor, TITAN Freight Systems

“No more toxic fumes, no smell, washes off with water, very little exhaust system maintenance needed anymore, it has led me to enjoy my job so much more.”

Chris Efird, Executive Chairman, NEXT Renewable Fuels, Partnering with BP & Shell to build a 700 million gallon a year renewable diesel production facility in Columbia County, OR

“You make good money on renewable diesel.”

“It’s all about logistics. Being near Oregon and California, the only two states with clean fuels programs, makes great economic sense.”

“We will provide \$91,000 per year average wages and benefits for 285 full time jobs.”

Angus Duncan, Chair Emeritus, Oregon Global Warming Commission

“While different clean fueling options continue to be explored for highway trucks, we don’t have to wait on the results to realize the operational and economic value today of cleaning up fossil diesel by switching to its renewable twin. We know this value accrues to truckers, to trucking firms and to Oregon communities deserving cleaner air to breathe. Introducing renewable diesel into our fleets brings these immediate benefits while it also drives down greenhouse gas emissions today, not ten or twenty years in the future. That alone makes the renewable diesel bill worth passing this year.”

“Bottom line: Renewable diesel is a lower carbon interim step toward a more durable EV+hydrogen transportation fuels future. It’s one that can be uploaded almost immediately given the ability of diesel engines to switch from fossil to renewable diesel (and, if necessary, back to fossil).”

Nicholas Antoine, Chairman, Midwest Motor Express

“We switched over our entire Oregon fleet to renewable diesel and our exhaust system maintenance issues have reduced. Super easy switchover.”

Research Papers & Presentations:

City of Eugene & City of Oakland – Gary Lentsch & Richard Battersby: [The New Alternative Fuel of Choice - Renewable Diesel](#)