



***Fuel For Thought On Diesel, Alternative Energy Sources,
Pump Prices and Maximizing Mileage***

Offered by:

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General Overview

- Presenter Information
- Operational Issues Overview
- Ultra Low Sulfur Diesel (ULSD)
- Diesel Fuel Price (Crude Oil & refiner mix)
- BioFuels (Ethanol, Biodiesel & Renewable Diesel)
- Carbon Credits
- Diesel Exhaust Fluid (Urea)
- Fuel Saving Tips
- Summary & Questions
- Extra - 2007 / 2010 Engines & Emission Summary

Presenter - Jay Thompson

- Growing up - Farming, service station, pipeline maintenance...
- College - “Energy & Transportation” focus
 - Drove trucks in logging, coal & construction
- In Industry - 13 years with major engine supplier
 - Sales, service & product performance engineering
- Transportation Business Associates - ~20 years
 - Investor, financier & banking work - analyst, M&A, BK...
 - Equipment, engine & other industry supplier marketing
 - Fleet operational profitability & training
 - Financing, leasing, fuel cost & insurance specialty
- Partner
 - Zenergy Bio Fuels - Full-chain seed-to-tank - renewable energy
 - Jatropha plantations, feedstock, biomass & carbon credits
 - Platinum Data Products - IT productivity services / RFID
 - Principal stockholder - Trucking and aviation companies

Top Operational Issues Today

- Profitability
 - Slow consumer spending / business levels --> changing habits
 - Fuel costs (surcharge) less an immediate issue
 - Financing / leasing a big problem (opportunity) - since 3rd qtr 2007
 - Equipment utilization still has biggest effect on profits
 - Quality drivers also key
- Productivity and efficiency
 - Going paperless - Internet, computer hardware / software, etc.
 - Equipment tracking / communication systems
 - Wireless integration with systems, RFID...
- Government regulations
 - Highway infrastructure / funding / tolls
 - Electronic On-Board Recorders
 - Potential Fuel Tax increases
 - Tort reform (liability)
 - CSA 2010 (CVSA)
 - Environmental / emissions issues - especially California
 - Green House Gas / Carbon Credits

CRUDE OIL COSTS & DIESEL FUEL PRICES

Why is diesel higher than gasoline?

Crude Oil & Refining Overview

- Crude Oil Price Impact
 - Historical oil recessions - '73; '80-'81; '90; '95; '00 & '08
 - Inflation adjusted crude price should be ~\$30 per barrel
 - Consumer spending is driver of economic growth
 - Oil / Energy cost swings “tax” global growth
 - Good News - Low prices & producers cheat of quotas!
- Refinery Issues - U.S. refineries use catalytic cracking
 - 50% gasoline and 15% diesel from a barrel of oil
 - Remainder into jet fuel, home heating oil, heavy fuel oil, liquefied petroleum gas, asphalt, and various other products
 - Can get up to 5% more diesel with problems (storage, cetane...)
- EU refineries (and most of rest of world) use hydrocracking process
 - 25% gasoline and 25% diesel from a barrel of oil
 - I.E. - Already maximizing diesel production
 - Process still produces too much gasoline and exports go to U.S.
- Refinery conversion is difficult and expensive
 - ExxonMobil, Marathon & Valero adding diesel capacity

Ultra Low Sulfur Diesel

- ULSD - <15 PPM Sulfur @ pump (80% until 2010)
 - Refineries - June 1, 2006
 - Pipelines / terminals - September 1, 2006
 - Retail - October 15, 2006 (key pricing date)
- “Technology enabler” for sulfur-intolerant exhaust emission control technologies
 - Diesel particulate filters for PM
 - Selective Catalyst Reduction (SCR) Catalytic Converter for NOx
 - Sulfur increases PM & plugs converters
 - Lowering sulfur content decreases fuel lubricity (be aware)
- Product mix in plants / pipelines / tanks
 - Sulfur PPM Levels: Gasoline @ 80; Low Sulfur Diesel (LSD) @ 500; Jet Fuel @ 3000 & Heating Oil @ 5000
 - It takes 5PPM sulfur @ refinery to get 7 PPM sulfur @ pipeline to get 12 PPM sulfur @ terminal
- ULSD meets European markets 10PPM sulfur specification
 - Global supply / demand pricing - being sold into EU & other countries

Breakdown of Cost of Gallon of Petro

- Recent Crude Prices
 - ≈ \$35 - \$150 per barrel
- Diesel Fuel Prices
 - ≈ Crude / 42 gpb + about \$0.10 per gallon
- Federal & State Taxes
 - ≈ Averages approximately \$0.46 per gallon
- Transportation / Jobbers / Dealers
 - ≈ Varies by network - \$0.08 - \$0.18 per gallon
- Refining & Profits
 - ≈ Varies by oil company and product mix
 - ≈ From \$0.10 - \$0.20 per gallon
- Since 9/06 - Traders & Speculators (global marketplace)
 - ≈ From \$0.40 - \$0.80 per gallon

Impact Of Crude (Only) On Diesel Price

Cost / Barrel versus Cost / Gallon Floor

Crude	<u>\$40</u>	<u>\$60</u>	<u>\$80</u>	<u>\$100</u>	<u>\$125</u>	<u>\$150</u>
Diesel	1.05	1.53	2.00	2.48	3.08	3.67
Federal	0.24	0.24	0.24	0.24	0.24	0.24
State	0.22	0.22	0.22	0.22	0.22	0.22
T / J / D	0.13	0.13	0.13	0.13	0.13	0.13
R / P	<u>0.15</u>	<u>0.15</u>	<u>0.15</u>	<u>0.15</u>	<u>0.15</u>	<u>0.15</u>
TOTAL	1.79	2.27	2.15	2.39	2.62	4.41

Local taxes / fees are additional
Add in traders / speculators costs

Why is ULSD pump price higher than gasoline?

- Global ULDS demand versus refining capacity
 - Diesel projected growth 5X+ that of gasoline
 - Diesel is where refiner profits are today
- U.S. distillate inventories (diesel, jet fuel & heating oil) are DOWN about 10% YOY
 - 2% cars / pickups are diesel (about 4% of new)
 - Diesel is 20% of all petroleum
 - Most other countries, mix favors diesel (EU 50%)
- U.S. gasoline stockpiles @ 14-year high (EIA)
 - Gasoline is 45% of all petroleum
- U.S. refiners / traders are exporting ULSD
- Plan for \$50 per barrel crude for 2009 (EIA)
 - Diesel / gasoline price differential to continue

BIOFUELS

CARBON CREDITS



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Biofuels Summary

- US carbon-based liquid fuel usage projected to be relatively flat for next 20-years (CAFÉ standards, converting oil to gas, wind, solar, etc.)
 - Growth also expected be addressed in large part with Biofuels
- Biodiesel and engines (B3-B5 & B99):
 - Numerous issues (mostly quality-related)
 - Mostly driven by mandates / incentives
 - ~500MM with 50B GPY diesel
- Renewable Diesel
 - Same feedstock - different process
 - Seamless integration with no implications
 - ~150MM GPY capacity
- Ethanol
 - Mostly driven by mandates
 - ~9B with 140B GPY gasoline
- Primary Issues
 - Transport, marketing, production & quality

Renewable Diesel & Biodiesel Feedstock

- Like oil industry, Biofuel “feedstock” (crude) is key driver!
- Renewable Diesel & Biodiesel
 - Soy beans / oil - best US source (characteristics)
 - Canola, rapeseed, sunflower, cottonseed, peanut, pennycress, Jatropha (Africa, SA) & Palm (Malaysia) - options
 - Animal fats, recycled oils, etc. can be used - availability, growth potential & quality are negatives
 - Algae is long-term multifaceted option
- Carbon Credits
 - Being **GREEN** is opportunity - Buying carbon offsets
 - Some feedstock’s have very positive carbon balance
- Renewable Diesel is optimum approach in developed world due to quality / logistics / cost issues
- Biodiesel is good option for developing markets

Biodiesel Summary

- Lower emissions (per EPA)
 - HC down significantly
 - CO / PM / Ozone / Greenhouse gases down notably
 - NOx within margins (very good with '07's)
- Other
 - Contains virtually no sulfur which helps lower fuel sulfur levels in tanks and pipelines
 - Non-toxic /non-hazardous/less flammable
 - Smells better - like popcorn or french fries!
 - Engines require no modifications
- All engine manufacturers allow up to 5% blend
 - Some higher (please contact your engine manufacturer for further information)
- Some users report improved performance

Biodiesel Summary

- Acts as a detergent
 - ≈ Cleans fuel system & combustion chamber
 - ≈ Provides lubricity lost with ULSD
 - ≈ Must change fuel filter after first tank
- Raises cloud point by 3-5 degrees F
 - ≈ May need to mix with #1 in cold weather as one would do in normal cold weather operations
 - ≈ Anti-gel additives available for blends up to B20 that lower cold filter pour point to -40 degrees F
- Biodiesel may degrade natural rubbers in older engines or affect worn seals. Newer engines and Viton seals show no negatives

WARNING! BUY BIODIESEL FROM REPUTABLE SUPPLIERS WHO MEET ASTM D6751 SPECS!

About half today don't meet that - resulting in plugged filters (glycerin), coking, varnishing & sludge

Ethanol Overview

- Ethanol and engines (E10-E85):
 - Auto manufacturers increasing percentage of flex fuel vehicles (lower mpg's)
 - Users don't really take advantage of it
 - Other problems exist (plugged parts, sensors, using "cheap fuel" in vehicles not made for it ...)
- Ethanol - primarily made from corn in US (Midwest)
 - Sugar cane is best source (Brazil, India, China & Pakistan - produce half in world) - \$0.54 tariff question
 - Sugar beets next (EU, USA, Russia & Ukraine)
- Cellulosic Ethanol next major mandate coming
 - Agricultural residues normally left on the field, such as corn stalks, wheat straw and rice stalks
 - Hardy grasses, fast-growing trees, wheat, sawdust & waste paper requires more processing

BioFuel Issues

- It's mostly about **PRODUCT QUALITY** (*with Biodiesel*)
- Cleans pipelines, tanks and engines
 - Ethanol attracts water (damages injectors and plugs filters)
 - Biodiesel cleans out carbon from fuel system
- Performance enhancers
 - Ethanol Octane - 10% = two points
 - Diesel Cetane - about the same amount or a plus
 - Diesel Sulfur Level - Zero
- Distribution
 - Ethanol cannot be transported in current pipelines as it picks up water (and rust) and corrodes pipelines and tanks
 - Renewable Diesel is being produced and put in pipelines
 - Biodiesel can be, but volumes too low

Diesel Exhaust Fluid (DEF) - Urea

- Diesel Exhaust Fluid (DEF) - Aqueous Urea solution
 - Proven Selective Catalyst Reduction (SCR) NOx reduction approach
- Commercially Available
 - Most Urea used for other applications such as fertilizer production or general chemical applications
 - Pilot Travel Center's, TA / Petro Travel Center's, Loves Travel Center's, Flying J's and others will have bulk DEF 'at the pump' for operator convenience
 - Retail channel will be filled in mid-to late 2009
 - 2.5 gallon jugs widely available as pre-packaged 'top-off' quantities from truck dealer locations, independent truck repair garages & local NAPA stores
 - Supply will be matched to the phase-in of engines with the manufacturers' dealers being the safety valve
- Projected improvements are noteworthy
 - 5% fuel mileage improvement with SCR equals 0.3 mpg or about \$0.02 per mile at \$2.50 per gallon fuel.
 - Projected SCR reduction in heat-related maintenance costs where estimates may be savings similar amounts to that from fuel
- Marketing benefit - **GREEN** fleet

California Considerations

- “In-Use Truck and Bus” emissions regulation
 - Applies to diesel-fueled vehicles with a manufacturer's gross vehicle weight rating greater than 14,000 pounds that operate in California, regardless of where the vehicle is registered.
 - For fleets with 4 or more vehicles, the regulation would require the installation of exhaust retrofits in 2010 and 2011 and accelerated engine or vehicle replacement from 2012 to 2022.
 - Implementation is delayed for fleets with one to three vehicles or low utilization.
- Technically - engines must be electronically controlled for retrofit
 - Several aftermarket products undergoing testing
 - Opportunity for marketing **GREEN**
- Litigation underway
 - Interstate Commerce & other aspects

OPERATIONAL FUEL COST SAVINGS

Operations & Fuel Costs

<u>Factors</u>	<u>Effect</u>	<u>Cost / Mile</u>
Speed: (-10mph)	- 1.0 MPG	- \$0.059
Idle Time: (10 hrs)	- 0.6 MPG	- \$0.047
Alignment:	- 0.1 MPG	- \$0.007
Tire Pressure:	- 0.1 MPG	- \$0.007
Wind:	- 1.5 MPG	- \$0.109
Temperature:	- 1.0 MPG	- \$0.059
Geography:	- 1.0 MPG	- \$0.059
Road Condition:	- 0.6 MPG	- \$0.047
Blended Fuel:	- 0.5 MPG	- \$0.038
Fuel Price	\$0.05 / gal	\$0.010

Note: at \$2.50 per gallon diesel price

Biggest Operations Fuel Savings

RULES OF THUMB

5 miles per hour changes fuel mileage

0.5 mile per gallon or \$0.03 per mile

(idling 10 hours per day costs more)

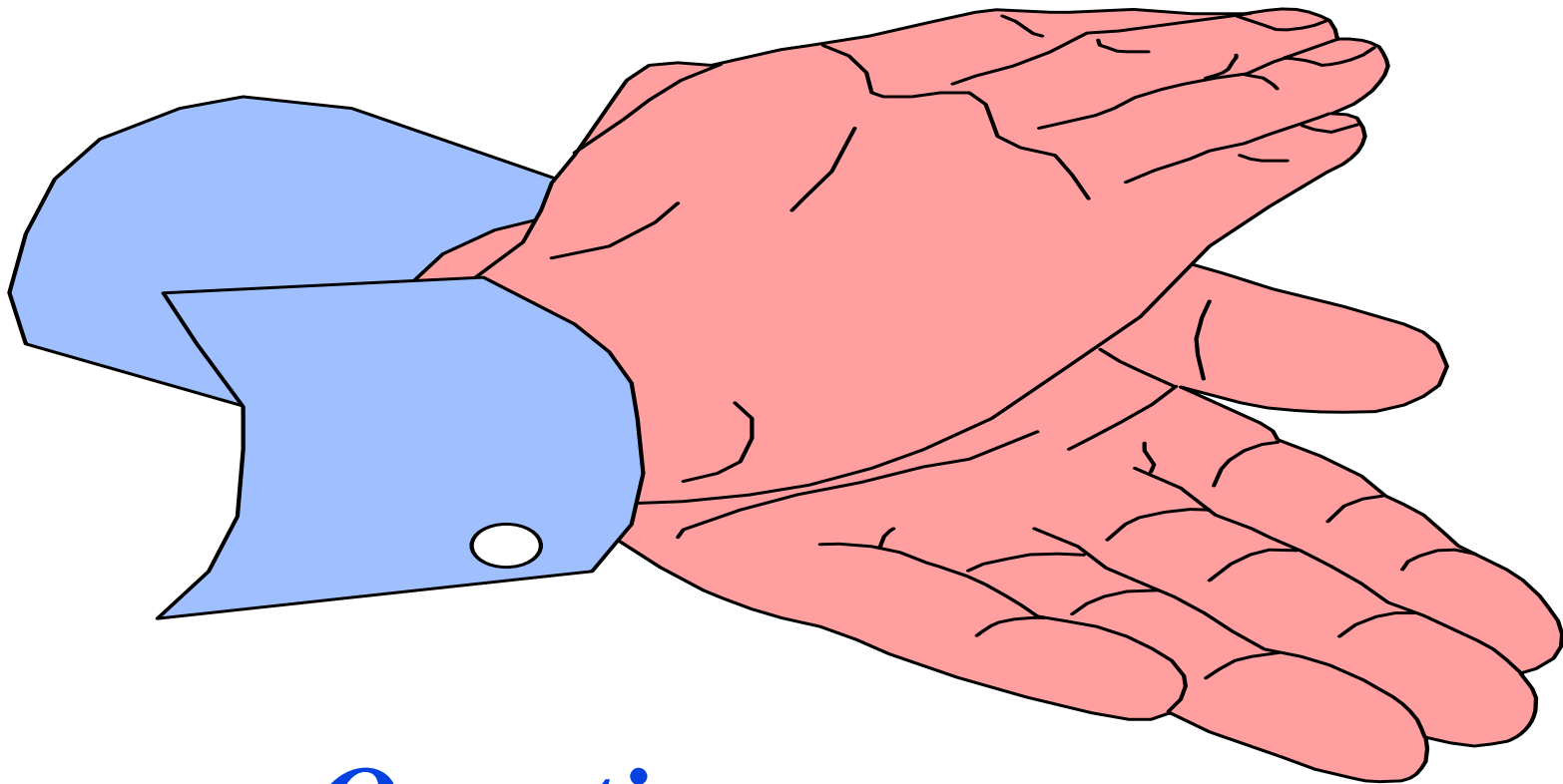
Just 5 miles per hour or reducing idling

can offset about \$0.15 per gallon

Summary

- There are a lot of things going on...
 - Fuel Costs - need to address consistently
 - ULSD - it's here for 80% of market
 - New Engines - '07 is here and '10 coming
 - Biofuels - develop right alternative fuel strategies
 - Hybrid Diesels - coming!
 - Carbon Credits - being GREEN!
 - More regulations coming
- There are many ways to profitably move ahead...
 - Basic planning for changing marketplace
 - Utilization - key for profits
 - Financing - will be tough, so planning is key
 - Fuels - know what type / quality fuels you are getting, assess surcharge program and look at operational changes
 - Equipment life-cycles - lengthening equipment service / engine life and trade cycles underway - assess your approach
 - Benchmarking and comparisons - best information is available from other members while using industry input adapted to your operation

Thank You!



Questions.....

2007 / 2010
ENGINE OVERVIEW

Past Regulations & Solutions

- Brief History - Primary emission issues surround NO_x and PM - others include HC, CO, warranties, testing, etc. started in 1970
 - US NO_x: '84-10.7; '90-6.0; '91-5.0; '94-5.0; '98-4.0
 - US PM: '88-0.60; '91-0.25; '94-0.10 plus new HC reg in '02 at 0.5
 - All this addressed through '90's with turbochargers, timing, electronics...
 - Big change in '04 was to lower NO_x to 2.5 and to harmonize California and the rest of the US
 - Decree pulled up '04 standards to Oct '02
- Solutions assessed for Euro III / US'04 onward - with some reductions noted
 - EGR could do NO_x 60%, which gets us thru US 07 and could have Euro V ('08) - but not with any reserve capacity
 - Diesel Particulate Filters - PM 90%; HC 80%
 - Diesel Oxidation Catalysts - HC 20-50%; CO/HC 90%
 - NO_x Absorbers - Light-duty NO_x 90% (Dodge P/U)
 - For Euro IV ('05), SCR easily got the 40% NO_x reduction
 - SCR can get us 90% for US 10 and Euro VI (2011)
- DeNO_x systems cost \$\$\$ - 2X for LD and 3X for HD vs. SCR
 - Variable cost of \$80 / liter for catalysts vs. \$15 / liter for SCR

2004 Summary Engines Regulations

- To meet '04 NOx standards, all US manufacturers utilized exhaust-gas recirculation (EGR) except for Caterpillar
- Other changes included the following
 - Timing changes
 - New pistons
 - Different air handling systems
 - Higher pressure injection systems
 - Variable geometry turbochargers
 - Additional engine controls / sensors
- Caterpillar used its ACERT technology (non-EGR)
 - Series turbochargers
 - Variable valve control
 - High-pressure multiple injection fuel system
 - Electronics control system

2007-2010 Engines Regulations

- Nitrogen Oxide (NOx) - ½ of all '07 engines will emit no more than 0.20 g/hp-hr, down from 2.5 g/hp-hr. An EPA phase-in provision lets '07 engines operate at 1.2g/hp-hr with requirement to reduce NOx to the 0.20 by 2010 in all on-highway diesel engines
 - To meet '07 NOx standards, Cummins, Detroit Diesel and Mercedes-Benz, Mack and Volvo are using cooled-exhaust-gas recirculation (EGR) while Caterpillar will continue using its ACERT technology. For '07, all have a Diesel Oxidation Catalyst (DOC) and Diesel Particulate Filter (DPF) to remove particulate matter from the exhaust stream
- Particulate Matter (PM) - a 10-fold reduction is required from .10 to .01 g/hp-hr, which will remain in effect in 2010
- Crankcase Emissions - now regulated as exhaust emissions
- Engine Manufacturer Diagnostics (EMD) - requires manufacturers to monitor the performance of and detect issues with emissions systems
- Useful Life - regulates engine emissions system life, which has been set at 435,000 miles for heavy-duty trucks.

2007-2010 Engines Techniques (cont.)

- Handling Ash - as ash from engine oil builds up in the DPF, regeneration and cleaning is required).
 - Cleaning can be performed on or off of the vehicle and the service time is expected to be the same as that for an oil change. Interval is from 150,000 - 300,000 miles depending on
 - Regeneration strategies
 - In cylinder dosing in which an existing fuel injector adds a dose of fuel into the cylinder after primary combustion has taken place. Unburned fuel is exhausted out of the cylinder down to the DOC where it burns and generates additional heat for the DPF. This additional heat helps convert soot into ash
 - Downstream dosing, which adds a fuel injector after the turbocharger in the exhaust system, and then works exactly like in cylinder dosing once it reaches the DOC
- For '07, Ultra Low Sulfur Diesel (ULSD) fuel was mandatory with the allowable level of sulfur in highway diesel fuel in the US reduced from 500 PPM to a maximum of 15 PPM (10PPM for



2004-2010 Engine Big Changes

- 2004 Big Changes (introduced October '02) pull-up's
 - Combustion technology
 - Exhaust Gas Recirculation (EGR) / turbocharging
- 2007 Big Changes
 - Ultra Low Sulfur Diesel
 - Enhanced EGR
 - Catalysts / Diesel Particulate Traps (DPF)
 - Crankcase vent recirculation
 - Redesigned cooling systems
 - Advanced electronic monitors / controls
- 2010 Big Changes
 - Advanced catalytic reduction (urea-injection)
 - Advanced EGR with emission credit trading
 - Super high fuel injection