Biodiesel Technical Update For Iowa Biodiesel Board

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Topics

• Where is diesel (CI) technology headed?
  – And why.....

• What R&D needs to happen for 2030?
  – Engines and after-treatment?
  – Production, blending and distribution?

• Where is heating oil heading?

• Current NBB technical efforts
Future CI Technology: Ultra Low Emissions Diesel Engine (ULEDE)

New Diesel NOx Standards:

- U.S EPA’s “Cleaner Trucks Initiative”
- CARB Heavy Duty Diesel Changes
- 2020 or later timing

➢ New Step Change in NOx After-Treatment
  ➢ From 0.2 g to ~0.02 g NOx, new tech needed
  ➢ PM from 0.01 to ~0.005, met with existing DPF
FROM THIS.....
TO SOMETHING LIKE THIS.....

= NO\textsubscript{x} Sensor
= DEF Dosing
= NH\textsubscript{3} Sensor
= Temp Sensor
= Heated DEF Dosing

DEF Mixer

DEF Mixer

DEF Mixer

DEF Mixer
CARB Heavy Duty Diesel Changes
Announced February 2019

• Over 1 Million Miles Full Useful Life!
  – Vs. 435,000 miles today....

• New Low Load, Low Speed Engine Emissions Certification Requirements
  – Addresses NOx In Modes Not Hot Enough for SCR Through Engine/Hardware Strategies

• New In-Use Testing Requirements
  • Make Sure NOx/PM Systems Are Working
Strong Diesel Future

- Ultra Low NOx Under All Uses....
- Extreme Durability...
- Low Carbon Fuels Like Biodiesel....
- Make Diesel the Engine of Choice for Medium and Heavy Duty Applications for Years to Come....
R&D Needed—Petrodiesel

• What changes are needed for ‘petrodiesel’?
  – Lower metals and contaminants from refining and distribution?
    • So after-treatment lasts over 1 million miles....
  – Fuel modifications for 1 million mile injector life?

• How will RHD, BD, or RHD/BD mixtures stack up?
  – RHD and BD burn cleaner...
    • Can new sophisticated engines/AT take advantage of this?
  – Are the metals low....or low enough
    • Most metals are below detection of current test methods
R&D Needed—RHD/BD: Future Fuel Properties/Infrastructure

- Cold flow properties with RHD/BD blends
- What high RHD/BD blends are the ‘best’ for the California market?
  - Economics, LCFS, Distribution/Blending, Cold Flow
- New RHD/BD production will be needed...
  - High vs. low capital cost
- New oils/fats will be needed
  - Brassica Carinata, UCO collection, more soy/high oleic soy, algae, others???
- USTs, Dispensers, CAWB and CUPA approvals
R&D Needed—Biodiesel: Future Engines/Vehicles

• Legacy emissions with high blends
• Confirm NTDE emissions w/ high blends
  – And then new ULEDE’s…..
• Long term fuel durability impacts on ULEDEs
  – Fuel filters, DPF clean out, SCR protection
• Fuel tank/fuel line heaters—high BD blends
• OEM support for high blends…..
  – Superior performance with optimized high blends???
Where is Heating Oil Heading

• Northeast policy makers are getting serious about reducing carbon
  – Incremental carbon reductions: Not enough
  – Must be ‘net zero’ carbon...eventually

• New England Fuels Institute resolution

• Unanimous Resolution at Heat Show: 9-16-19
  – 15% carbon reduction by 2023 (i.e. B20)
  – 40% carbon reduction by 2030 (i.e. B50)
  – Net zero carbon by 2050 (i.e. B100+)
NBB Technical Program Highlights
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• FORD Optimization Project, Univ. of Michigan
  • B5, B10, B20
  • Potentially B50/B100 next year

• Cummins Optimization Project, Purdue
  • B20, potentially B50/B100

• Efforts with GM on their diesel plans

• CARB high blend emissions testing
  • B50/B100
  • CNH
  • Cummins
  • John Deere

• CARB Low Emission Diesel (CARB-2)
NBB Technical Program Highlites

• ASTM Standards
  • Extend storage recommendation from 6 months to 12 months for B20

• Testing to set lower metals levels in B100

• B21-B50, B51-B100 in heating oil
  • Use B20 work as model
    • Bench testing
    • Durability testing
    • Field trials
NBB Technical Program Highlites

• Partnering with Optimus Technologies on B100
  • Dual heated fuel system
  • Projects occurring around the country

• Balloting B5 in on-ground gas turbine spec
  • Cooperative efforts with Solar Turbine San Diego
  • Investigating potential for biodiesel to produce low carbon electricity

• Monitoring upcoming IMO 2020 sulfur reduction
Some Really Forward Thinking

• Tailoring soybean oil to make an optimum biodiesel:
  – Current: High oleic soybean oil
  – Future: 100% Oleic (C18:1) and Palmitoleic (C16:1)
    • Cetane over 50, Cloud Point around -20F!

• What about pipelining B20, B50 or even B100?
B20 OEM Support

• The vast majority of new diesel engines now have full OEM support for B20 and lower blends meeting ASTM standards

• However, some OEMs remain limited at a B5 approval level, and all OEMs are under pressure to comply with increasingly stringent emissions, vehicle performance and fuel efficiency requirements using conventional ULSD

• For a summary of OEM position statements on biodiesel, visit: [https://www.biodiesel.org/docs/default-source/fact-sheets/oem-support-summary.pdf?sfvrsn=4e0b4862_8](https://www.biodiesel.org/docs/default-source/fact-sheets/oem-support-summary.pdf?sfvrsn=4e0b4862_8)

OEMs Supporting B20
OEMs Supporting B20

*Only Daimler models equipped with Cummins engines support B20. Detroit Diesel engines support B5.*
About NTEA’s Fleet Purchasing Outlook

NTEA’s annual Fleet Purchasing Outlook explores the commercial vehicle landscape and measures common acquisition incentives. Report findings reveal significant insights from commercial fleet managers. Directional patterns presented in this research initiative can help companies effectively respond to market swings and vocational fleet activity. Content is based on survey results, with data from previous years serving as a benchmark to establish trends and allow year-to-year comparisons.

The Association captures responses from a variety of fleet professionals in mid- to high-level management, with authority to make truck acquisition and vehicle specification decisions. Participants represent a wide range of fleet sizes, vehicle weight classes and vocational truck applications across the U.S. and Canada. Primary sectors include government/municipal, construction, delivery and utility/telecom application markets.
Summary of Results for Biodiesel:

- Currently Biodiesel is the most used alternative fuel among fleets
- Fleets also expressed the highest degree of interest in biodiesel for future use compared to other alternatives
- 65% of fleets use biodiesel blends year-round, regardless of climate
- 72% of fleets use blends higher than B5, with the majority (42%) using B20
FLEETS: Make Your Voice Heard

• Ultimately, OEMs make their product development and production decisions based largely on regulatory requirements and demands from their consumers – the Voice of the Customer is key.

• Sending a strong market signal to OEMs regarding the continued demand for new clean diesel vehicles and the ability to use higher biodiesel blends in those vehicles to lower carbon emissions is critical to garner OEM support.
FLEETS: CALL TO ACTION

• We invite you to join your fellow fleet managers and make your voice heard by reviewing and signing on to the following letter, which tells Original Equipment Manufacturers (OEMs) to support B20 or higher biodiesel blends in their diesel vehicles.

• The letter will be shared with major OEMs, and with key legislators and other policymakers involved with automotive issues.
The “real” scientific method

Will it work? I think so...

TESTING...

Need more testing

Thank You!