



NGB introduction June, 2009



Advanced Renewable  
Technology

# Company Update – 1Q09

- Completed construction of first commercial-scale plant in Baltimore
- Institution of a quality control program designed to move NGBF along ISO 9000 path
- Continues Successful Application Testing
  - Progress Energy
  - Delta Chemical
  - Catoctin Mountain Growers
- Sales contracts announced
- Fuel deliveries under initial contracts

# NGB Baltimore Plant

- First Production Facility Completed
  - February 2009
  - Nominal 5 million gallons/year capacity
  - Expandable to 50 million gallons/year
- Process improvements to deliver consistent quality
- Excellent results in production runs

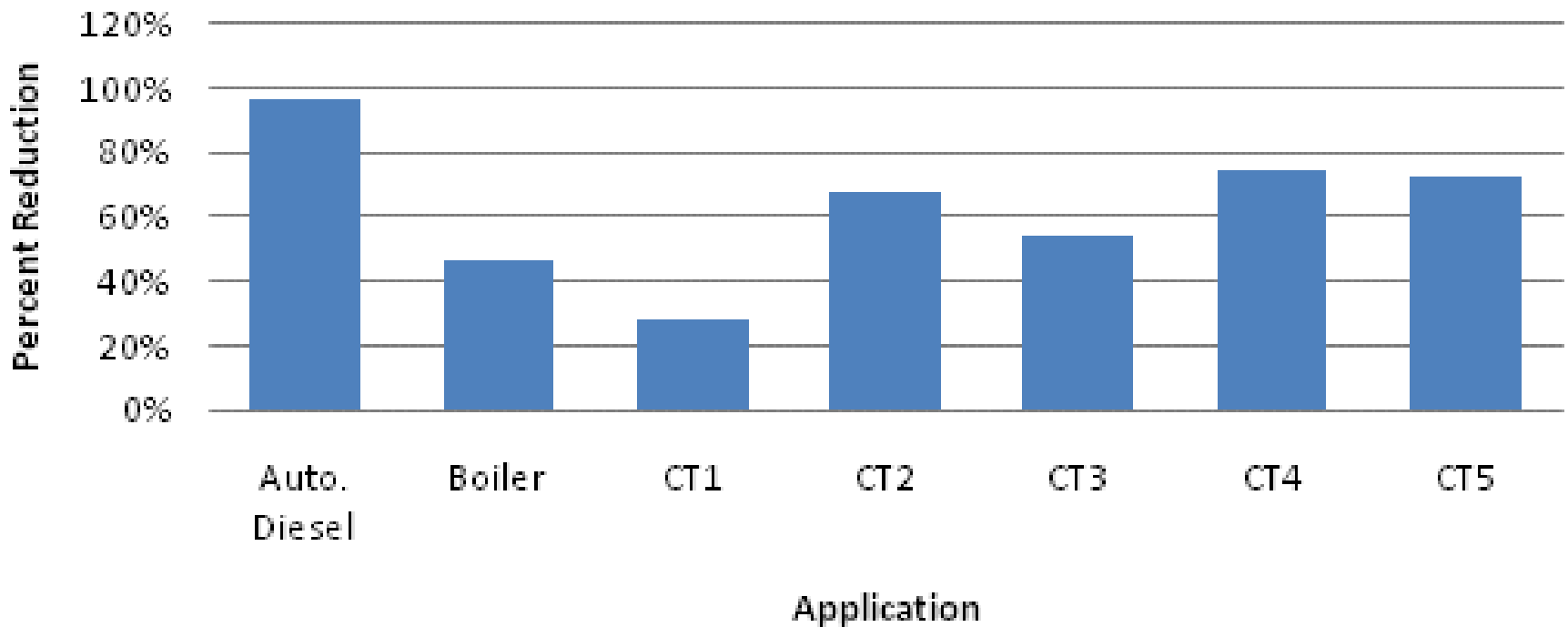


# Additional Application Tests

- Initial tests in GE Frame 7, GE Frame 5, and Pratt & Whitney FT4
- Progress Energy
  - Bartow Steam Plant (Babcock & Wilcox steam boiler)
  - Demonstrated ignition and flame stability
- Boiler Tests
  - Delta Chemical
  - Catoctin Mountain Growers
  - > 40% reduction in NO<sub>x</sub> emissions

# NO<sub>x</sub> Reduction by Application

## New Generation Biofuels NO<sub>x</sub> Improvement



# SOx Reduction

- NGB feedstock's are inherently free of sulfur
- SOx emissions are essentially eliminated
  - Substantial reductions even when compared to ULSD

# 2009 Sales Contracts

- Delta Chemical (Baltimore, MD)
- Catoctin Mountain Growers (Keymar, MD)
- Taunton State Hospital (Taunton, MA)
- Seaboard Asphalt (Baltimore, MD)
- City of Baltimore
- Tri Gas and Oil (Marketer, MD)

# Technical Overview

- Product Lineup
- Atomization and Combustion
- Stability
- Viscosity

# Product Lineup

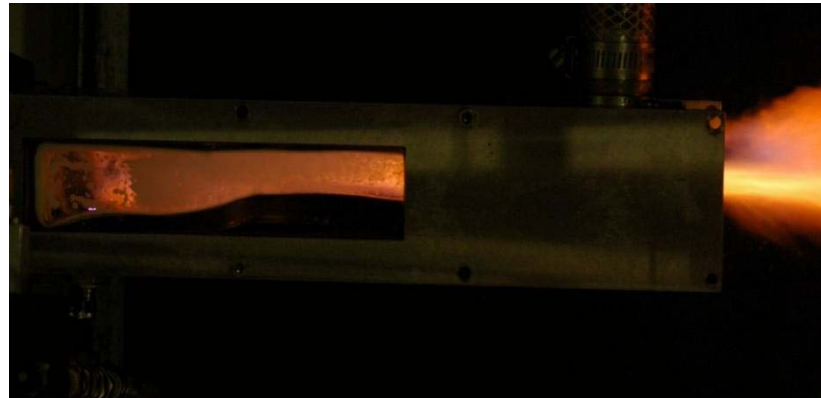
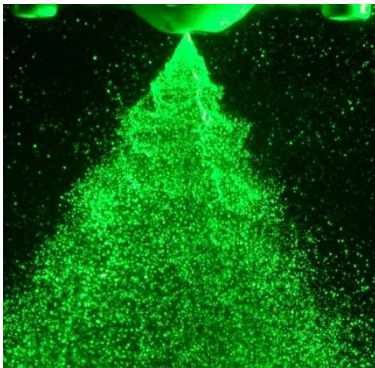
- NGB currently is commercializing two versions of its fuel
  - Classic – lowest cost product intended for applications where a lower flash point is acceptable
  - Ultra HF – premium product with higher flash point and energy content
- Both fuels provide significant NOx and SOx advantages

	Classic	Ultra HF
Flash Point (°F)	>75	>140
Heat of Combustion (BTU/gal)	>91,000	>102,000
Kinematic Viscosity @ 40°C (cSt)	<70	125 typ.
Bottom Sediment & Water (%)	<0.1	<0.5
Specific Gravity	0.934	0.954
Pour Point (°F)	<0	<5



# Atomization and Combustion Study

- Atomization and combustion properties studied by the University of Minnesota Center for Diesel Research
- Key findings:
  - NGB emulsions are non-Newtonian fluids
    - “Shear-thinning” behavior
  - Classic formulation atomized well at all pressures in excess of 100 psi
  - Combustion was stable, with ignition characteristics equivalent to or slightly better than #2 diesel



# Stability

- Emulsion resistance to separation
  - Bottom Sediment & Water (ASTM D2709)
    - Centrifuge at 800g for 10 minutes
    - < 0.1% separation (Classic & Ultra HF)
- Breakdown of triglyceride compounds
  - Oxidation Stability (EN14112)
    - European biodiesel goal of 6.0 hours requires additives
    - 5.6 hours (Classic)
    - 4.7 hours (Ultra HF)
- Storage stability
  - Iodine Number (AOCS Cd 1d-62)
    - Target value of < 115 to avoid polymerization
    - 70 Classic)
    - 86 (Ultra HF)

# Viscosity

- Equipment makers often specify viscosity maximums
  - Primary purpose is as a proxy for atomization quality
  - The presence of water in NGB fuels provides excellent combustion atomization due to rapid expansion of micro-droplets into steam
  - University of Minnesota study reveals excellent atomization and combustion qualities
- NGB's shear-thinning behavior results in lower viscosity in actual use than standard tests indicate
  - Straightforward testing can reveal if excessive pressures are required to reach desired flow rates

# NOx and SOx Credits

- Emissions tests conducted with NGB's fuel show a 40% or greater reduction in NOx
- Near 100% reduction in SOx
- NOx and SOx Credits (as reported by Platts, week ending April 3, 2009)
  - \$400 to \$500/ton NOx
  - \$55 -\$60/ton SOx
- EPA indicated high likelihood of acceptance of NGB's fuel to reduce emissions under CAIR or NOx SIPCall
- Petition EPA under 40 CFR Part 75 Appendix D Methodology

# Carbon Analysis #6 Fuel Oil

- Typical #6 Fuel Oil
  - 0.15 MMBtu / gallon
  - 88% carbon by weight
- Carbon to CO<sub>2</sub>
  - Each lb of carbon creates 3.67 lb of CO<sub>2</sub>
  - Each gallon of #6 fuel oil yields 26.3 lbs CO<sub>2</sub>
  - 179 lbs CO<sub>2</sub> / MMBtu
- A typical boiler burning 100 gallons/hour:
  - Uses 2400 gallons of fuel per day
  - Emits 63,120 pounds (29 metric tons) of CO<sub>2</sub> per day

# Carbon Analysis # 2 Fuel Oil

- Typical #2 Fuel Oil
  - 0.13 MMBtu / gallon
  - 87% carbon by weight
- Carbon to CO<sub>2</sub>
  - Each lb of carbon creates 3.67 lb of CO<sub>2</sub>
  - Each gallon of #2 fuel oil yields 22.5 lbs CO<sub>2</sub>
  - 168 lbs CO<sub>2</sub> / MMBtu
- A typical boiler burning 100 gallons/hour:
  - Uses 2400 gallons of fuel per day
  - Emits 54,000 pounds (25 metric tons) of CO<sub>2</sub> per day

# Carbon Value

- Chicago Climate Exchange or Chicago Climate Future Initiative possible trading platform
- CCFE European carbon trade @ \$18.60 / metric ton
  - If 100% carbon-neutral:
    - \$0.14 / gallon compared to #6 fuel oil
    - \$0.13 / gallon compared to #2 fuel oil
- At \$50 / metric ton
  - If 100% carbon-neutral:
    - \$0.39 / gallon compared to #6 fuel oil
    - \$0.36 / gallon compared to #2 fuel oil

# Summary

- Truly renewable & sustainable biofuel
- Small Carbon Footprint
- Cost competitive with existing fuel oil
- Simple fuel switch
- Significantly lower emissions
- Carbon, NOx & SO2 value
- Growing track record of success
- Available now



Contact details:

Phil Wallis

Chief Marketing Officer

[pjwallis@newgenerationbiofuels.com](mailto:pjwallis@newgenerationbiofuels.com)

Ph: 713 483 4770



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