MARITIME ADMINISTRATION

Office Of Environment

AAPA Environment Committee Meeting
May 8, 2014

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OFFICE OF ENVIRONMENT

Two primary missions

MARAD Environmental Compliance

- EO 13514 goals for Federal Agencies - making improvements in environment, energy and economic performance

✓ Agency Green Programs/Sustainability
✓ Ship and facility operational compliance
✓ National Environmental Policy Act (NEPA)

Maritime industry stakeholder assistance

✓ Vessel owners and operators
✓ Port, shipyards operators
✓ Federal, state environmental regulatory and resource agencies
✓ Public

MARAD does not regulate environment

META Initiatives

Maritime Environmental and Technical Assistance (META) Initiative

- Stimulate technology advances for improved sustainability
- Address critical marine transportation environmental issues
  - non-indigenous aquatic species (ballast water management technologies, underwater hull husbandry)
  - port and vessel air emissions and energy.
- **Collaborative** effort among Federal agencies, academia, industry and public stakeholders

  - $3-4M per year since 2010 – leveraged over $17M from Federal partners and more from the private sector.

META Initiative

- **Objectives - Stimulate technology advances for improved sustainability; seek solutions; demonstrate and inform**
  - ✓ **Maritime Use of Alternative Energy and Technology**
    - Natural gas
    - Advanced Renewable "drop-in" biofuel
    - Hybrid propulsion
    - Fuel cell
  - **Goals:**
    - ✓ Technology validation and demonstration
    - ✓ Reduction of polluting emission from ships and in and around ports

Marine Application of Fuel cells
On-going Project

- **MOU with DOE established on June 2013**
- **Prototype project funded by MARAD & DOE with several industry partners**
  - Demonstration of fuel cell auxiliary power unit for shore/shipboard power
  - Collaboration *with multiple industry partners*
    - ✓ *Hybrid hydrogen PEM fuel stack in a 20' container*
    - ✓ *100kW 230V AC 3 phase*
    - ✓ *Power for 10 refer containers*
      - ABS and USCG approval

Marine Application of Fuel Cells
Current & Future Project

- **Current project** (FY 2014 currently under planning)
  - Shipboard technology demonstration of fuel cell for auxiliary power
    - ✓ 10kW s120-240 V AC
    - ✓ JP-8, ULSD, No. 2 diesel

Future projects (subject to availability of funding)

- Shipboard auxiliary power with higher power fuel cells
  - Alternative or logistical fuels
- Ship propulsion
- Hybrid power system
- "Cold Ironing" of vessels/port power
- Port applications – port equipment/emergency power

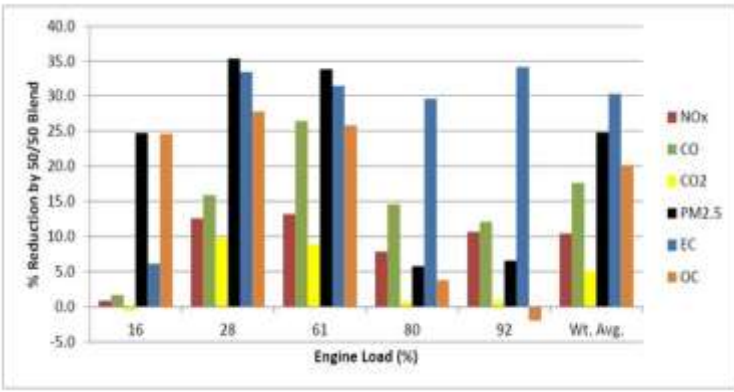
Advanced Renewable Fuel Oil Tests

Test Results:

Average **Weighted Emission Reduction with B50 blend fuel compared to ULSD**

- ✓ NO_X–emissions -10%
- ✓ CO-emissions -18%
- ✓ CO_2-emissions -5%
- ✓ $PM_{2.5}$-emissions -25%
- ✓ SO_X reduced from 0.0055 g/bhp-hr to 0.0020 g/bhp-hr (based on the actual sulfur in the fuels)

- ❖ A 5% reduction in CO2 reflects a similar amount of fuel savings for the B50 blend
- ❖ Calorific Values:
  - 42.938 (USLD) 43.400 (B50) MJ/kg

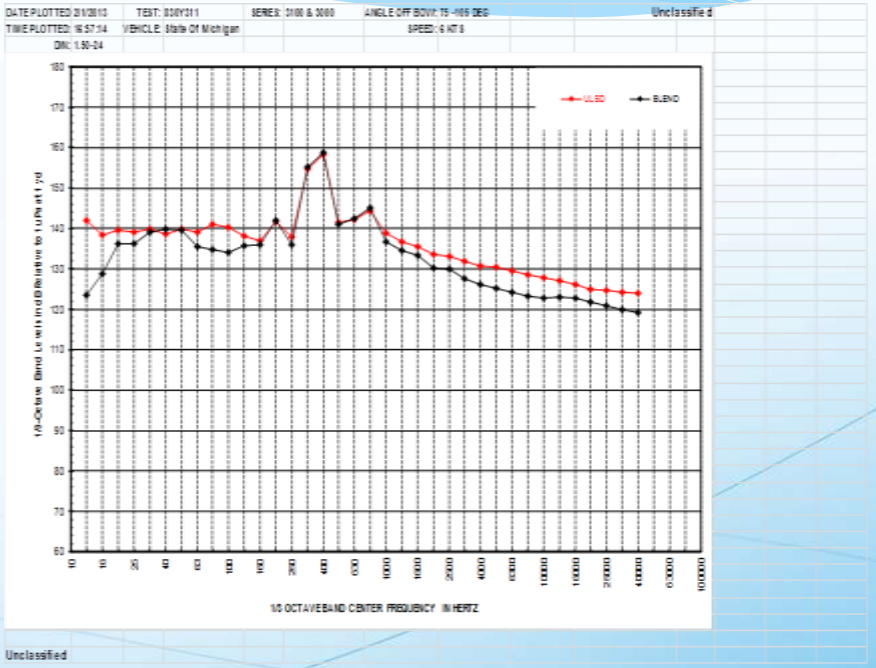


Percent Reduction in Pollutants by 50/50 Blend

Renewable Fuel Oil Tests
Underwater Radiated Sound Transmission Test

* Plot at 11 Kts Cruising Speed : ~2 dB
* Difference at 4000 to 16000Hz

Plot at 6 Kts Cruising Speed : ~3 dB difference at 2000 to 12000 Hz



OPPORTUNITIES FOR EXPANDED PORT/MARAD COLLABORATION

* FUEL CELLS
* BIO DEISEL (BIOMASS)
* NATURAL GAS
* OTHER??????????

Thank You