



Maritime Administration Energy Technologies Program

Presented to
**Shipboard Energy Technologies
Conference**

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by

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**Office of Shipbuilding and Marine Technology
Maritime Administration**



Presentation Contents

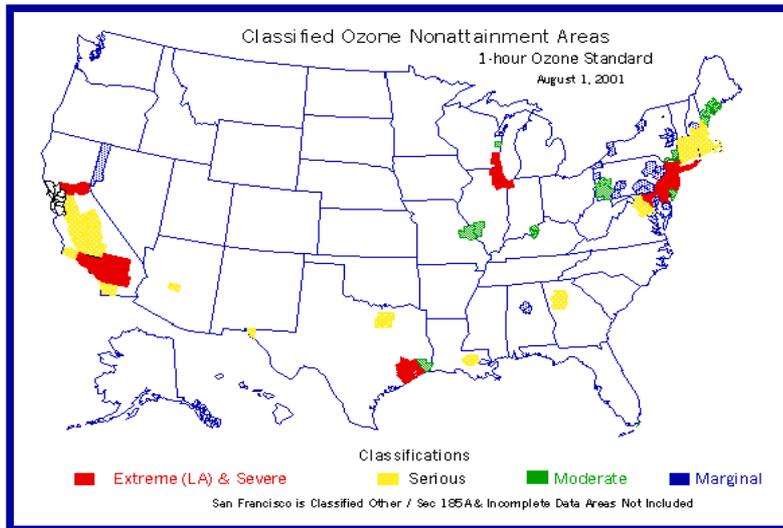


- **“Why an Energy Technologies program?”**
- **Brief overview of the program plan**
- **Ferry retrofit projects**
- **Cargo ship projects**
- **Fuel Cell and laboratory projects**
- **Emission measurement protocol activities**
- **Website and contact information**
- **Theme for today’s Workshop**

Why A Maritime Energy Technologies Program?



Recent Emission Pressures

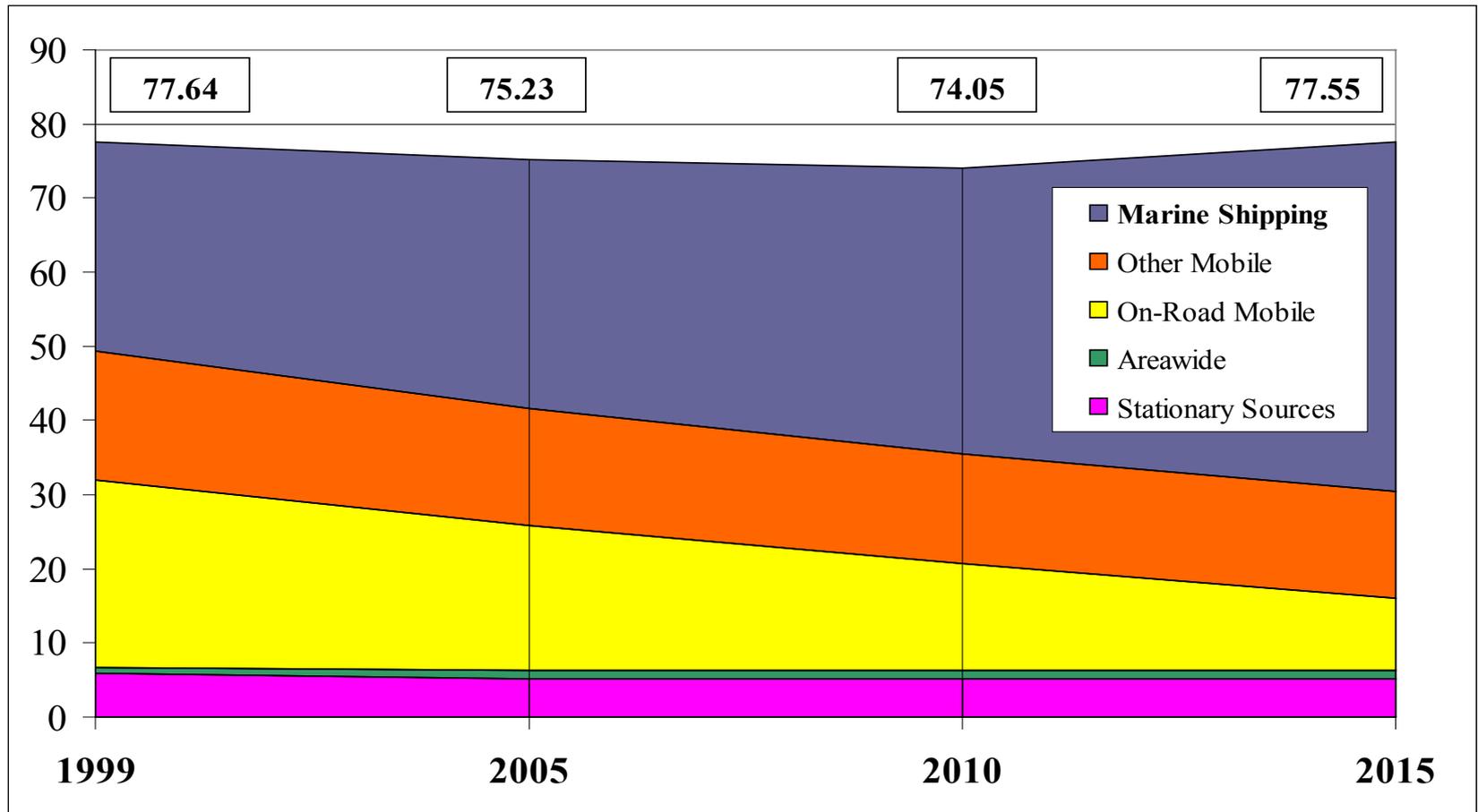


U.S. Ozone Nonattainment Areas

- Maritime in spotlight
- MARPOL Annex 6
 - NOx and Sulfur limits in 2004
- EPA regulations
 - New category 1, 2 eng's (1999)
 - NOx, HC, CO, and PM
 - New category 3 eng's (2002)
- CARB regulation
 - Ferries use hwy diesel
- Ozone Nonattainment
- Public pressure



Growing Marine Emissions Santa Barbara NOx Example



NOx Tons per Day

Program Overview



Program Objectives



- **Investigate and demonstrate the potential for new technologies and fuels to improve marine power plant efficiency and to reduce air emissions**
- **Disseminate energy technology and related policy information to the maritime community**



Program Plan

- **Baseline performance testing**
 - Existing vessel data and measurement techniques
- **Diesel retrofits**
 - Emulsified fuel, water injection, SCR, particulate traps
- **Alternative fuels**
 - Natural gas, biodiesel, hydrogen, synthetic diesel
- **Advanced technologies**
 - Fuel cells, high efficiency gas turbines
- **Supporting studies**
 - Technology evaluations, incentives & emission measuring
- **Industry outreach**
 - Newsletter, conferences, website, and presentations

Partners



Ferry Retrofit Projects



Water Injection System (WIS) & Ultra Low Sulfur Diesel (ULSD)



MV WAVERIDER - San Diego

Modified Hydrofoil Design

SCX Ferries

2003

- **Technologies**
 - Combustion Air Water Injection System (WIS)
 - 15 PPM Sulfur Diesel
- **Engine Type & Ops**
 - DD 12V92 TA, 2 Stroke
 - 1050 HP at 2300 RPM
 - Long runs at cruise speed
- **Partners**
 - SCX Ferries, DOE, West Virginia University



Biodiesel and Water Injection System (WIS)



MV OSKI - San Francisco Bay

Blue and Gold Fleet

2002

- **Technologies**
 - Biodiesel - B100 & B20
 - Renewable
 - SO₂ & CO₂ friendly
 - Combustion air water inject
- **Engine Type & Ops**
 - (2) DD 12V-71
 - Tour Vessel
- **Partners**
 - Water Transit Authority
 - B&G Fleet, Walthers Engineering, UC Berkeley



Sister Ferries

Natural Gas - Diesel Comparison



Elizabeth River Ferry II - Norfolk

Hampton Roads Transit Auth.

2001

- **Two sister ferries**
 - MV Echols - Natural Gas
 - MV ERF II - Diesel
- **Engine Types**
 - (2) CAT 3406 spk ign- gas (NA)
 - (2) DDC 6V 71 (NA)
- **Operations**
 - Cross river, heavy idling
- **Partners**
 - HRTA, USCG, NAVSEA, West Virginia University, Department of Energy, Mar. Chemists & Environ. Cons.



Selective Catalytic Reduction & Diesel Oxidation Catalyst



Staten Island Ferry
Scheduled 2003 - 2004
MARAD - Advisory Board

- **Pilot Project - Austen Class**
 - (2) Cat 3516 Engine (TC)
- **Eventually all 7 SI ferries**
- **SCR for NO_x >70% reduction**
- **DOC for PM**
- **15 PPM Sulfur Diesel?**
- **Sponsors - PANY&NJ, NYC DOT**
- **Partners - EPA**
- **Contractors - MJ Bradley & WVU**



NYC Harbor Private Ferry Emissions Reduction Program



NY Waterway

Seastreak

New York Water Taxi

Scheduled 2003 - 2004

MARAD - advisory role

- **NYSERDA - Program Manager**
- **\$6.8 M Program**
 - Identify NY ferry fleet
 - Data log vessel operations
 - Ultra Low Sulfur Diesel testing
 - Down select technologies
 - Install, demo, & test
 - Deploy technologies to fleet
- **Sponsors - NYC DOT, FHWA, & FTA**
- **Partners - EPA, Ferry Operators**
- **Contractors - Seaworthy Systems, Environment Canada, NESCAUM, ESI**

Cargo Ship Projects



Maersk Vessel Baseline Emission Testing



- **MV SINE MAERSK,**
 - Containership from L.A. to Tacoma
- **Sponsor - Port of LA w/MARAD assist**
- **Parties Involved -**
 - Maersk Lines, MAN B&W, University of California Riverside, CARB
- **NOx, PM, HC, CO and CO₂**
- **Testing both underway and at pier**
- **Presentation today**



Large Vessel Diesel Engine Retrofit



- **Potential Sponsors**
 - MARAD, EPA, Ports LA & LB, CARB, Air Quality Districts
- **Main Engine & Auxiliaries**
- **California Coast & Ports**
- **Promising Technologies**
 - 25% NOx Reduction
 - Better Fuel Economy
- **Cooperative Research Approach w/Operators**

Fuel Cell and Laboratory Projects



NAVSEA Diesel Engine Pilot Retrofit Program



- Laboratory tests of DDC 12V-71N
- Scheduled 2004

- **Technologies - Individual & comb.**
 - Air humidification, ferrocene fuel additive, combustion chamber & injector modifications, electrically regenerated particulate trap and mini-sac injectors
- **Fuels**
 - F-76, JP-5, ULSD, B-20, and Fischer Tropsch Diesel
- **Sponsors - \$1M**
 - MARAD, Navy, CARB, DOE, WVU, others



DOT Hydrogen and Fuel Cell Ferry Projects



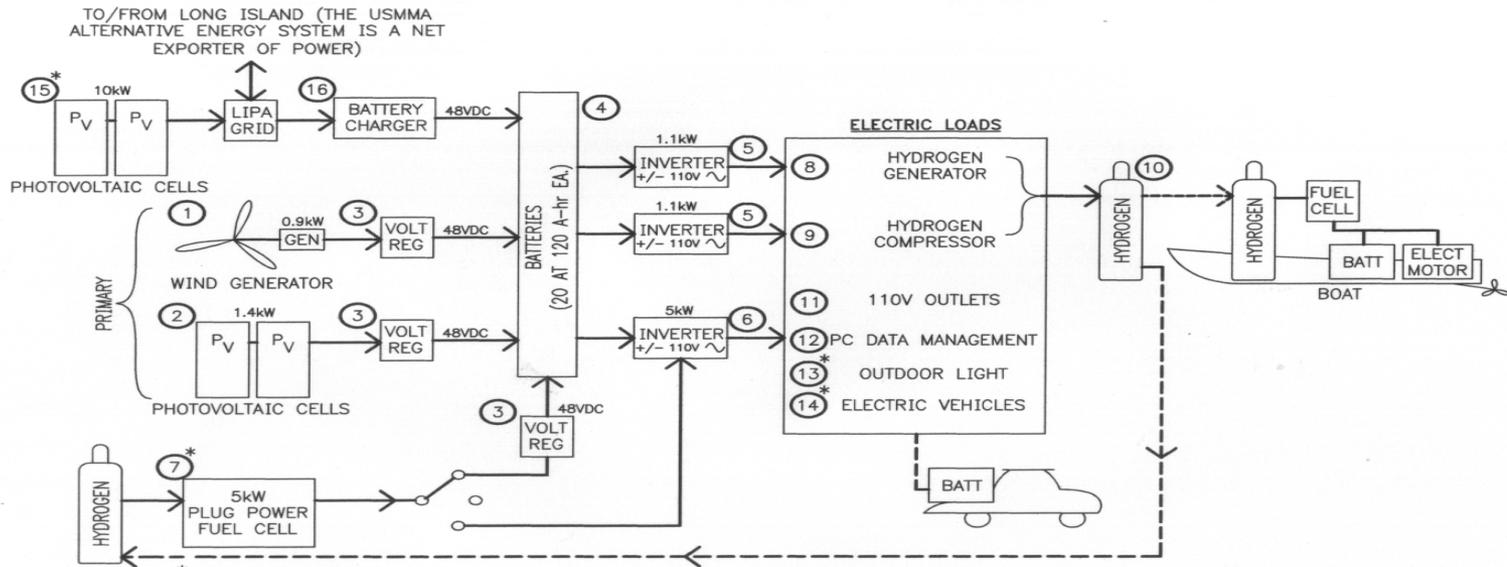
- **Treasure Island Ferry**
 - S.F. Bay Water Transit Authority commissioning
 - Design & build of a 49 - 100+ passenger ferry
 - 400 kW power from fuel cell, solar, and battery
- **Arizona War Memorial Shuttle**
 - Hawaii Electric Vehicle Demonstration Project
 - Envisions design & build of 149 passenger water shuttle
 - Dual 200kW propulsion system w/75kW fuel cell
- **Sodium Borohydride Water Taxi (DOT - Phase 1)**
 - Phase 2 - Duffy Electric Boats & Seaworthy Systems
 - 22 passenger water taxi for Newport Beach, CA
 - 15 kW battery propulsion sys w/3kW PEM Fuel Cell



USMMA Renewable Energy Fuel Cell Laboratory



ALTERNATIVE ENERGY LABORATORY AT KINGS POINT



* NEW TO SYSTEM
THE 5kW FUEL CELL CUTS IN WHEN SOLAR/WIND POWER IS INSUFFICIENT.

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REV	DESCRIPTION	DATE	APPD

U.S. Merchant Marine Academy
Kings Point, New York

Alternative Energy Project

BLOCK DIAGRAM

DESIGN: J. Thompson	SIZE: 11x17	REV. NO.:	REV.:
CHECKED: D. Brown	SCALE: B	DATE: 25 Sept 03	APP.:
SCALE: N.T.S.	DATE: 25 Sept 03	SHEET: 1 of 1	APP.:

Emission Measurement Protocol Activities



Emission Measurement Protocol Activities



- **Vessel Engine Emission Measurement Guide**
 - James Corbett of UDEL
- **Views on a Universal Measurement Protocol**
 - SNAME MEETS Conference - MARAD & 7 Authors
- **Staten Island Ferry Protocol**
 - West Virginia University
- **Maersk Container Ship Testing**
 - MAN B&W with CARB Guidance
- **Large Vessel Emission Test Protocol**
 - University of California Riverside

Contact Information



Website and Contact Info



- **Website - www.marad.dot.gov/nmrec/**
 - Link to “Energy Technologies”
- **For no-cost newsletter subscription:**
 - Regina.Farr@marad.dot.gov
 - (202) 366-1924
- **Re: Presentation or program**
 - Daniel.Gore@MARAD.DOT.GOV
 - (202) 366-1886

Theme For Workshop



Workshop Theme

- **Describe Energy Technologies Program**
 - MARAD national program assisting regional interests
- **Provide emission reduction technology info**
 - Several equipment designers presenting
- **Address emission measuring protocols**
 - Several monitoring organizations presenting
- **Facilitate future vessel owner involvement**
 - Emission reduction pressures will increase
 - Cooperative R&D possible with MARAD and others