

US EPA ARCHIVE DOCUMENT



U.S.-Mexico Demonstration of Fuel Switching on an Ocean Going Vessel in the Gulf of Mexico

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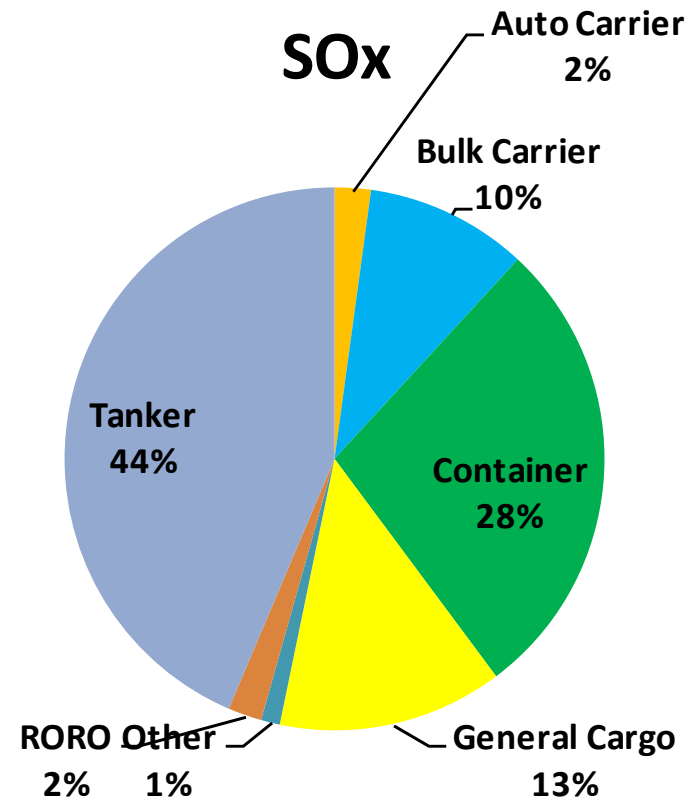
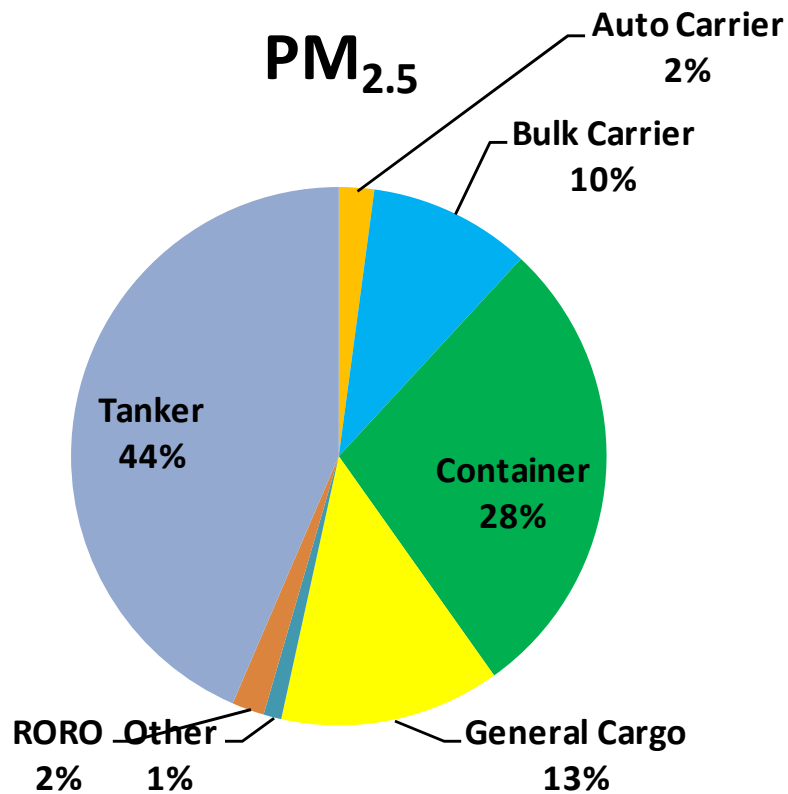
Project Details

- ▶ **Demonstrate Switching to Low Sulfur Distillate Fuels on an Ocean Going Vessel sailing between Houston and Mexico**
- ▶ **Measure Emission Reductions**
- ▶ **Start Dialog with Mexico about Benefits of Fuel Switching at Mexican Ports**
- ▶ **Discuss with Mexican Government US commitments to establish an Emission Control Area under the International Maritime Organization Treaty for the Prevention of Pollution from Ships**

Fuel Switching

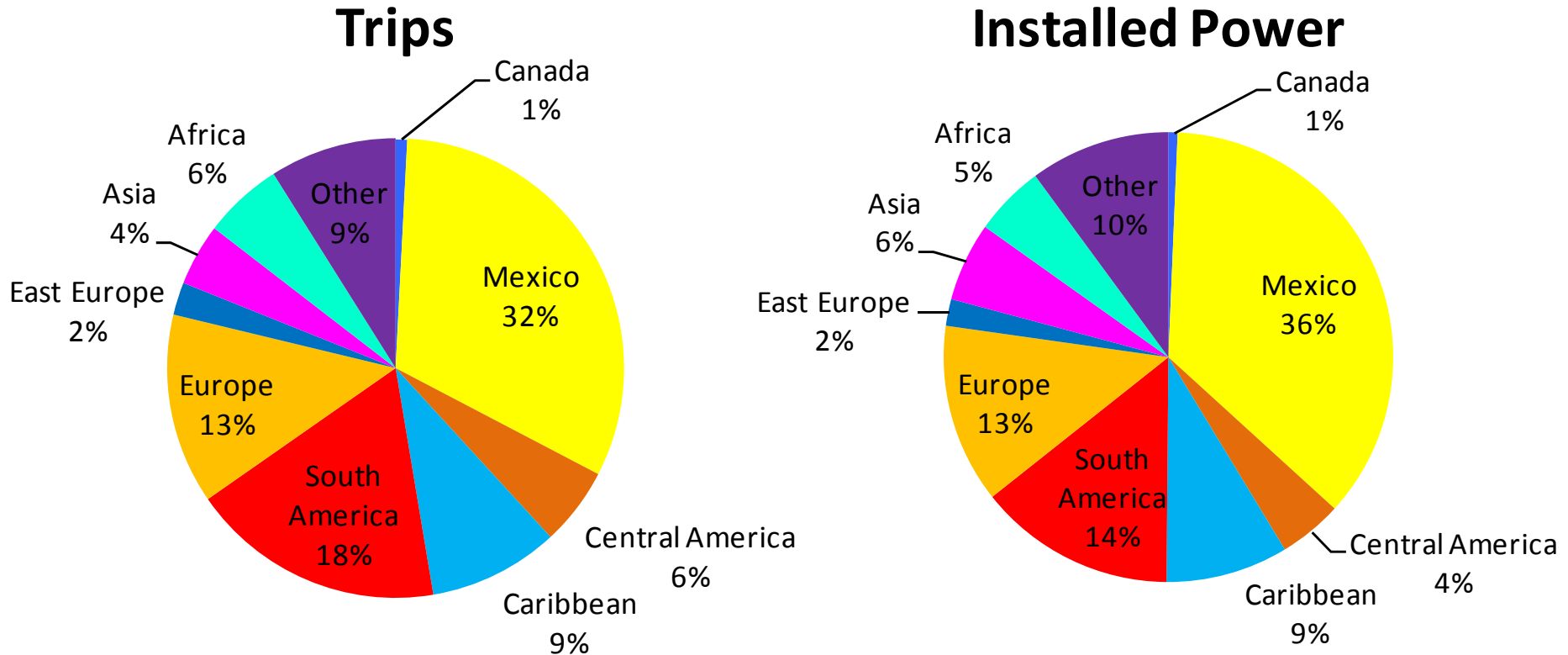
- ▶ **EPA is partnering with Port of Houston Authority to demonstrate fuel switching on two ocean going vessels of Maersk and Hamburg Süd**
- ▶ **Ocean going vessels normally operate on bunker fuel with a sulfur content between 2.5% and 4.5% (e.g., 25,000 and 45,000 ppm sulfur)**
- ▶ **Switching to low sulfur (0.1% or 1,000 ppm) distillate fuel will reduce PM emissions by 88% and SOx emissions by 96%**
- ▶ **Most ships already have additional Marine Distillate Oil/Marine Gas Oil (MDO/MGO) tanks**

2007 Port of Houston Emissions Estimates



Based upon 2007 Foreign Cargo Movements (USACE)

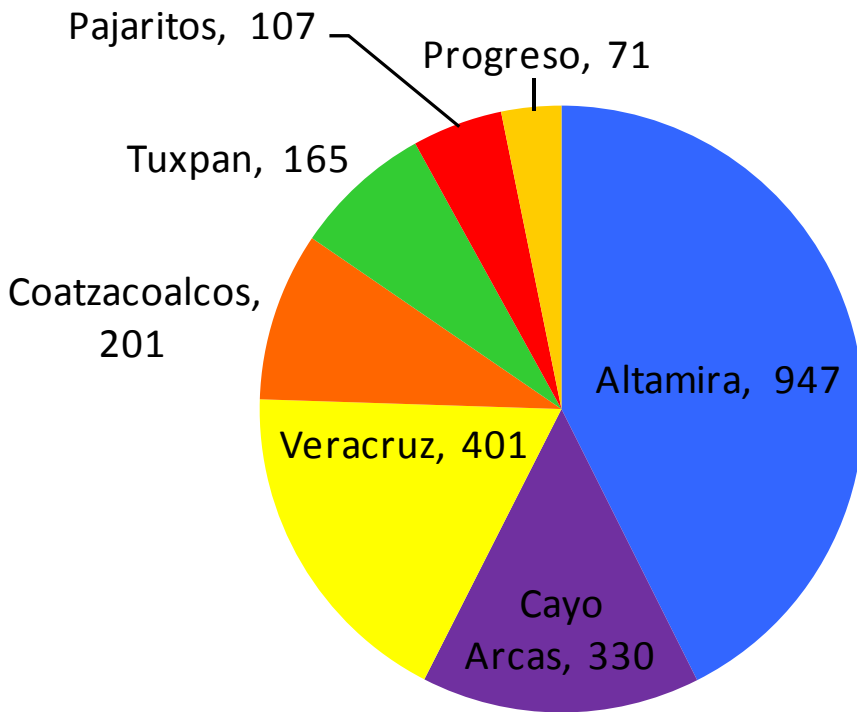
2007 Port of Houston Foreign Cargo Movements



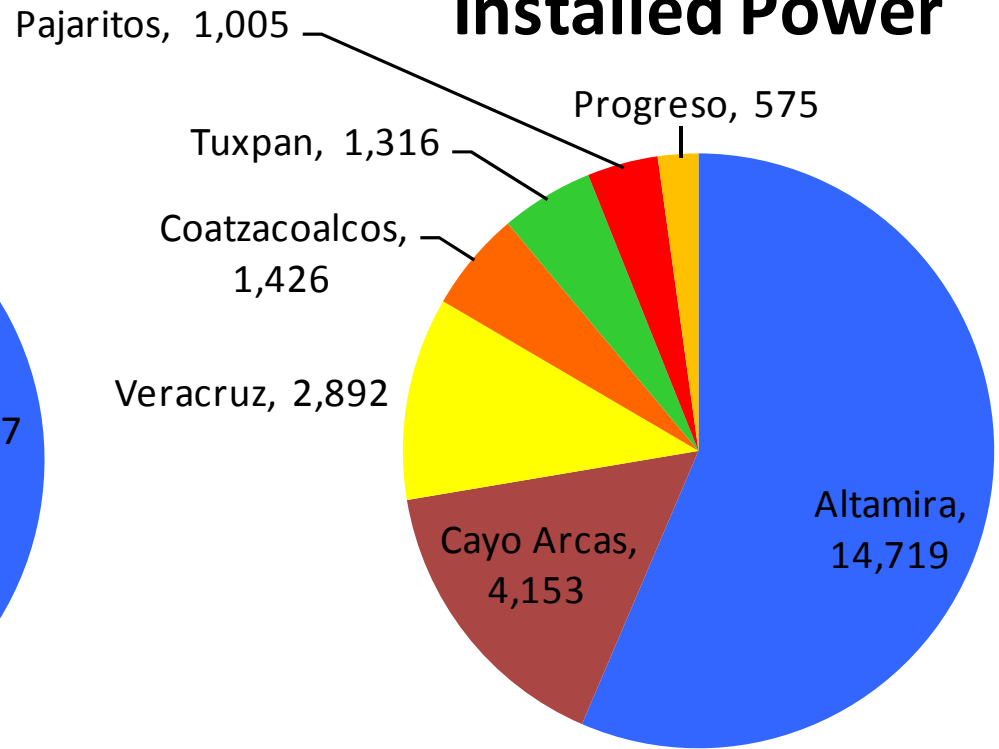
Based upon 2007 USACE Entrances and Clearances data
 Vessels that called upon the Port of Houston in 2007
 Installed Power = Total Ship Power x number of calls

2007 Houston to Mexico Foreign Cargo Movements

Trips



Installed Power



Based upon 2007 USACE Entrances and Clearances data
Ships traveling between Port of Houston and Mexico

Maersk Demonstration



■ Maersk Roubaix

- Container Ship – 1118 TEUs
- 9.7 MW Propulsion Engine
- Medium Speed Engine

■ Switched from Bunker Fuel (3.3% Sulfur) to Distillate Fuel (0.14% Sulfur) 24 nm from shore at Port of Houston and Port of Progreso, Mexico

■ Calculated Emission Reductions per call at Progreso

- 45 kg NO_x (6%)
- 100 kg PM_{2.5} (84%)
- 745 kg SO_x (90%)
- Differential Fuel Cost \$1,248
- Fuel Costs Progreso to Houston \$28,318
- Represents only 4.4% of voyage fuel costs

Hamburg Süd Demonstration

Cap San Lorenzo

- Container Ship – 3,739 TEUs
- 28.8 MW Propulsion Engine
- Slow Speed Engine

Emissions to be measured in port and at sea

Estimated Emissions Reductions / Fuel Costs

Veracruz (per call)

- 90 kg NO_x (6%)
- 130 kg PM_{2.5} (88%)
- 1,192 kg SO_x (97%)
- Differential Fuel Cost \$3,273

Altamira (per call)

- 93 kg NO_x (6%)
- 137 kg PM_{2.5} (88%)
- 1,259 kg SO_x (97%)
- Differential Fuel Cost \$3,465

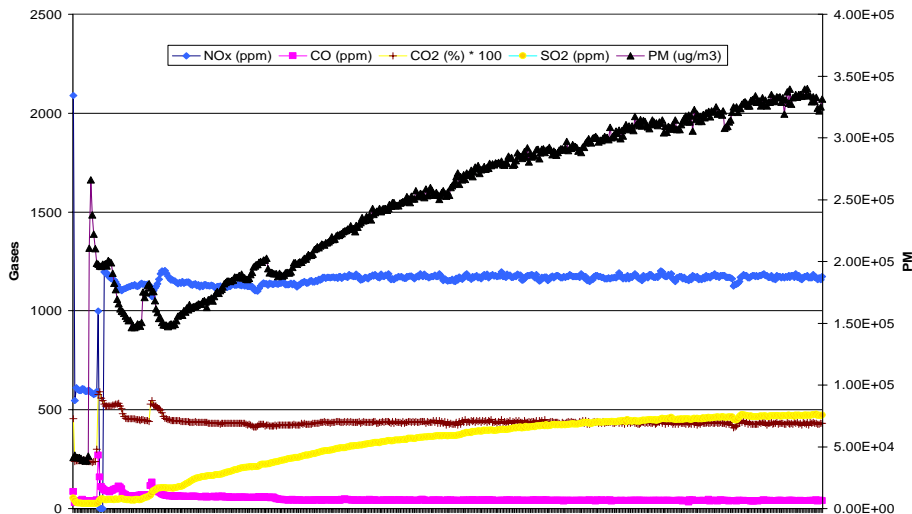
Fuel Costs for Veracruz -> Altamira -> Houston \$75,617 – Differential only 9%



Emission Sampling

UC Riverside will conduct measurements of in-use emissions and their reduction from fuel switching

- In compliance with the MARPOL NO_x Technical Code (NTC) and other protocols
- Measure emissions on both high- and low-sulfur fuels at both specific engine loads and transient operations, main and auxiliary engines

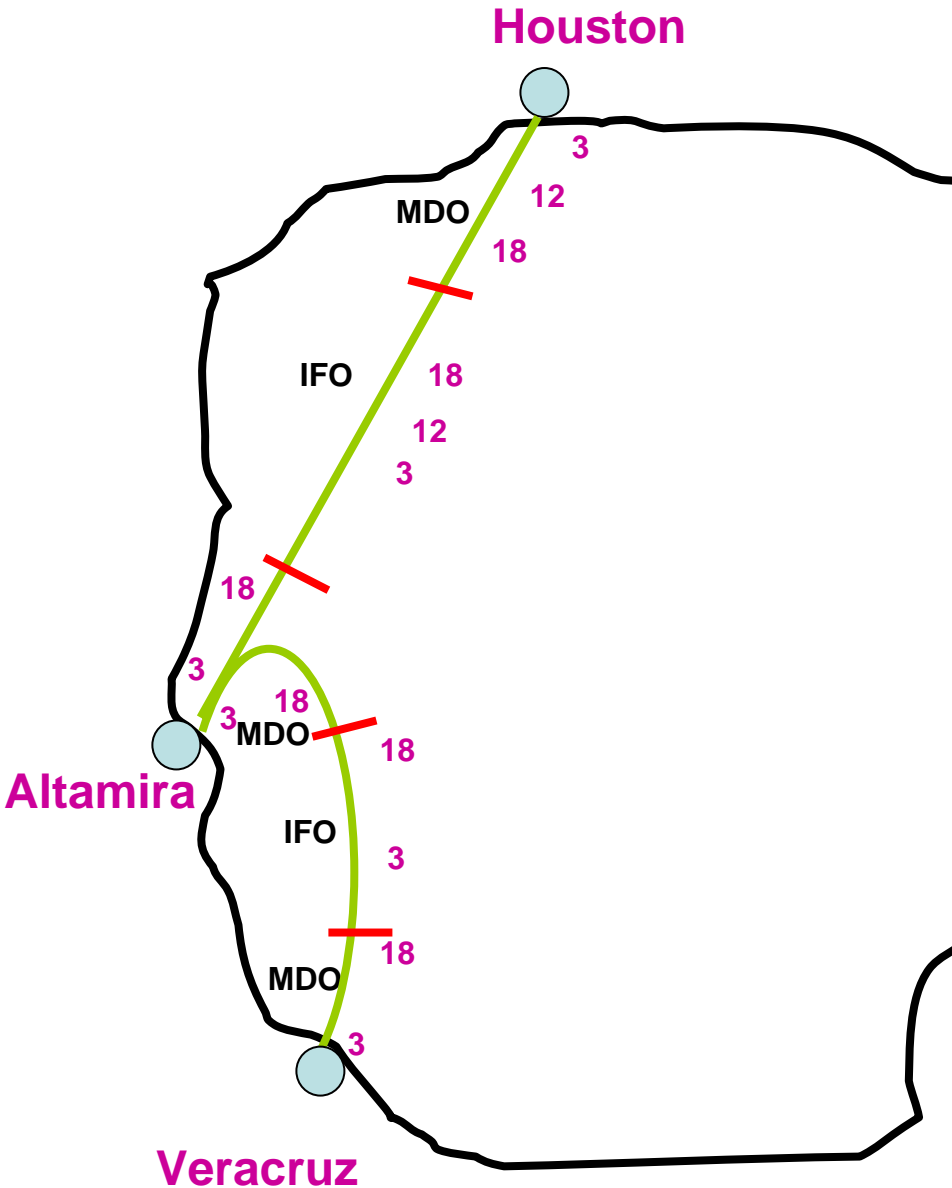


Example of measured gas, PM emissions during a fuel switch

- Measure all pollutants of interest:
 - NO_x, CO, CO₂ continuously
 - PM continuously and speciated PM (EC, OC) with discrete filter samples
 - Measure SO₂ and calculate SO_x from fuel measurements
- Report on engine performance, emission reductions, and implications for Gulf ports

Fuel Switching Project Draft Vessel Stack Monitoring Plan

Docking/leaving Veracruz,
Approaching/docking
and leaving Altamira and
Approaching/docking Houston



Fuel	Speed (knots)		
IFO	18	12	3
MDO	18	12	3

Fuel Switch Point — (24 nm from shore)

Fuel Switching Issues

▶ Fuel Cost

- Currently MGO costs ~\$210/MT more than HFO

▶ Tank Size

- MDO/MGO tank size may be an issue – may require larger MDO/MGO tanks or converting some HFO tanks for MDO/MGO

▶ Fuel Switching Procedure

- Boilers must be slowly turned down to prevent fuel system problems when switching fuels
- Typical fuel switching takes from ½ to 1 hour

▶ Low Sulfur MGO Availability (0.1% Sulfur)

- Currently available in Houston
- Not currently available anywhere else along the test vessel routes

▶ Port Programs

- Port of Houston to pilot a fuel switching program with Maersk