

Controlling Air Emissions From Ocean Going Vessels in Port

Advanced Maritime Emissions Control System (AMECS®)

Advanced Environmental Group, LLC

Pollution Control Specialists



The Environmental Challenge

- Emissions regulations require a significant reduction in port-wide emissions.
- Berthed ships are a major source of air pollution and public health risk.
- Cost effective solutions are necessary to keep from driving traffic to alternative ports.
- AMECS significantly reduces emissions with minimal impact on operations or economics.



The Health Challenge Ports of LA and Long Beach

Health Outcome	2005	2010	2020
Premature Death	67	75	96
Hospital Admissions (respiratory)	14	16	21
Hospital Admissions (cardiovascular)	27	30	38
Asthma and Other Lower Respiratory	2,100	2,300	3,000
Acute Bronchitis	170	190	250
Work Loss Days	12,000	14,000	18,000
Restricted Activity Day	71,000	79,000	100,000

ARB 2006 Emission Reduction Plan for Ports and Goods Movement

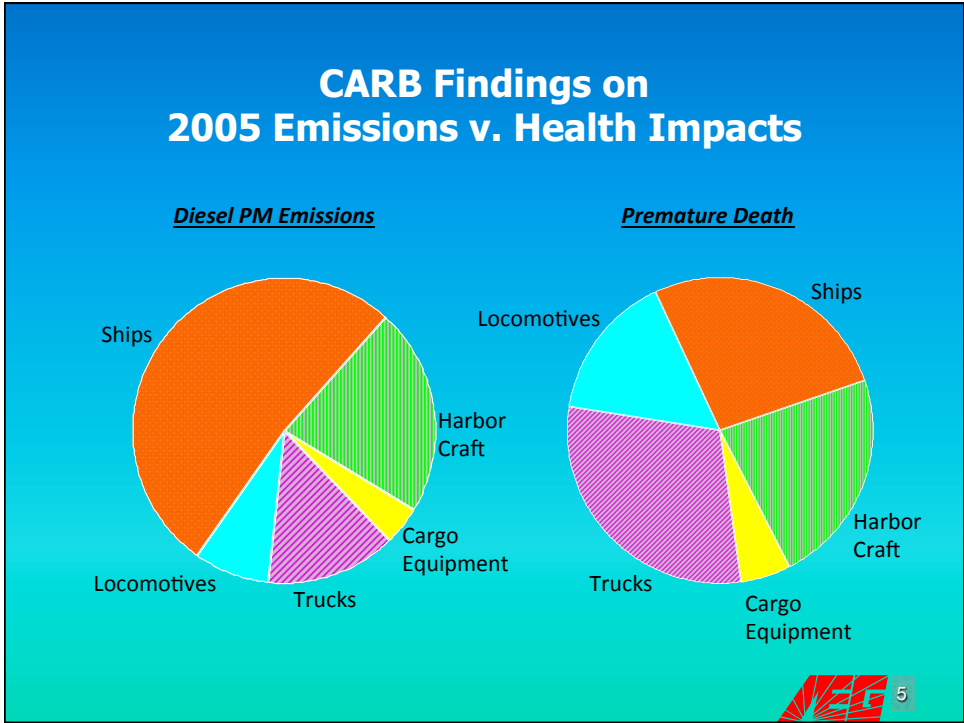


The Cost Challenge - Annual California PM_{2.5}

Health Outcome	Cases per Year	Uncertainty Range ¹ (Cases per Year)	Valuation ² (Millions)	Uncertainty Range ³ (Valuation - Millions)
Premature Death	19,000	6,000 to 33,000	\$170,000	\$55,000 to \$300,000
Hospital Admissions (Respiratory & Cardiovascular)	9,400	5,600 to 14,000	\$370	\$220 to \$540
Asthma and Other Lower Respiratory Symptoms	280,000	110,000 to 430,000	\$5.6	\$2.3 to \$8.6
Acute Bronchitis	22,000	0 to 44,000	\$10	\$0 to \$20
Work Loss Days	1,900,000	1,600,000 to 2,100,000	\$370	\$310 to \$420
Minor Restricted Activity Days	13,000,000	9,700,000 to 16,000,000	\$830	\$620 to \$1,000
TOTAL VALUATION	NA	NA	\$170,000	\$56,000 to \$300,000

CARB Data for 2009 in 2007 dollars





Measured Emissions Reduction of AMECS

Testing conducted by ARB & SCAQMD-Approved Outside Testing Companies

Pollutant reduction in full scale tests:

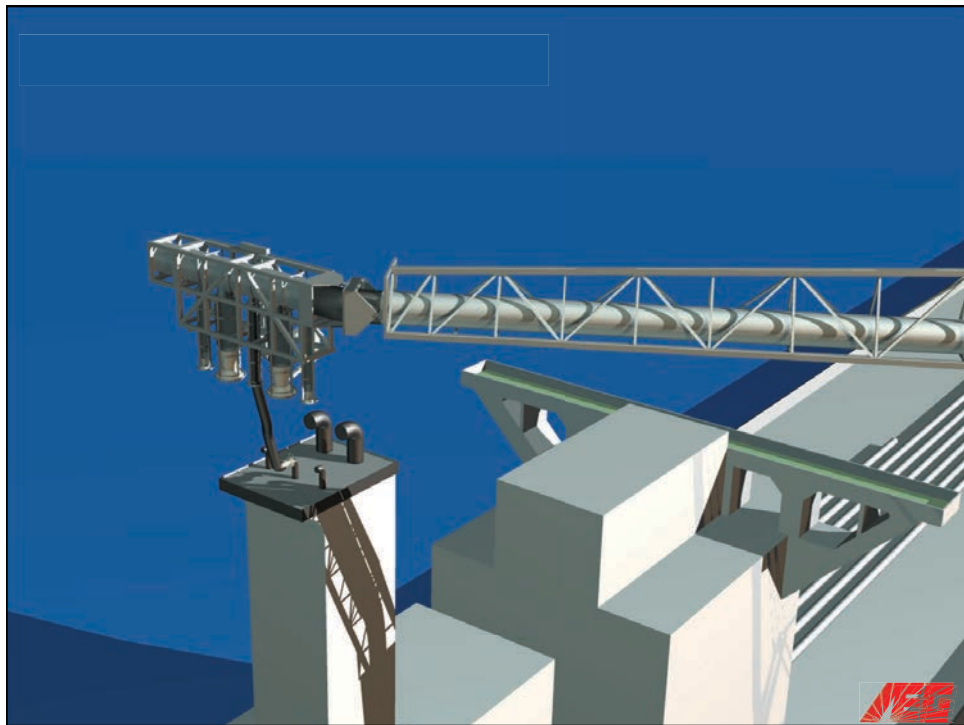
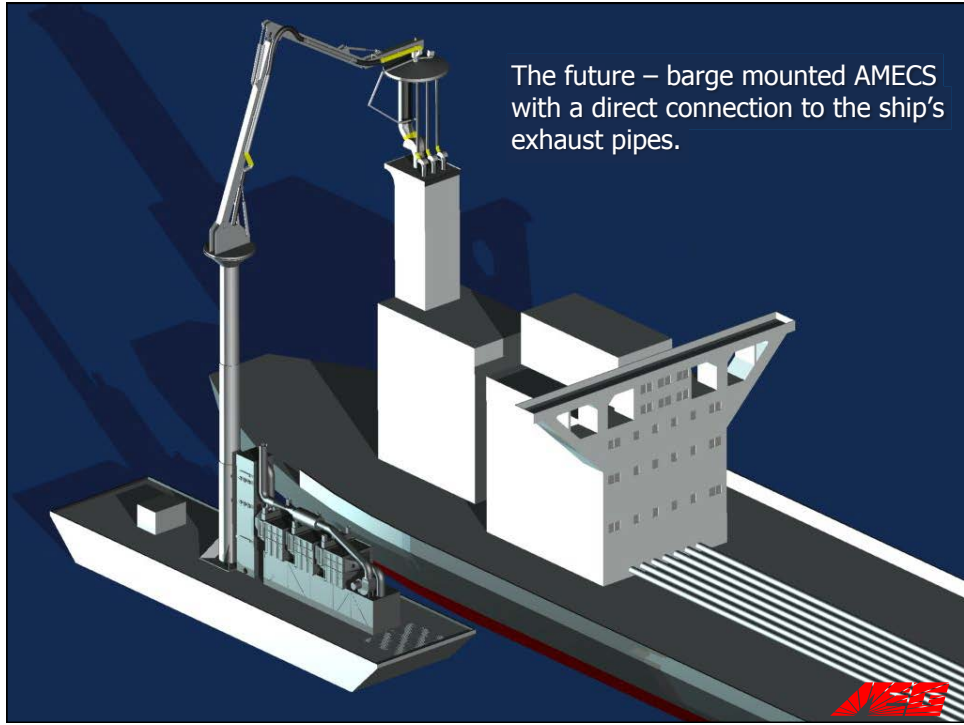
Sulfur Dioxide (SO₂)	99%
Particulate Matter (PM)	95%
Nitrogen Oxides (NO_x)	99%
Volatile Organic Compounds (VOC)	96%

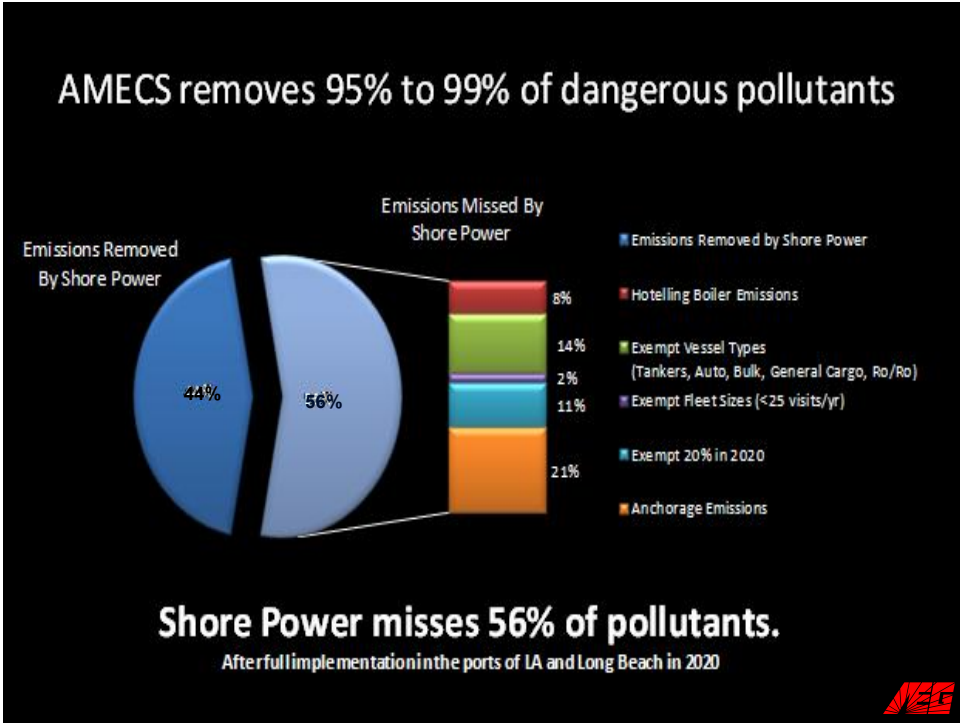


The Updated AMECS

- ❖ **Replace wet system with active PM filters**
 - No waste water
 - 80% reduction in power to operate
 - Much lower maintenance
 - Lower cost, smaller size, less reheat fuel
- ❖ **Packed bed SO_x scrubber replacing spray tower**
 - Much less waste water
 - Greatly reduced power to operate, smaller size
- ❖ **Large bonnet replaced with small connectors that attach to each exhaust pipe**
 - 100% capture efficiency, robotic attachment
 - Very small wind effects, ship antennas no obstacle







Cost Effectiveness of Shore Power and AMECS

Vessel Type	Shore Power Cost Effectiveness (Cost per ton of Pollutant Removed)		AMECS Cost Effectiveness (Cost per ton of Pollutant Removed)		AMECS Fraction of Shore Power Cost	
	Carl Moyer Method (PM x 20)	CARB Methodology (PM x 1)	Carl Moyer Method (PM x 20)	CARB Methodology (PM x 1)	PM x 20	PM x 1
Container*	\$24,167	\$31,148	\$6,391	\$8,315	26%	27%
Reefer*	\$77,463	\$99,837	\$7,994	\$10,455	10%	10%
RoRo	\$19,723	\$25,420	\$5,021	\$6,464	25%	25%
Vehicle Carrier	\$170,514	\$219,763	\$12,338	\$15,968	7%	7%
Bulk Carrier	\$510,947	\$658,524	\$36,465	\$47,726	7%	7%
General Cargo	\$115,518	\$148,883	\$15,414	\$20,135	13%	14%
Tanker	\$123,724	\$159,460	\$9,317	\$13,863	8%	9%
Passenger*	\$11,375	\$14,661	\$3,300	\$4,243	29%	29%
All Vessels at POLA & POLB	\$44,319	\$57,120	\$9,038	\$12,147	20%	21%
*Regulated Fleets	\$22,135	\$29,954	\$6,379	\$8,298	29%	28%



Questions & Answers

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