

AAPA Climate Change Workshop

Mitigating the Effects of Port Operations on Climate Change



November 12, 2008

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Shipping Association



Alliance of the Ports of Canada,
Latin America and the United States

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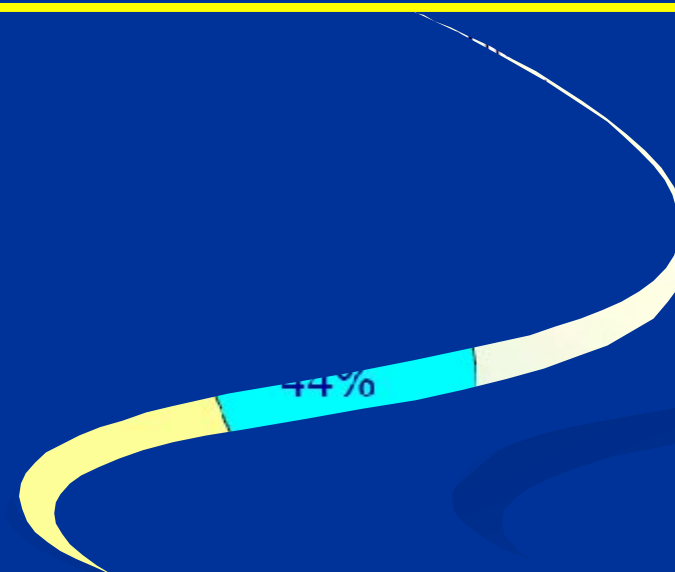
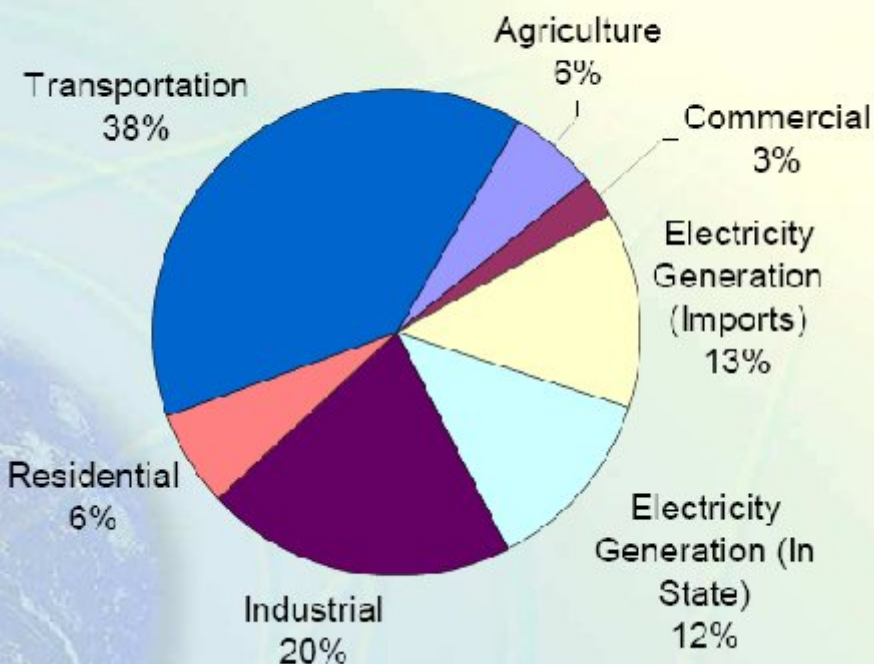
AB32

California Global Warming Solutions Act



Goal 1990 levels by 2020
est. 173 MMT CO₂

2004 Emissions (480 MMT CO₂E)



Goods Movement = 3%

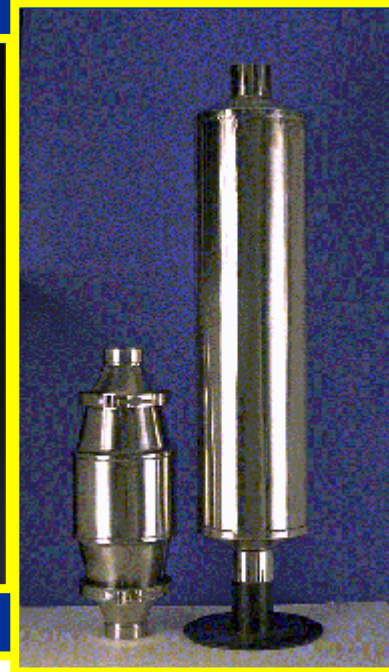
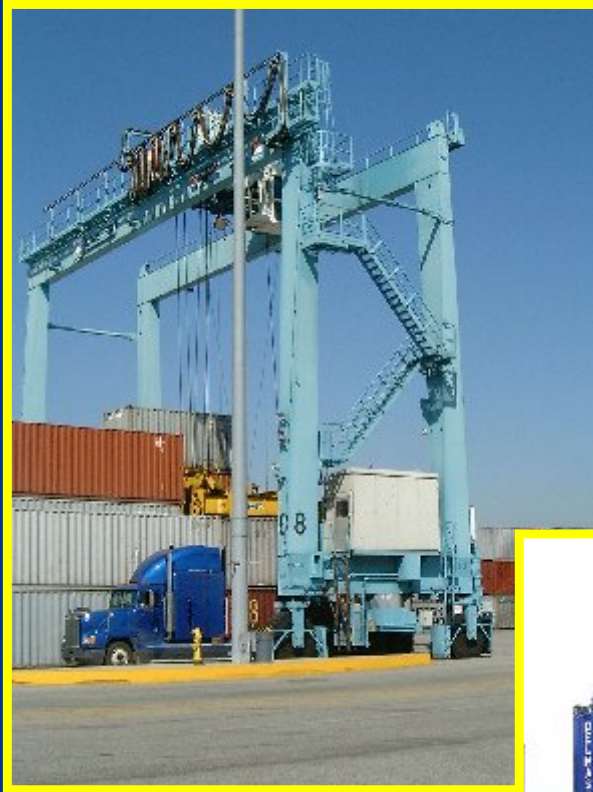
CARB Cargo Handling Equipment Regulation



Pre-2003 –	50% in 2007
2003-2007	100% in 2008
2007+	phased over 8 to 11 years
	Tier 4 goal

*One year extensions given for on-road engines and verified retrofits

Non-Yard Tractors Cargo Handling Equipment



**Retrofit or Replace*
25% increments**

- 2007 – pre-'88
- 2008 – '88-'95
- 2009 – '96-'02
- 2010 – '03-'06
- 2012 – Tier 4



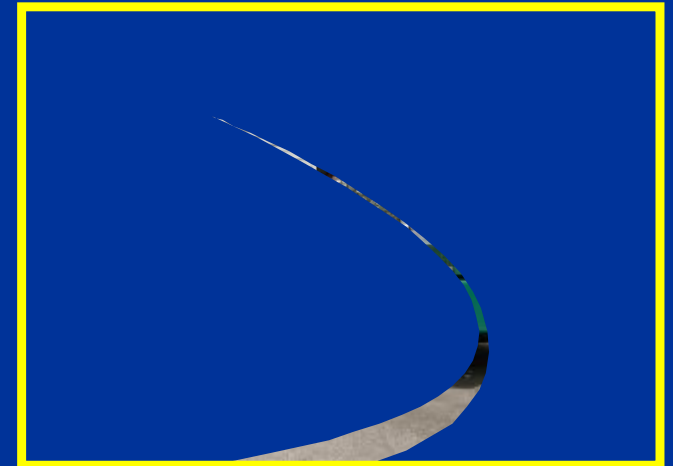
***Equipment not
capable of retrofit
must be replaced
by 2015**

Cargo Handling Equipment

Propane



Electric



LNG



RMGs
Regen.
Flywheels



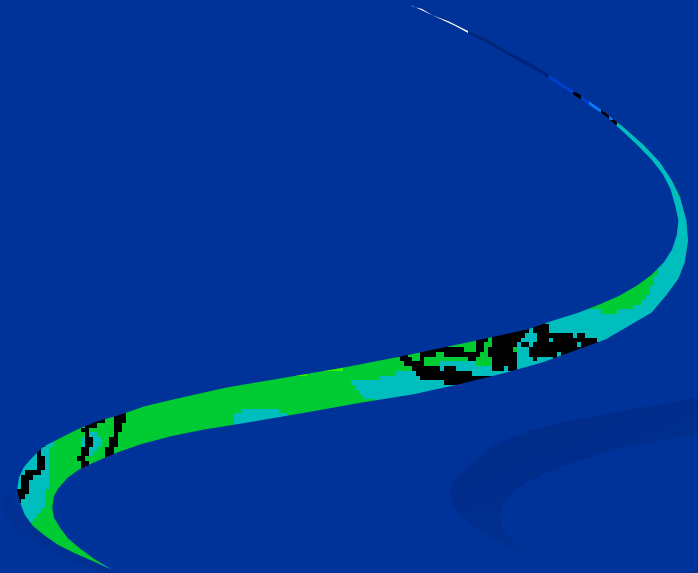
Advanced Terminal Design



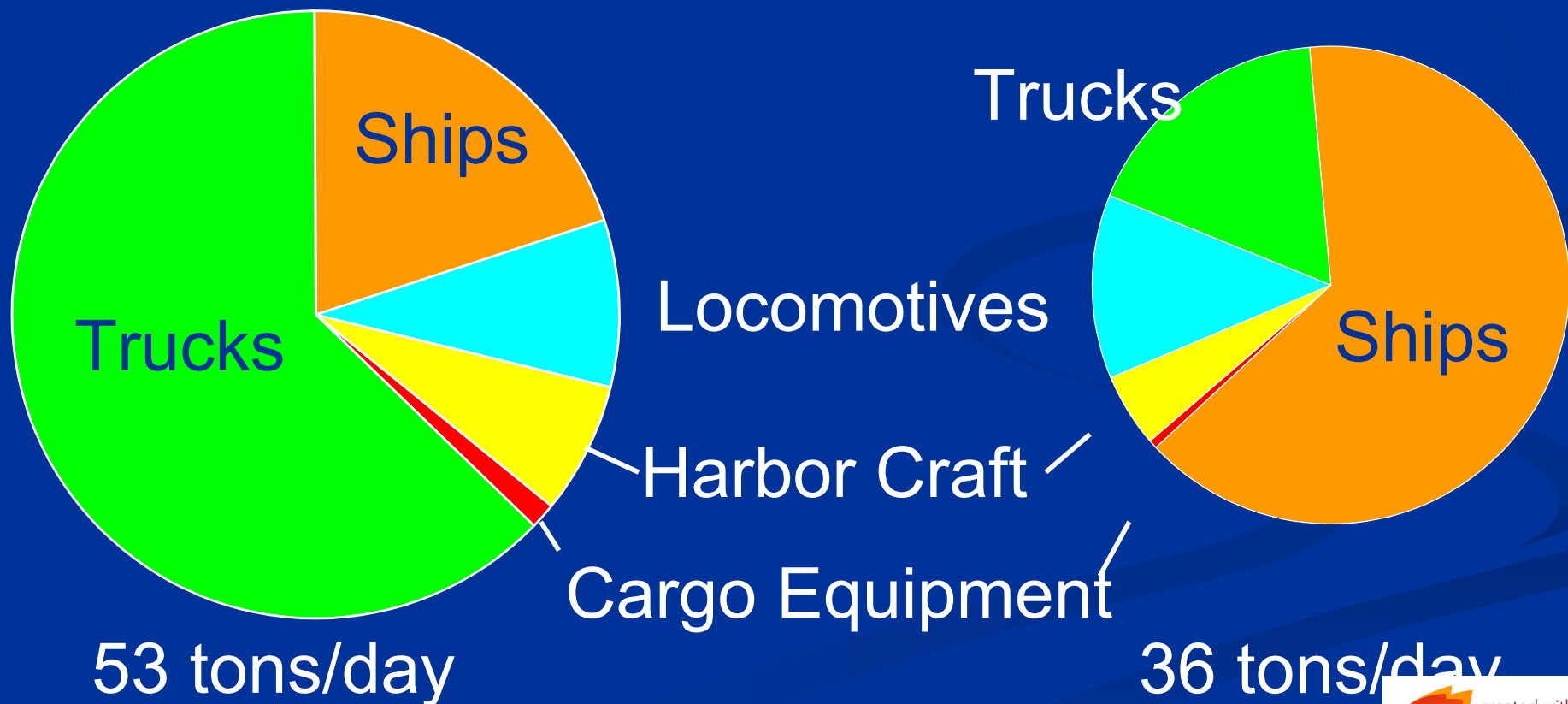
Advanced Terminal Design



Ship Emissions are a World Wide Issue



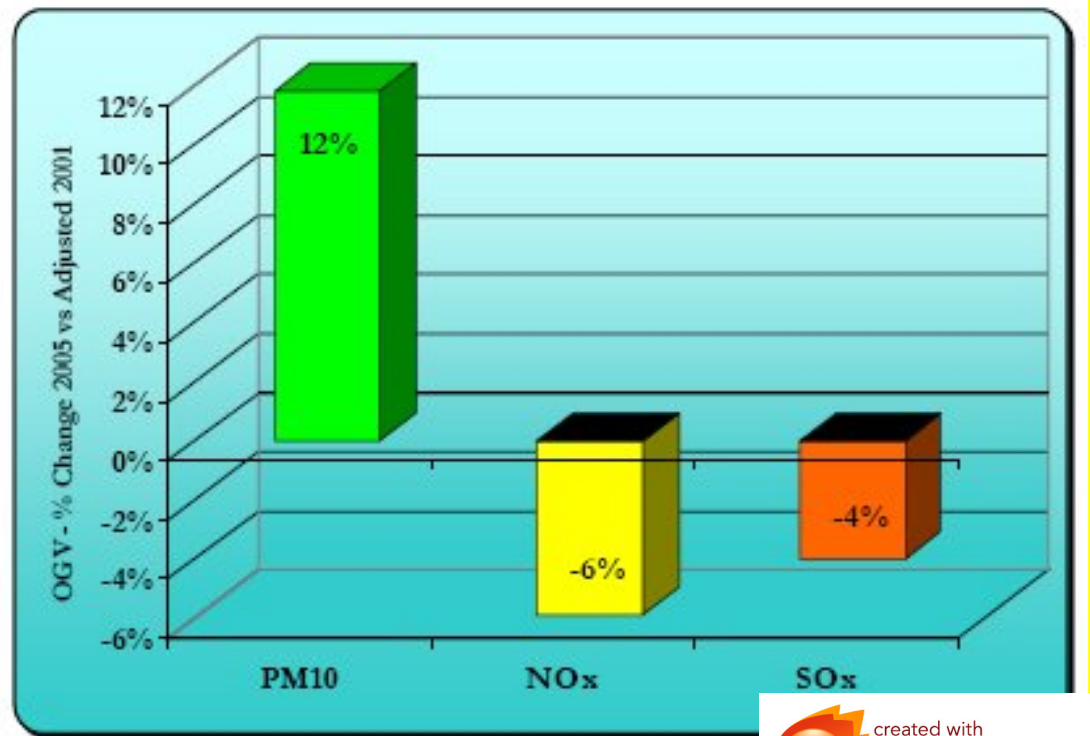
Diesel PM from Goods Movement



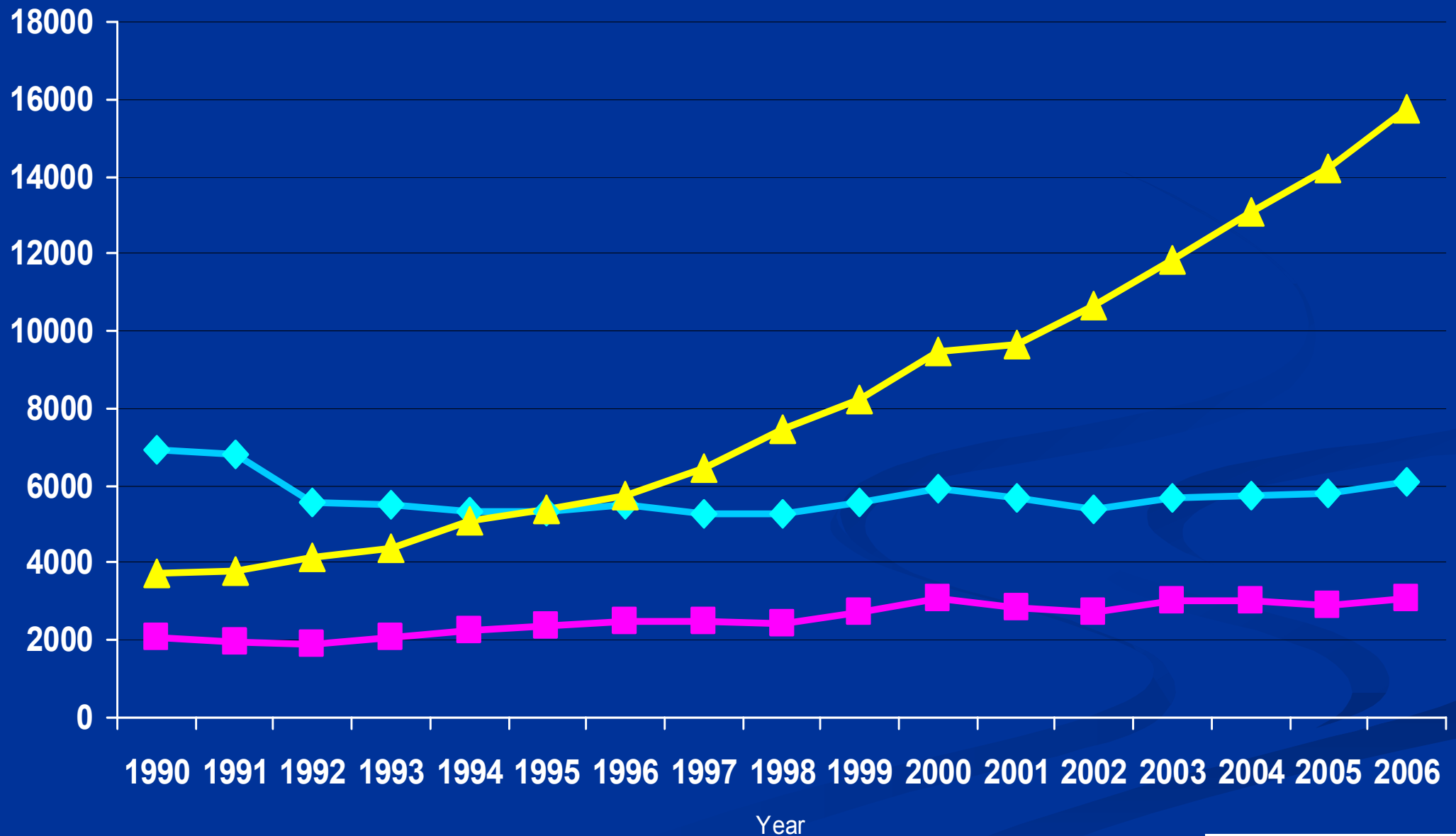
Throughput vs Emissions

Throughput up 44%

Vessel Emissions



Ship Calls & TEUs



◆ Total Ship Calls ■ Total Container Ship Calls ▲ Total TEUs (000)

Container Ship Evolution

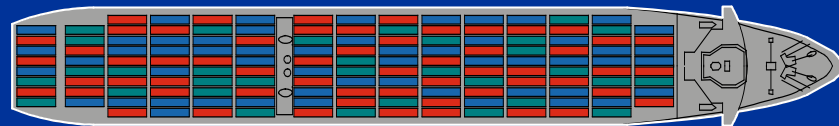
TEU Capacity



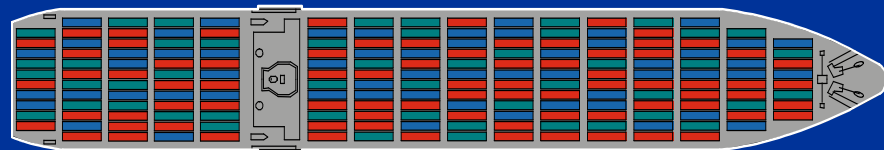
1st Generation (Pre-1960 - 1970)



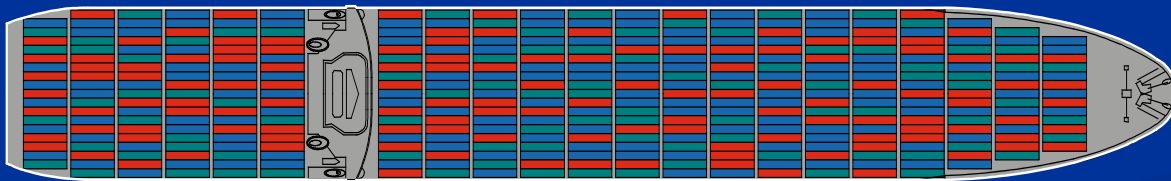
2nd Generation (1970 - 1980)



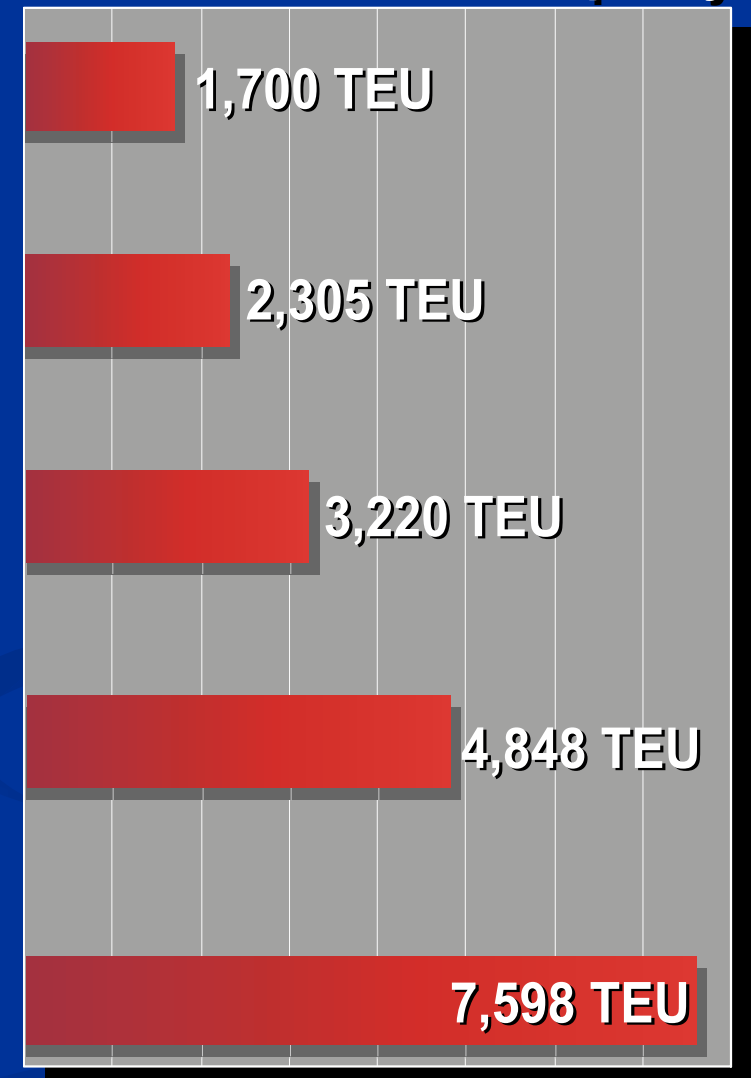
3rd Generation (1985)



4th Generation (1986 - 2000)



5th Generation (2000 - ?)



IMO

MARPOL 73/78, Annex VI



Entered into Force May 19, 2005*

- Establish Ship Engine NOx Standard**
- Sets a Cap on Fuel Sulfur Content**
- Limits Ozone Depleting Chemicals**
- Provides for Sulfur Emission Control Areas (SECAs)**

***Limited in Scope, still not adopted by the U.S.A.
Needs to be more stringent and comprehensive**

Amendments to Annex VI



NOx Engine Standards

- Tier 1 – 17.0 g-NOx/kW-hr, vessels 1990 - 2010
- Tier 2 – 14.4 g-NOx/kW-hr January 1, 2011
- Tier 3 – 3.4 g-NOx/kW-hr January 1, 2016

In ECA, Tier 2 outside ECA

Global Sulfur Cap

- 4.5% reduced to 3.5% in 2012
 - 0.5% as early as 2020 but no later than 2025*
- * fuel availability study 2018.

SECAs to ECAs

- 1.5% sulfur reduced to 1.0% on March 1, 2010
- 0.1% on January 1, 2015

CARB Fuel Sulfur Regulation

Auxiliary, Main Engines & Auxiliary Boilers

Switch to distillate fuels 24 @ nm

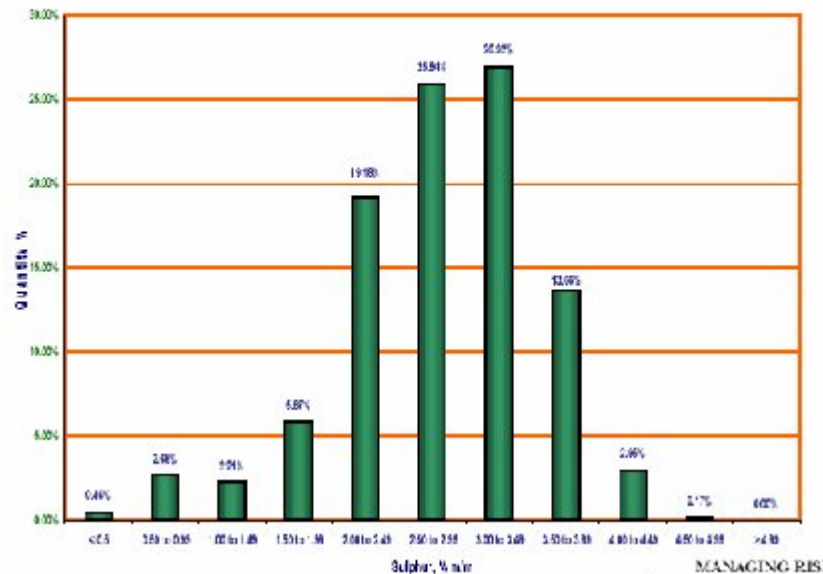
- **July 1, 2009**
 - **1.5% S Marine Gas Oil (MGO)**
 - **0.5% S Marine Diesel Oil (MDO)**
 - **NO Alternative Compliance Plans**
- **January 1, 2012**
 - **Distillate fuel between 0.1% & 0.2% Sulfur**
 - **Exemptions for Innocent Passage, Safety, Essential Modification**
 - **Non-compliance fees, \$45,500 - \$227,500**



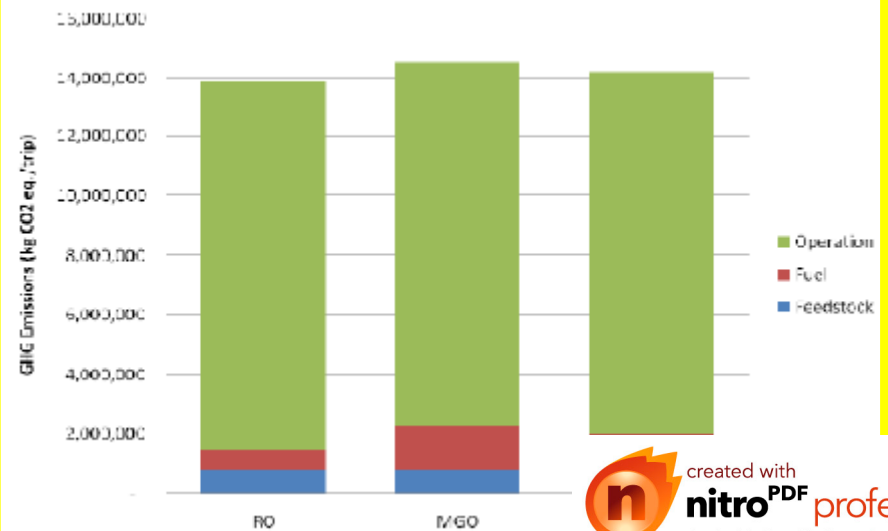
Low Sulfur Marine Fuels

- Cost
- Availability
- GHG Penalty

Marine Fuel Distribution by Sulfur Content 2004



GHG Emissions by Fuel Type



Ports' Clean Fuel Incentive

- 100% of Cost between Residual Fuel and 0.2% Sulfur MGO (LA Index)
- 1yr. July '08 – July '09 (CARB Reg.)
- \$9.9 Million - POLB, \$8.6 million – POLA
- Requires VSR and LSF in Auxiliaries
- 160 Ships Registered-350 calls/quarter
- PMSA Members ~ 80% participation



IMO Green House Gas Considerations (MEPC 58/60)



Short Term

- Global Levy Scheme
- Improvement of Fuel Consumption
- Energy Efficiency Design and Management Plan
- Onshore Power
- Wind Power
- Voluntary/Mandatory CO₂ reporting, information exchange, performance ratings
- Strict limitation on refrigerant gas leakage
- Vessel Speed Reductions
- Improved Traffic Control, Fleet Management, Cargo Handling Operations

IMO Green House Gas Considerations (MEPC 58/60)



Longer Term

- Technical Measures for Ship Design
- Use of Alternative Fuels
- CO₂ Design Index for New Ships
- Verification Scheme for CO₂ Operational Index
- Non-compliance penalty mechanism
- Emission Trading Scheme
- Mandatory CO₂ Index for Port Infrastructure
- Other Measures Developed by the GHG Working Group (Oslo June 2008)

GHG Emission Reduction Proposals



- **Germany**
 - Ports Collect, Based on Fuel Consumed
 - Ships Specific Accounts
 - IMO Creates Cap, Auctions Allowances, Disperses funds
- **Norway**
 - IMO Sets Cap based on Existing Carbon Markets
 - Administers Revenue for Marine Technology, Credits, Developing Countries
- **Denmark**
 - Fuel Bunker Levy to International funds
 - International Agency Uses Funds in Developing Countries or IMO Technical Corporate Program
- **United States**
 - Performance Based Vessel Standards, Ship Specific Management Plan
 - Consistent with Emission Based Approach of Annex VI

AB32 Vessel Measures



- Shore Power (0.24 MMT CO₂)
- Vessels Speed Reduction (1.4 MMT CO₂)
- Vessel Operation Best Practices (1.6 MMT CO₂)
 - Engine Maintenance
 - Optimized Propeller/Hull Designs
 - Advance Hull Coatings & Maintenance
 - Air Cavity System
 - Sails
 - Advanced Heat Recovery
 - Alternative/Renewable Fuels
 - Route Planning/Vessel Speed Reductions

COLD IRONING



CARB Regulation, Dec '07

- Ship Types, Grid (2014) & Non-Grid (2010) options
- Percent Calls & Emission Goals (80% 2020)



Clean Air Logix Non-Grid Cold Ironing

LNG Genset
1 Megawatt



On-Dock Transformer
& Synchronization
Bow thruster interface



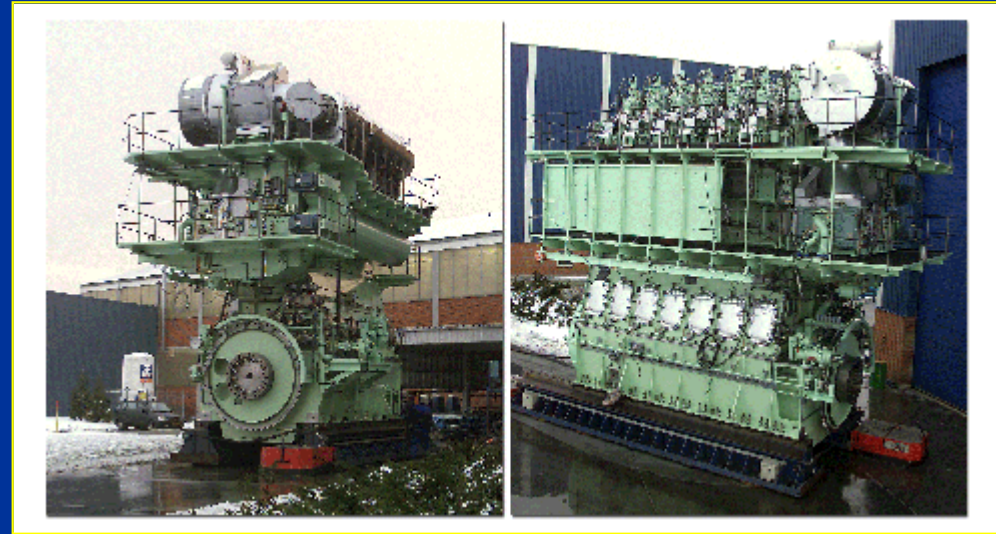
Voluntary Vessel Speed Reduction Program/Reg?



Initiated May 2001
Green Flag Program
+ 90% compliance

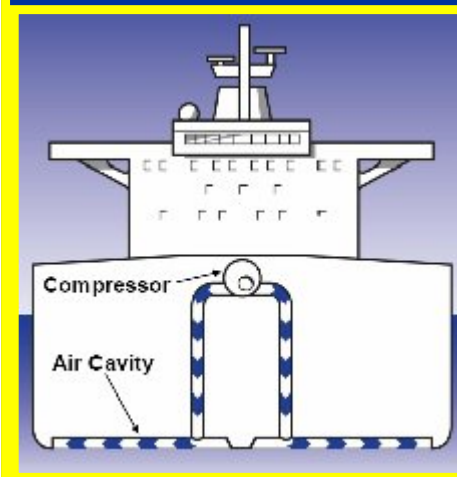
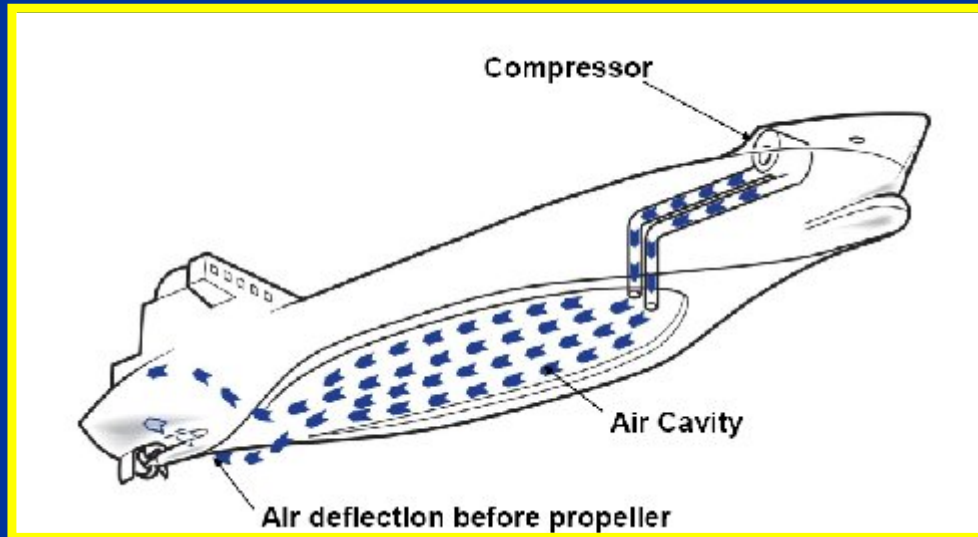


MAN Diesel Engine Technology (NO_x)



Electronic Controls	-30%
Slide Valves	-30%
Water Emulsification	-30%
Scavenge Air Moistening	-50%
Exhaust Gas Recirc. (EGR)	-60%
Selective Catalytic Red	-80%

Fuel Saving Strategies

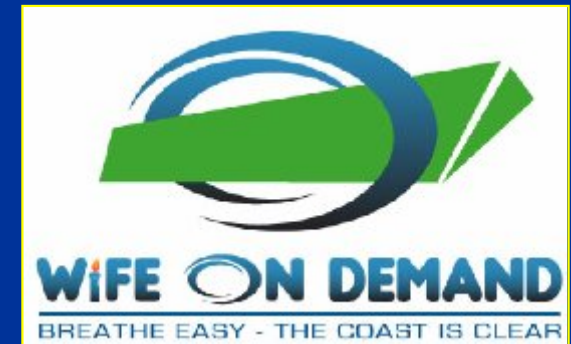
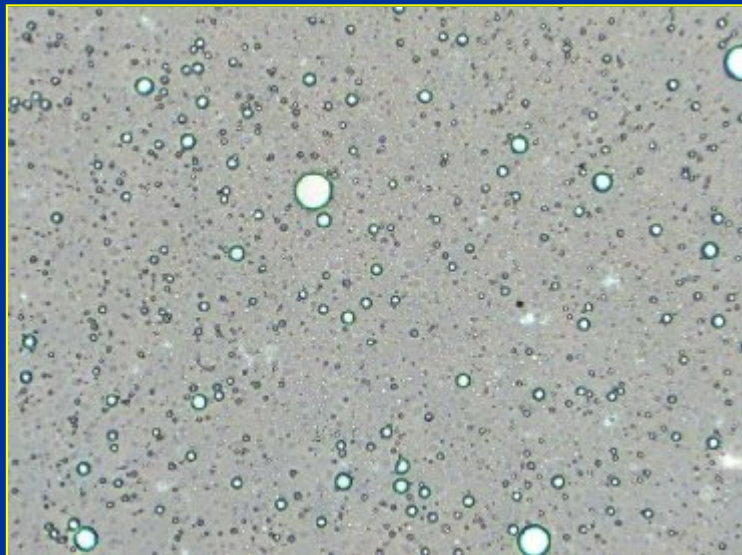


SkySails



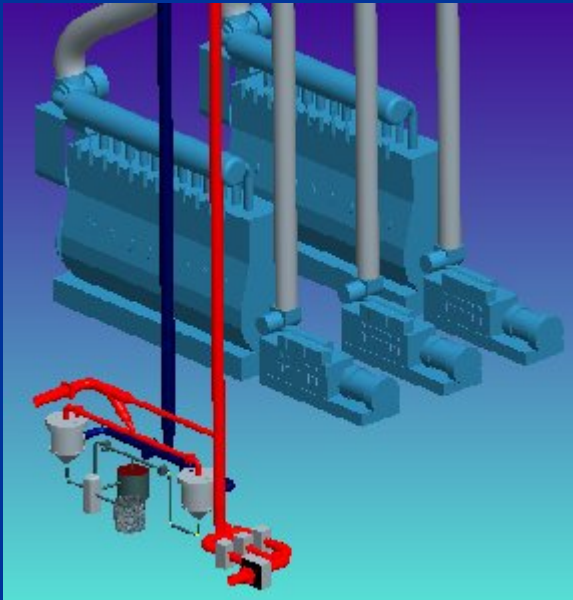
Water In Fuel Emulsification

- Water content of 10-20% tested
- NOx reduction = water content
20% water = 20% less NOx
- PM reduction is 2-3 times % of water
20% water = 60% less PM



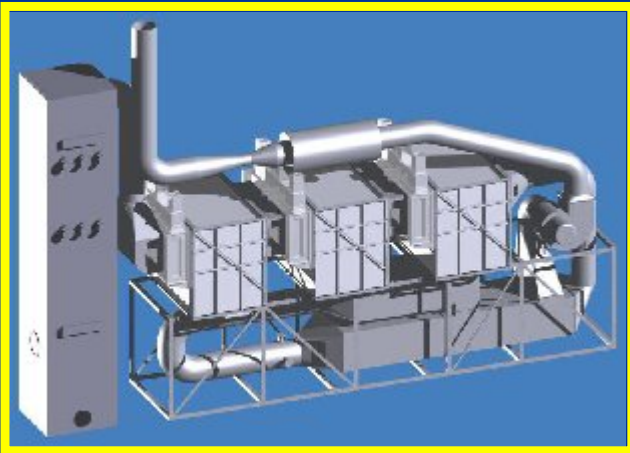
Sea Water Scrubbing (SO_x & PM)

Sea water is pumped to the scrubber
CaCO₃ absorbs the SO_x from the exhaust
Produces CaSO₄ in discharge

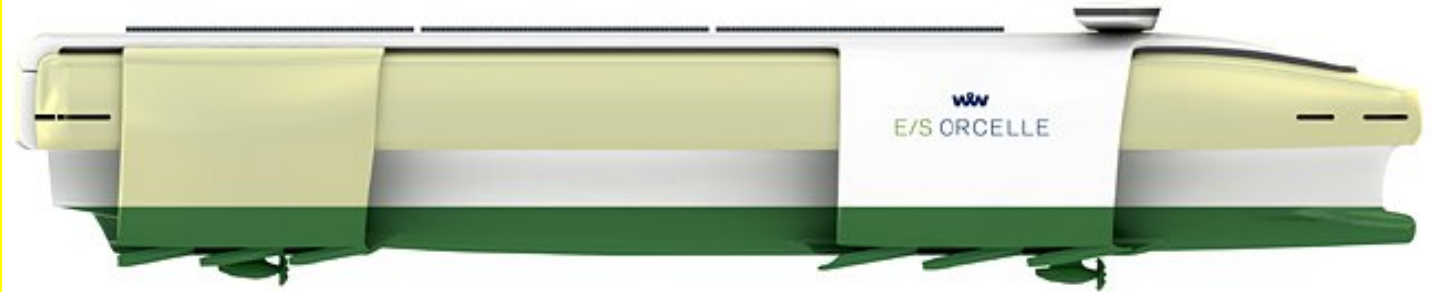


Scrubber also removes most of
the particulates
PM is removed from the discharge
and disposed at dock

Advanced Maritime Emissions Control System (AMECS)



Concept Vessel of the Future



- Solar
- Wind
- Wave
- Fuel Cells



W&W
WALLENIUS WILHELMSEN
LOGISTICS

Thank you! Questions?

