



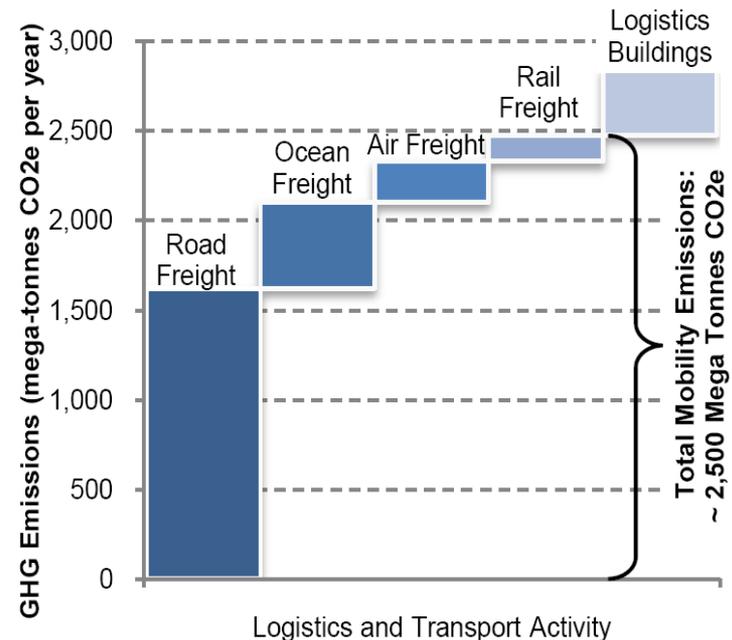
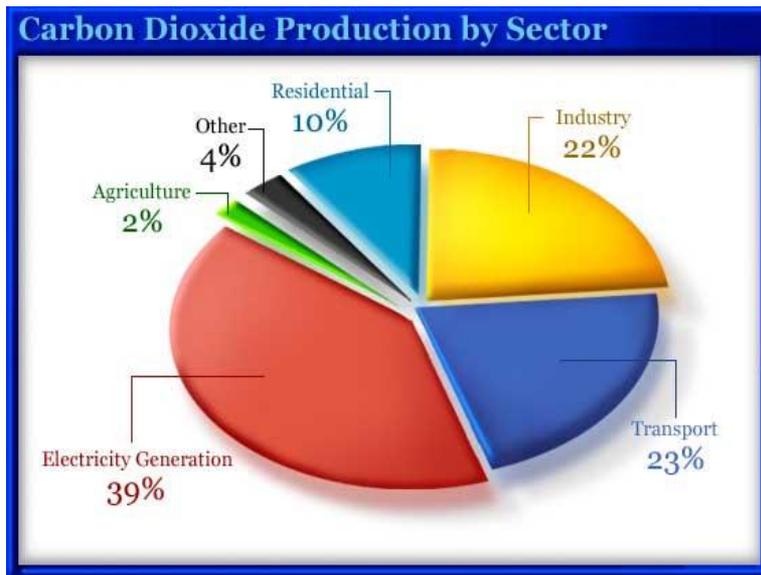
# Improving Vessel and Supply Chain Fuel Efficiency

CAAAC – 2/27/2013

Lee Kindberg

Director, Environment & Sustainability

# Transportation is a significant source of CO<sub>2</sub> and other air emissions.



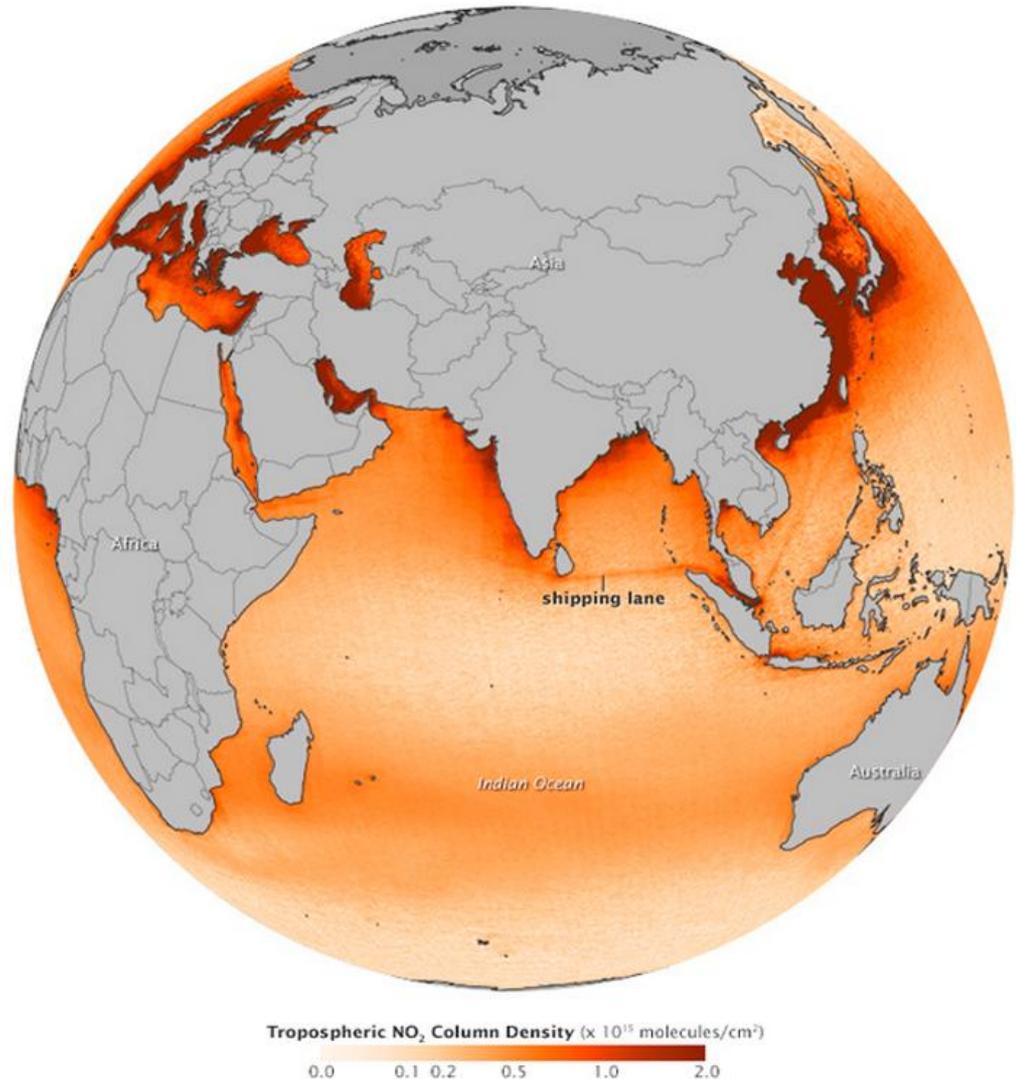
- Human activity generates GHG emissions of about 50,000 mega-tonnes CO<sub>2</sub>e.
- An estimated 5.5% of the total is contributed by the logistics and transportation sector.

Source: World Economic Forum, 2009; Energy Information Administration (EIA), 2007

Ocean shipping is the most energy-efficient way to move cargo long distances...  
*But is impacting the planet*

90% of all goods transported globally are carried by ship.

Ocean shipping generates 4% of all man-made CO<sub>2</sub>.

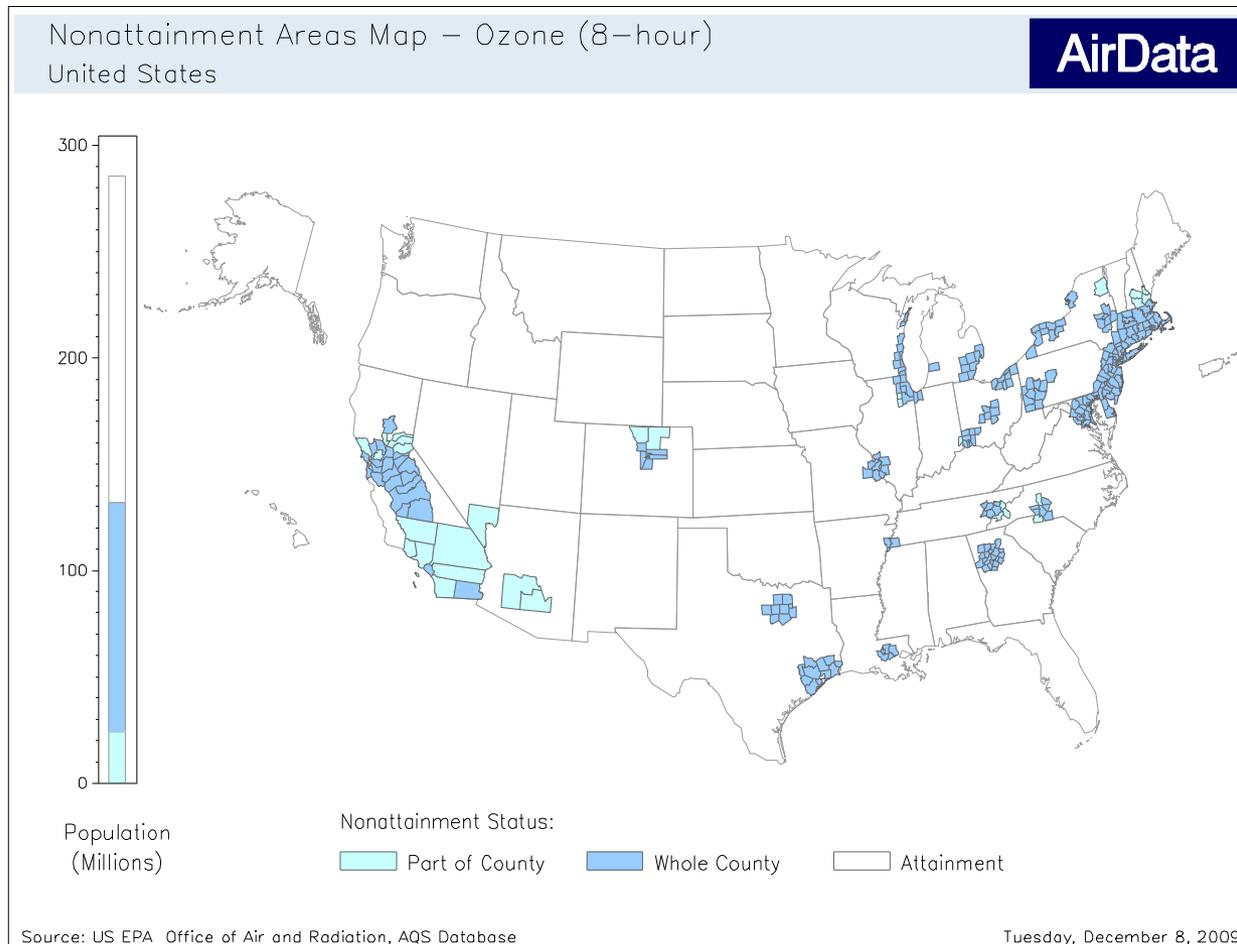


acquired 2005 - 2012

<http://climate.nasa.gov/news/860>



# Air quality in many US ports exceeds national standards, requiring reductions in emissions



# The A.P. Møller–Maersk Group

- Headquarters: Copenhagen, Dk
- 2011 Revenue: \$60 B
- Shipping, Energy, Banking and Supermarkets



Est. 1904 by Arnold Peter Møller with his father, Captain Peter Mærsk Møller.

1965 -- Mærsk Mc-Kinney Moller assumed leadership

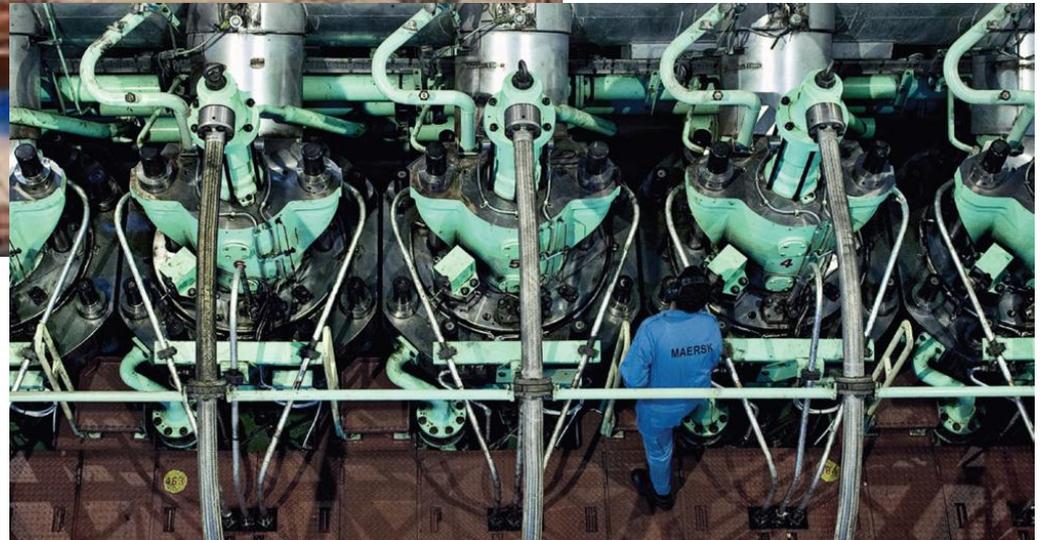
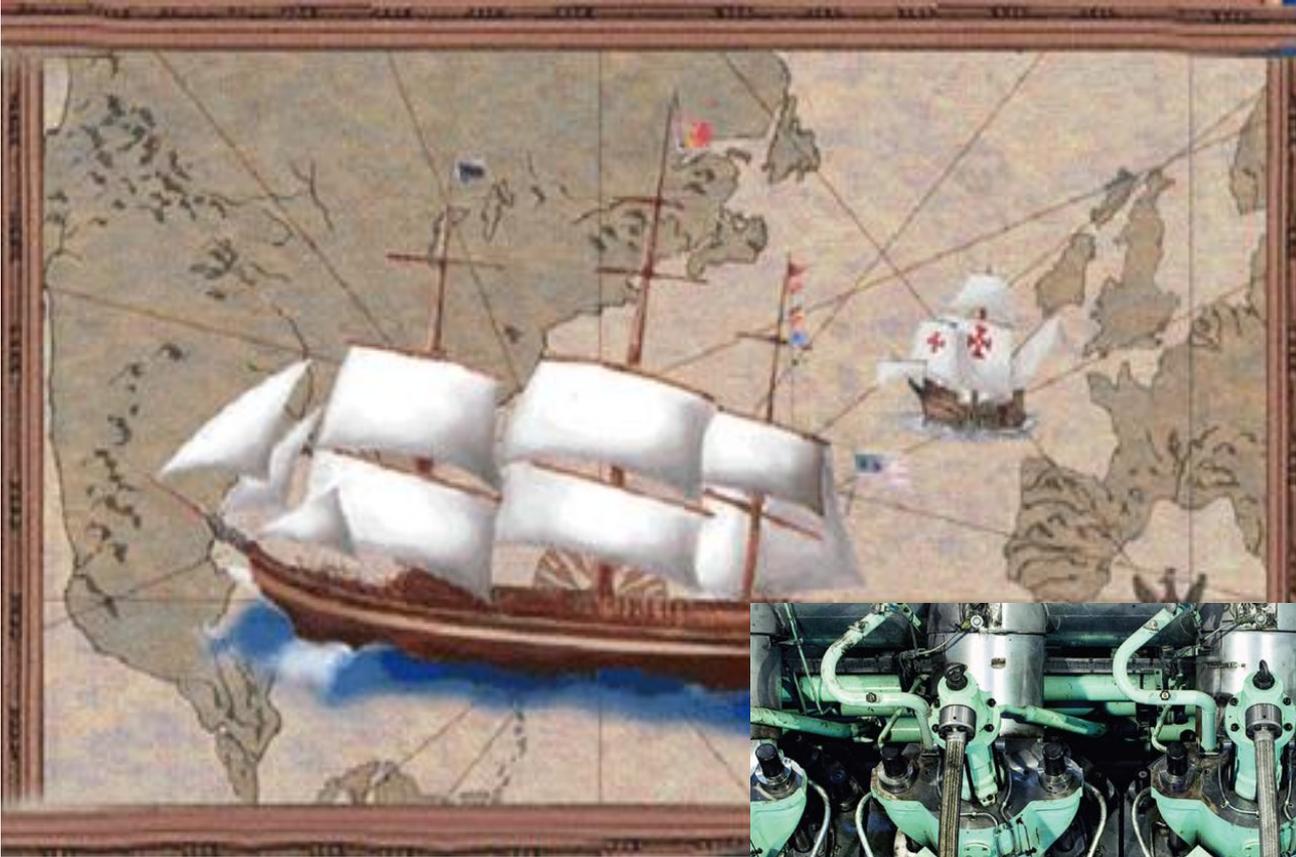
1993 MMM withdrew from day-to-day management

The Group is currently headed by Nils S. Andersen, the fourth Group CEO.

Today, a single ship can deliver thousands of tons of cargo for many customers to dozens of ports. But it was not always this way ...



Diesel engines have replaced wind power



# Containers have replaced “break bulk” cargo handling



# Containers are standard sizes: 20', 40' or 45'

- A 40-foot container is the size of a city bus
  - Can hold:
    - 1,500 DVD players
    - 18,000 T-shirts
    - 90,000 lamb chops
- 45-foot container can hold  
28,000 Barbie Dolls



“Liner shipping” means vessels have strict routes and schedules.

*Routes require several weeks, so multiple vessels are scheduled on each route to provide regular service (weekly).*

### Transpacific 6 (TP6) - Eastbound



Port	Arrives	Departs	Transit
Tanjung Pelepas, Malaysia	FRI	SUN	--
Ho Chi Minh City (Vungtau), Vietnam	TUE	TUE	2
Nansha, Mainland China	FRI	SAT	5
Yantian, Mainland China	SAT	SUN	7
Hong Kong, Hong Kong	SUN	MON	8
Los Angeles, CA, USA	SUN	THU	22

### Transpacific 6 (TP6) - Westbound



Port	Arrives	Departs	Transit
Los Angeles, CA, USA	SUN	THU	--
Ningbo, Mainland China	WED	THU	12
Shanghai (YS), Mainland China	FRI	SAT	14
Xiamen, Mainland China	MON	MON	17
Yantian, Mainland China	TUE	WED	19
Tanjung Pelepas, Malaysia	SAT	MON	23

# A 14 week round trip requires 14 vessels.

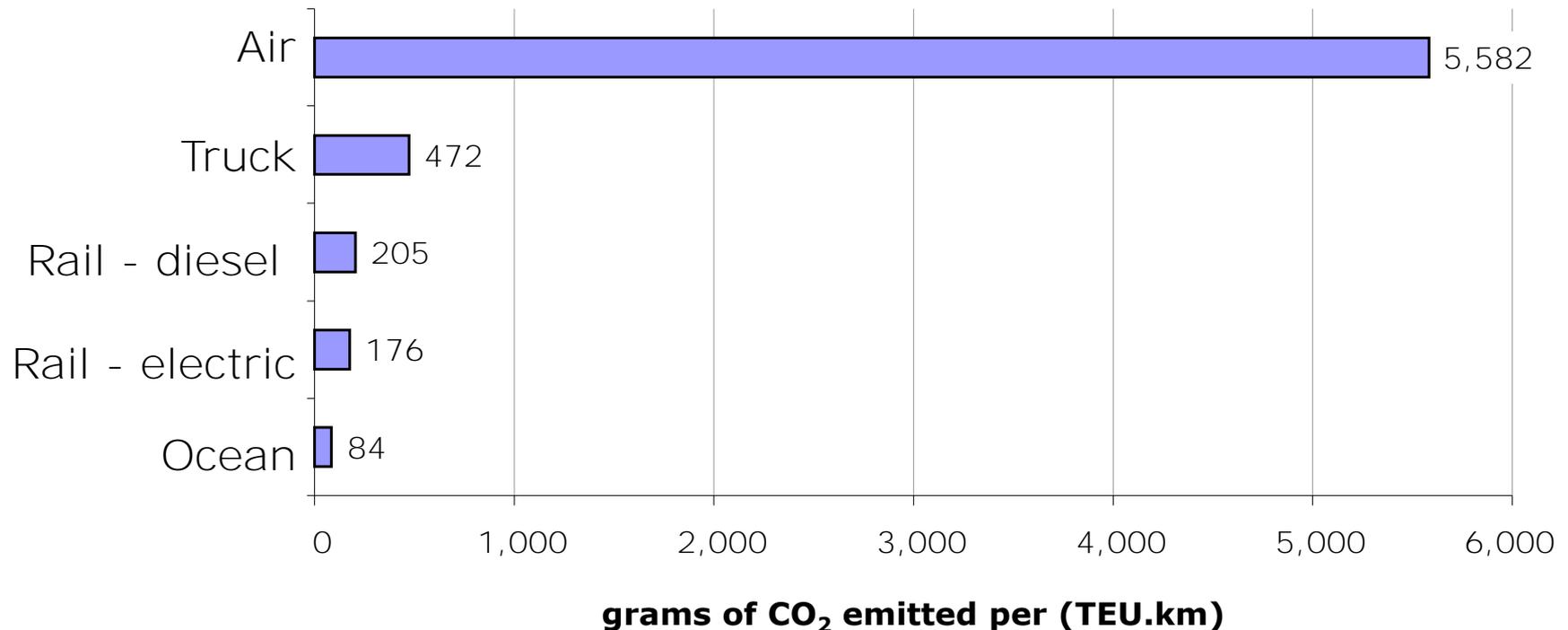
*Sample Vessel Schedule: Georg Maersk on TP-6 in 2010*

Port Name	Arrival Date	Arrival Time	Departure Date	Departure Time
Hong Kong	18 Apr 2010	04:00	19 Apr 2010	04:00
Los Angeles	30 Apr 2010	18:00	03 May 2010	17:00
Yokohama	20 May 2010	01:00	20 May 2010	16:00
Nagoya	21 May 2010	08:00	21 May 2010	18:00
Shanghai	23 May 2010	17:00	24 May 2010	07:00
Ningbo	24 May 2010	19:00	25 May 2010	06:00
Xiamen	26 May 2010	13:00	27 May 2010	00:01
Hong Kong	27 May 2010	18:00	28 May 2010	11:00
Yantian	28 May 2010	17:00	29 May 2010	07:00
Tanjung Pelepas	01 Jun 2010	09:00	02 Jun 2010	16:00
Jeddah	11 Jun 2010	23:00	12 Jun 2010	23:00
Suez Canal	15 Jun 2010	01:00	15 Jun 2010	17:00
Barcelona	19 Jun 2010	08:00	20 Jun 2010	08:00
Valencia	21 Jun 2010	02:00	22 Jun 2010	08:00
Algeciras	23 Jun 2010	08:00	24 Jun 2010	14:00
Port Tangier Meditteranee	25 Jun 2010	00:01	26 Jun 2010	02:00
Suez Canal	01 Jul 2010	19:00	02 Jul 2010	17:00
Tanjung Pelepas	17 Jul 2010	02:30	18 Jul 2010	10:30
Vung Tau	20 Jul 2010	08:00	21 Jul 2010	08:00
Yantian	23 Jul 2010	15:00	24 Jul 2010	22:00
Hong Kong	25 Jul 2010	04:00	26 Jul 2010	04:00
Los Angeles	08 Aug 2010	18:00	12 Aug 2010	03:00

14 week  
round  
trip

# Ocean shipping has the lowest environmental impact for long distance transportation.

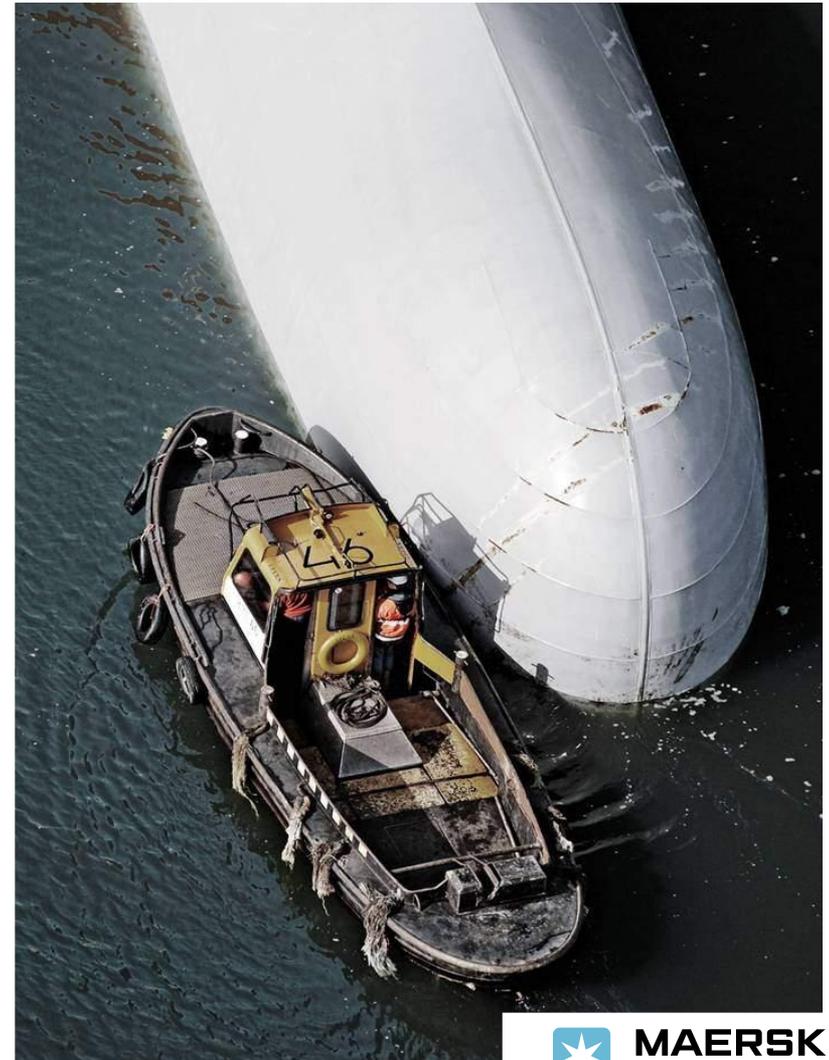
CO<sub>2</sub> Emissions by Mode of Transportation



**90% of all goods transported globally are carried by ship.**

# Things used to be simpler for the shipping industry...

- Fuel costs were **low and predictable**
- Environmental regulations were **limited and manageable**
- **CO<sub>2</sub> emissions** were not an issue
- Marine fuels were “**one size fits all.**”
- Shipping as an industry was **not on the radar screen** (as long as we avoided big oil spills)



# What are we facing now?

Increased transparency

Increased accountability

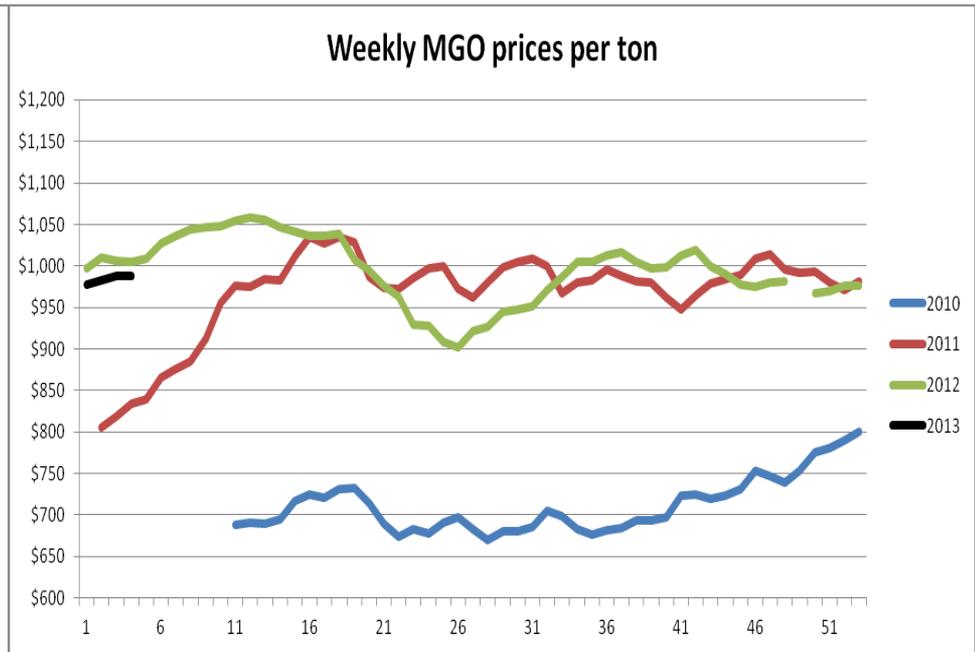
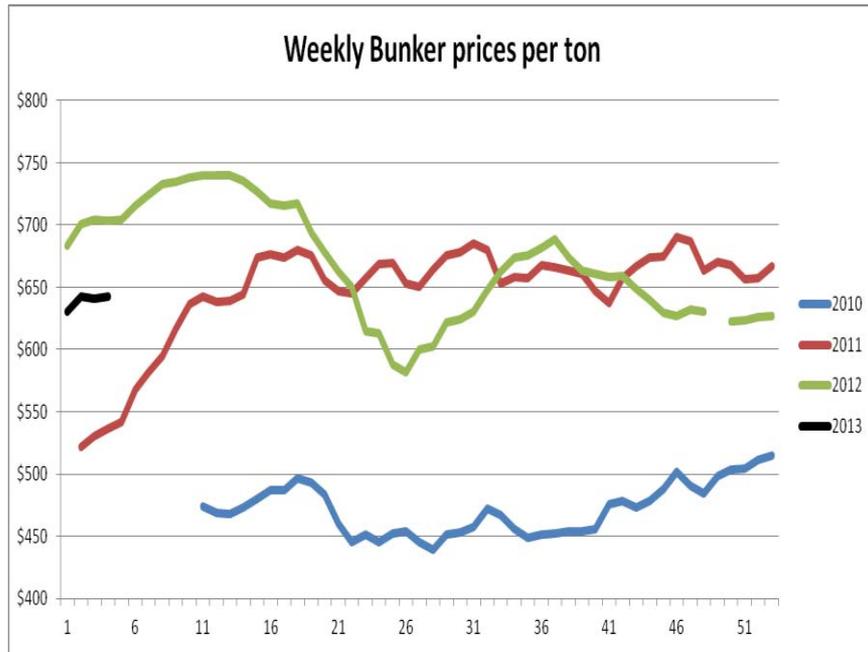
Increased & changing  
regulation

Increased customer  
expectations

Increased competition



# Vessel fuel prices have soared since 2010 and are volatile.



## Bunker fuel (\$/metric ton)

2010	\$440 - 520
2011	\$520 - 680
Q1 2012	\$680 - 740
Q2 2012	\$740 - 611
Q3 2012	\$580 - 680
Q4 2012	\$620 - 660

## Marine Gas Oil (\$/metric ton)

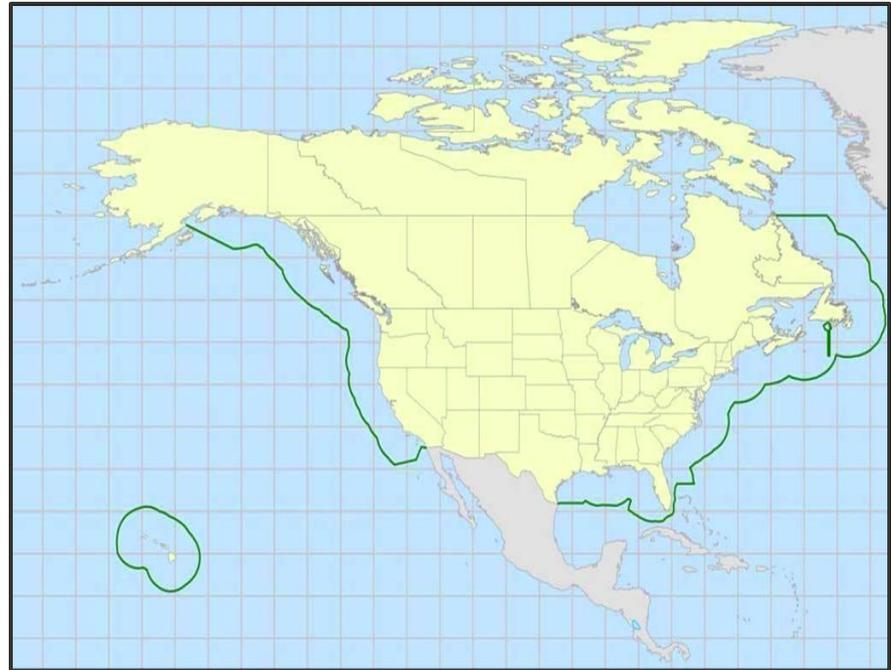
2010	\$ 670 - 800
2011	\$ 800 - 1040
2012	\$ 900 - 1060

Use: California and voluntary fuel switches.

# The North American Emissions Control Area (ECA) now requires lower sulfur fuel.

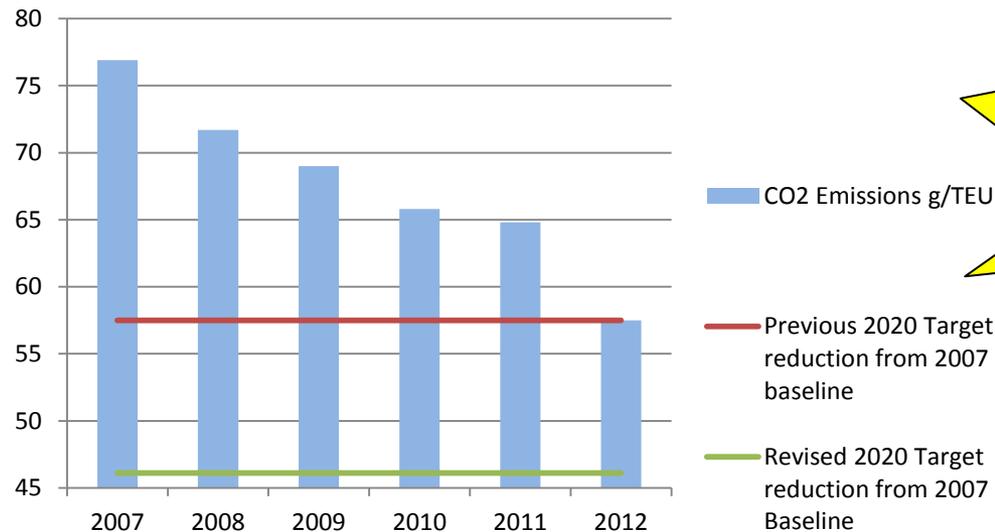
- Effective Aug. 2012
  - Caribbean ECA 1/2014
- 200 nautical mile zone around the US and Canada
- Fuel sulfur max:

2012-2014	<1%
Jan. 2015	<0.1%
- Cost premium \$50-150/T.



Vessels are increasingly fuel efficient.  
*This reduces fuel use, CO<sub>2</sub> and other air emissions.*

### Maersk Line CO<sub>2</sub> Reductions



**Met 2020 CO<sub>2</sub> reduction goal 8 years early!**

2007-2011 data was verified by:

Lloyd's Register

250 YEARS OF SERVICE

- CO<sub>2</sub> and other emissions were reduced 25% per TEU km from 2007 to 2012.
- CO<sub>2</sub> reduction goal has now been raised to 40% for 2020
- Reductions were achieved through a combination of vessel size, technologies, route planning and operational changes.

# Innovation is essential for sustainability

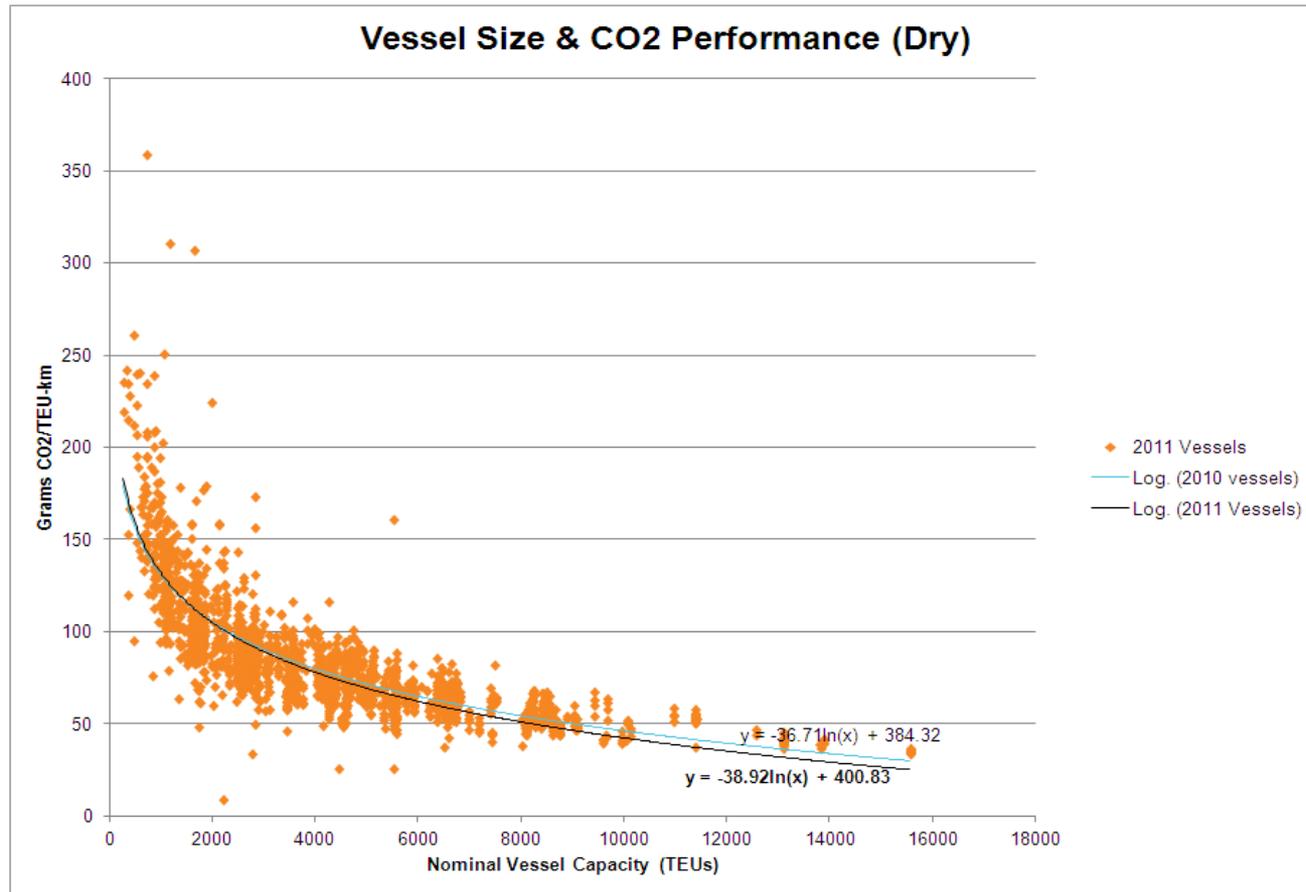


- Propeller, hull & trim optimization
- Waste heat recovery system
- Slow steaming and super-slow steaming

## Other Initiatives

- Alternative fuel tests
- New propulsion technologies
- ISO 14001 certified
- Crew awareness and engagement
- Maintenance of hull and propeller
- Voyage Efficiency System (VES)
- Trim optimization
- SOx scrubber studies
- Antifouling hull paint
- QUEST: Low energy chilled containers
- Modified bulbous bow
- Micro bubbles
- Ballast water optimization and treatment systems

Vessel size drives much of energy and CO<sub>2</sub> performance.



Source: BSR Clean Cargo Working Group, 2012 Environmental Performance study.

All Maersk Line new builds are more energy efficient, and some being delivered today are 28 to 50% better.

### **Triple E – 18,000 TEU**

- Coming in 2013
- 50% more efficient



### **WAFMAX class – 4500 TEU**

- 28% less CO2 per TEU
- 10 in service (2011)
- 12 more delivered by 2012



### **SAMMAX class – 7500 TEU**

- 50% less CO2 per TEU
- 6 vessels in service in 2011
- 10 more by 2012.



# Vessel environmental improvements take time and partnerships.

## New vessels

- Optimize vessels for intended services
- Potential energy efficiency improvements 20-50%
- Work with shipyards, equipment and fuel suppliers
- Long-term view plus short-term impact

## Personnel

- Vessel crews
- Shore side teams
- Structures, metrics, idea sharing

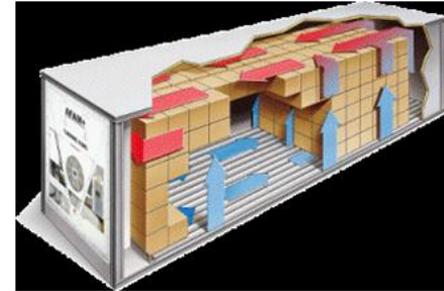
## Existing fleet

- Identify or develop technologies
- Work with Charter vessel owners
- Partner with technology, software and engine suppliers
- Identify the right mix for each vessel



# Improvements go beyond the vessels

- **Refrigerated (“reefers”)** – a new, innovative control system reduces energy consumption by 50 to 63%).
- Container flooring is now recycled plastic, bamboo or FSC certified timber.
- **Slow or “steady” steaming** – voyage efficiency systems improve on-time delivery at the same time they are minimizing fuel usage.
- Testing alternative fuels and propulsion.
- Using our vessels to assist ocean scientists.



Study Period	On-time %	Ranking Among Top 20
3Q11	83	1
2Q11	76	1
1Q11	66	3
4Q10	70	1
3Q10	79	1
2Q10	77	1
1Q10	69	1
4Q09	63	1
3Q09	71	2
2Q09	79	1
1Q09	78	1
4Q08	77	1
3Q08	68	1
2Q08	76	1
1Q08	63	3

# Cleaner fuel reduces toxic air emissions in ports significantly.

## US & Canada:

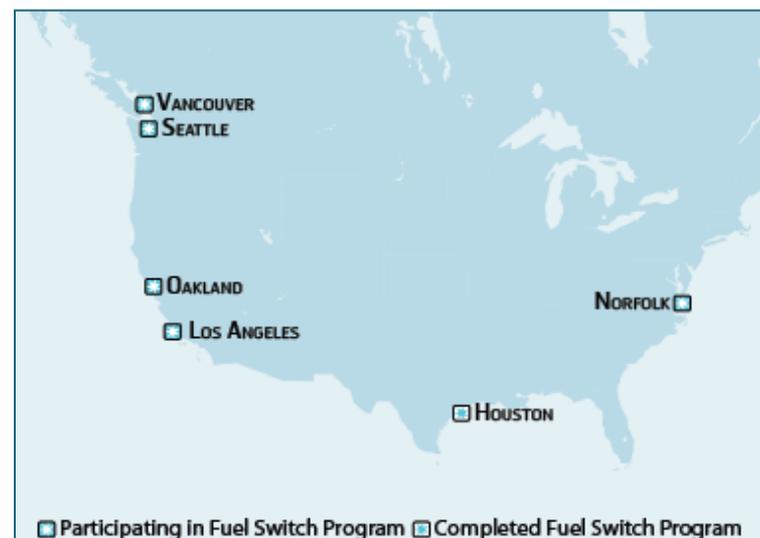
- Over 2800 port calls 3/06 to 12/12
- Fuel is MGO 0.1%S vs. 2.7%S bunker
- Reduced over 5000 MT of emissions:

SOx	95%
Particles (PM)	86%
NOx	6-10%

- Now a global Maersk initiative
  - Hong Kong 9/2010
  - Singapore 7/2011
  - Gothenburg Sweden 1/2012



First port call with MGO fuel: Maersk McKinney Moller and Sine Maersk in LA 3/31/2006.



# Changing the way we think about shipping:

- **It isn't only the biggest ships -- it's the right ships.** This means optimizing the ships for the service, and upgrading the whole portfolio -- new, existing and charter.
- **"Steady Steaming"** delivers more environmental benefits than just slow steaming.
- **Reliability / On-time delivery** benefits the customer and can also benefit the environment.
- Leading in **transparency** -- publishing every vessel's performance using global standard methods, and third-party verification.
- Sustainability is the right thing to do and also **makes good business sense.**

# Our customers are demanding more sustainable supply chains.



"Supply chain collaboration plays a crucial role to become faster, more cost efficient and more sustainable in our end to end operation. We are looking to others outside our industry to help us improve this. Our partnership with Maersk Line is a great example".

- **Simon Smith**  
Vice President, Logistics



"Maersk Line as a global leader in sustainability enables us to differentiate service providers by their carbon emission intensity and integrate that into our future cargo allocation plans".

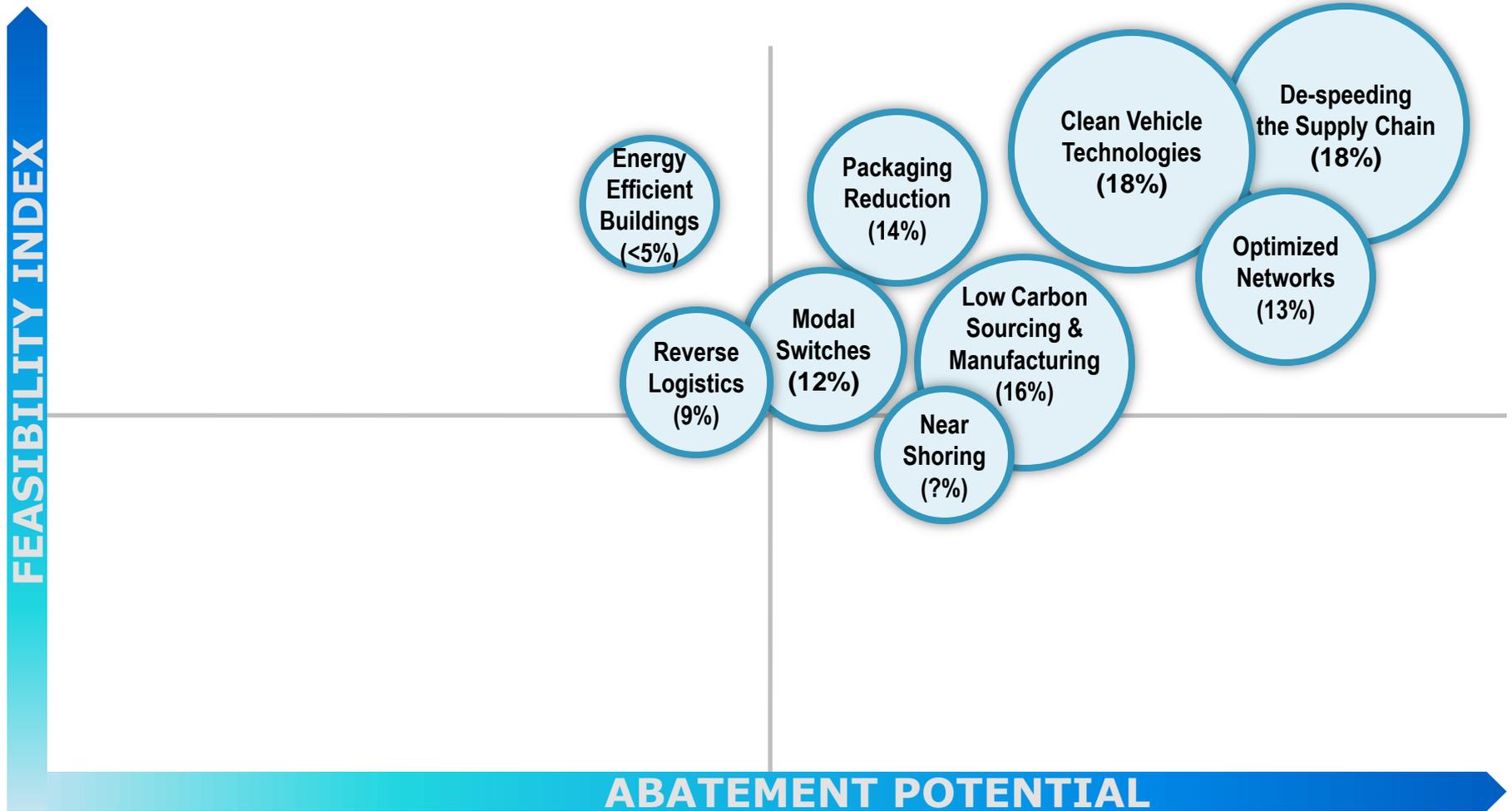
- **Neil McKenna**,  
Vice President, Transportation



"Our expectations for Maersk Line are that we together go as far as we can with the well know factors of environmental logistics. We also need to focus on innovation to secure that next generation logistics can start to reduce the major impact that transportations has on emissions globally".

- **Robert Ingvarsson**  
Group Transport Manager

The World Economic Forum has identified these opportunities for supply chain impact reduction:



Source: World Economic Forum – Supply Chain Decarbonization – the Role of Logistics and Transport in Reducing Supply Chain Carbon Emissions

Standard methods exist to report environmental impacts of shipping.

*Clean Cargo Working Group is a business-to-business forum with the goal “to promote more sustainable product transportation.”*

### Carriers

**MOL** Mitsui O.S.K. Lines

**Matson.**  **OOCL**  
We take it personally  
**MAERSK**

 **UASC** اللاحة العربية المتحدة **HAMBURG SÜD**

**YANG MING GROUP** **CMA CGM** **HMM**

 **APL** **LOSCO**  
Moving Business Forward

**Hapag-Lloyd** **CSAV**

**NYK LINE** **HANJIN SHIPPING**

### NVOCCs

**DHL** **KUEHNE+NAGEL**

**DB SCHENKER** **JF Hillebrand**  
global beverage logistics  
**DAMCO**

### Shippers

**NORDSTROM** **WAL\*MART\***

**Heineken** **Electrolux**

**MARKS & SPENCER** **KOHL'S**  
expect great things

**PVH** **IKEA** **NIKE**

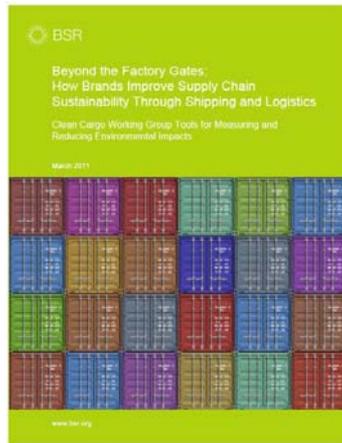
PHILIPS-VAN HEUSEN CORPORATION

**Tchibo** **POLO RALPH LAUREN** **AMERICAN EAGLE OUTFITTERS**

- **Clean Cargo members carry over 60% of all TEU shipped globally**
- Annual environmental performance survey
- Standardized CO<sub>2</sub> analysis
  - Third party verification
- Annual publication of trade lane averages.

<http://www.bsr.org/en/our-work/working-groups/clean-cargo>

# CCWG publishes CO<sub>2</sub> methods and industry averages by trade lane.



CCWG average emissions per trade lane are based on:

CUMULATIVE - weighted average gCO<sub>2</sub>/TEU-km

	Dry	Reefer
Intra-Americas (Caribbean)	102.28	133.41
Europe (North & Med)--Oceania (via Suez / via Panama)	101.52	128.62
North America--Oceania	100.48	126.87
North America--Africa	97.37	139.65
Asia--Oceania	92.80	120.34
Europe (North & Med)--Africa	88.67	122.65
Europe (North & Med)--Latin America/South America	87.33	114.91
North Europe--North America EC (Incl. Gulf)	85.41	112.46
North America--South America (EC/WC)	84.96	112.84
Asia--Africa	84.87	110.51
North America EC--Middle East/India	84.20	108.59
Asia--South America (EC/WC)	80.57	104.40
Mediterranean--North America EC (Incl. Gulf)	80.03	108.83
North Europe--North America WC	79.81	104.64
Other	78.55	108.51
Asia--North America EC	78.15	97.44
South America (EC/WC)--Africa	77.81	97.79
Europe (North & Med)--Middle East/India	76.19	106.10
Intra-Asia	76.14	100.67
Asia--North America WC	74.20	97.13
Asia--Middle East/India	73.72	103.50
Intra-Europe	72.75	102.59
Asia--Mediterranean	67.52	96.71
Asia--North Europe	67.26	93.91
Mediterranean--North America WC	59.69	89.93

- Methods based on fuel efficiency
- Enable CO<sub>2</sub> benchmarking and supply chain CO<sub>2</sub> calculations
- Verification guideline

<http://www.bsr.org/en/our-work/working-groups/clean-cargo>

These factors allow us to compare routes for CO2 emissions.

*Example: Central America to Atlanta GA*

Route	Data source	From	To	Distance (km)	Emission Factor	Kilograms of CO2 per FFE
<b>Ocean to Miami, truck to Atlanta GA</b>						
Ocean	CCWG 2011 Intra-Americas Industry Average	Santo Tomas	Miami	1533	87.9 g CO2/TEU/Km	270
Truck	SmartWay	Miami	Atlanta	1041	1148 g CO2/km	1195
<b>Total</b>				<b>2575</b>		<b>1465</b>
<b>Ocean to Savannah, truck to Atlanta</b>						
Ocean	CCWG 2011 Intra-Americas Industry Average	Santo Tomas	Savannah	2228	87.9 g CO2/TEU/Km	392
Truck	SmartWay	Savannah	Atlanta	373	1148 g CO2/km	429
<b>Total</b>				<b>2601</b>		<b>820</b>
		<b>CO<sub>2</sub> Savings via Savannah (Kilograms per forty foot container)</b>				<b>645</b>
		<b>% Reduction</b>				<b>44%</b>

Note 1. Clean Cargo Working Group report "Beyond the Factory Gates: Global Trade Lane Emissions Factors", page 2

Note 2. The US EPA SmartWay Shipper Logistics Model states that if carrier-specific emissions factors are unavailable, the model will estimate CO2 emissions using a factor of 1,847.5 g/mile. This was converted to 1,148 g CO2/kilometer.

# Alignment will add credibility and drive environmental improvements

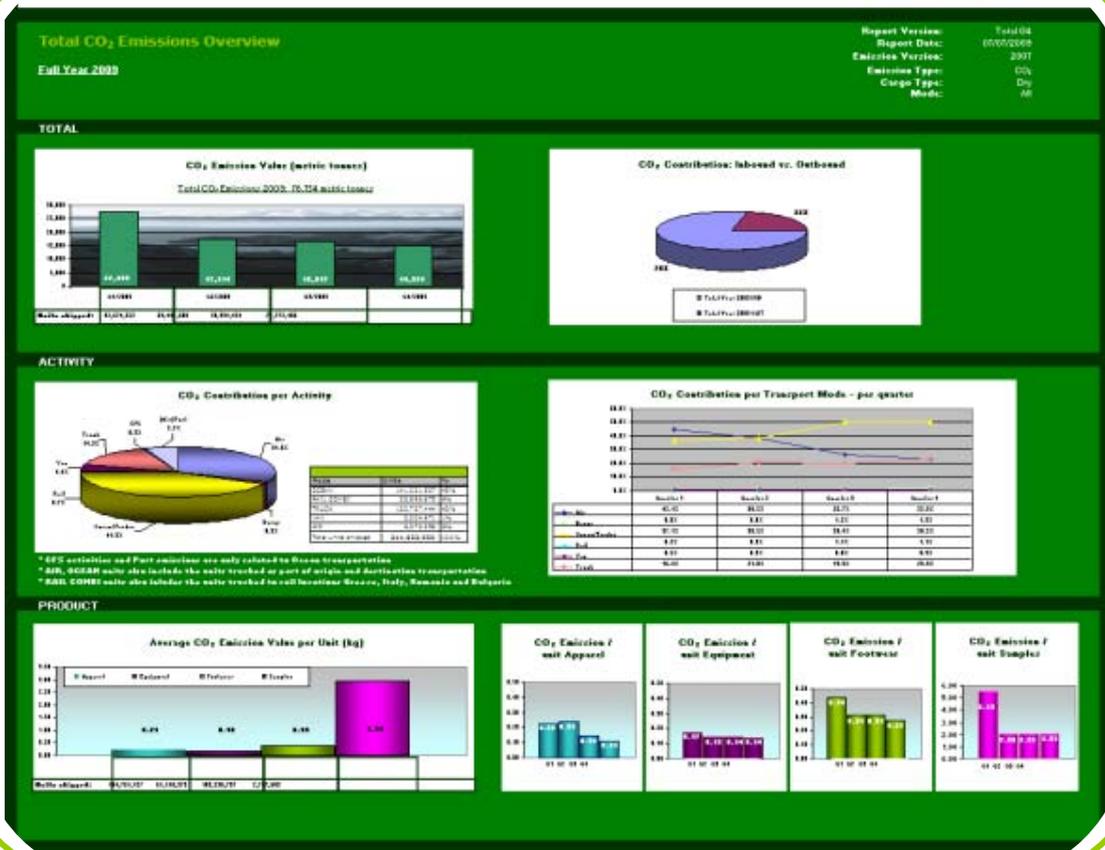
- CCWG is working to align and harmonize environmental methodologies globally across modes.
- Collaboration and dialogue between existing and emerging initiatives will drive transparency and improvements
- Some existing initiatives:



# Case study: Nike

Target: 30% reduction of GHG for 2020

FY2009 Result: 12% reduction (-39% in air freight, some lower volume)



# Transportation CO<sub>2</sub> Emissions can be reduced.

<b>Part of supply chain</b>	<b>Driver of emissions</b>	<b>Ways to reduce emissions (examples)</b>
<b>Ocean transportation</b> 	<ul style="list-style-type: none"><li>• Volume moved</li><li>• km covered</li></ul>	<ul style="list-style-type: none"><li>• Higher container utilisation</li><li>• Use of more eco-friendly carriers</li></ul>
<b>Air transportation</b> 	<ul style="list-style-type: none"><li>• kg moved</li><li>• km covered</li></ul>	<ul style="list-style-type: none"><li>• Air to Sea-Air conversion</li></ul>
<b>Port moves</b> 	<ul style="list-style-type: none"><li>• Number of containers</li></ul>	<ul style="list-style-type: none"><li>• Higher container utilisation</li><li>• 20' to 40' conversion</li><li>• CFS-CY conversion</li></ul>
<b>Domestic distribution</b>  	<ul style="list-style-type: none"><li>• Transportation mode (truck vs. rail)</li><li>• km covered</li><li>• Volume moved</li></ul>	<ul style="list-style-type: none"><li>• Higher utilisation of delivery trucks/vans</li><li>• Double-decker trailers</li><li>• Increased use of rail</li><li>• Use of bio-fuel</li></ul>
<b>Warehousing</b> 	<ul style="list-style-type: none"><li>• Number of days in warehouse</li><li>• Number of CBM</li></ul>	<ul style="list-style-type: none"><li>• Reduce safety stock</li><li>• DC bypassing</li></ul>

# What we've learned about supply chain calculations:

- 1. Use a consistent calculator approach**
- 2. Transportation footprints can and have been reduced**
- 3. It's the total lifecycle footprint that matters**
  - Transportation is just part of the total.
  - You have to do the full analysis to see the big picture
- 4. Focus on improvements and incorporating CO<sub>2</sub> into business decisions**
- 5. Opportunity: work together to reduce both CO<sub>2</sub> emissions and costs**

# Surprising facts about Liner Shipping that impact planning for research and developing regulations:

- 1. Liner shipping is like an air line or bus line – not a taxi.**
- 2. International vessels spend only about 5% of their lifetimes in the waters of any one country or state.**
- 3. Schedule conformance is critical in cost and air emissions.**
  - Higher speeds dramatically increase fuel use and air emissions.
- 4. Vessels operate with total crews of only 16 to 24.**
- 5. Homeland Security and other rules require notice and planning to visit or sail with a vessel.**
  - Anyone doing this work should have a TWIC card.
- 6. The rest of the world uses metric units for environmental, supply chain and other calculations.**

Thank you

