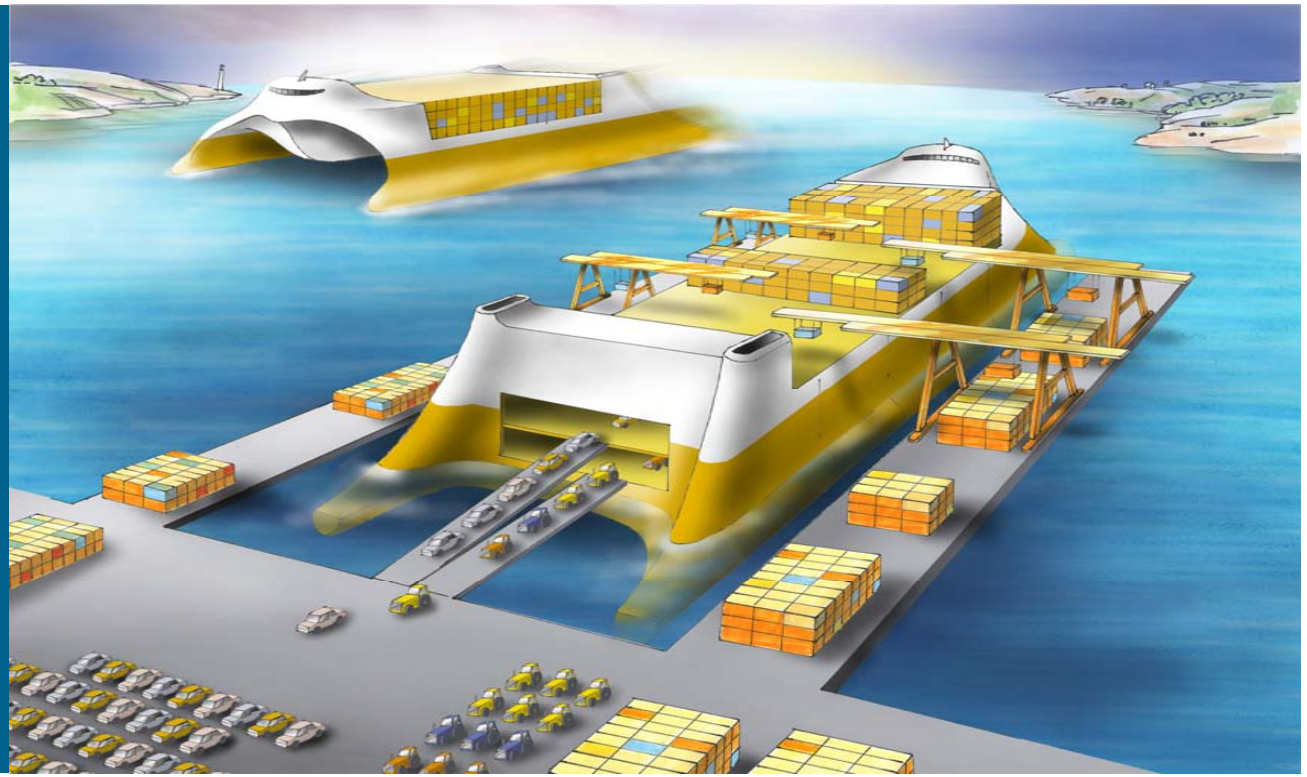
Germanischer Lloyd

Technology and Fleet Modernization – Benefits for the Investor –

Capital Link, New York, 25th of March 2011

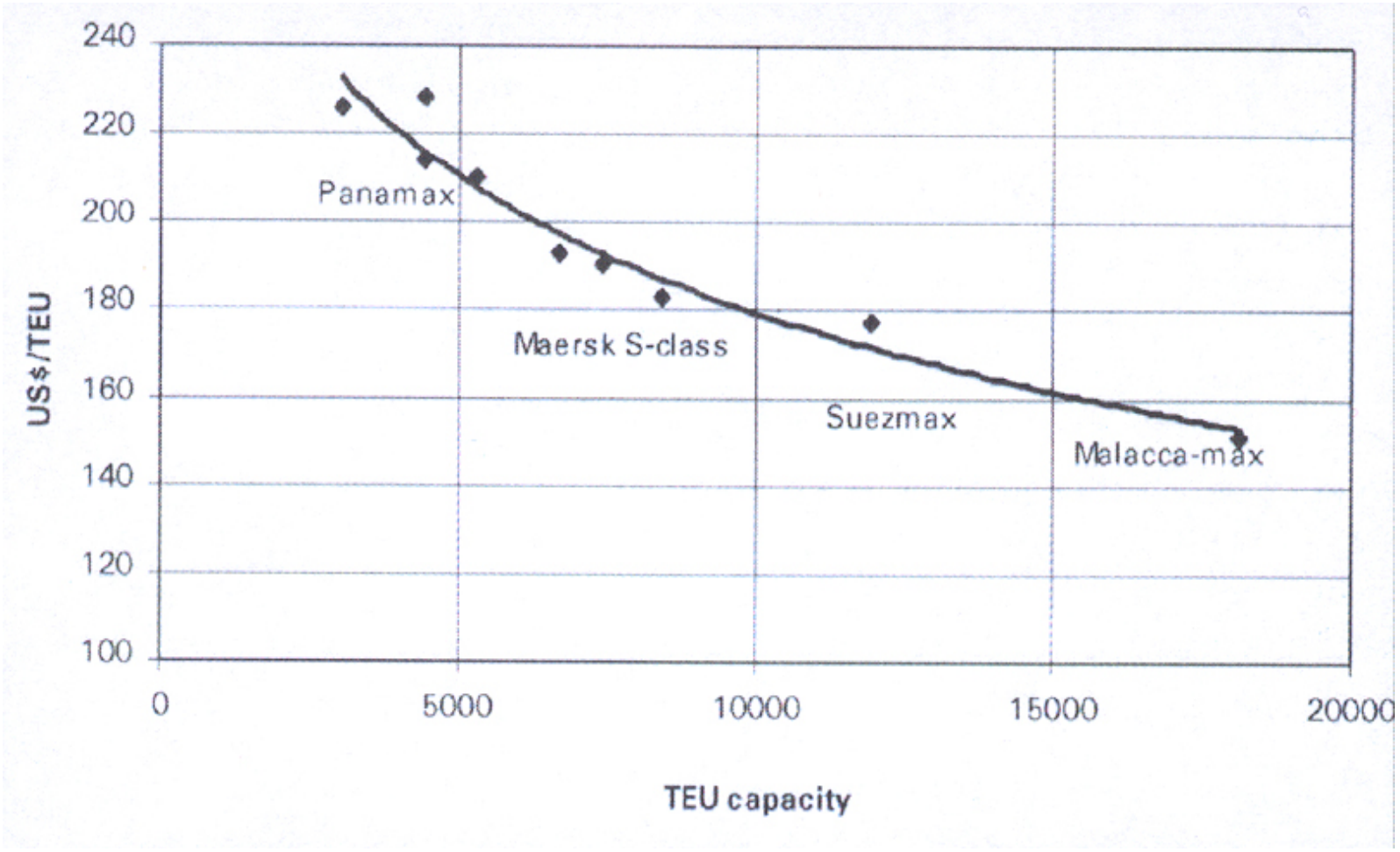
Dr. Hermann J. Klein



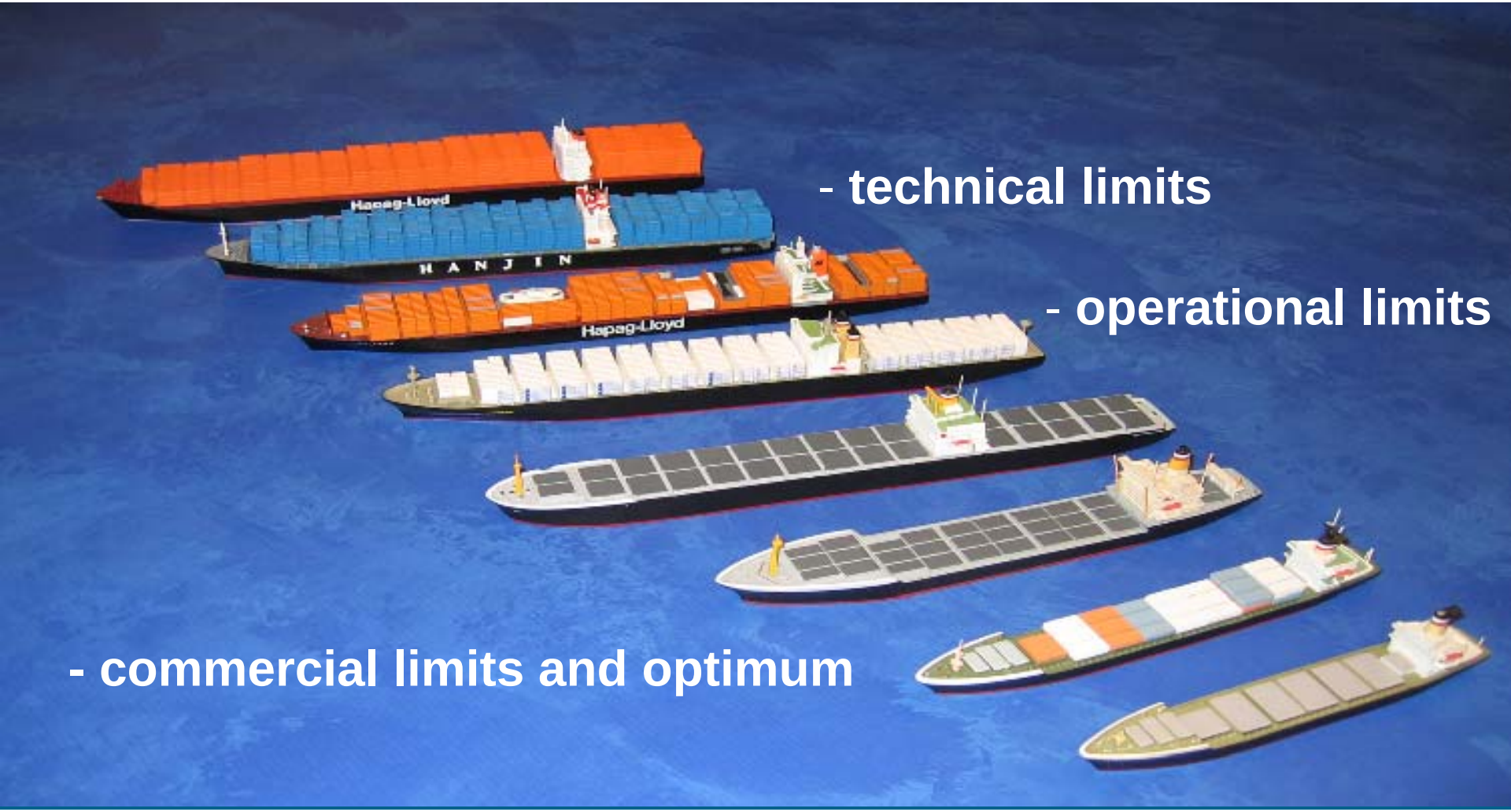
Content

- Economy of Scale
- Efficiency of Ship Newbuildings
- Fleet Modernization / Fleet Optimization

Economy of Scale



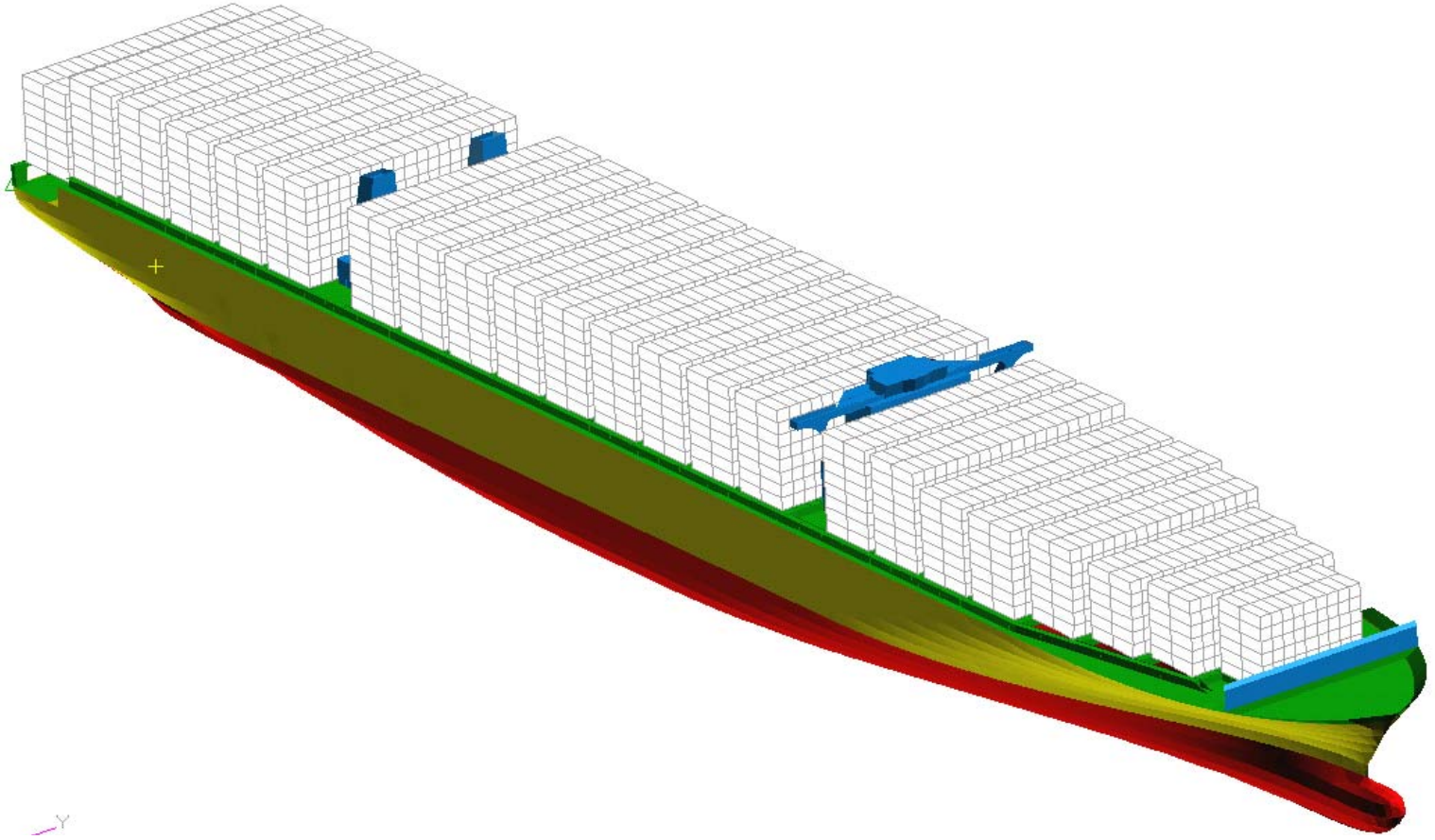
The size of Boxships is further increasing



14.000 TEU Container Ship
MSC Danit of MSC

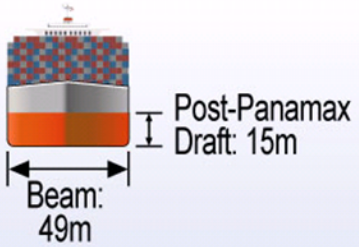
Largest Container Ship of the World
The „new“ Post-Panamax Vessels with B = 51,2m
Builder: Daewoo Shipbuilding & Marine Engineering, Korea

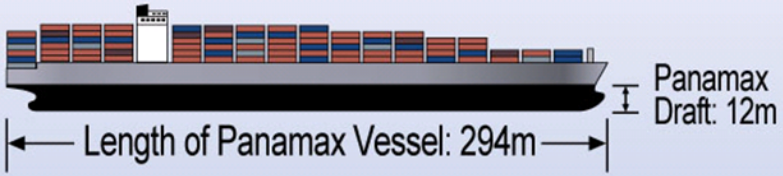
14.000 TEU Container Ship
Loa = 398,0 m, B = 54,2 m, H = 27,7 m

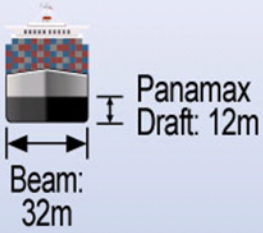


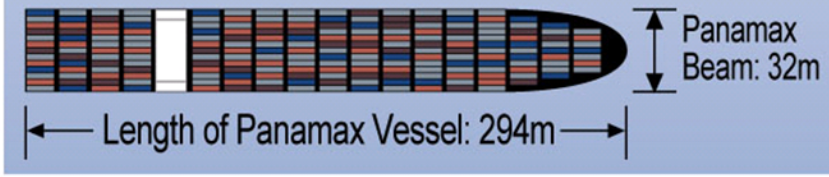
The New Panama Canal

Pana Max – Today and Tomorrow





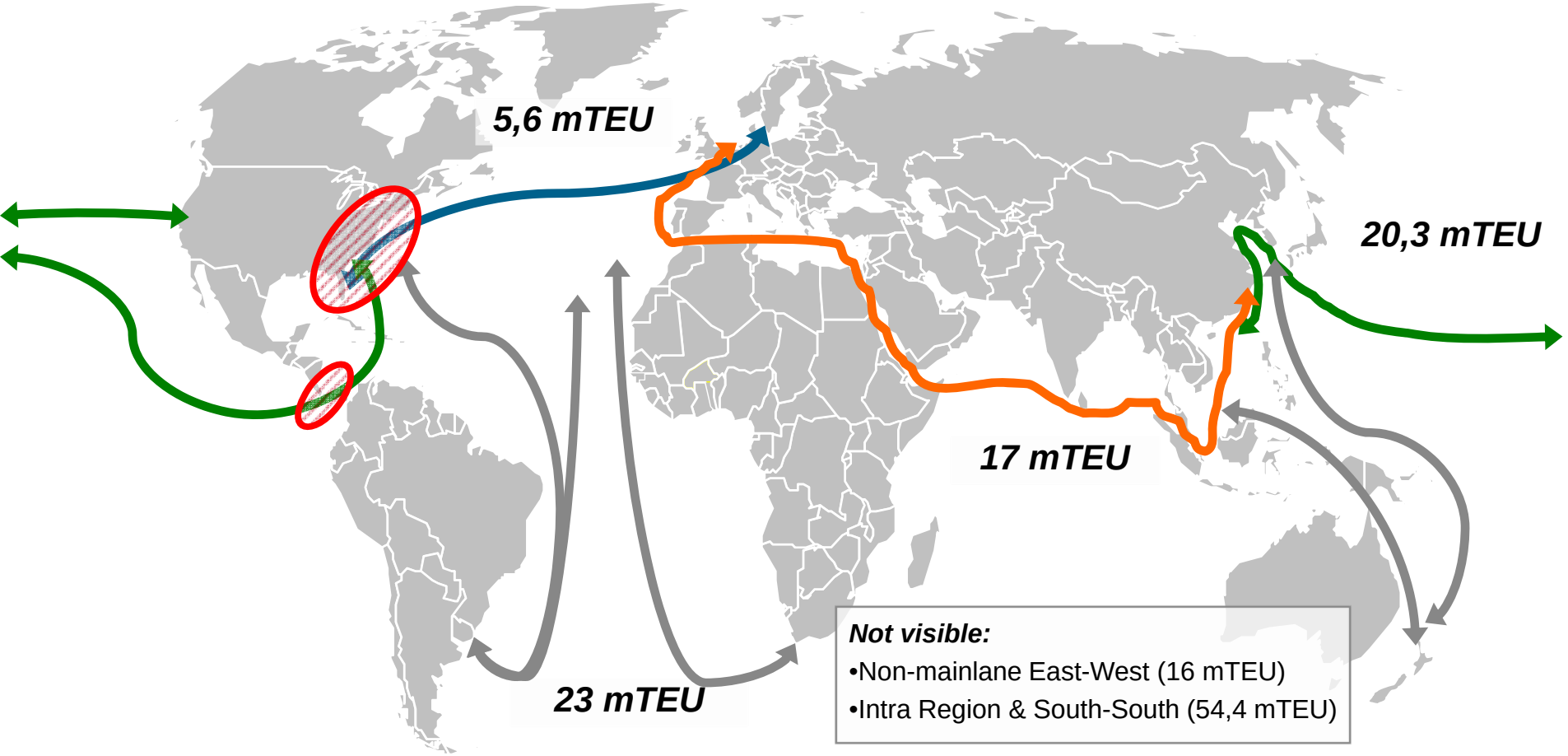




	Panamax	Post-Panamax
Capacity:		
Containers(TEUs)	4,500	12,000
Dimensions:		
Beam	32m (106')	49m (160')
Length	294m (965')	366m (1,200')
Draft	12m (39.5')	15m (50')

The proposed new Panamax vessel has a capacity of about 12,000 TEUs

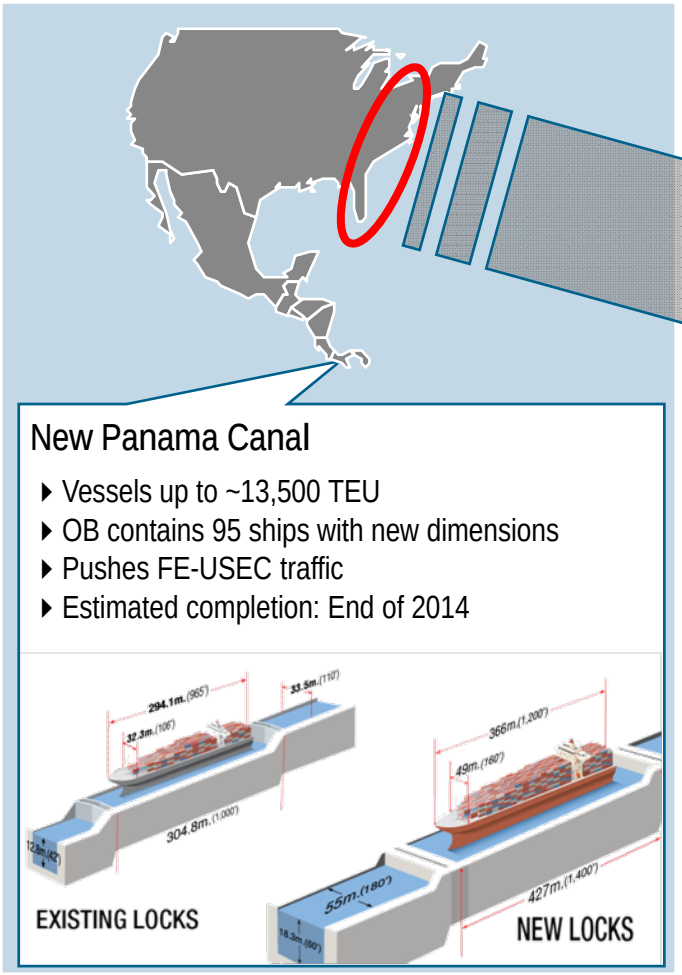
Container – Eye on Panama Canal & US East Coast

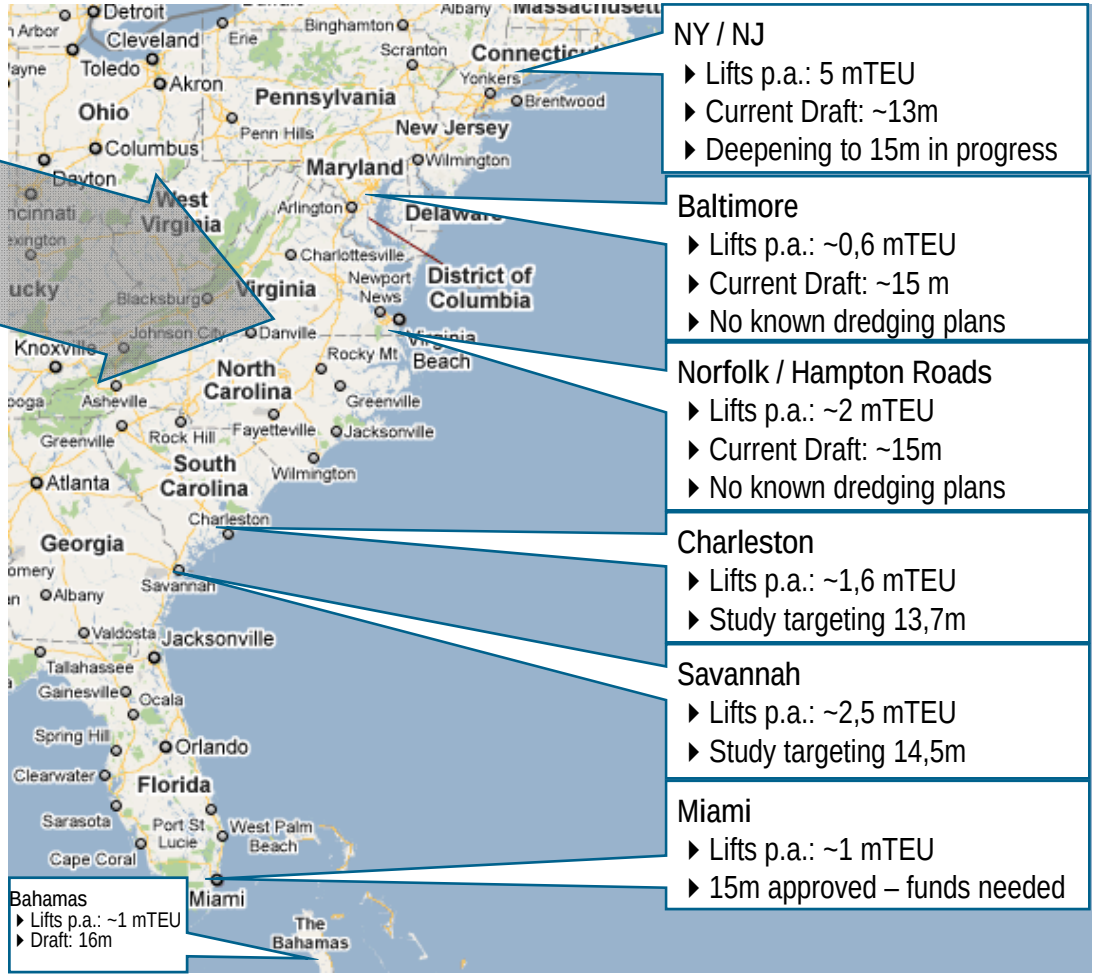


➡ Currently, Panama Canal locks and draft restrictions at ports repress Megaboxer activity at USEC

Source: SIN; GL-Analysis

Container – Eye on Panama Canal & US East Coast





NY / NJ
- Lifts p.a.: 5 mTEU
- Current Draft: ~13m
- Deepening to 15m in progress

Baltimore
- Lifts p.a.: ~0,6 mTEU
- Current Draft: ~15 m
- No known dredging plans

Norfolk / Hampton Roads
- Lifts p.a.: ~2 mTEU
- Current Draft: ~15m
- No known dredging plans

Charleston
- Lifts p.a.: ~1,6 mTEU
- Study targeting 13,7m

Savannah
- Lifts p.a.: ~2,5 mTEU
- Study targeting 14,5m

Miami
- Lifts p.a.: ~1 mTEU
- 15m approved – funds needed

➡ Opportunity for Megaboxer - Expansion of Panama Canal & dredging at USEC ports

Source: GL-Analysis

Economy of Scale in Transport

Content

- Economy of Scale
- Efficiency of Ship Newbuildings
- Fleet Modernization / Fleet Optimization

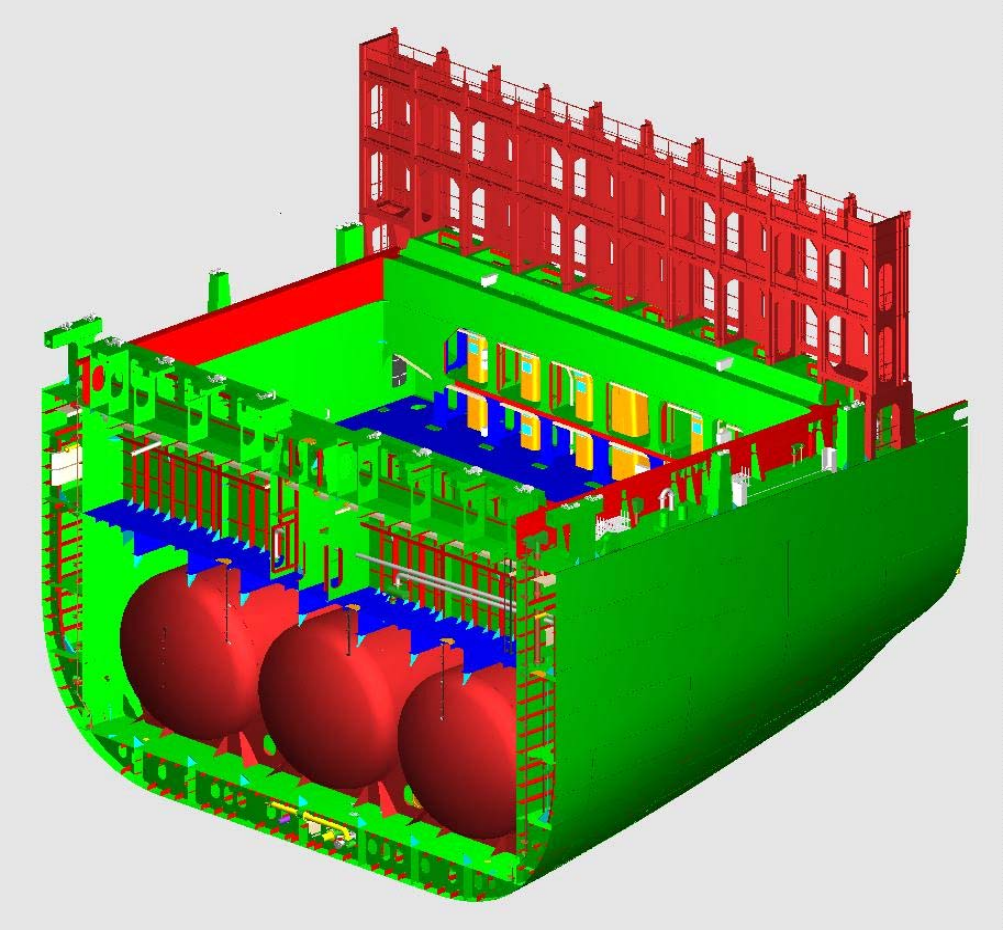
Propulsion Assistance by Wind Kite

Propulsion Assistance by Flettner Rotor

Propulsion by Fuel Cell and Hydrogen

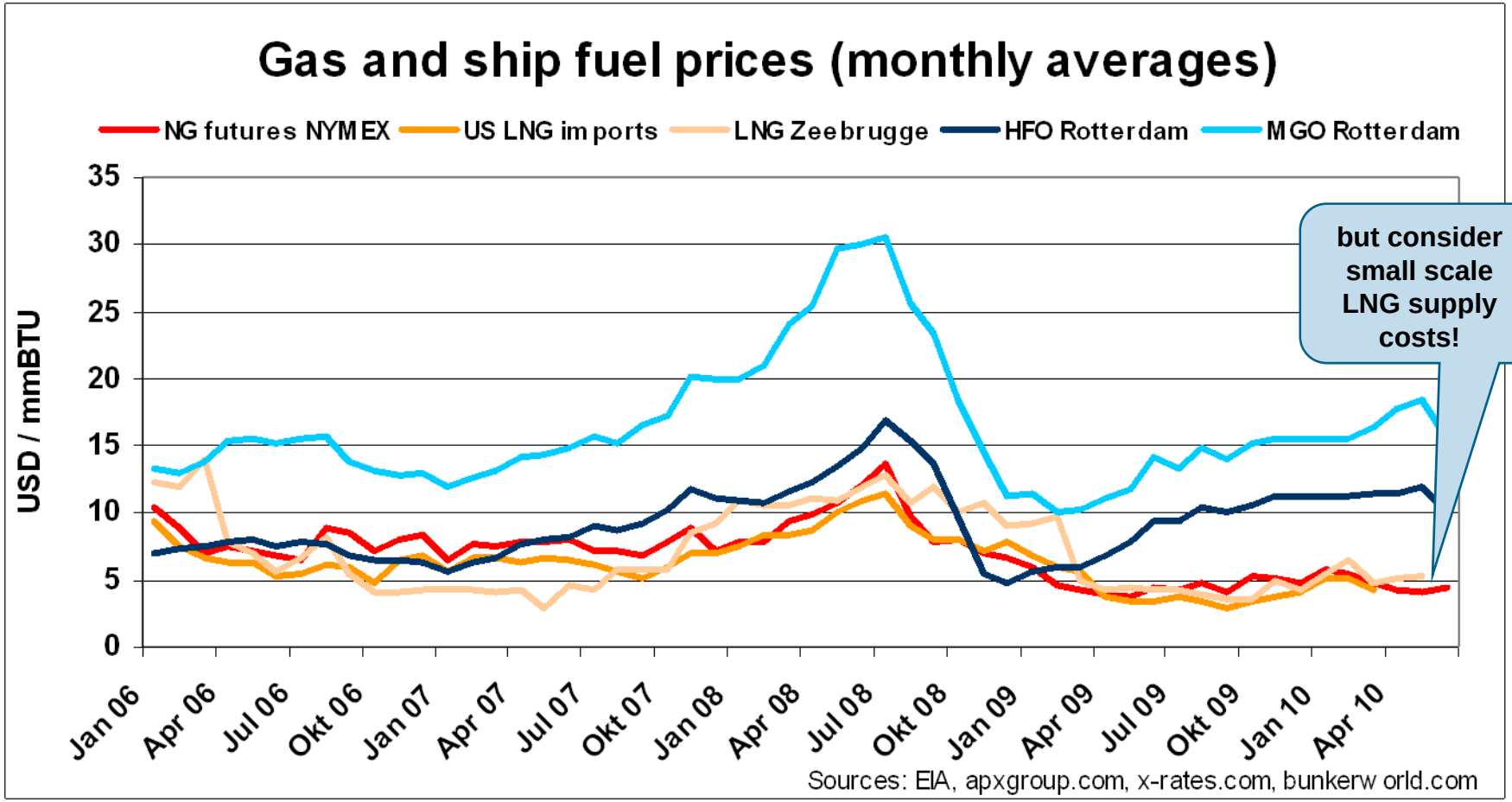
Propulsion by Solar Power

HFO versus LNG



- Pressure tanks type C, maintain pressure using boiler
- Sealed tank space, no pumps inside, no access during operation
- Gas preparation with LT-cooling water in separate room
- Emergency venting t.b.d.
- Minimum distance to outer hull: 760mm

Historic records of fuel prices



NG: Natural Gas, LNG: Liquefied NG, HFO: heavy fuel oil (IFO 380), MGO: marine gas oil, BTU: British thermal Unit = 1,06 kJ

Ship Design - Best Relation

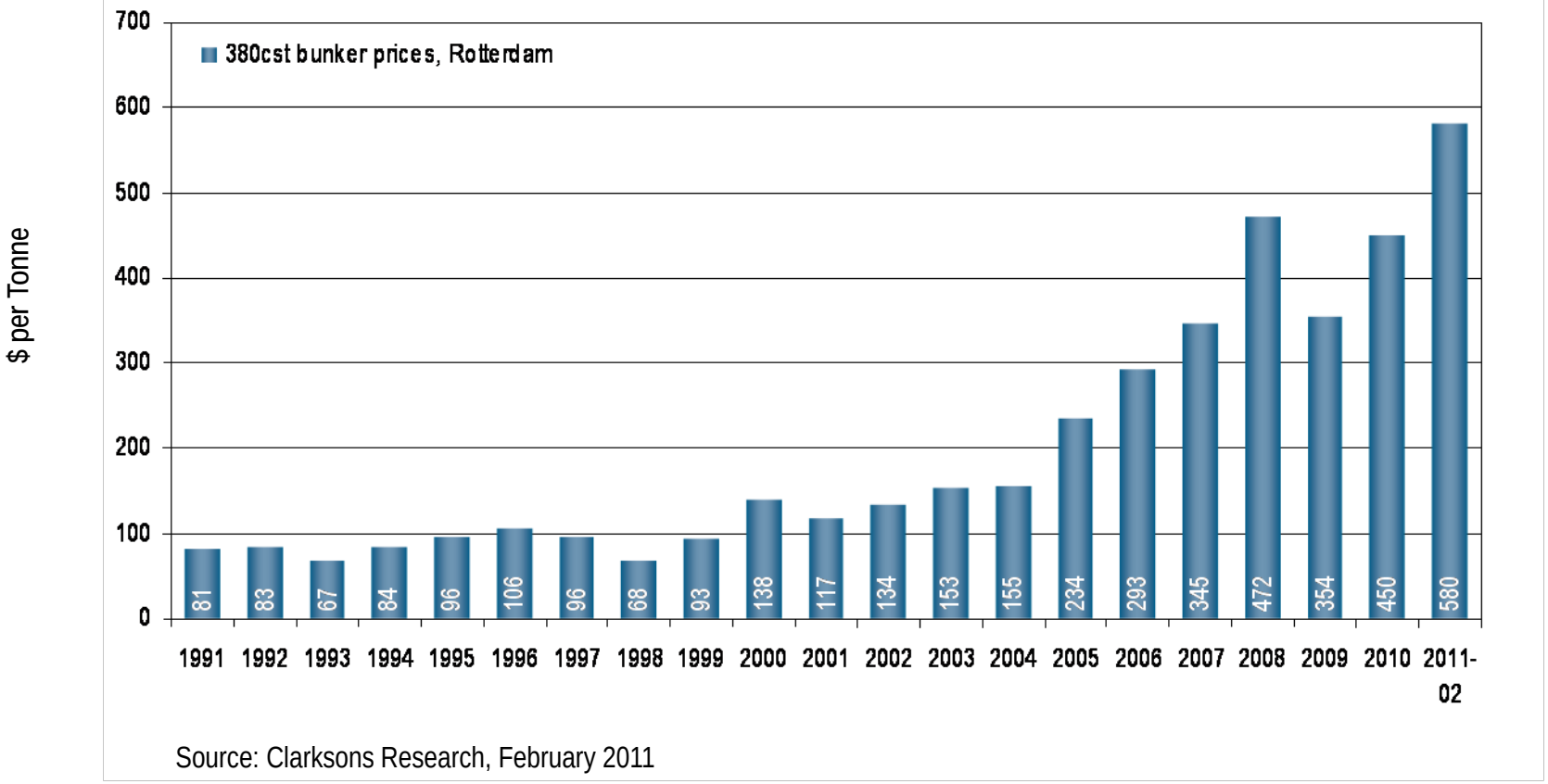
Load Optimization

Energy Consumption

http://www.omega-ems.com/images/13635-Hvad-skal-maales---UK.gif

Fuel Oil Prices

Bunker 380 cst, Rotterdam
Yearly Average prices, per metric ton



Source: Clarksons Research, February 2011

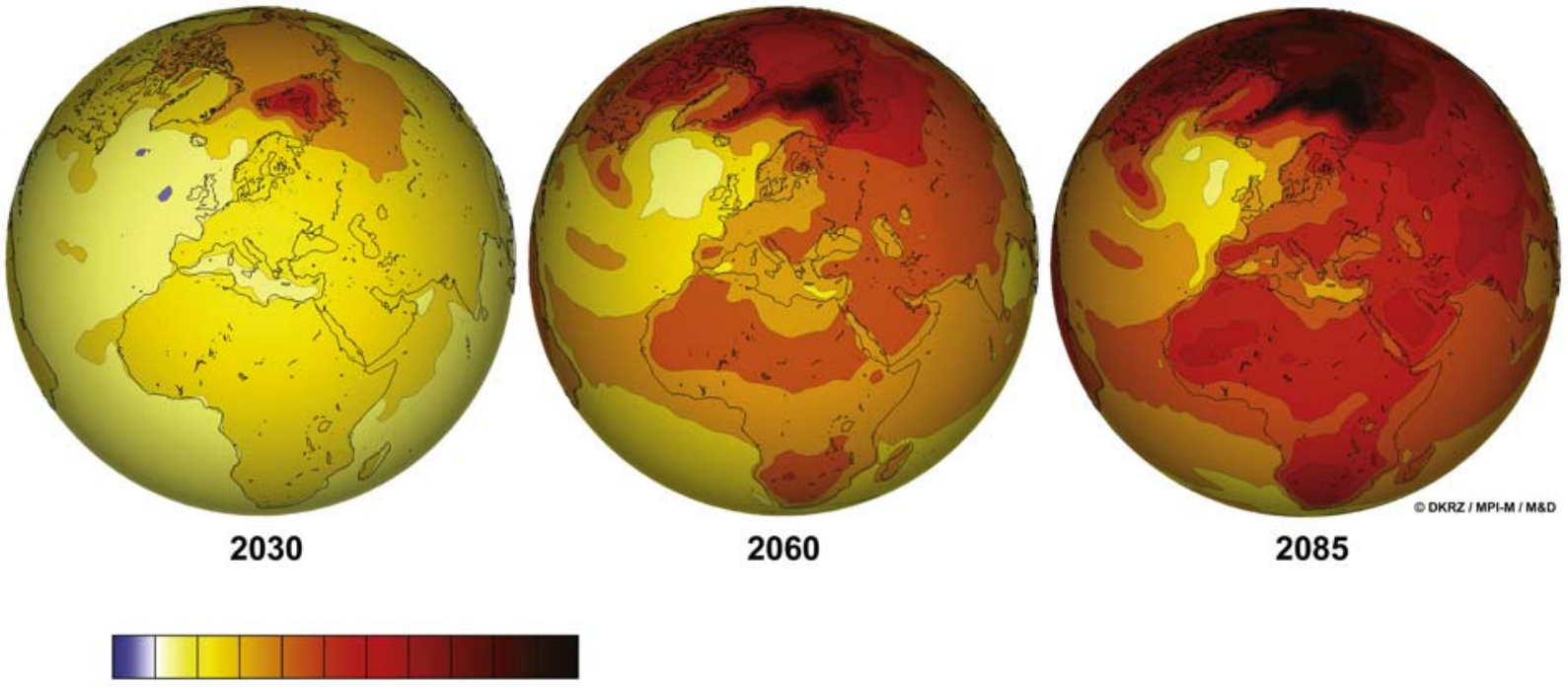
Example 9.000 TEU Container Ship

- ca. 200 t Fuel/Day x 365 Days = 73.000 t Fuel/Year

- 2004: 73.000 t x 150 US$/t = 10,95 Mio US$
- 2007: 73.000 t x 492 US$/t = 35,92 Mio US$
- 2011: 73.000 t x 590 US$/t = 43,01 Mio US$

x 25 Years = 1.077 Mio US$

The future – climate and the environment



Shipping CO_2-emissions in a global context

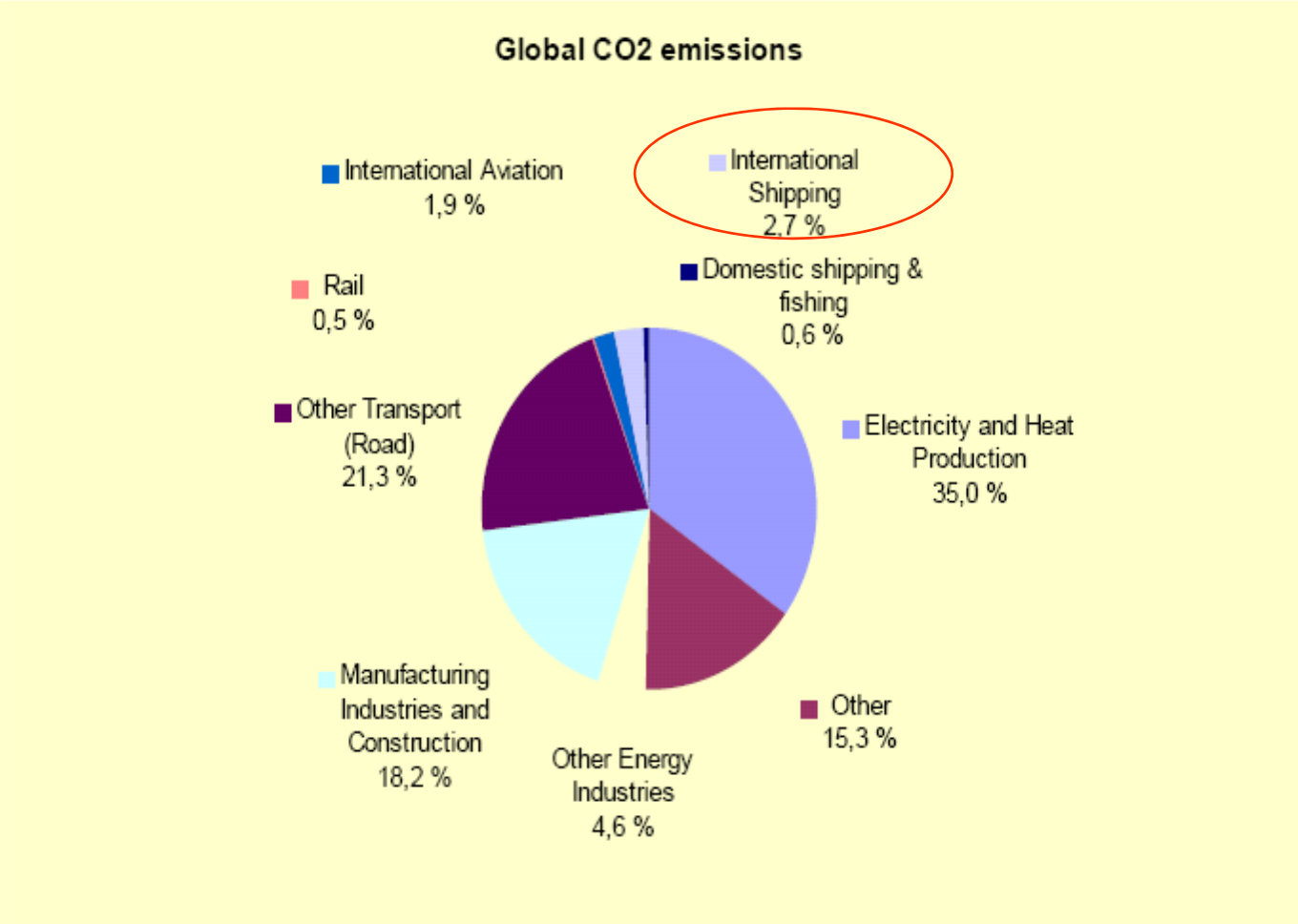


Figure 9-7 – Emissions of CO_2 from shipping compared with global total emissions

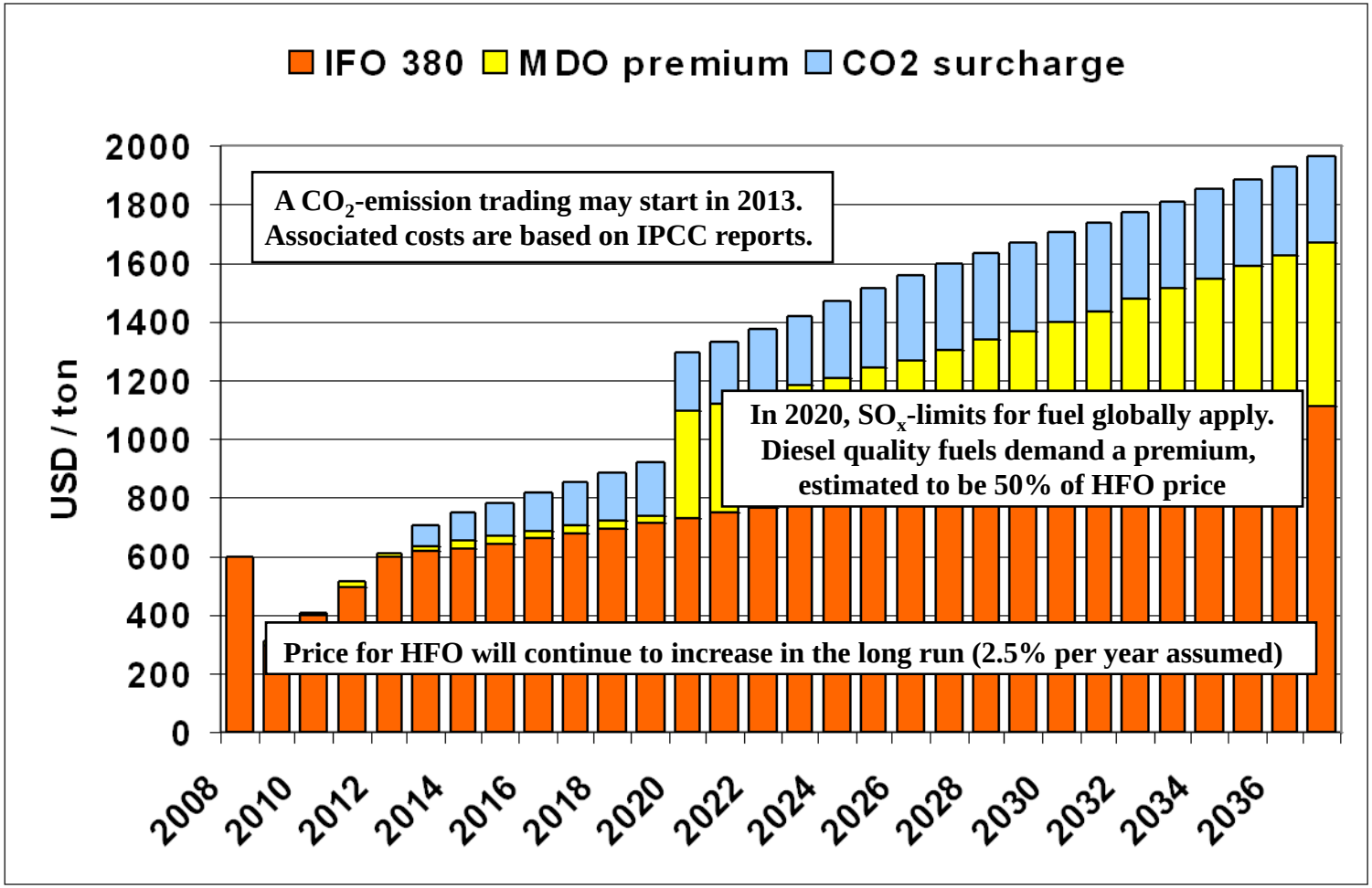
Deforestation contributes by 17% to global GHG emissions

Correlation Fuel Costs and CO_2-Emission

Handelsschiffe nutzen heute meist Heavy Fuel Oil (HFO) als Brennstoff für die Hauptmaschinen.

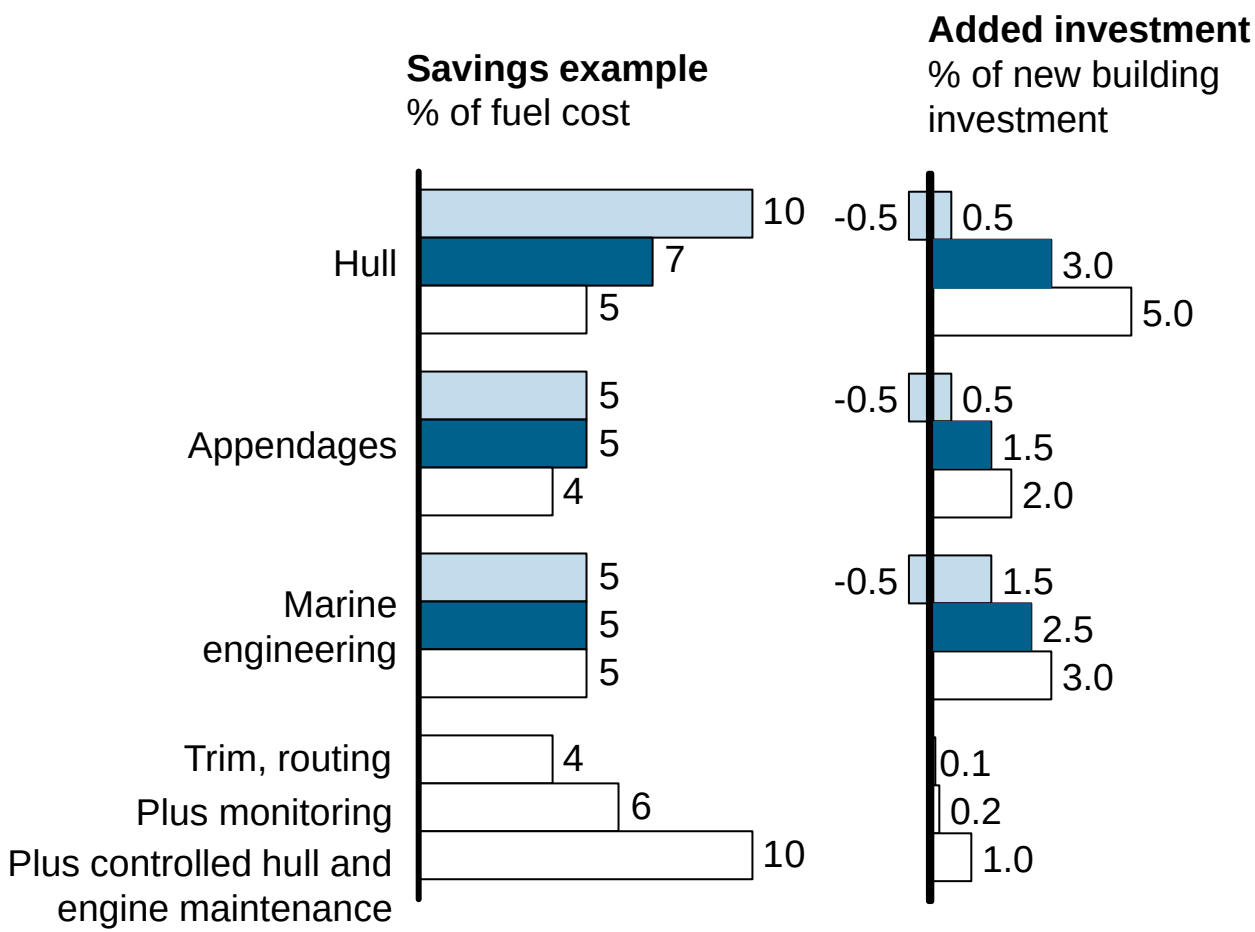
Für HFO mit einem Kohlenstoffmassenanteil von 85% liegt die spezifische CO_2-Emission bei (ca.) 3,114 t / t HFO.

Possible Development of Fuel Costs



Source: GL research. The analysis excludes inflation effects.

Opportunity for Savings



- Figures are indicative and cannot be added
- Savings depend on original design and operational environment
- Particularly high potential after change of operations (e.g. after speed reduction)

Source: GL research and GL analysis

Options for Improvement

green digits – new building
red digits – ship in service

Fluid dynamics

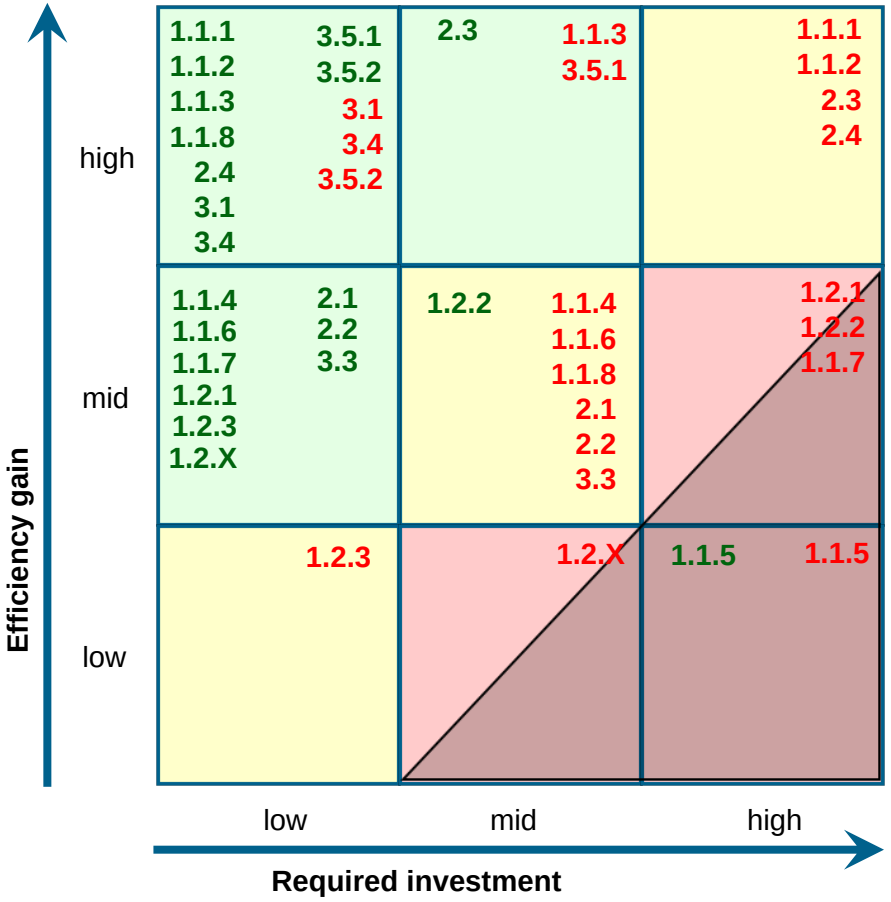
1.1.1	Main dimensions
1.1.2	Lines
1.1.3	Bulbous bow
1.1.4	Coating
1.1.5	Windage
1.1.6	Alignment of appendages
1.1.7	Rudder
1.1.8	Sea margin
1.2.1	Propeller tip
1.2.2	CRP
1.2.3	PBCF
1.2.X	PID

Systems

2.1	Periphery systems
2.2	Other e-driven systems
2.3	Additional energy sources
2.4	Main/Aux Engines

Operations

3.1	Trim & Draft
3.2	Level speed during voyage
3.3	Routing
3.4	Awareness
3.5.1	Hull maintenance
3.5.2	Engine maintenance

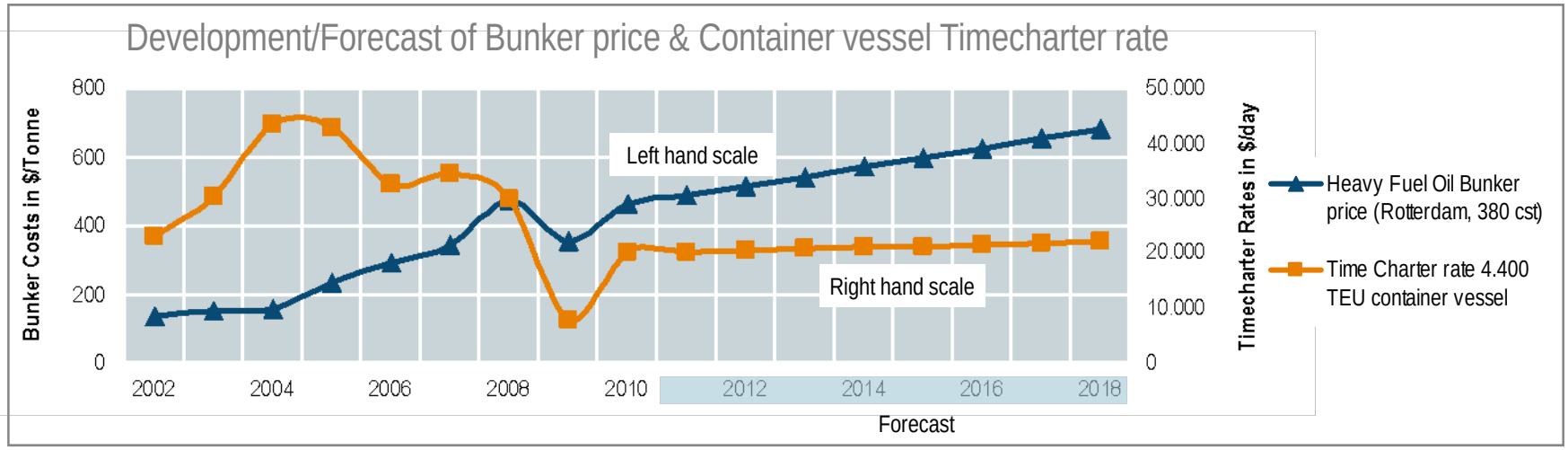


Benefits for the Investor

	Operator	Owner	Designer	Financer
1 Competitive advantage	⇧	⇧	⇧	⇧
2 Resale value	⇧	⇧		⇧
3 High return on investment	⇧	⇧		
4 Fuel saving	⇧			
5 Higher charter rates		⇧		
6 Easier/cheaper financing	↗	↗		⇧
7 Green image	⇧	⇧	⇧	⇧
8 Crewing (noise, vibration)	↗			
9 Maintenance monitoring	↗			

Applicability of criteria: ⇧ high ↗ medium

4.400 TEU Container Vessels – Fuel Efficiency



	2002	2010	2018
Fuel costs*	17.500	40.500	60.000
1 yr charter rate $/day	23.125	20.000	22.000
Ratio fuel costs / charter rate	0,75	2,0	2,7
Efficiency improvement**	10%	10%	10%
Daily total savings*** [in US$]	1.750	4.000	6.000
Yearly total savings*** [in US$]	500.000	1.200.000	1.800.000
Daily savings in % of charter rate	7,5%	20%	27%

* Assumptions for bunker consumption, vessel speed and sailing days per year: 130 tonnes per day/24 knots/300 days (2002), 88 tonnes per day/21 knots/300 days (2010), 88 tonnes per day/21 knots/300 days (2018).

** Estimated reduction of HFO Bunker consumption, based on GL efficiency products/services.

*** Savings due to a decrease of yearly fuel costs.

Content

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Key success factors:

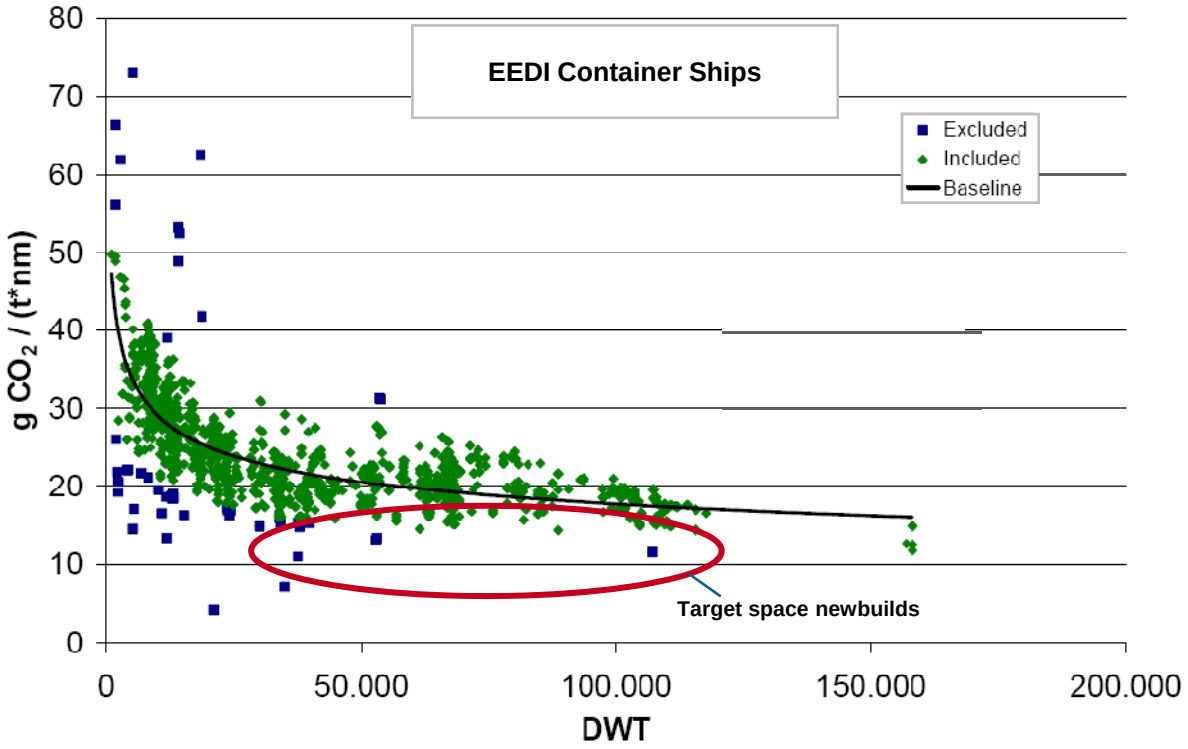
Design optimisation

Efficiency

Minimizing costs

- Design will be a key lever and future ships can be expected to be significantly more efficient and thus competitive than those designed in the past and sailing today. Comprehensive/holistic solutions are required to achieve significant improvements
- An additional cost-reduction potential of 5 - 15% can be generated through FutureShip's operations oriented tools – focusing on fuel efficiency – without impacting the operational profile of a vessel
- In an increasingly competitive industry, minimizing bunker costs will be a key success factor. Slow steaming has been a first step but will not be sufficient moving forward

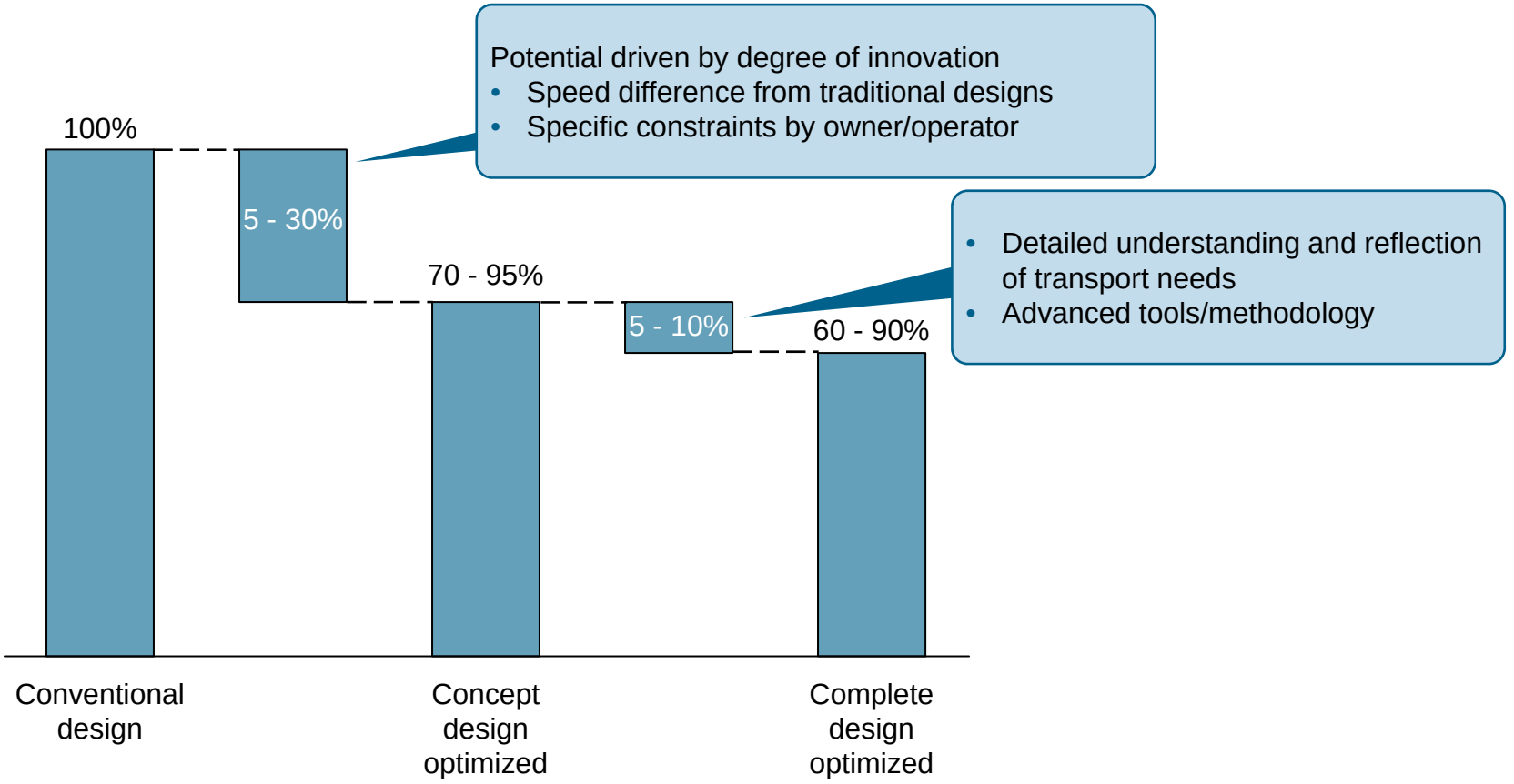
Newbuilding concepts need to target superior efficiency to achieve sustainable competitiveness



- Already significant differences in efficiency between similar ships today
- Superior designs with lower EEDI resulting into lower costs and improved competitive-ness

2-step systematic optimization of new design

– Reduction Cost/'000 container miles –



Reference Case "ECO Solutions“ / Schulte, 9.000 Teu vessel

BERNHARD SCHULTE
SHIP OWNING & SHIP MANAGEMENT

COSTAMARE Inc.

Client’s starting point

- Shipping companies Bernhard Schulte and Costamare ordered container vessels at a Chinese shipyard
- The original design of the hull lines was performed by a major Chinese ship designer
- In order to increase the vessel’s competitiveness owners decided to subject hull lines to a computational optimisation process aiming on minimization of wave resistance and improved arrangement of propeller and rudder

Our service

- Based on the existing design hull line constraints were agreed with design office
- Hull lines and propulsion arrangement were optimised by means of CFD analysis
- Towing tank tests were performed at HSVA in order to verify the calculated results and to establish a basis for comparison with the original design

Results

- Total resistance could be reduced by more than 10%
- Hereby owners attained the possibility to reduce main engine’s MCR which leads to
  - Daily fuel oil savings of app. 30 tons
  - Lube oil savings of about 30 tons per year
- The optimisation will pay within a period shorter than one month

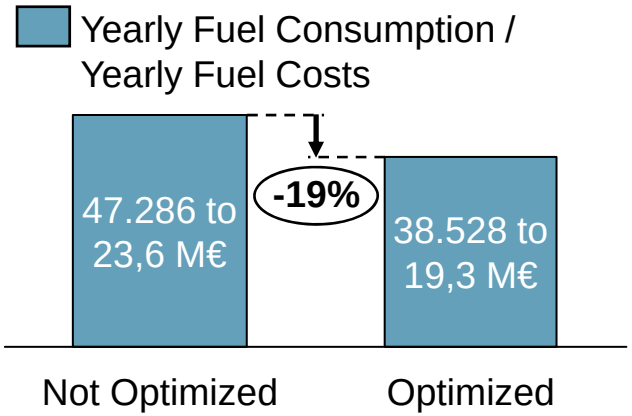
FutureShip
A GL company

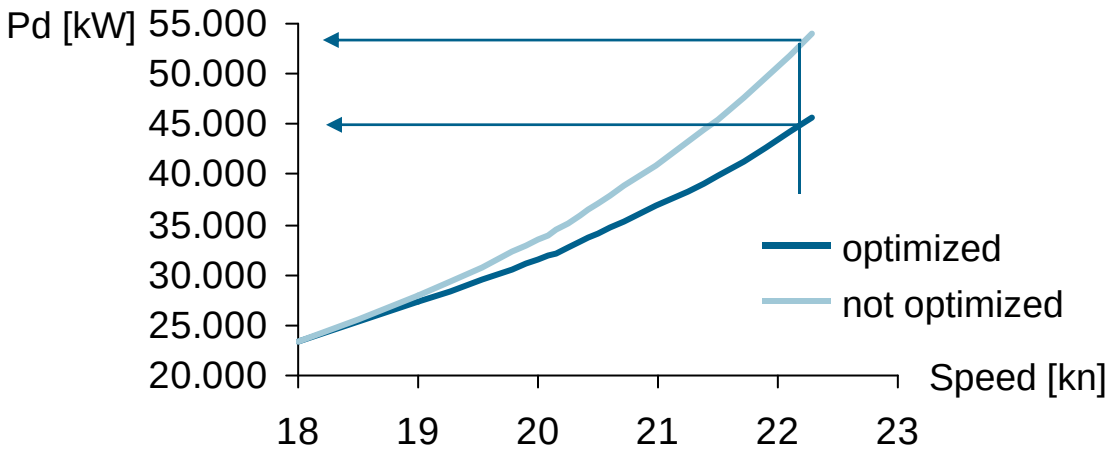
9000TEU Container Vessel

Basic Data

Lpp:	288m
Speed:	22,2kn
Installed Power:	54.180kW

Results





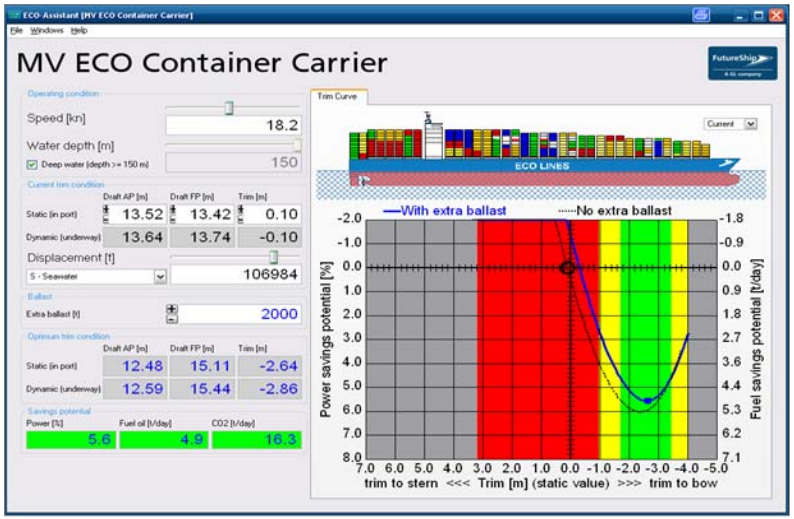
Tank Test Results

Base Line Modell

Post Modell

ECO Assistant: State of the Art Tool

- Key arguments:
  - proposes optimal trim for several thousand operating conditions
  - considers ballast water requirements
  - state of the art methodology
  - no installation needed



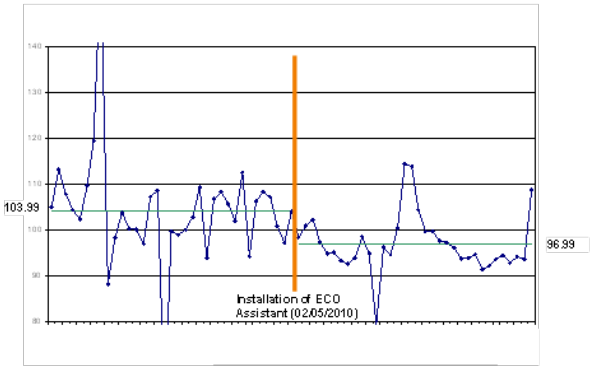
- Benefit: 3-6% documented
- Cost: 45k€ (+20% for sister vessel) – changes upcoming

ECO-Assistant: Fuel saving of 3.4% (respectively 6.7%) verified through 'real' consumption data over 5 month period

Summary

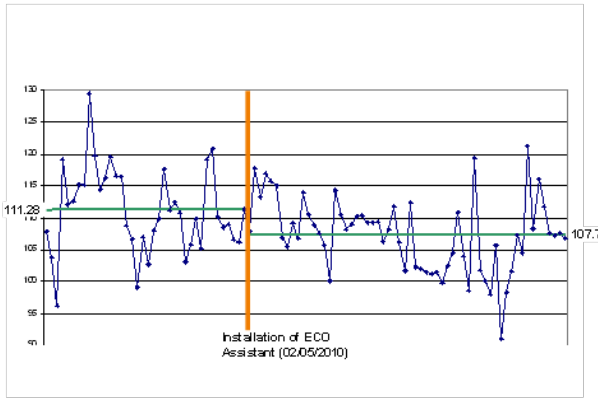
Ballast condition

- 6.7% savings (from 103.99 kg/NM to 96.99 kg/NM)
- Performance speed went up by 0.55kn to 14.83kn



Laden condition

- 3.4% savings (from 111.14 kg/NM to 107.33 kg/NM)
- Performance speed remained constant (13.43 kn, resp. 13.44 kn)



- Consumption could be reduced by 3,4% in laden and 6.7% in ballast condition
- This translates into fuel saving of 340t HFO or $160k per year

Bulk Carrier of >70.000 t cargo deadweight

Thank you for your kind attention!

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