Green shipping– challenges and opportunities from a Danish perspective

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CV

Professional Experiences

- CEO and co-founder. Odense Maritime Technology, Denmark
- CEO and co-founder Valcon Innovation, Denmark
- Industrial Ph.D. program, Odense Steel Shipyard, Denmark

Education

- Ph.D., Mechanical Engineering, Technical University Denmark,
- M.Sc., Mechanical Engineering, Technical University Denmark, Denmark

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Odense Maritime Technology (OMT)

- Odense Maritime Technology (OMT) was established in 2010 as a spinoff from Odense Steel Shipyard.

- OMT given right to use
  - Existing's design projects, predesigns, concept designs
  - Standards, reference data, tanktest, sea trials

- OMT now employ 120 employees in Denmark, China and India.

Intelligent robots

High quality welds

The core of shipbuilding + in service support

E P C O M

E = Engineering

P = Procurement

C = Construction

O = Operation

M = Maintenance

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Development of next generation designs

- SEAHORSE 35 (35,000 DWT)


…. target : reduce energy consumption per transported cargo unit


Retrofit

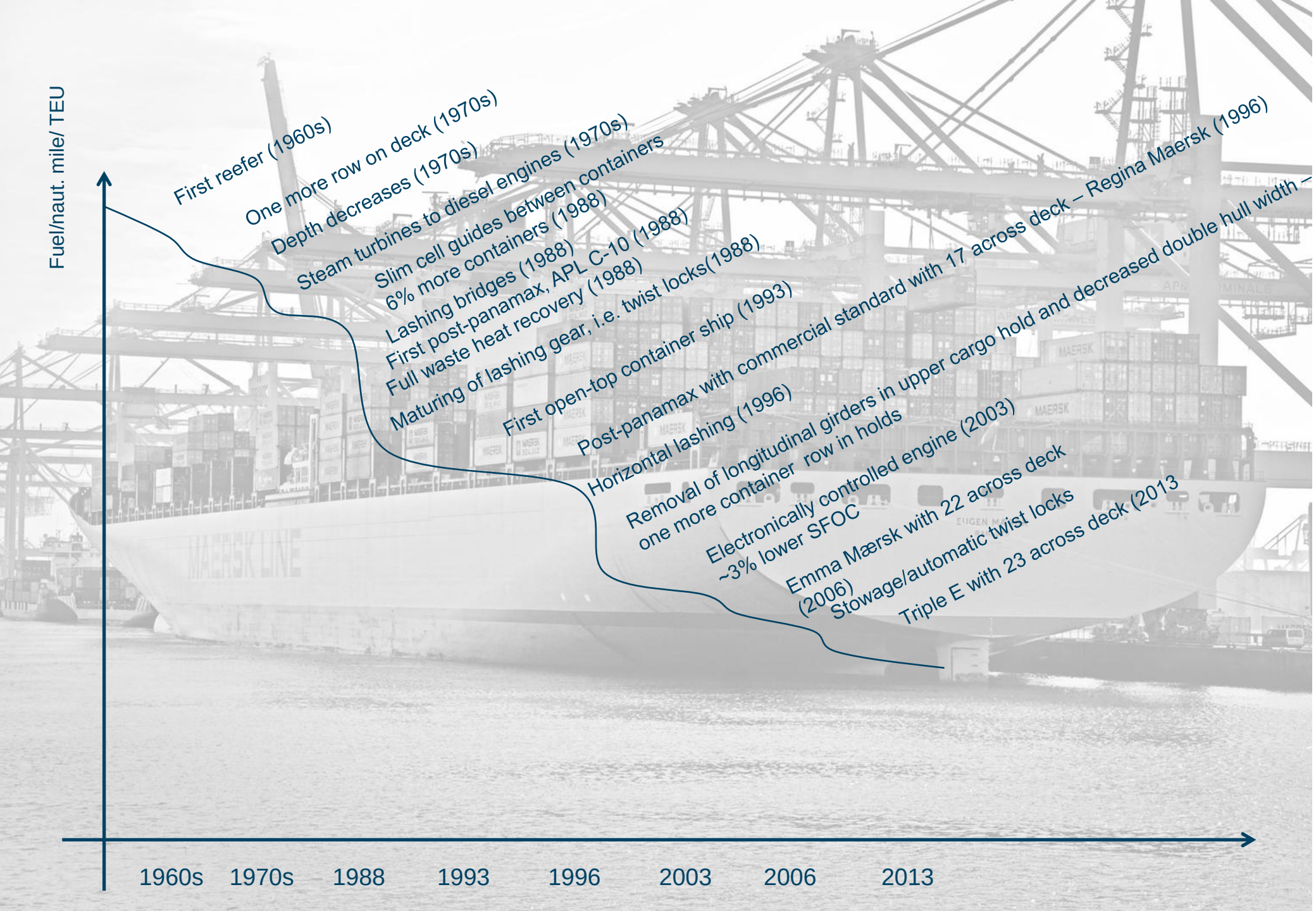
Polarcus Retrofit with twin fin propulsion: 30% fuel efficiency improvement & improved reliability

Global export has increased a lot

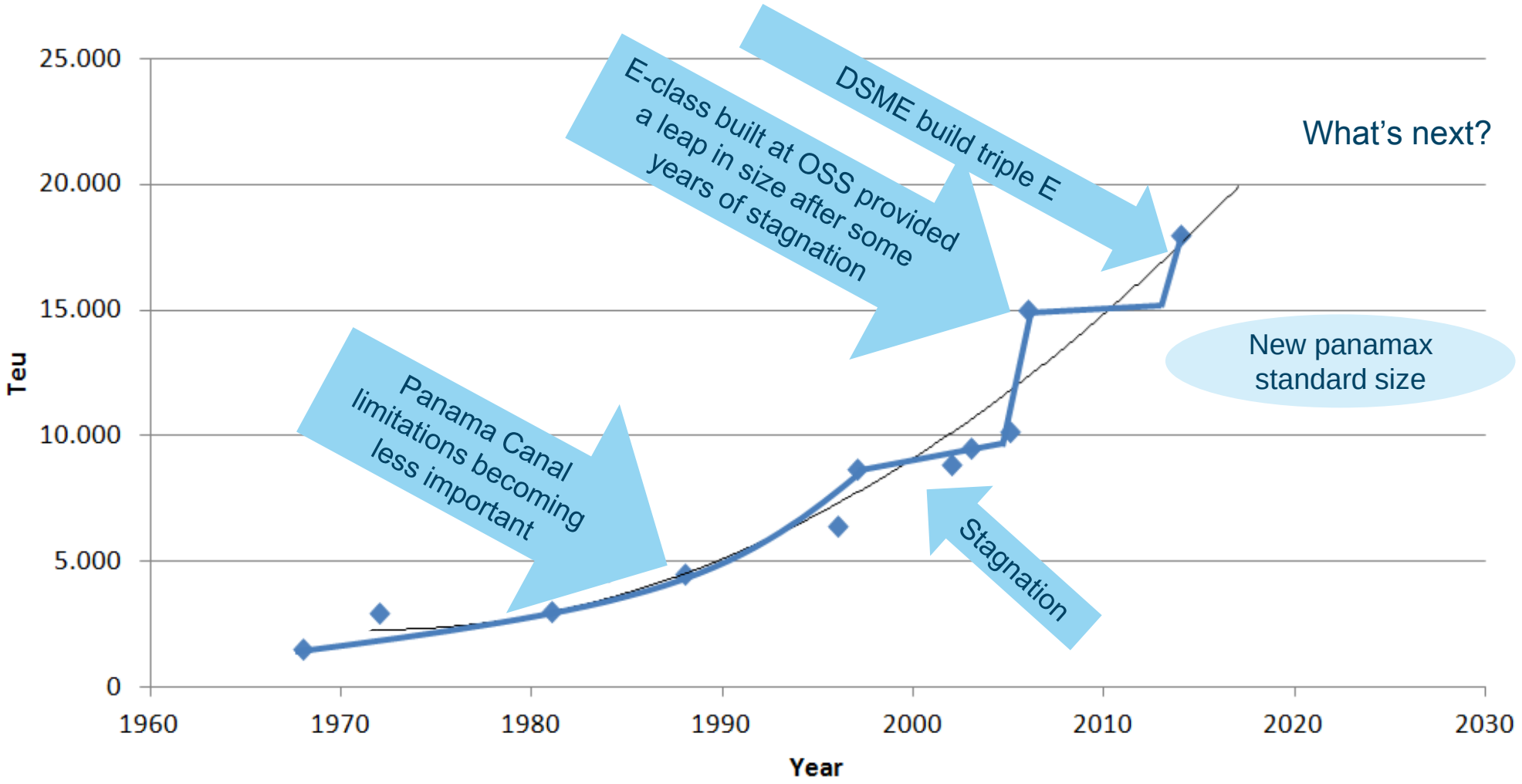
- Since 1970 the global export of food, clothes, electronics, and vehicles has increased from 1.8 billion USD to 12.4 billion USD in 2010.
- Containerized shipping has been a major factor enabling this development.
- The CO2 footprint per transported container has in this period been reduced significantly.
- The development of the intermodal transportation concept has certainly contributed to green shipping.

The innovation of the low-tech container has done more for global trade than anything else [Søren Skou]


MAERSK LINE
EUGEN MÆRSK
RANDERS
MAERSK
APM TERMINALS


Fuel/naut. mile/ TEU
First reefer (1960s)
One more row on deck (1970s)
Depth decreases (1970s)
Steam turbines to diesel engines (1970s)
Slim cell guides between containers
6% more containers (1988)
Lashing bridges (1988)
First post-panamax, APL C-10 (1988)
Full waste heat recovery (1988)
Maturing of lashing gear, i.e. twist locks(1988)
First open-top container ship (1993)
Post-panamax with commercial standard with 17 across deck – Regina Maersk (1996)
Horizontal lashing (1996)
Removal of longitudinal girders in upper cargo hold and decreased double hull width –
one more container row in holds
Electronically controlled engine (2003)
~3% lower SFOC
Emma Mærsk with 22 across deck
(2006)
Stowage/automatic twist locks
Triple E with 23 across deck (2013
1960s
1970s
1988
1993
1996
2003
2006
2013

Trend for container ship sizes



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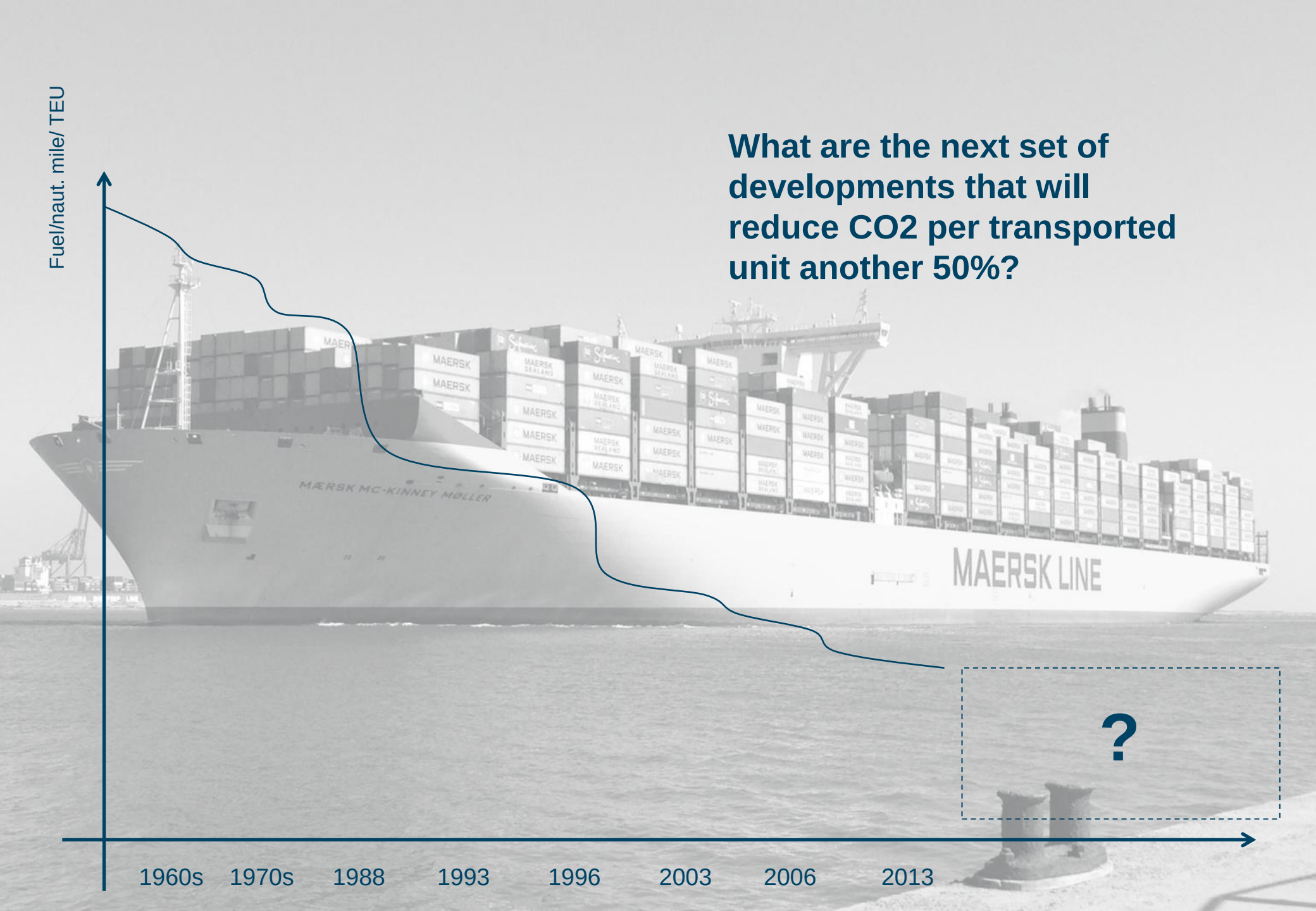
Triple E – but what's next?


Fuel/naut. mile/ TEU
What are the next set of developments that will reduce CO2 per transported unit another 50%?
?
1960s
1970s
1988
1993
1996
2003
2006
2013
MAERSK
MAERSK LINE
MÆRSK MC-KINNEY MØLLER

Risk for stagnation at 21- 22,000 TEU

Technical

- Strength of containers limited to 86.4 t/corner – upgrade not possible due to large number of containers in service
- Increased beam of ship provides too much stability → large roll options
- Strength of ship
- Speed/propulsion line

Infrastructure

- Shore terminal crane outreach limited in terminals, especially outside the major terminals
- Port and canal restrictions

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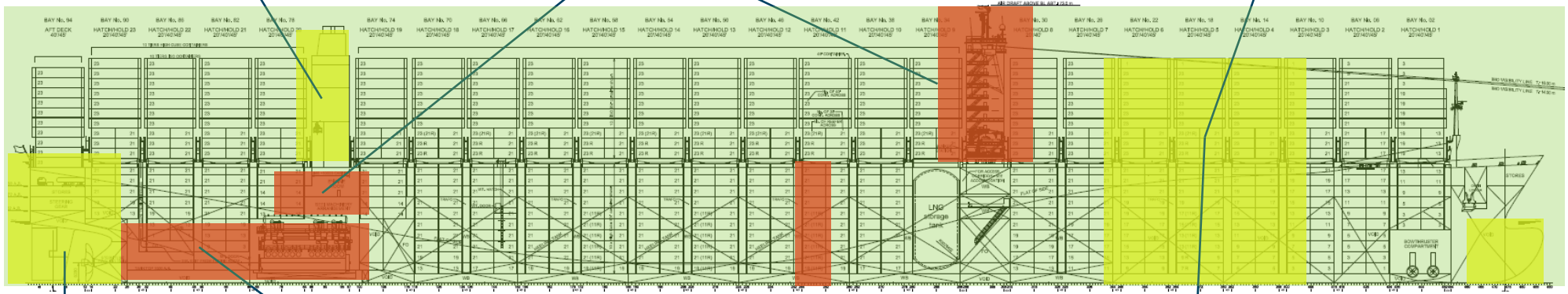
Bill of Energy can be further reduced

Waste heat recovery system for Slow steaming

Reduction of energy consumption in auxiliary system

Higher pay load percentage. Lashing systems and systems to reduce rolling



Energy saving devices, rudders and propellers

Drive trains allowing good fuel economy in a broader speed range

Reefer cooling

New loading and unloading concepts

Further hull form optimization

Emissions – large cost for sure – but what about enforcement ?

- Green shipping is also a matter of NOx and SOx emissions.
- Scrubber Technologies to deal with SOx requirements are ready …… but they are expensive.
- After engine treatment systems to deal with the NOX requirements are ready – but are also expensive.
- Problem - weak or non-existent enforcement of the regulations.
- Temptation: Run on the cheaper, high-sulphur fuel oil instead of the expensive low-sulphur fuel required to meet the standards.

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Can we learn from other industries?

- Wind turbine Industry is younger.
- The drive train, pitch technology and software in these products have undergone a lot of development in recent years to generate more energy with less hardware.
- The drive trains concept developed for this industry is far more advanced compared to what we have seen in shipbuilding.
- A general reflection - it might be worth to explore whether there are green technologies developed for another purposes that can be applied into ships.

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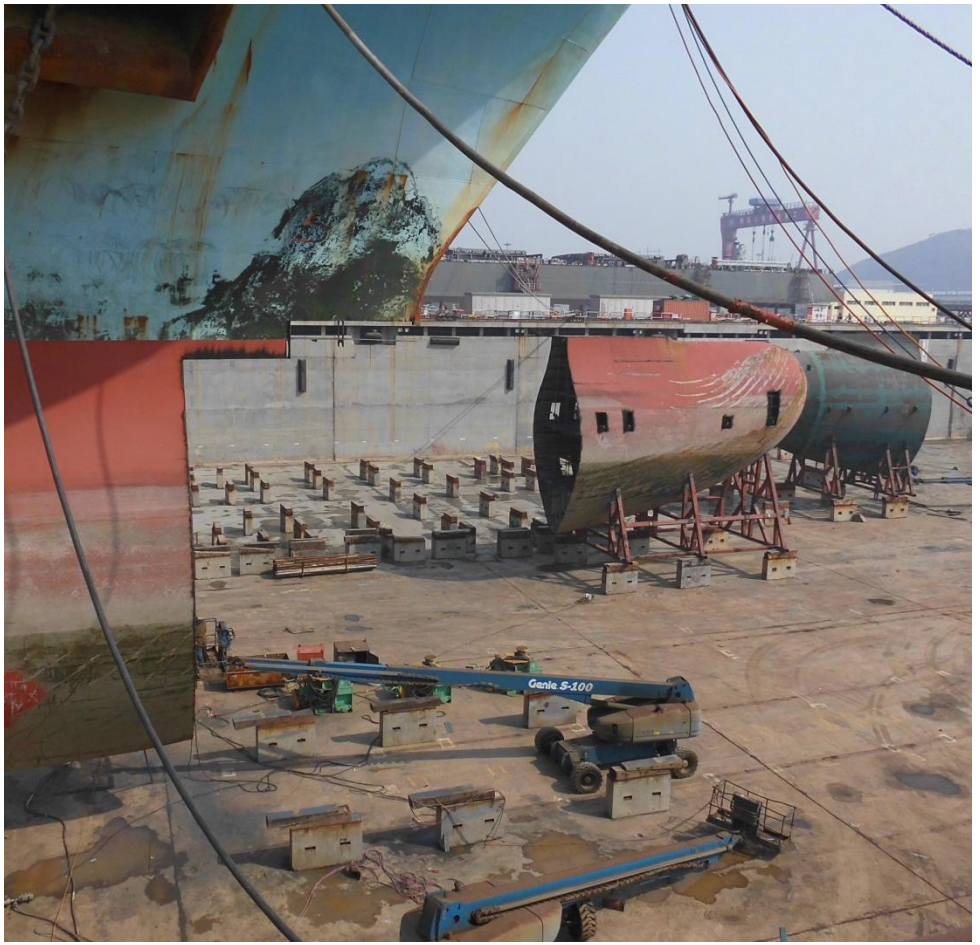
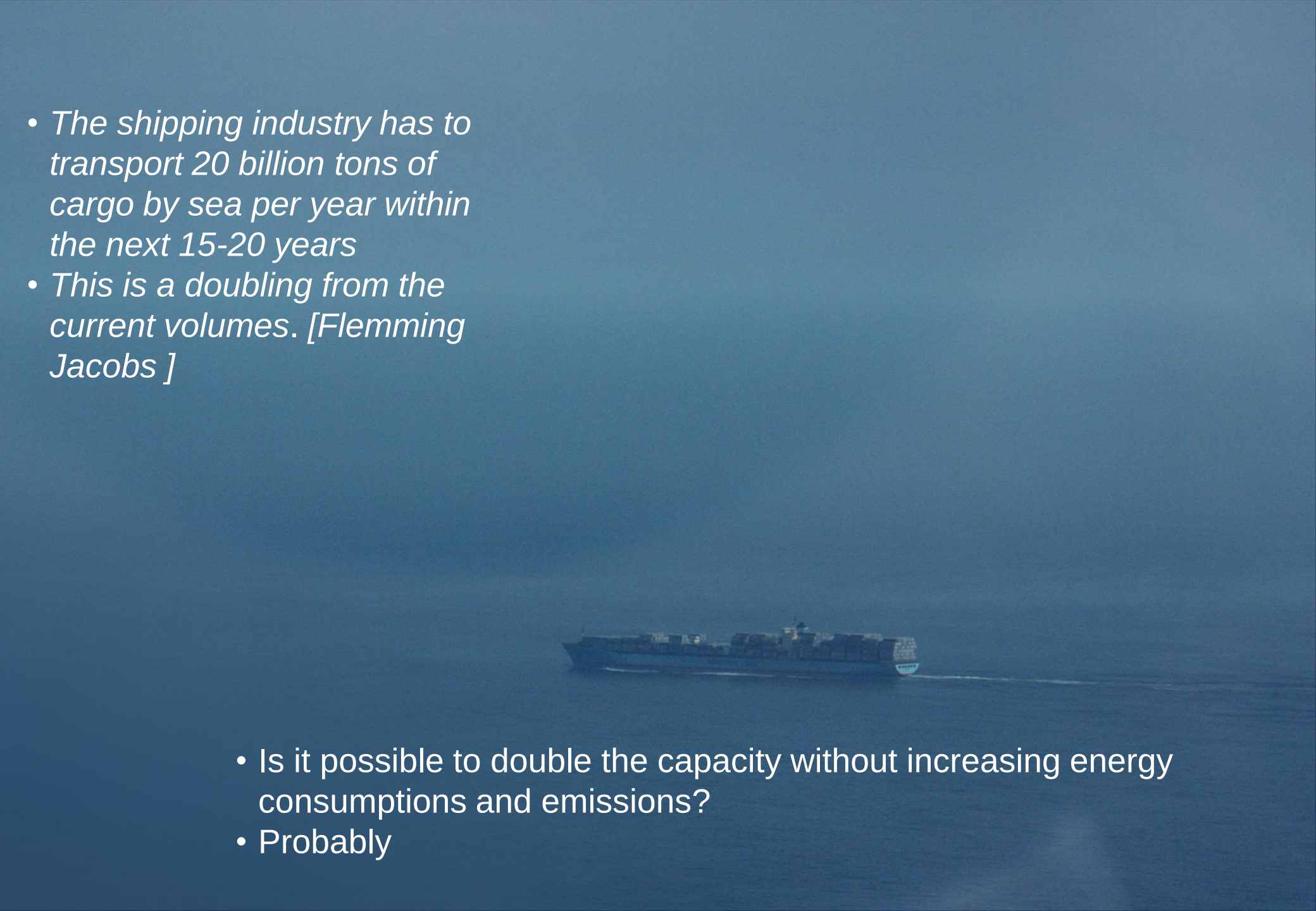
More retrofit is needed

- New green technologies and solutions should not only target newbuilding.
- The biggest immediate potential for energy saving per transported unit is not related to the ships we build next year but is related to the ships we have built in the last 10 - 15 years.
- Setting up and delivering ship life cycle management concepts as a technical support service might be a green solution that can save more energy globally than even the best idea targeting newbuildings.



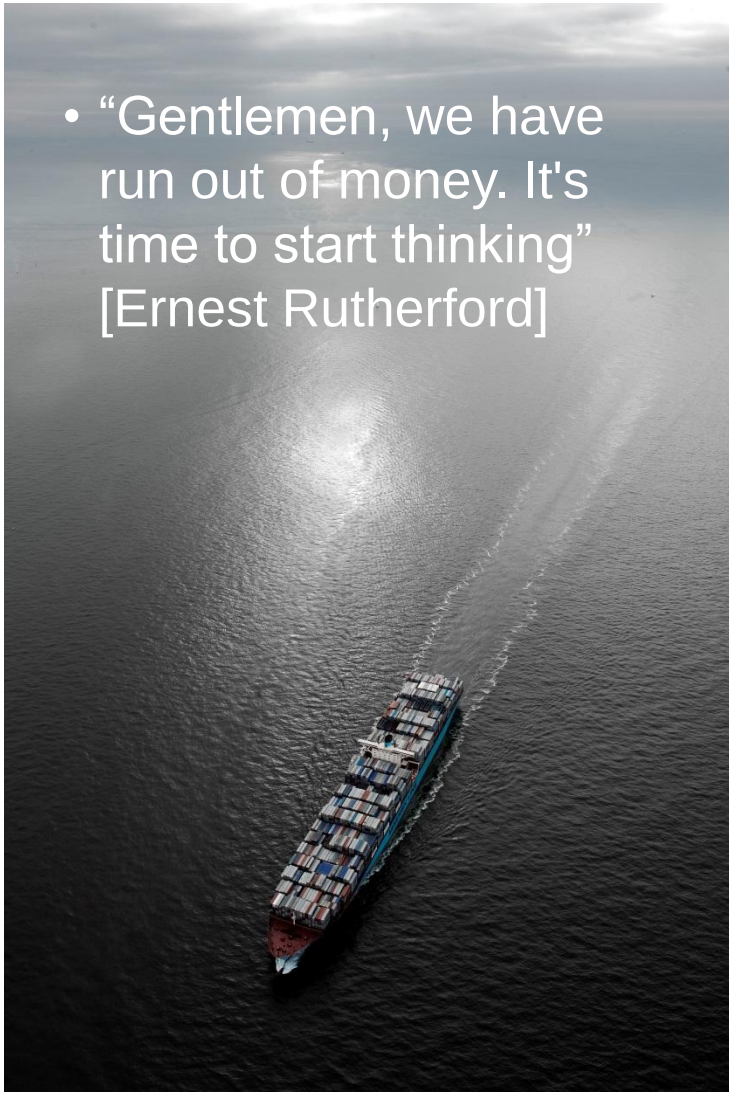


- *The shipping industry has to transport 20 billion tons of cargo by sea per year within the next 15-20 years*
- *This is a doubling from the current volumes. [Flemming Jacobs]*

- Is it possible to double the capacity without increasing energy consumptions and emissions?
- Probably

Industry Challenges

- The shipping companies and the shipbuilding industry have created a lot of value to the global community by making global trade/commerce affordable.
- However, neither shipyards nor shipping companies have delivered a return on invested capital that is acceptable to shareholders.
- ROIC below 5% as we have seen for many years is simply not good enough.
- It is not acceptable to shareholders long term.



Inspiration – Star Alliance

From project to product development?

A **product** – design work starts when idea is conceived or need identified
IPR protection

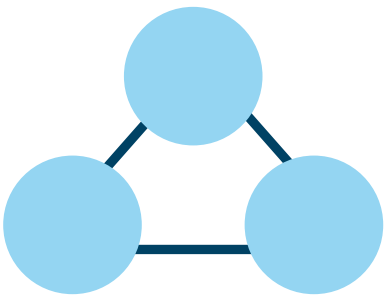
A **project** – design work starts when a customer is prepared to pay for the development
No IPR protection

Challenges

- To ensure sufficient funds and not less experienced engineering capacity to develop the technologies and concepts that can deliver significant improvement to ship performance-

- …… we have to start collaborating more across the regions and utilize the comparative strengths and skills in the various maritime valleys in Europe, Korea, Japan and China.

Operator alliance



Ship product development alliance?

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