Institut für Logistik- & Dienstleistungsmanagement
der FOM University of Applied Sciences

Integrated Sustainability Model Regarding a Technology, Business and Policy Analysis for Ship Propulsion Systems

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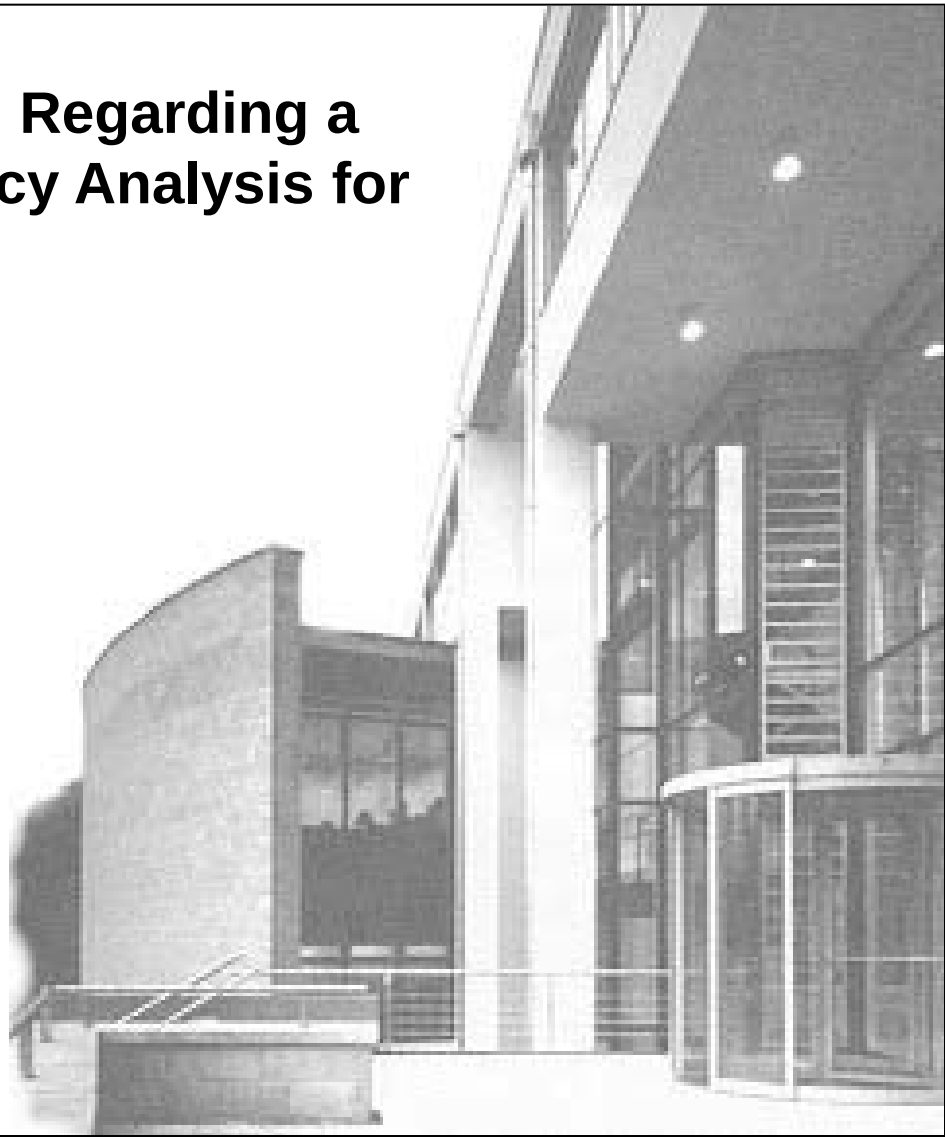
08-09 September 2011
TU Hamburg-Harburg

HICL 2011



Agenda

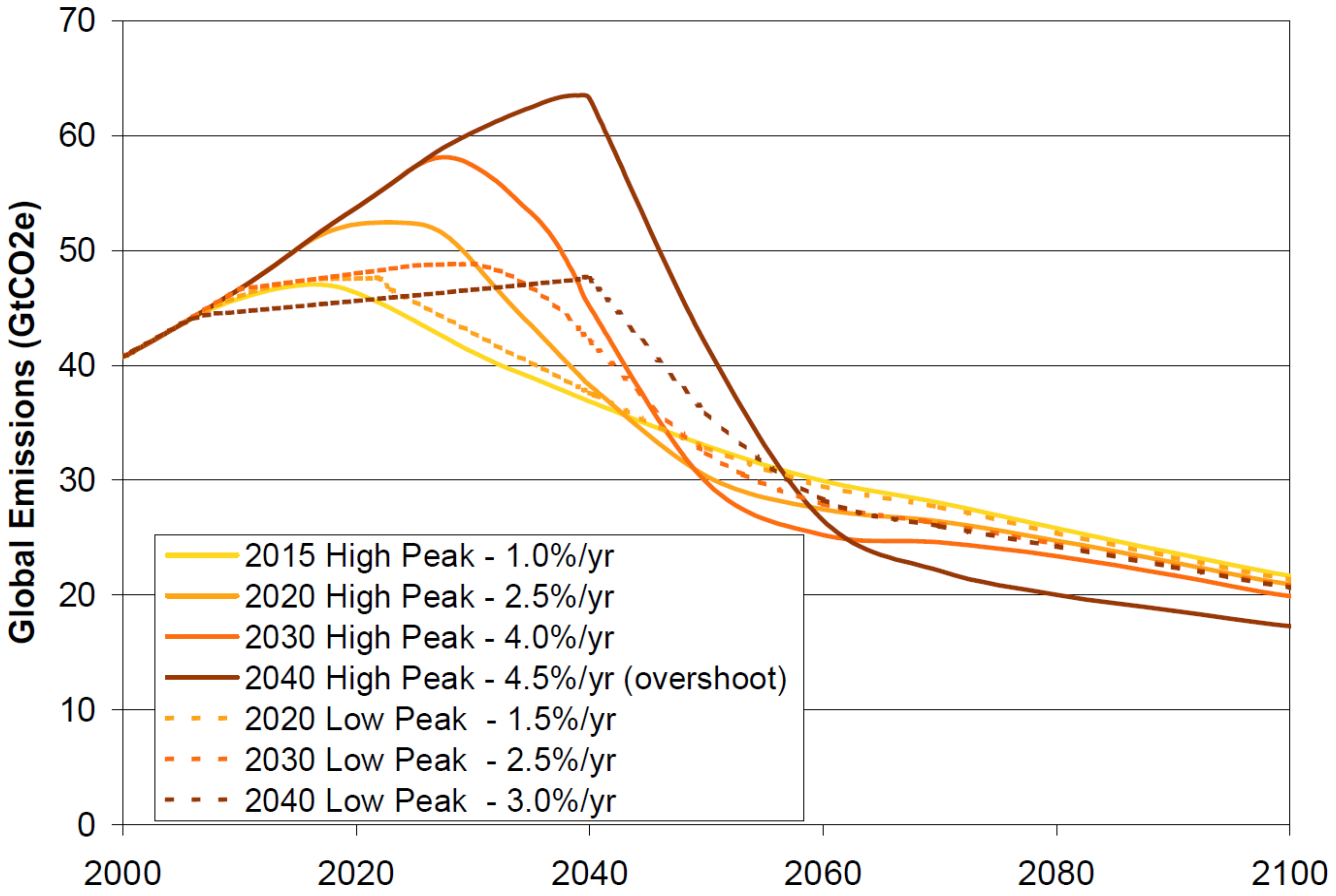
1. Introduction
2. Politics of Carbon Reduction
3. Situation and Outlook in Sea Shipping
4. Carbon Reduction Technologies in Sea Shipping
5. Fleet Replacement Simulation
6. Conclusion

1. Introduction

- Green logistics as major trend driven by politics and customers
- Sea shipping as „backbone“ of world trade and global supply chains
- Energy consumption and emission reduction in sea shipping in discussion and development (IMO)
- *Research question*: How (fast) will fleet renewal lead to political carbon reduction objectives?

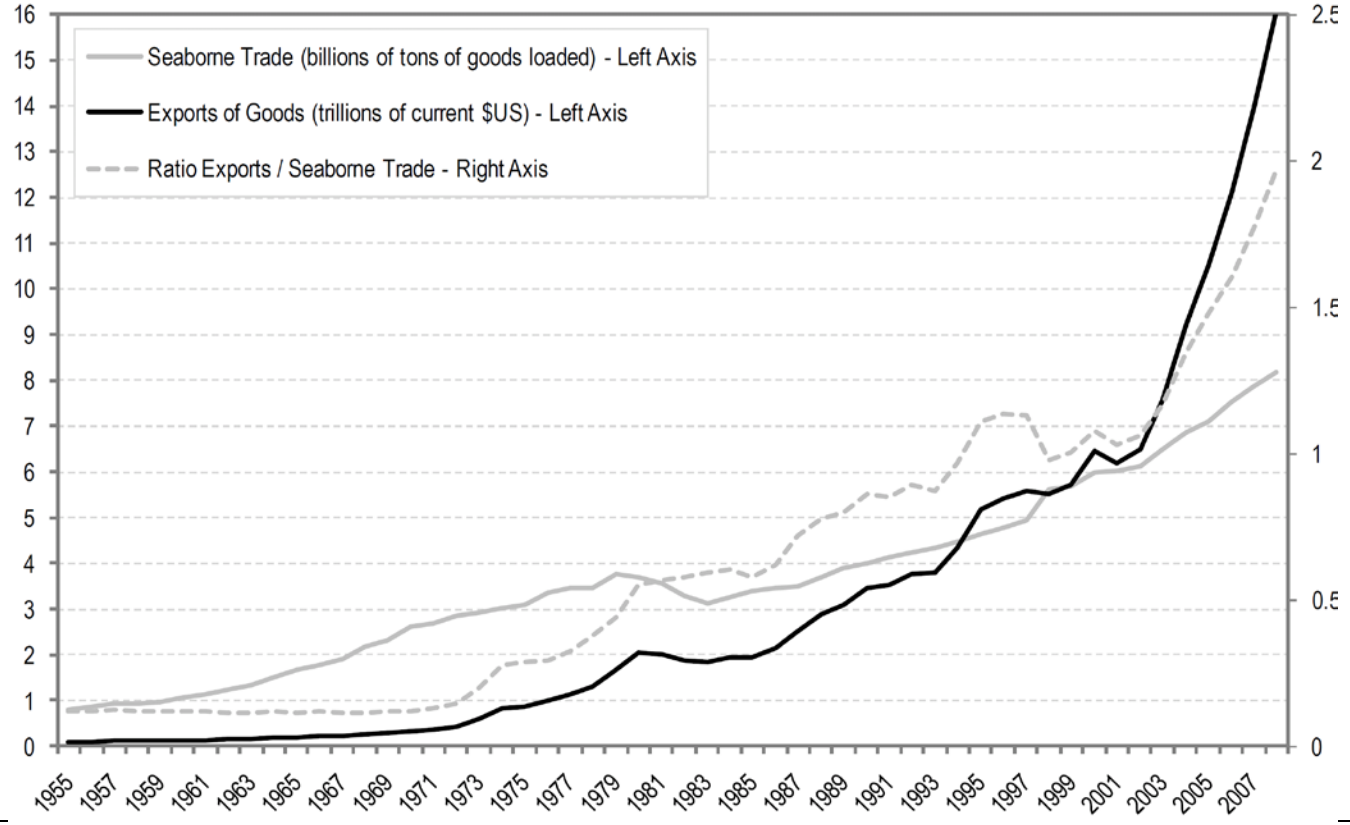
2. Politics of Carbon Reduction

- 2 ° Celsius objective to limit global warming effects



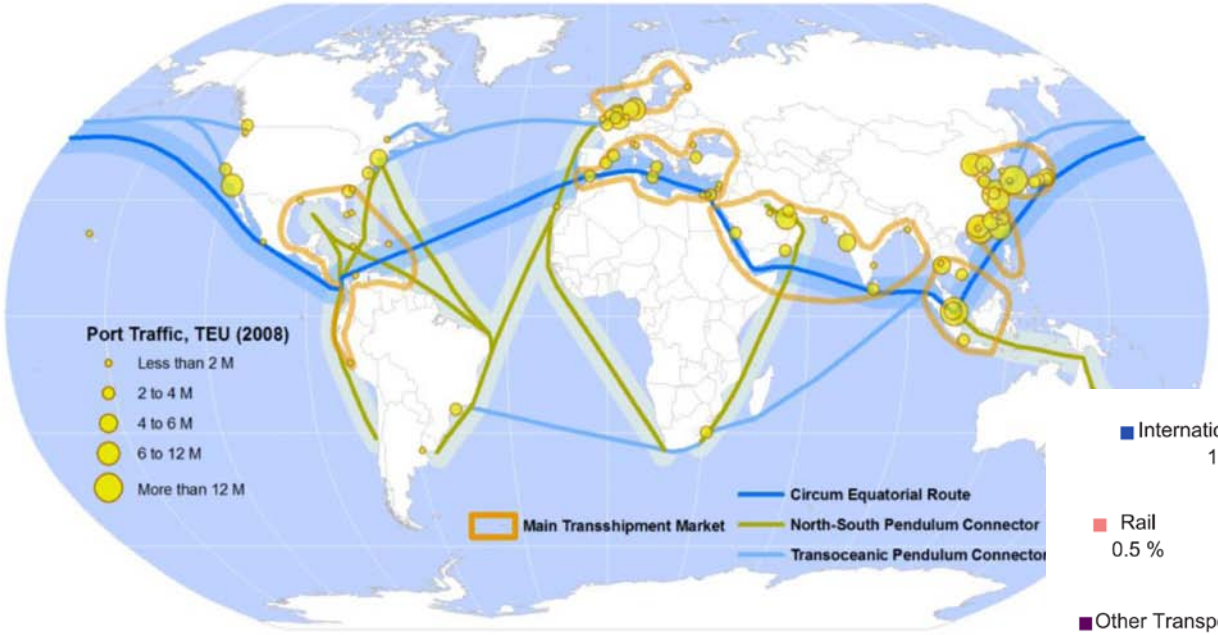
3. Situation Sea Shipping

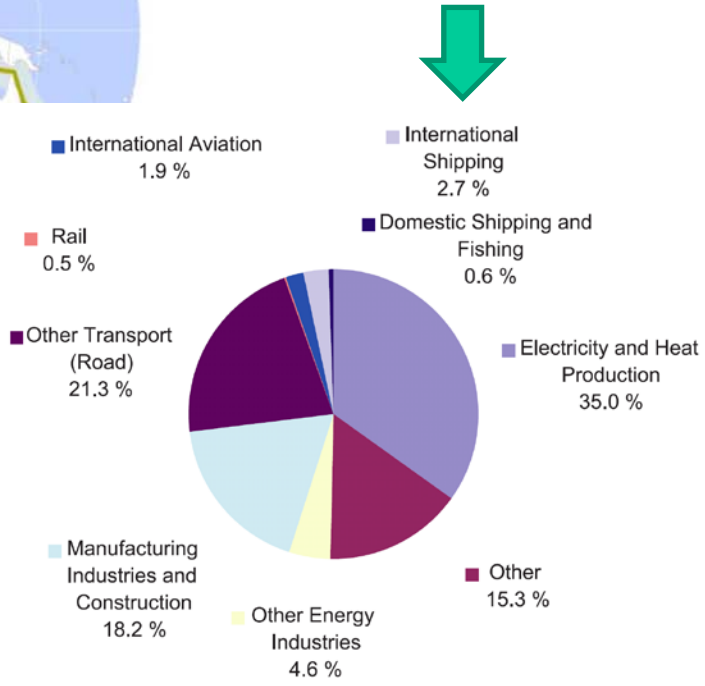
- Main problem green logistics: transport length and volume increase due to globalization, here: sea shipping



3. Situation Sea Shipping

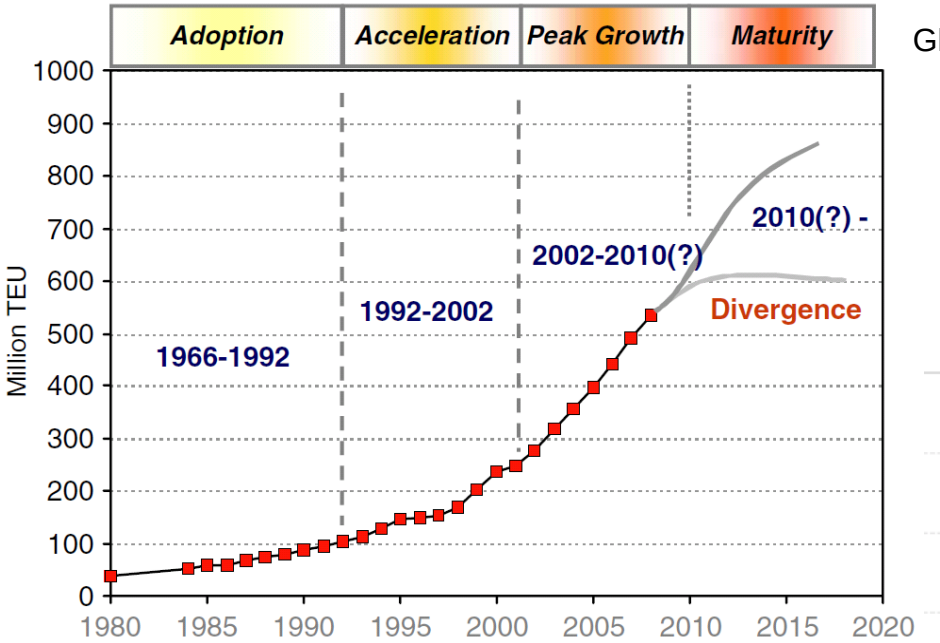
- Global container belt (lines), carbon emissions share



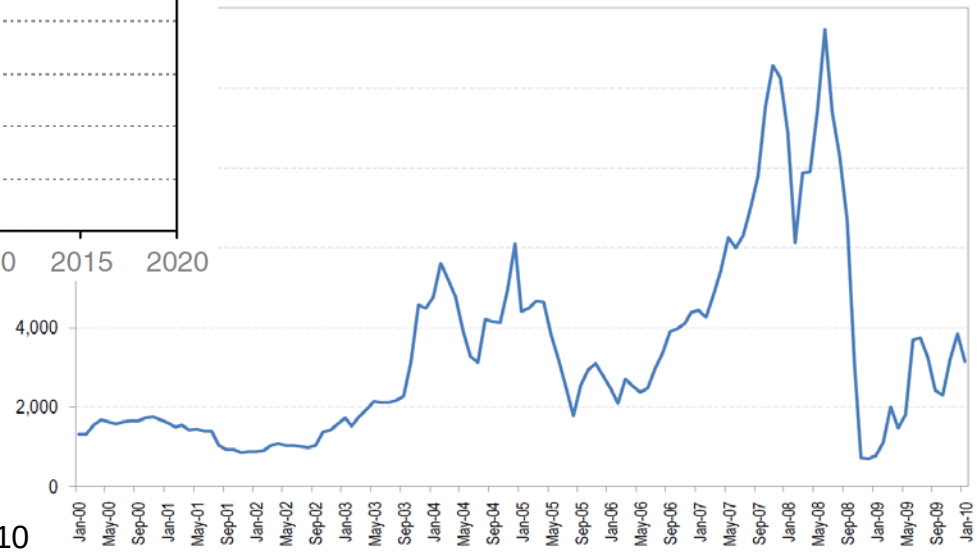


3. Situation Sea Shipping

- Price volatility & scenario divide: investment problem



Global Container Development Prognosis



Baltic Dry Index 2000-2010

4. Carbon Reduction Sea Shipping

- New ship technology with 71% carbon reduction potential

Measure	Average reduction potential	Payback time (years)	Lifetime/frequency of investment
Autopilot upgrade/adjustment	1.75%	0.5	10
Common rail upgrade	0.30%	5	10
Low-energy/low-heat lighting	0.45%	10	10
Main engine tuning	0.45%	10	10
Propeller brushing	3.50%	0.5	1
Propeller performance monitoring	2.25%	0.5	10
Propeller/rudder upgrade	4.00%	10	10
Propeller upgrade (winglet, nozzle)	2.50%	10	10
Speed control pumps and fans	0.60%	10	10
Power management (newbuilds only)	2.25%	10	30
Transverse thruster opening (flow optimization, grids)	3.00%	0.5	10

-21.05%

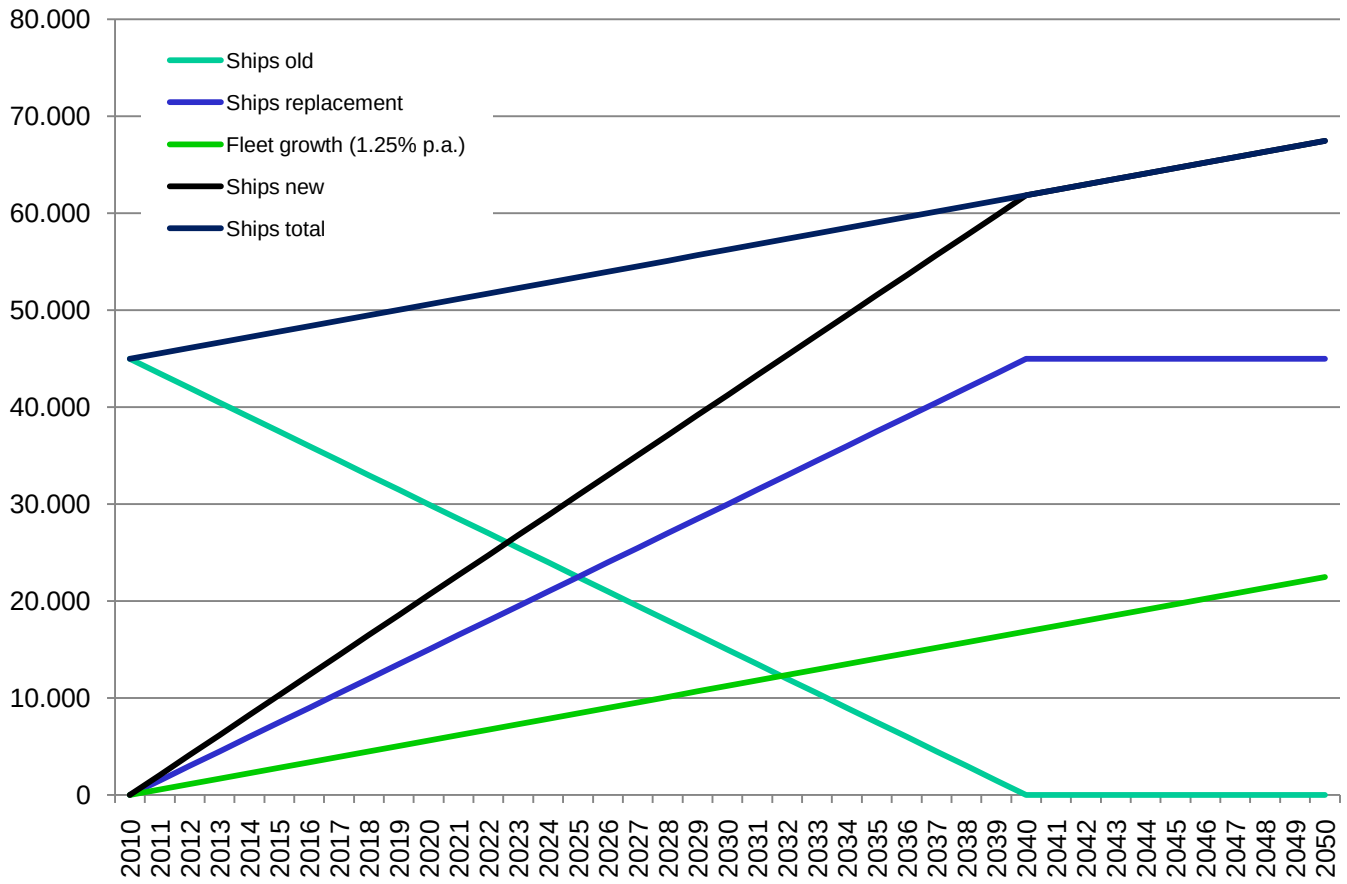
DESIGN (New ships)	Saving (%) of CO_2/tonne-mile	Combined	Combined
Concept, speed and capability	2–50†		
Hull and superstructure	2–20		
Power and propulsion systems	5–15	10–50%†	
Low-carbon fuels	5–15*		
Renewable energy	1–10		
Exhaust gas CO_2 reduction	0		25–75%†
OPERATION (All ships)			
Fleet management, logistics and incentives	5–50†		
Voyage optimization	1–10	10–50%†	
Energy management	1–10		

-50.00%

* CO_2 equivalent based on the use of LNG.
† Reductions at this level would require reductions of speed.

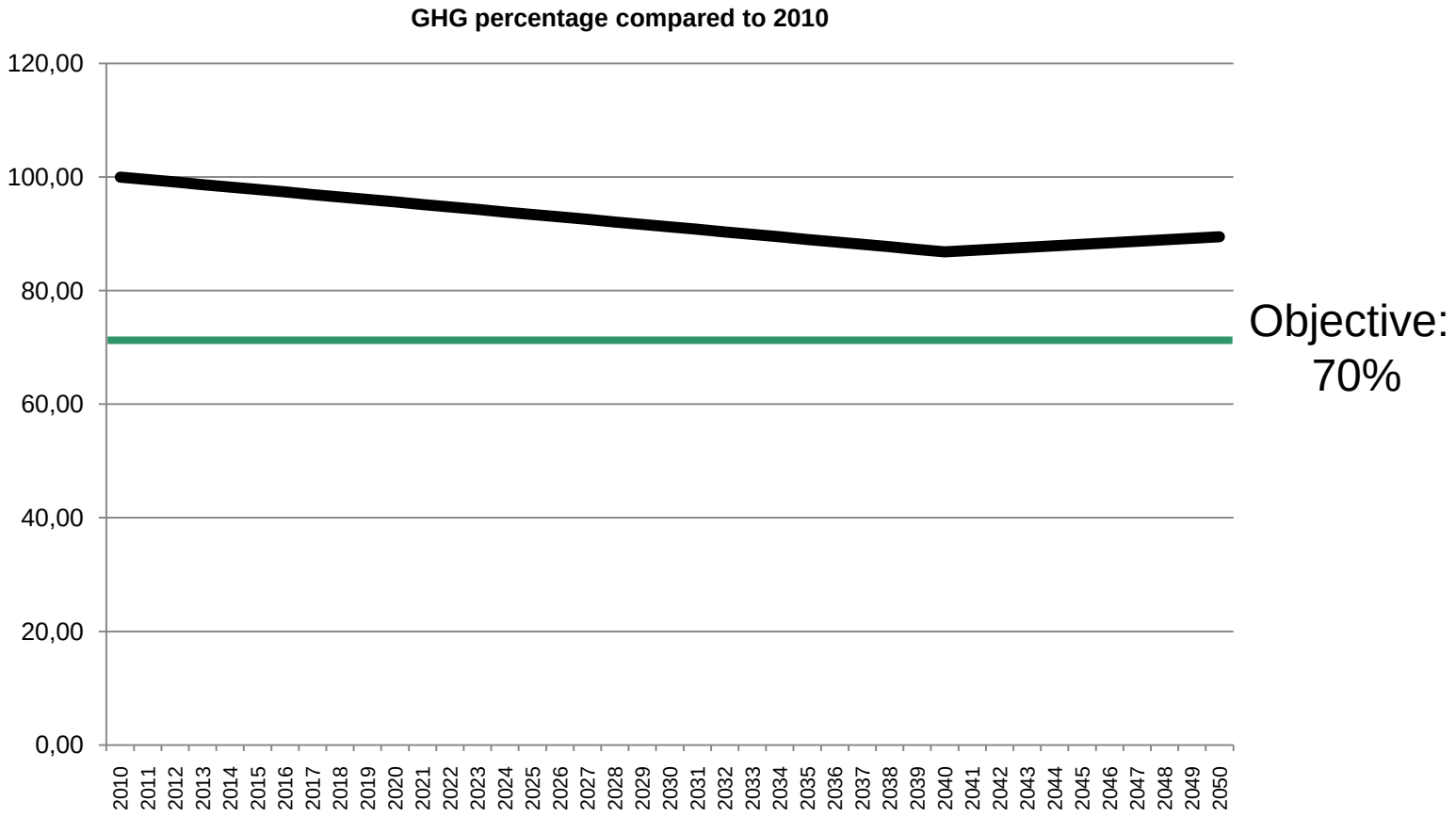
5. Fleet Simulation

- Fleet replacement regime: 30 years, **1.25% av. growth**



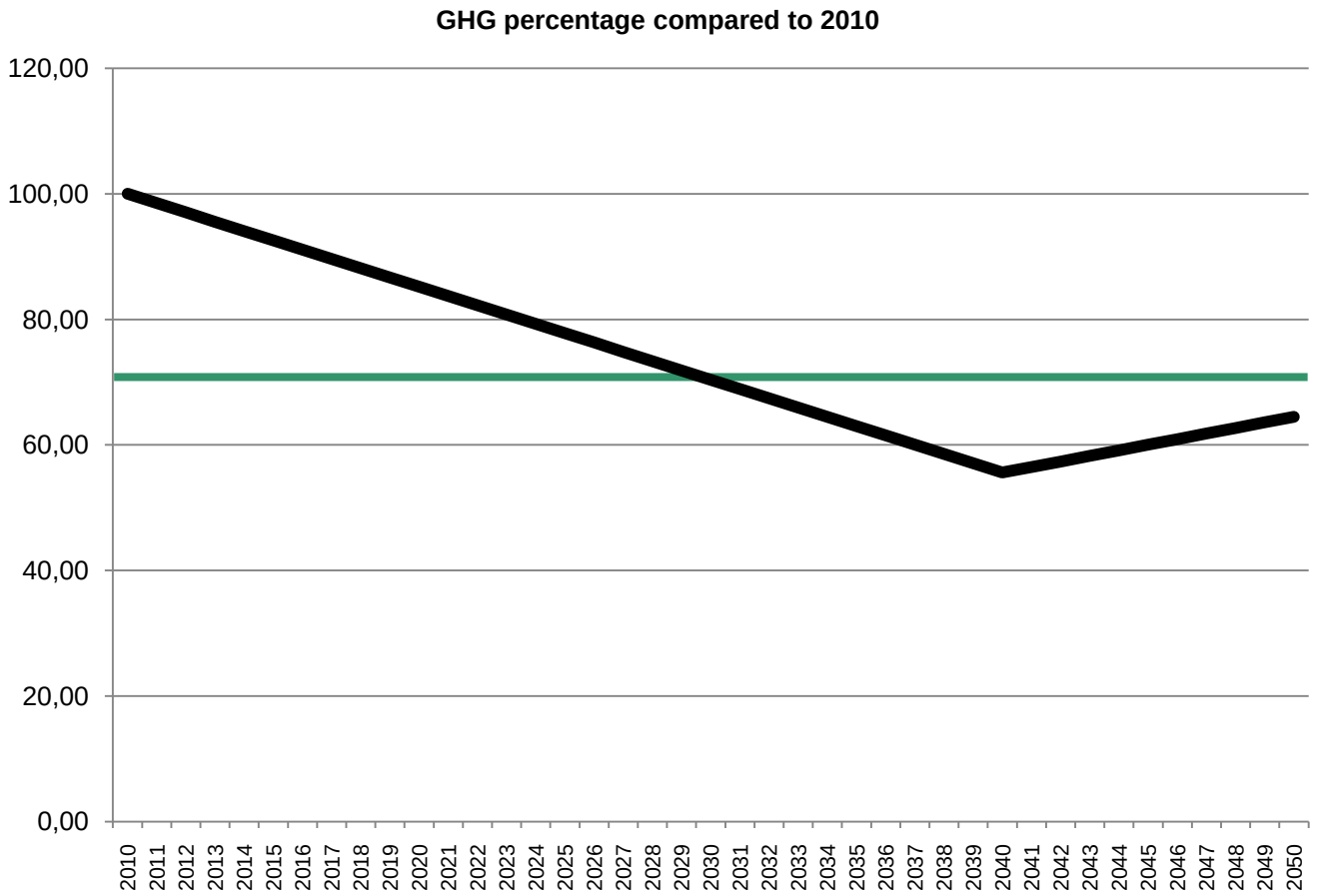
5. Fleet Simulation

- Carbon reduction effectively **only 10%** (rebound effect)



5. Fleet Simulation

- Carbon reduction > 35% with slow steaming



6. Conclusion

- Though **technical innovations** provide for up to 70% carbon reduction in shipping this is **not sufficient** for long-term carbon reduction objectives due to transport and therefore fleet growth
- Only **combination with slow steaming regimes** feasible carbon reductions of up to 35% are possible
- Therefore political regimes with marine-diesel **taxes are necessary** to ensure slow steaming even with high transport prices (boom phases)

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Thank you for your kind attention.

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