

Waterways, Shipping and Environment - Towards a Sustainable Future?

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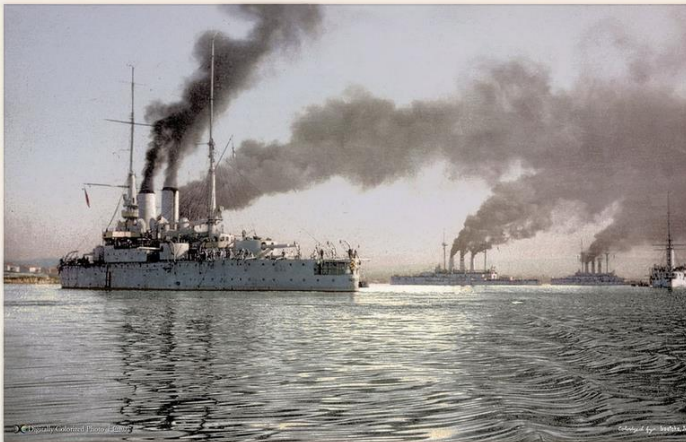
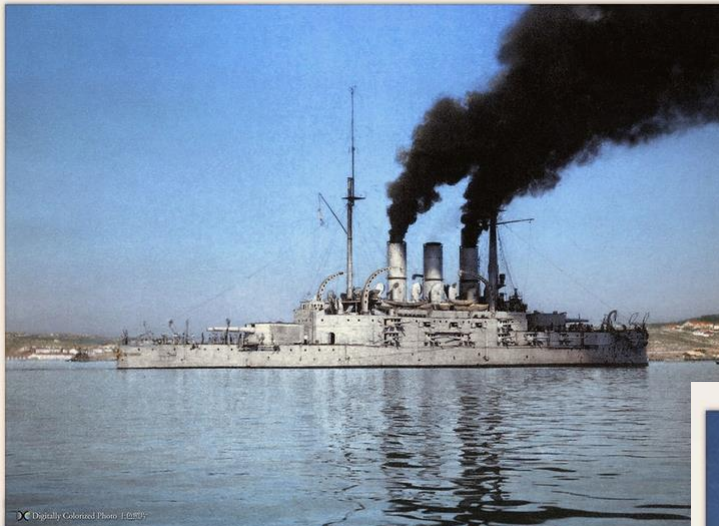
Environmental impacts from shipping

- Air pollution, aerosol particles
- Nitrogen emissions cause eutrophication (too much nutrients)
- CO₂ changes climate and lowers pH
- Methane is a strong greenhouse gas
- Washing and other discharged waters cause local pollution
- Ballast waters introduce invasive alien species
- Toilet waters cause eutrophication
- Soot emissions melt snow and ice (especially in the Arctic)
- Small, closed environment
- Noise pollution disturbs animals
- Accidents, erosion, re-introduction of pollutants from sea floor
- Trash, plastic, loose paints
- Dismantling / demolition of vessels

Almost every process involving burning causes air pollution and GHG emissions



CO₂ Changes climate and lowers pH of ocean water



1910s: Black Sea Fleet in Sevastopol. ✕

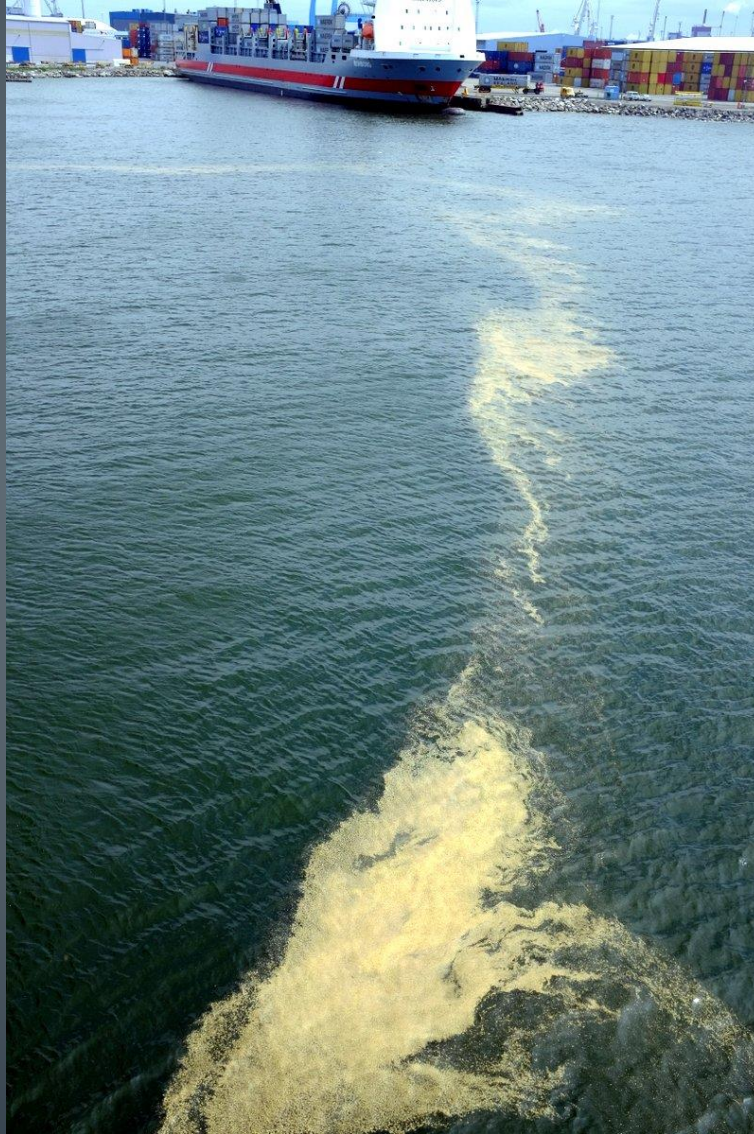


Russian Black Sea Fleet Battleship "Panteleimon", 1906. ✕

Shore erosion



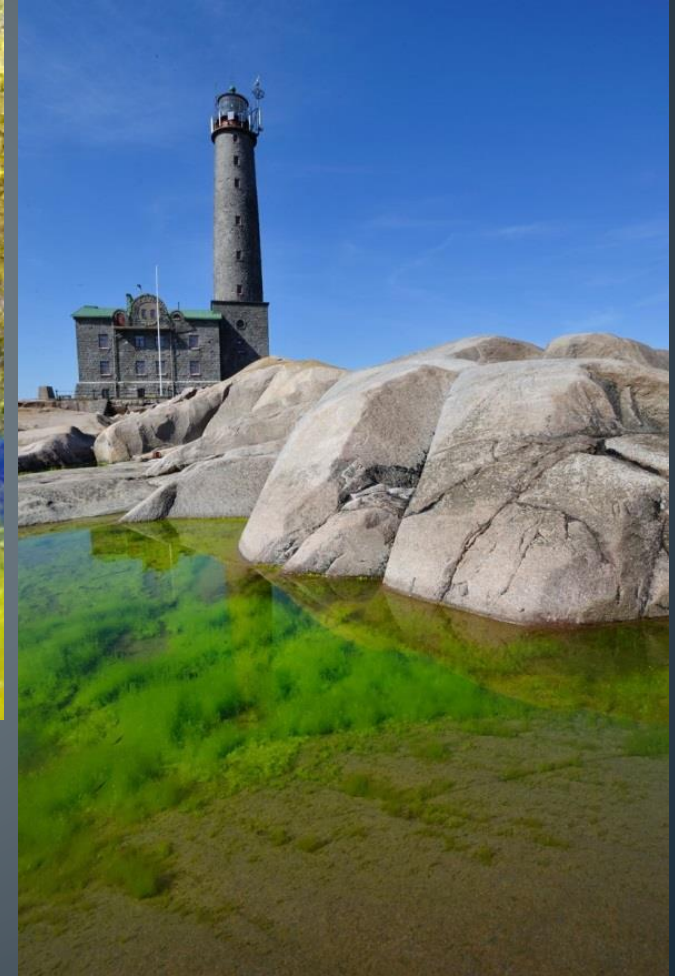
Port operations introduce materials



Accidents



Eutrophication



Marine life encounters all kinds of distractions and problems



Invasive alien species



Small, closed areas especially vulnerable



Soot melts ice and snow



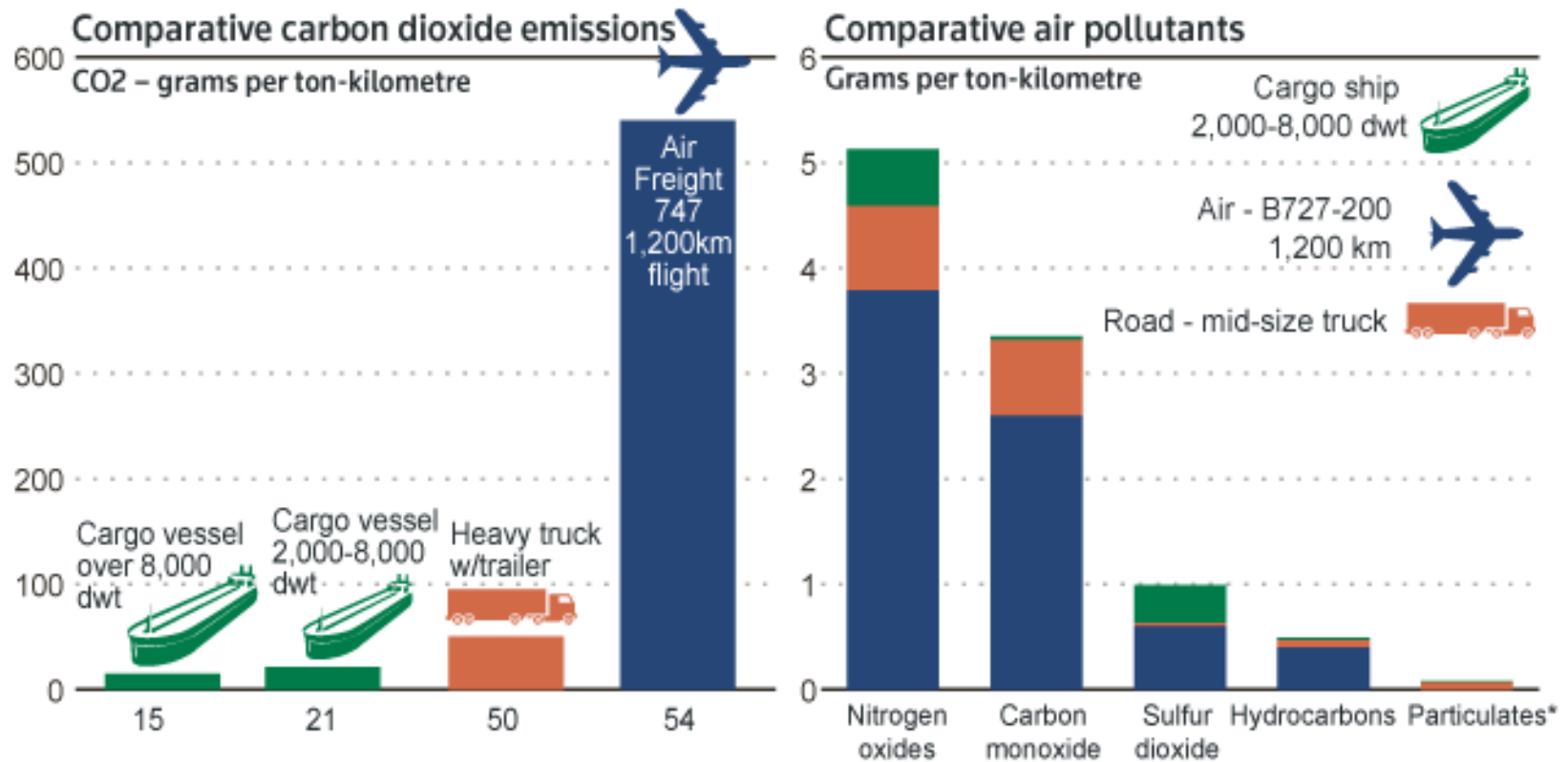
What about micro plastics?

- No need to worry too much yet. No adverse effects shown.
- Plastics waste in general is of course a serious issue



On the other hand

Global shipping emissions



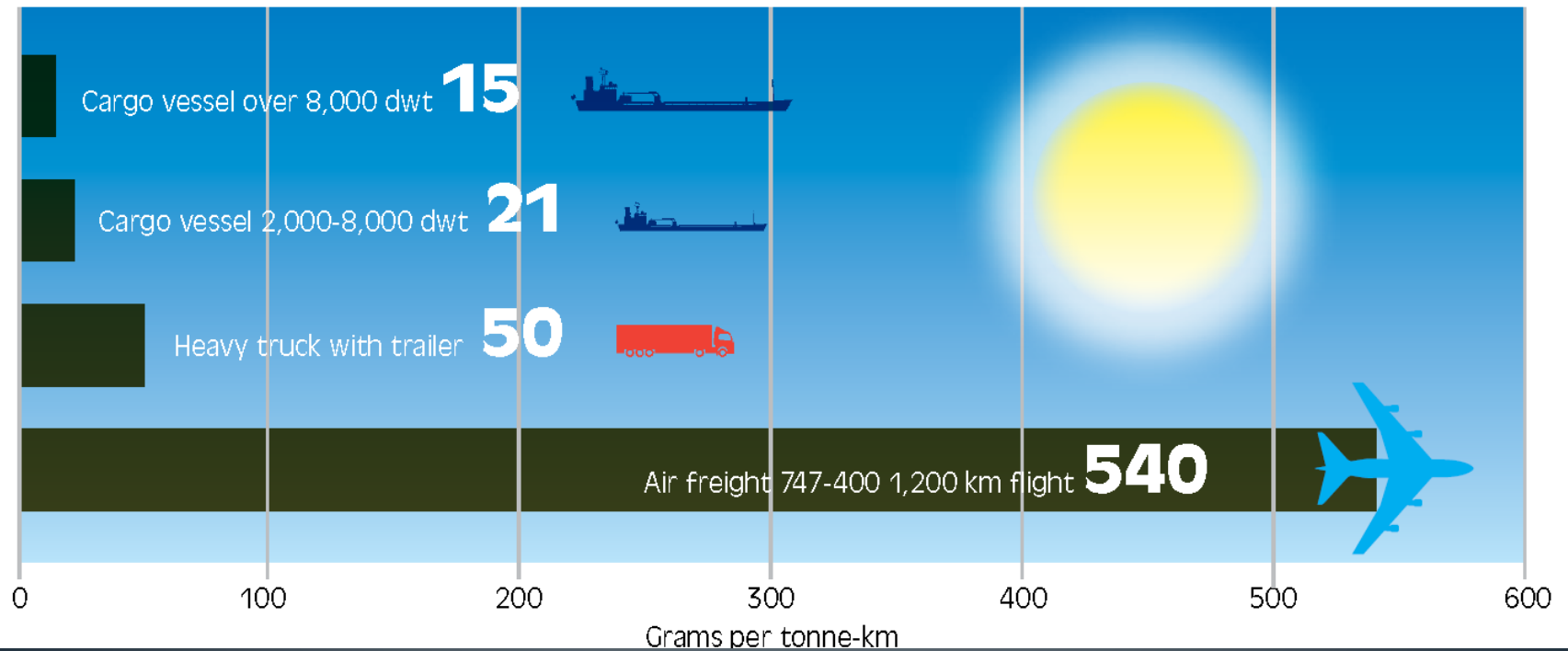
Source: NTM (Swedish network for transport and the environment) /*Data NA for air cargo particulates



Indeed

Comparison of CO₂ emissions between different modes of transport

Source: NTM, Sweden



Yes indeed

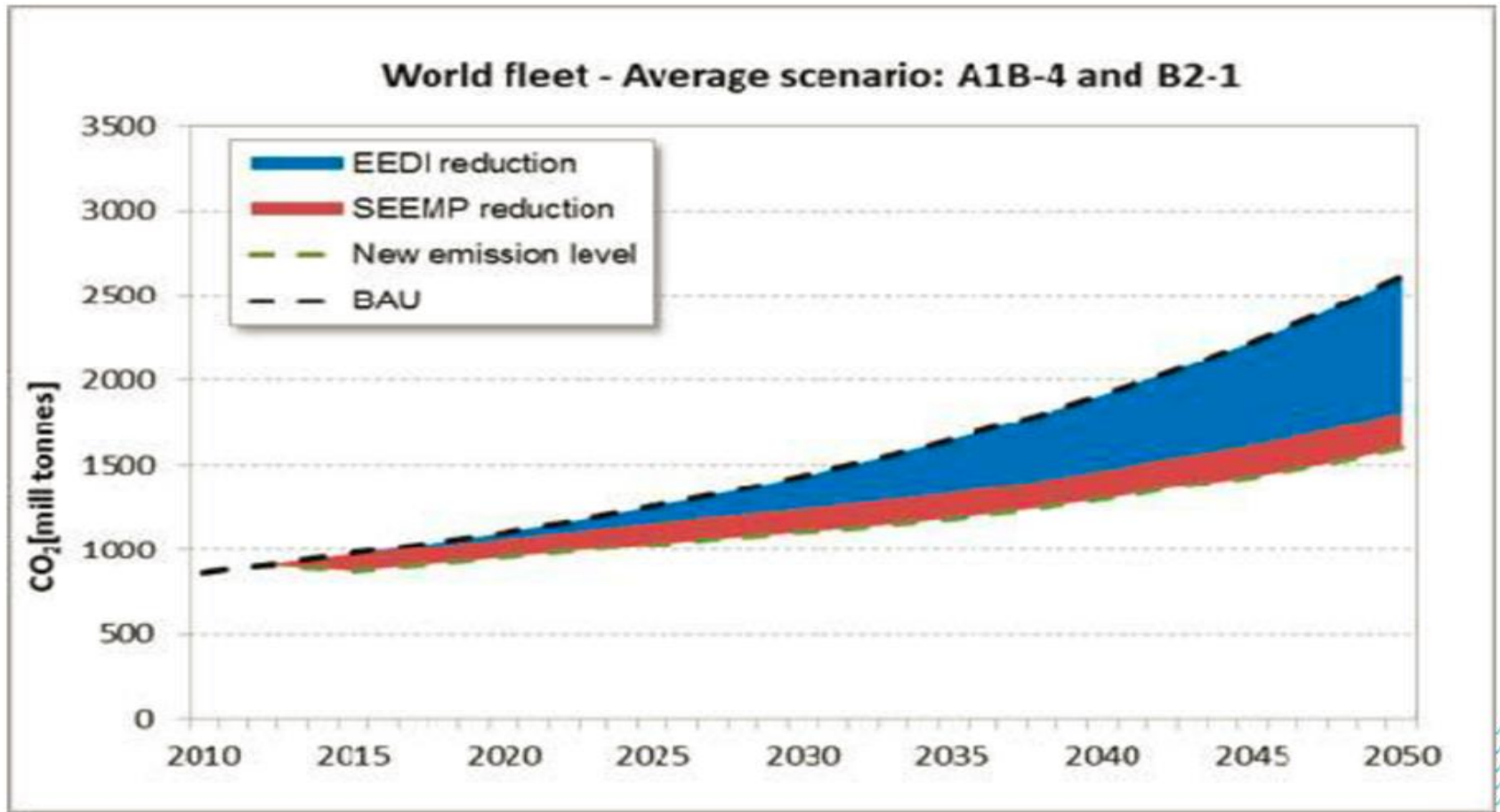
- Small emission, efficient
- Far from our lungs, no dust while sailing
- No collateral damage in case of accidents
- No noise where people live
- Less need for land based infrastructure (roads etc)



Distance to shore matters



Does regulation help?

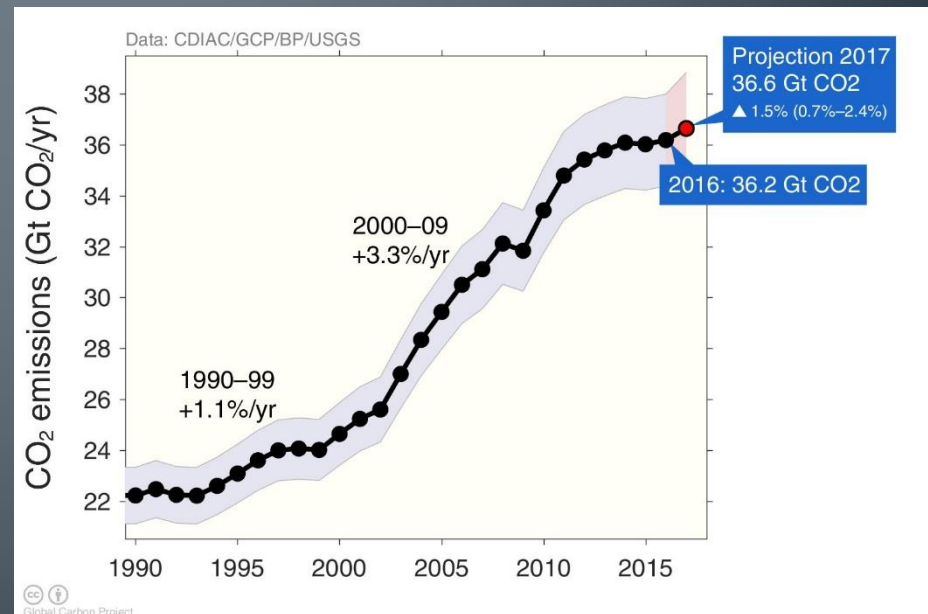
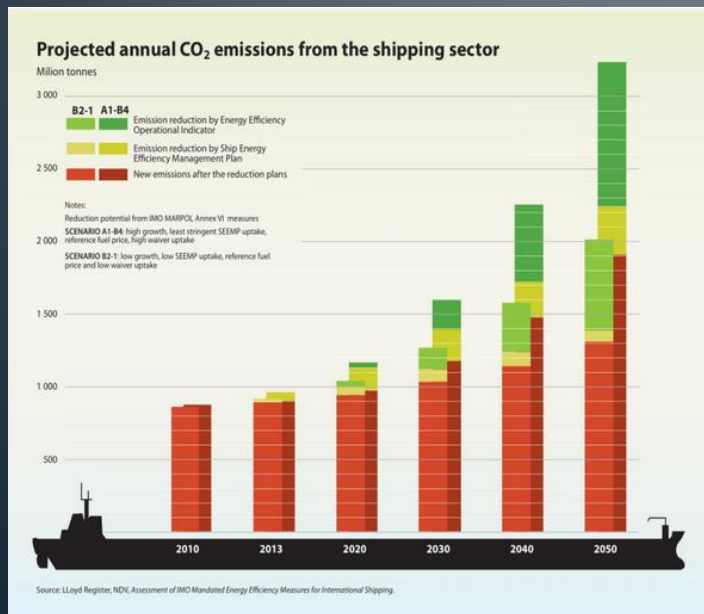


Is this the best they can do? We need more ambition

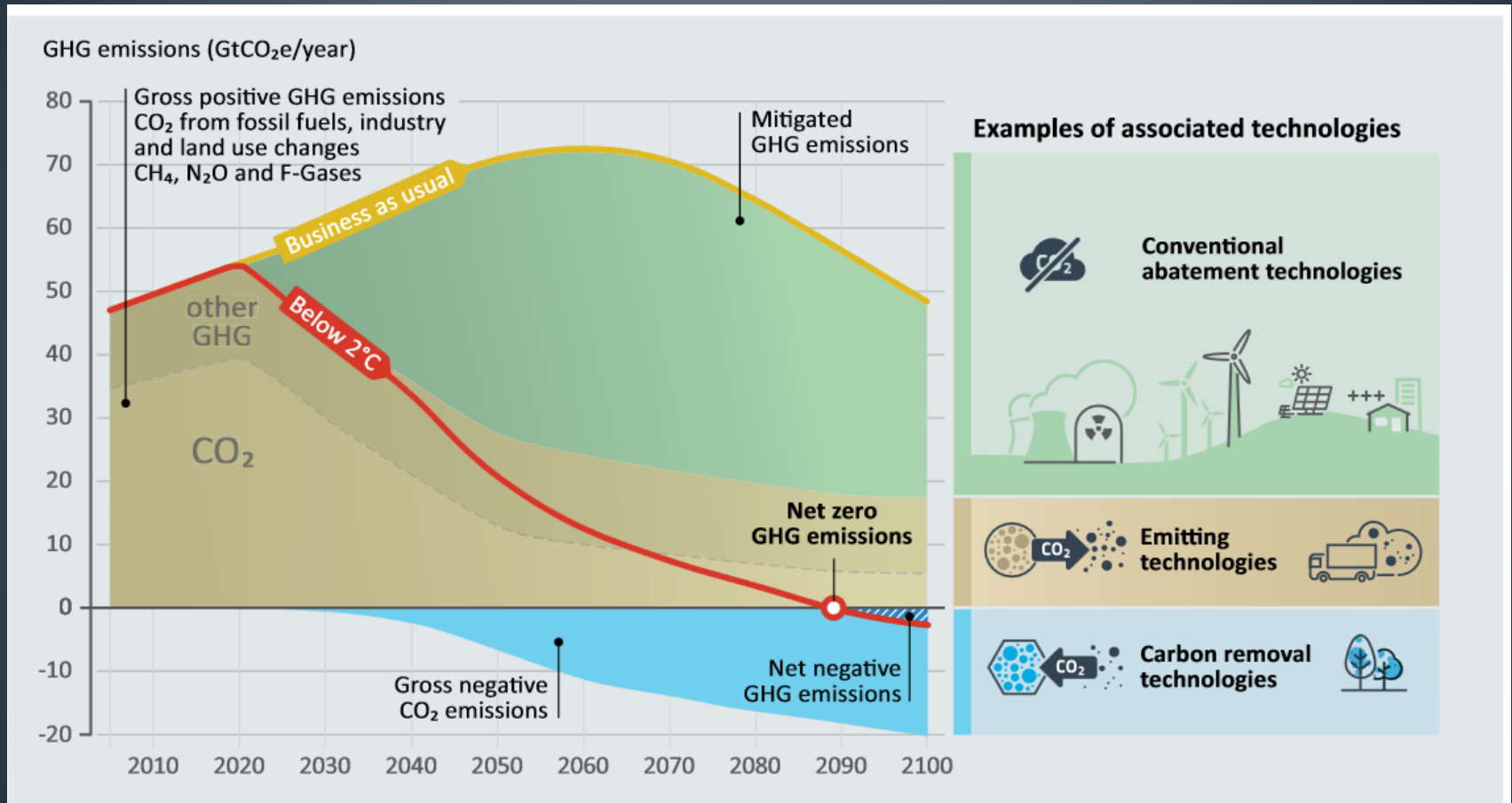
- mandatory requirements for ships of 5,000 gross tonnage and above will have to collect consumption data for each type of fuel oil they use, as well as other, additional, specified data including proxies for transport work. These ships account for approximately 85% of CO₂ emissions from international shipping. The data collected will provide a firm basis on which future decisions on additional measures, over and above those already adopted by IMO, can be made.....yadi-yadi-ya
- So all we are doing is collecting data – no efforts to actually reduce emissions so far by IMO or governments

Call for higher standards

- Absence of an industry standard prevents the formulation of an industry-wide CO₂ reduction target
- In the absence of regulations, voluntary use of costly alternative environmentally friendly fuels creates a competitive disadvantage, unless clients are prepared to pay a premium



What really needs to be done?



Note: This figure shows emission reductions from conventional mitigation technologies combined with carbon dioxide removal. This exemplary scenario is consistent with an at least 66 percent chance of keeping warming below 2°C relative to pre-industrial levels. Emission reductions are shown against a business-as-usual scenario without any additional climate policies. Global net emissions levels turn to net negative towards the very end of the century, but carbon dioxide removal is already being deployed much earlier. Some residual greenhouse gas emissions remain at the end of the century, as they are too difficult to mitigate in the scenario. Note that the scenario used is different from the scenarios used in Chapter 3, which leads to small variations in emission levels and timing of negative emissions.

Source: Jérôme Hilaire (Mercator Research Institute on Global Commons and Climate)

Fossil fuels are just too cheap (don't have to pay for damages) – biofuels to the rescue?



Our own bio-oil, best case example

Reducing greenhouse gas emissions is important for us and we believe a great way to engage you is to share information about the environmental impact of this voyage.

Please feel free to share this report or use it in your own reporting. We are happy to answer any questions you may have.



Voyage (first port-last port):			Distance:
Tunadal (SETUN) - Fecamp (FRFEC)			2233 km
with a cargo of:			Cargo quantity in tons:
woodpulp			4850 mt
Date:			Transport work (tonkilometer):
23.08 - 28.08.2018			= 10830050 tkm
Ship:			Total bunker consumption at sea:
Eeva VG / Ice 1A, DWCC 4850, 216000 CBFT			25.2 mt
HFO cons. tons:	MGO cons. tons:	Light Bio Oil cons. tons:	Total CO ₂ emissions:
0 mt	5.2 mt	20 mt	32.71 mt
HFO CO ₂ factor:	MGO CO ₂ factor:	Light Bio Oil CO ₂ factor:	Carbon footprint (gCO ₂ /tkm):
3.114	3.206	0.802	3.02

How much is this emission level?

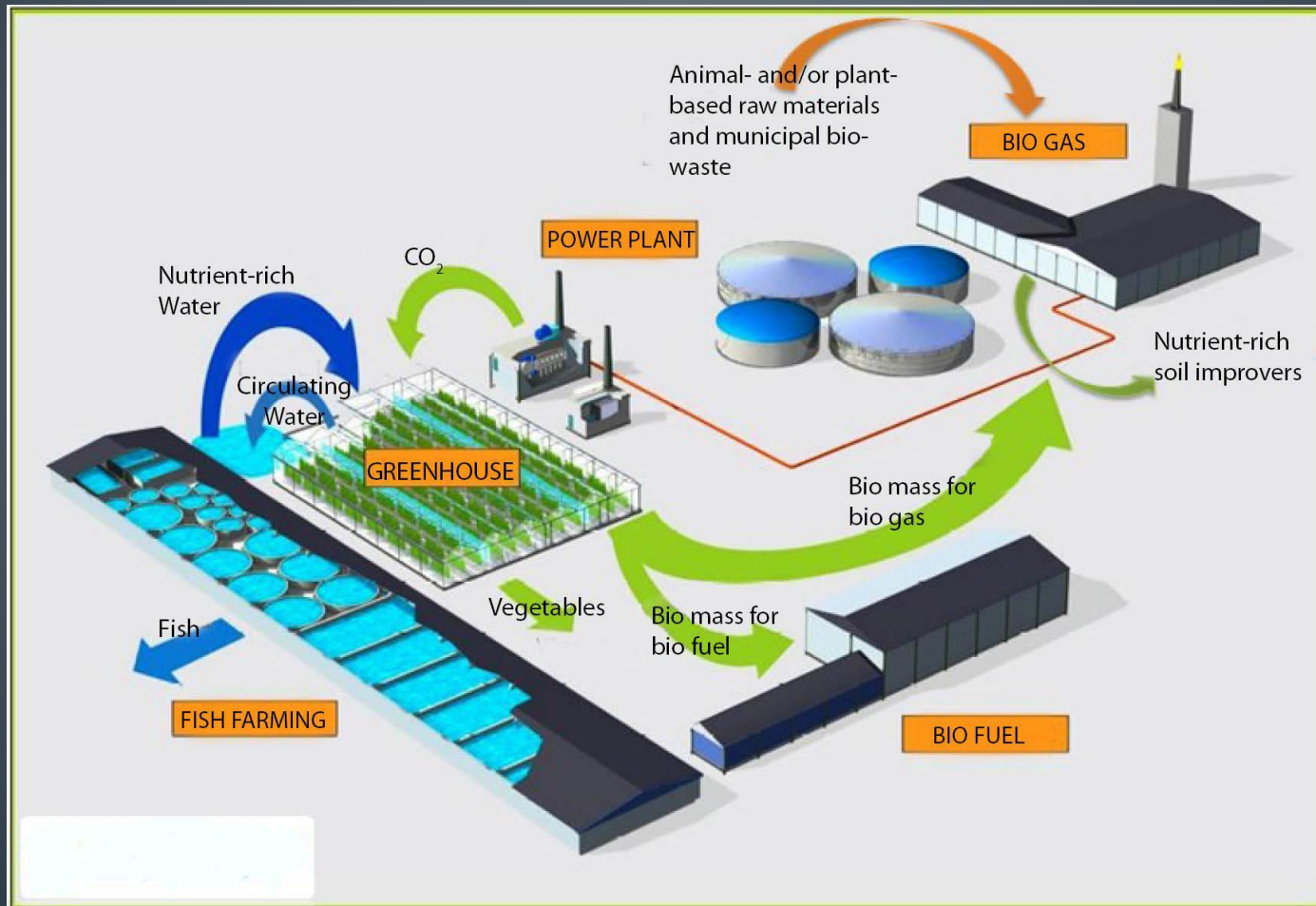
Transporting goods with ships and especially in bulk is generally very efficient, and uses the globe's scarce resources less than other forms of transport since ships operate at moderate speeds and can carry large payloads with the help of the lift of water. The below graph shows a comparison of carbon footprint between different transport forms.





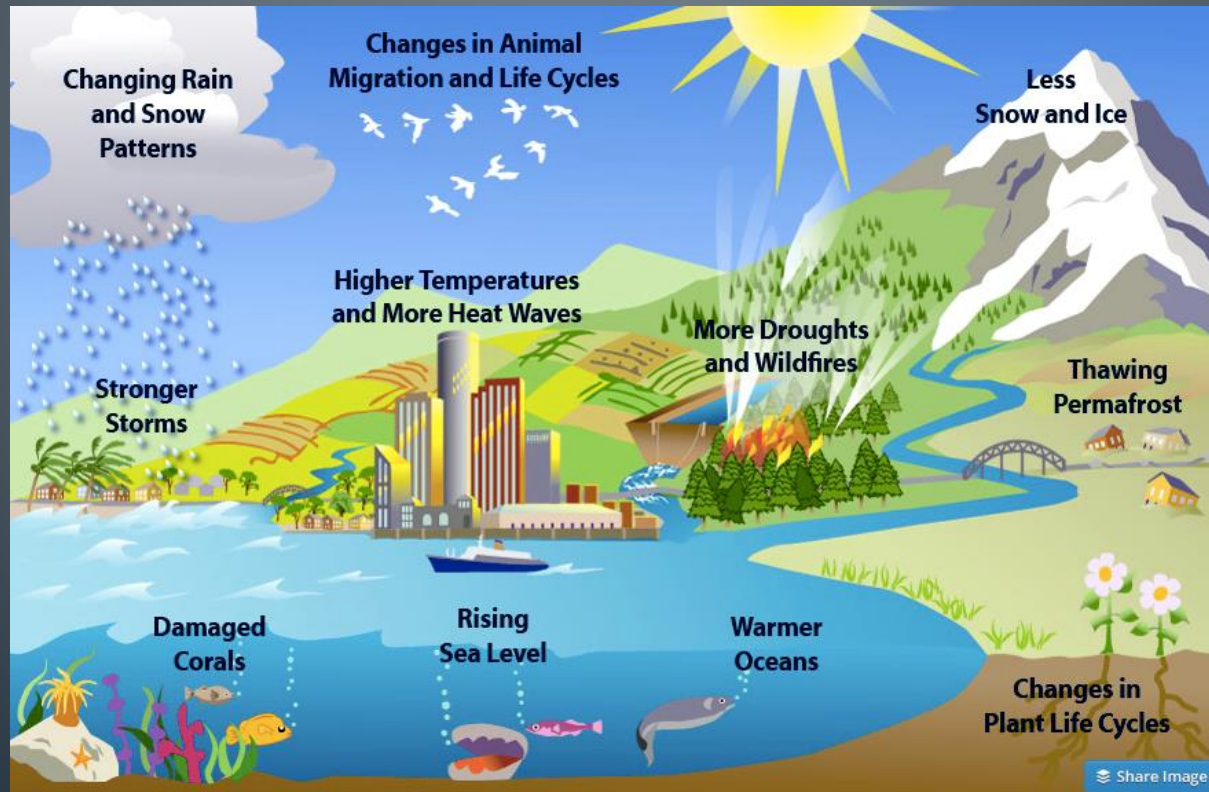
- 100% recycled or waste based raw materials
- Purified Used Cooking oil (UCO)
- Crude fish oil from fish industry side streams
- Biodegradable (in case of oil spills)
- Oils can be supplied separately or as a blend
- Raw materials are sourced in the Nordic Region
- Produced in South West Finland
- Not competing against food production

What we have tried to do? Not enough raw materials for whole industry though.



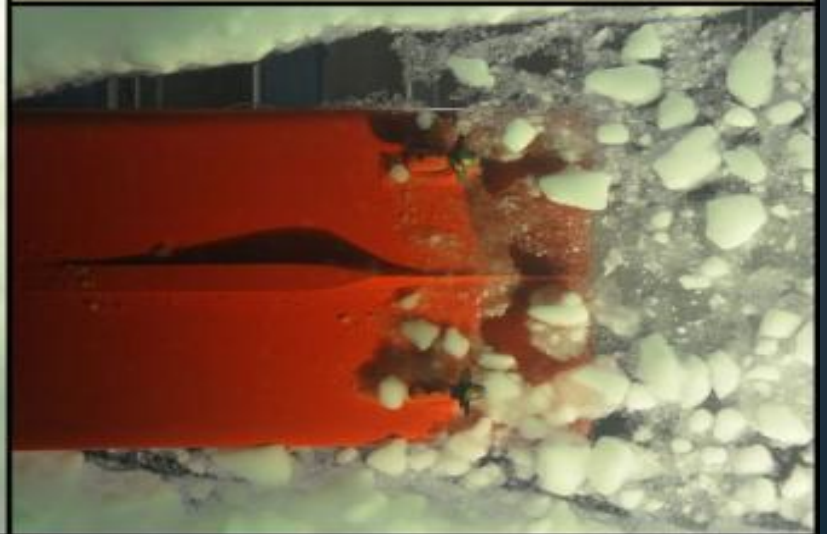
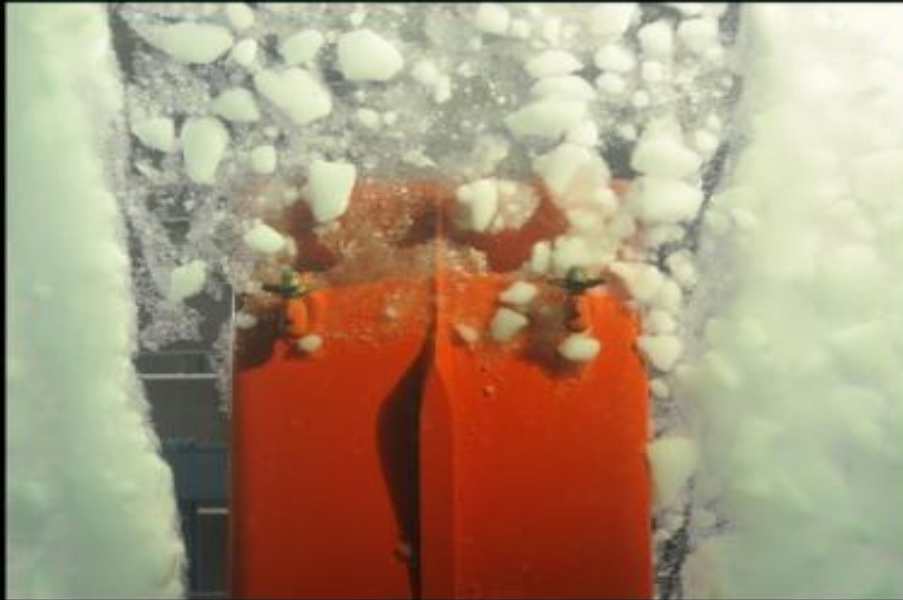
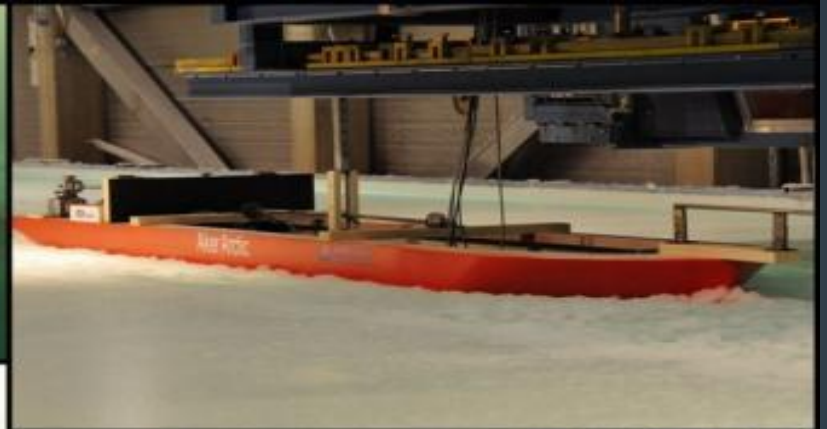
What is wrong with regulation?

- Easy problems regulated first
- The biggest risk to marine environment is not regulated at all
- Reducing GHG emissions seems to be the hardest task



EEDI-SEEMP

- Energy Efficiency Design Index (EEDI) to new vessels, global
- Ship Energy Efficiency Management Plan (SEEMP) to all vessels



I always forget how to calculate EEDI

2 Energy Efficiency Design Index (EEDI)

The attained new ship Energy Efficiency Design Index (EEDI) is a measure of ships energy efficiency (g/t*nm) and calculated by the following formula:

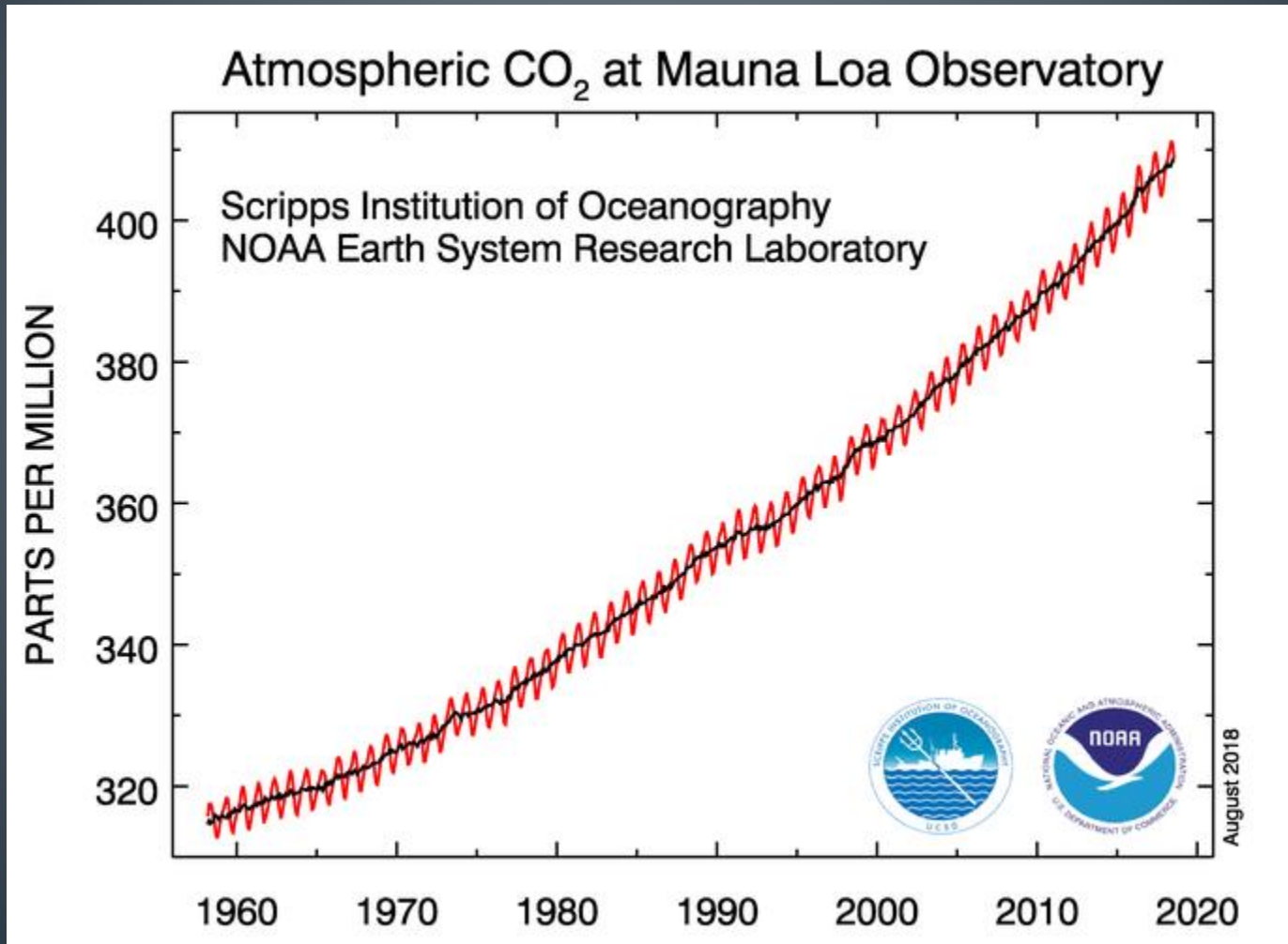
$$\frac{\left(\prod_{j=1}^n f_j \right) \left(\sum_{i=1}^{nME} P_{ME(i)} \cdot C_{FME(i)} \cdot SFC_{ME(i)} \right) + (P_{AE} \cdot C_{FAE} \cdot SFC_{AE}^*) + \left(\left(\prod_{j=1}^n f_j \cdot \sum_{i=1}^{nPTI} P_{PTI(i)} - \sum_{i=1}^{neff} f_{eff(i)} \cdot P_{AEff(i)} \right) C_{FAE} \cdot SFC_{AE} \right) - \left(\sum_{i=1}^{neff} f_{eff(i)} \cdot P_{eff(i)} \cdot C_{FME} \cdot SFC_{ME}^{**} \right)}{f_i \cdot f_c \cdot Capacity \cdot f_w \cdot V_{ref}}$$

- * If part of the Normal Maximum Sea Load is provided by shaft generators, SFC_{ME} and C_{FME} may – for that part of the power – be used instead of SFC_{AE} and C_{FAE}
- ** In case of $P_{PTI(i)} > 0$, the average weighted value of $(SFC_{ME} \cdot C_{FME})$ and $(SFC_{AE} \cdot C_{FAE})$ to be used for calculation of P_{eff}

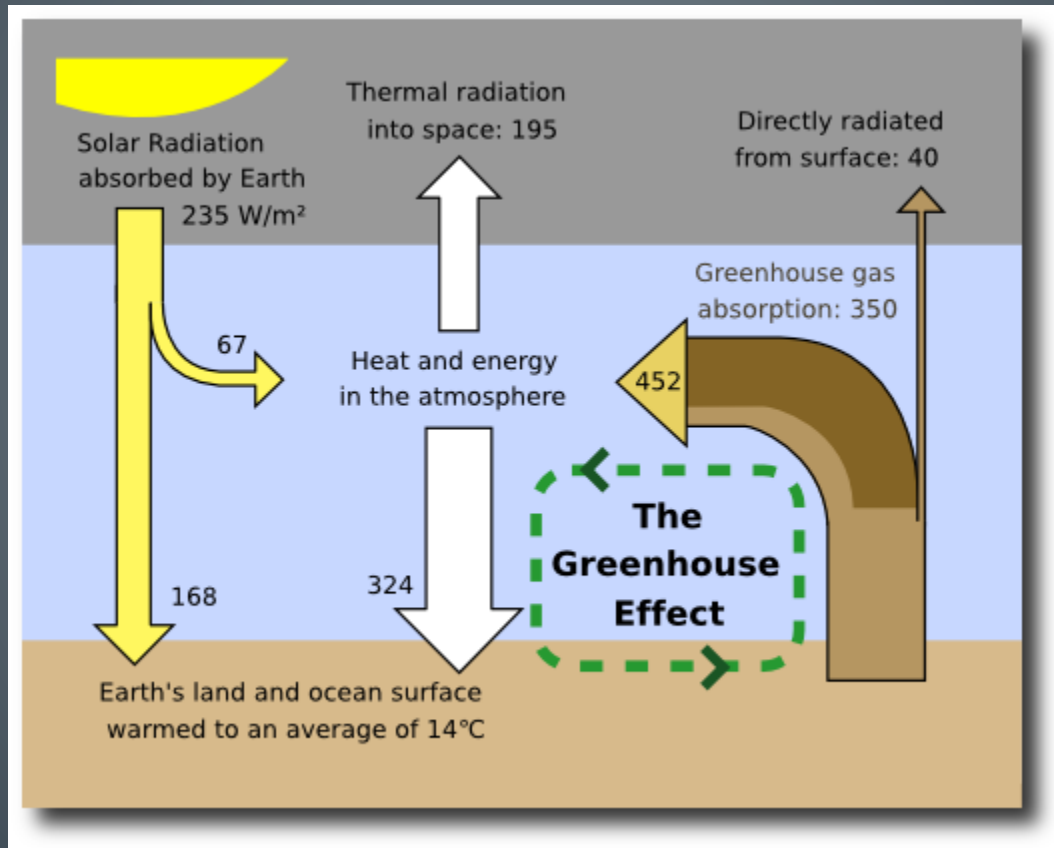
Note: This formula may not be able to apply to diesel-electric propulsion, turbine propulsion or hybrid propulsion system.

EEDI tule vaikuttamaan erityisesti matkanopeuksiin ja on pakollinen kaikille uusille aluksille tai aluksille joille tehdään major conversion

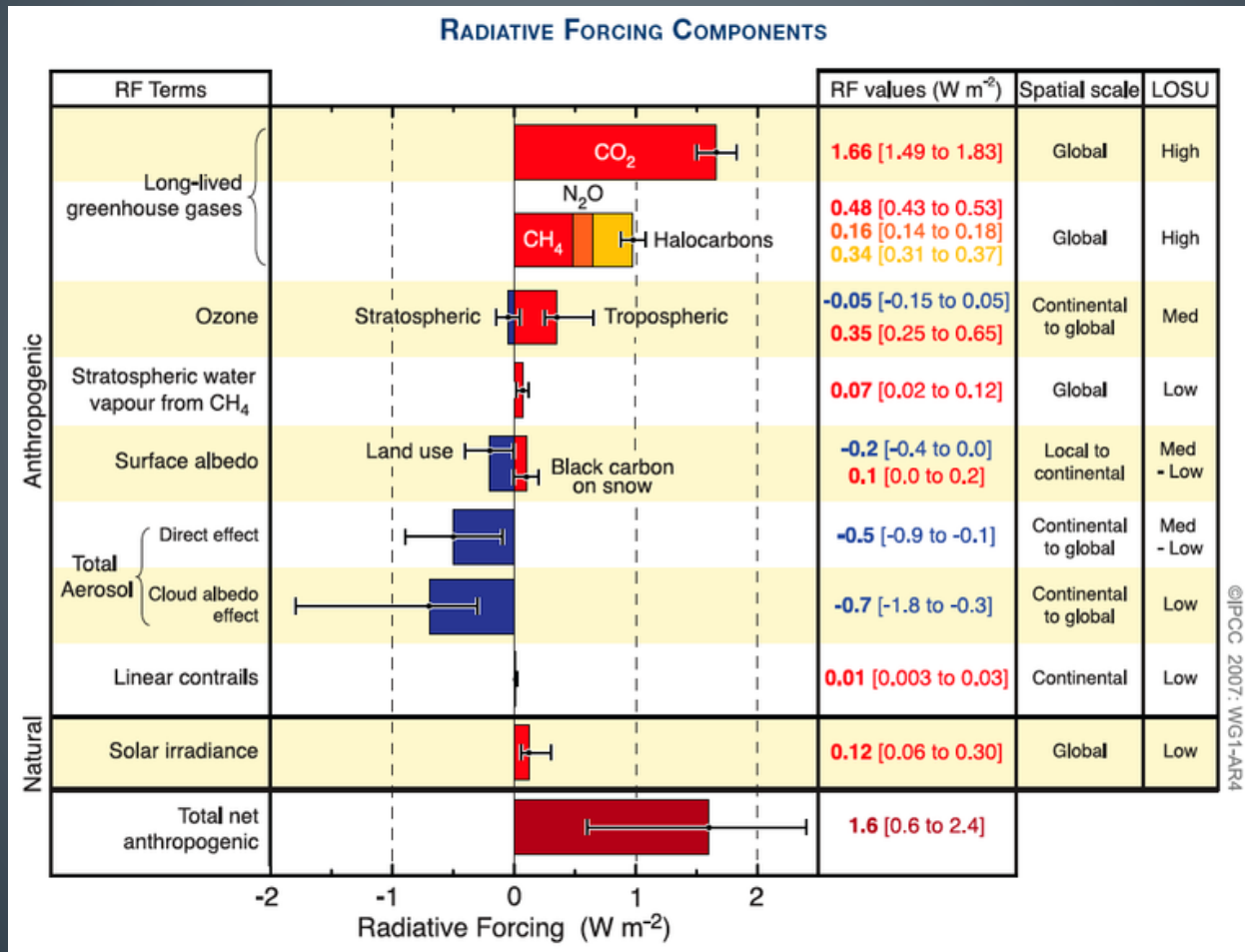
One graph to rule them all



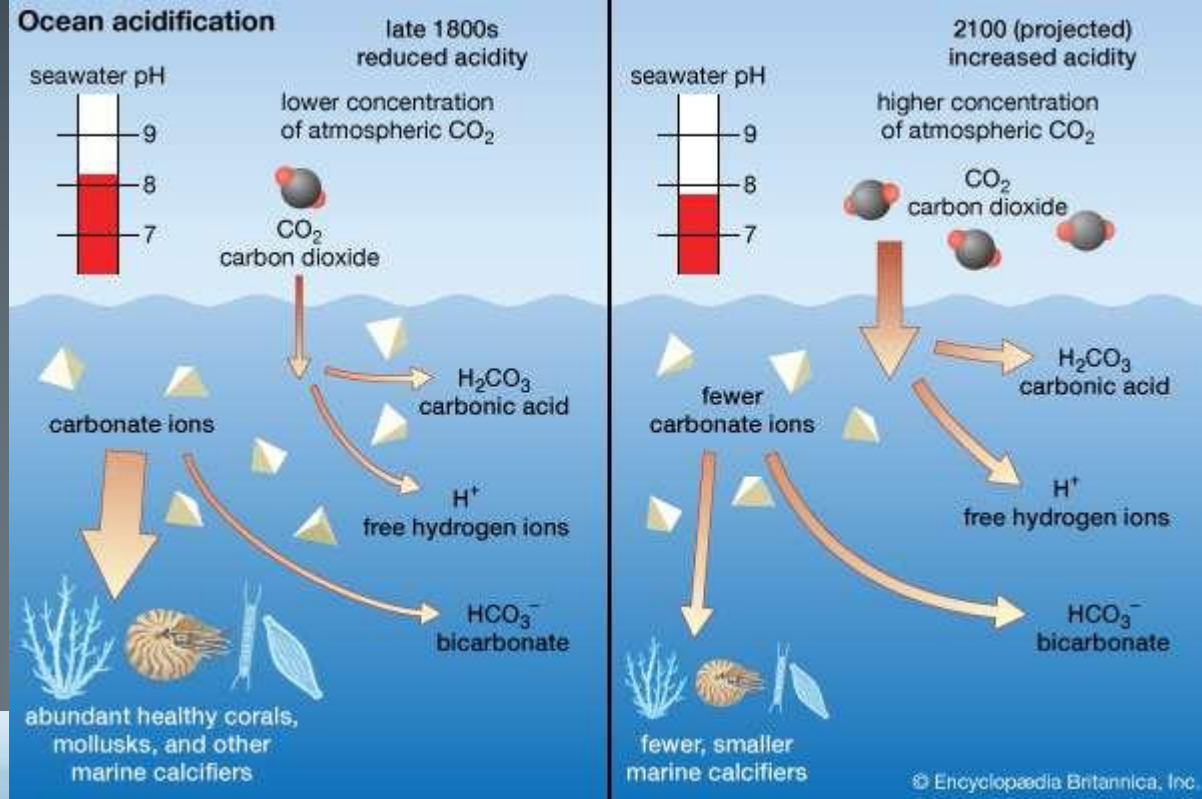
Change explained



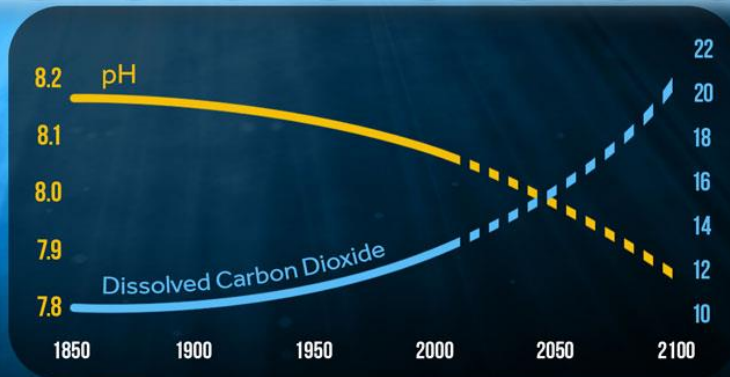
Forcings



The evil twin



OCEAN ACIDIFICATION More CO_2 = More Acidic



Dissolved CO_2 Measured in Micromoles/Kg, high emissions scenario.
Source: Feely, Richard A., et al. (2006)

What else does climate change do to our waters?

- More extreme weather. Potential for more rain, more runoff, more nutrients to lakes – making efforts to maintain good water quality more difficult.
- More flooding
- Less ice, shorter winter



Are these solutions?

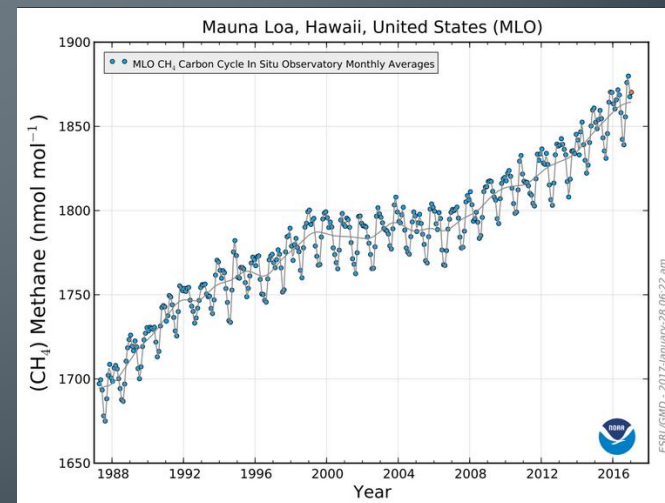
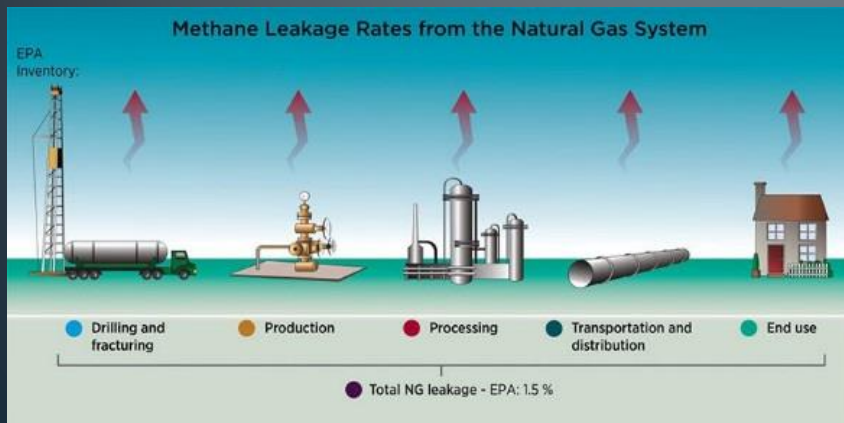


“Any way the wind blows, it don't matter to me”



What about LNG?

- Burns cleanly, no soot or particles
- Smaller CO₂ emissions
- Methane is much stronger GHG than CO₂ (86x /20yr scale)
- Part of the gas is lost unburned in every phase of LNG usage negating any climate benefits
- Investing in LNG now ties us to a new fossil fuel



Every fuel used causes GHG emissions

- Zero emission solutions
- Wind, Solar, Wave
- All require storage
- Nuclear, plenty of experience since 1950's in naval operations
- Small reductions are easy, zero emissions very hard
- If we all reduce a little, emissions will reduce a little.



Conclusion

- Shipping pollutes, others pollute more
- Accident risk lower
- Health risks lower
- More efficient
- Requires much less land area



Thank you

