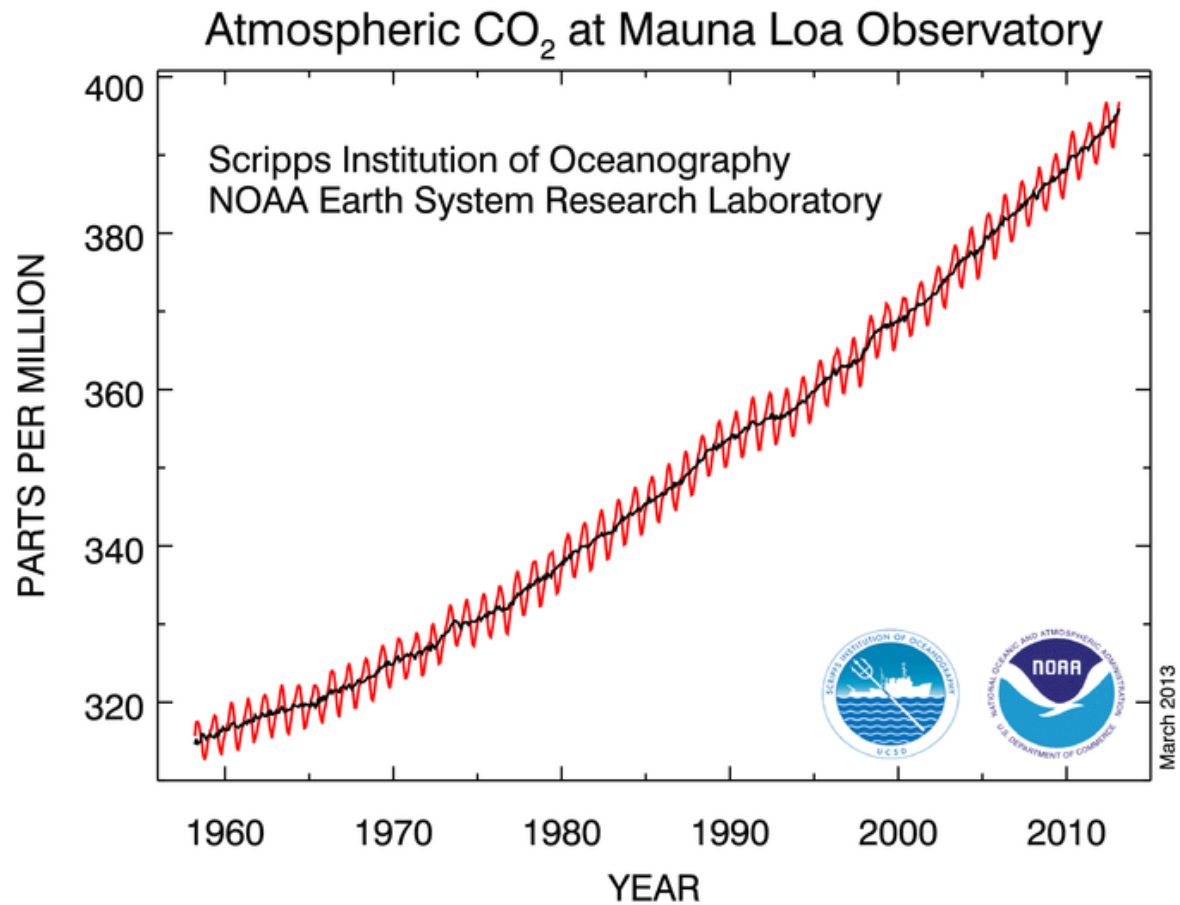


Reducing greenhouse gas emissions in shipping.

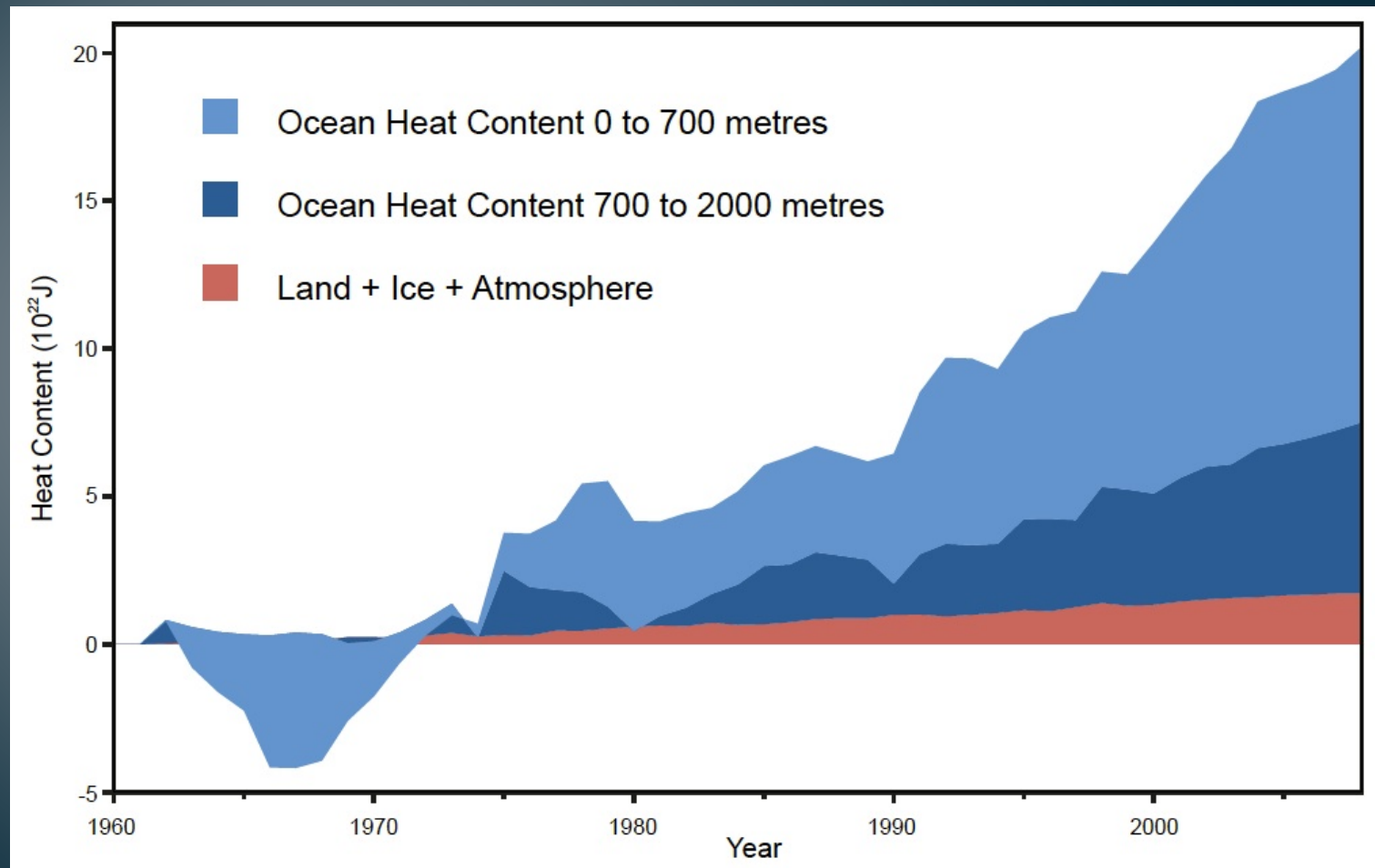
Esko Pettay

Meriaura Ltd

Most of the know reserves of fossil fuels must be left untouched if we wish to maintain safe climate



Earth is gaining heat



Climate change is not the only environmental problem: Loads of new regulations

- Energy Efficiency Design Index (EEDI) to new vessels, global 2013
- Ship Energy Efficiency Management Plan (SEEMP) to all vessels, global 2013
- Monitoring, reporting and verification (MRV) of CO₂ emissions, EU 2013
- Discharge limits of dry bulk cargo residues and washing waters, MARPOL Annex V 2013
- Ban of discharge untreated sewage from passenger ships in the special area, MARPOL Annex IV 2013
- Ballast water management (BWM) mandatory, global 2014
- More stringent sulphur limits in the special area, MARPOL Annex VI 2015
- Ship recycling, EU/IMO 2015
- More stringent environmental regulations in the Polar areas, Polar Code 2015
- Reduction of black carbon (BC) emissions in the Arctic 2015
- More stringent NO_x regulations in the special area for new ships, MARPOL Annex VI 2016
- Market-based measures to compensate CO₂ emissions (GHG MBM), EU/IMO 2018

What are the priorities?

Investment / ship

Estimated influence to freight prices

Sox	3-6 M€	30-50 %
Nox	0.5-2 M€	3-5 %
GHG		5-23 %
BWM	0.5-1 M€	5 %
Others		5-15 %
Total	4-9 M€	48-98 %

Other forthcoming environmental regulations

Harmonization of no-special-fee system (HELCOM/EU)

Particle matters (EU/IMO)

Incentives to decrease NOx emissions of existing ships (HELCOM)

Sewage discharge limits for existing ships (HELCOM)

Biofouling (IMO)

Underwater noise (IMO)

Reducing GHG emissions should be 1st priority

- Shipping is the most efficient way of transporting and should keep the N:O 1 position
- New technologies are implemented too slowly => we need to make do with what we currently have
- So what are the solutions?



What about gas?

Low CO₂ emissions when burning

High methane emissions during production

Methane slips throughout

Better than oil at best, Not a solution to global warming

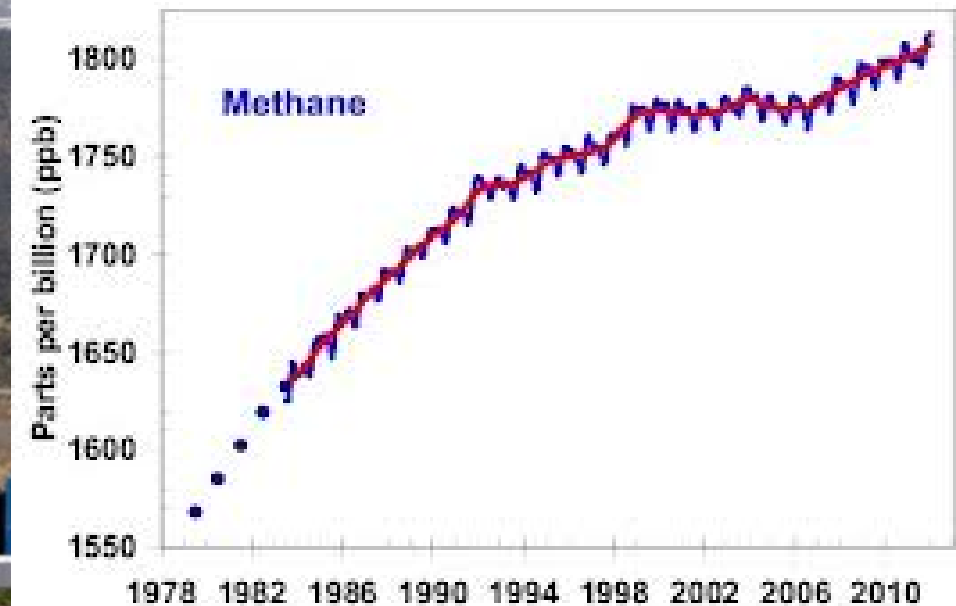
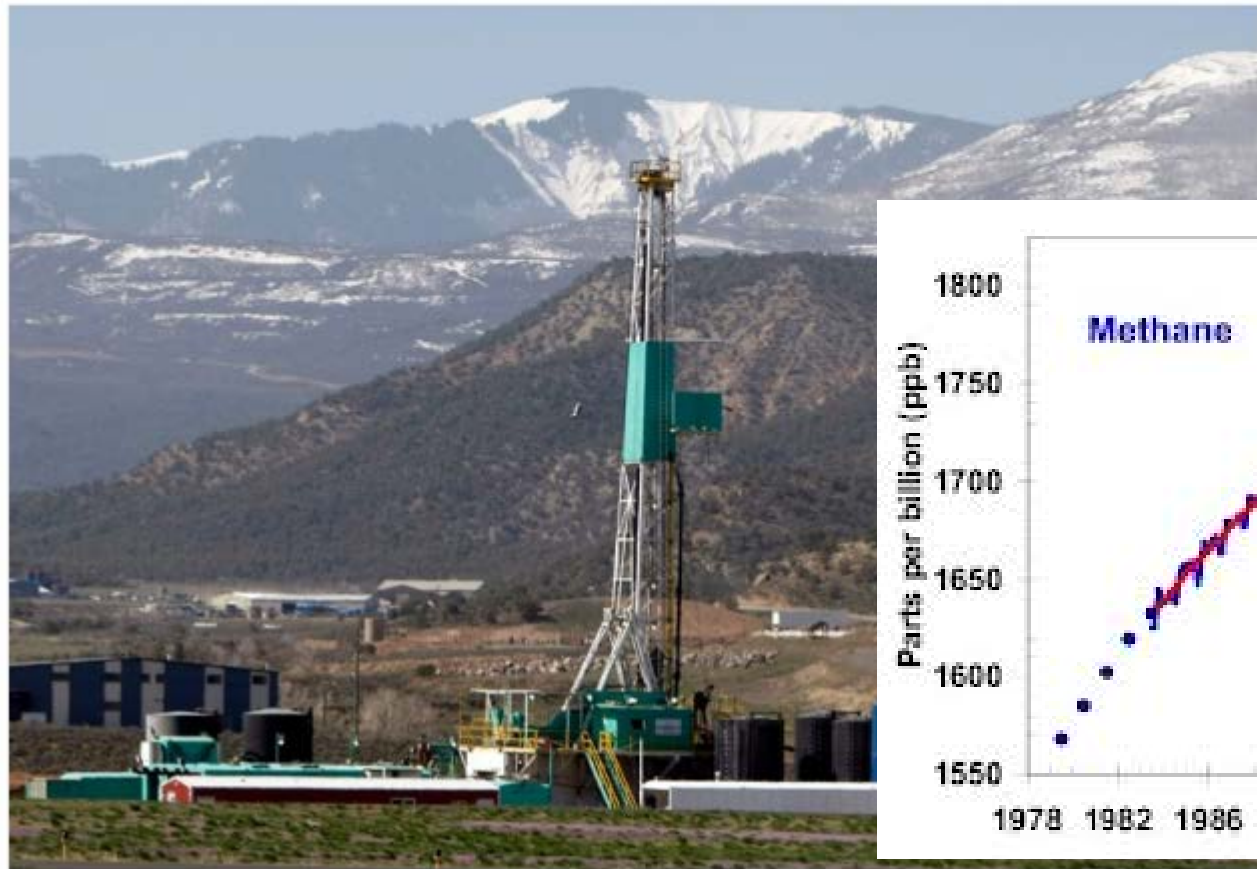


Methane leaks erode green credentials of natural gas

Losses of up to 9% show need for broader data on US gas industry's environmental impact.

Jeff Tollefson

02 January 2013

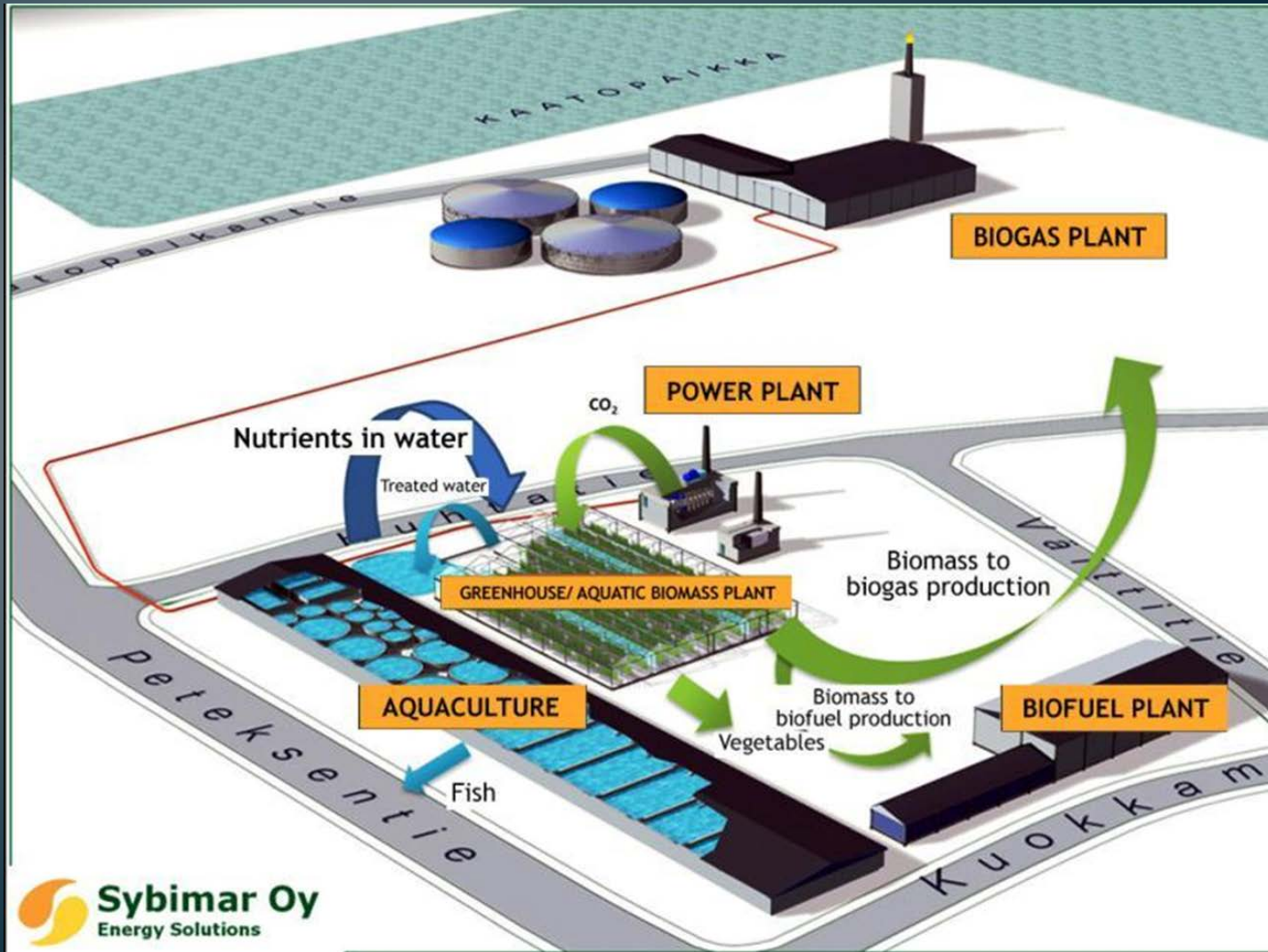


Bio fuels could be part of the solution

- Works with existing vessels and technology...mostly
- Win-Win situation at best
- Good for trade deficit
- Potential for great environmental damage and high emissions if not done properly



Back to the Nature



Sybimar Ltd.

Bio fuels and renewable energy technology

Waste based bio fuels

Research and development



More potential in wood based fuels

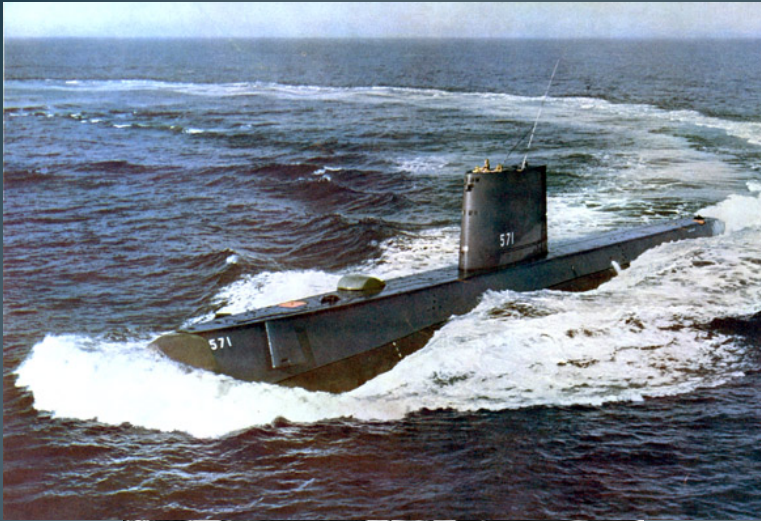


- **Fuel-Efficient Operations**
- **Improved voyage planning**
- **Weather routing**
- **Just in time**
- **Speed optimization**
- **Optimized shaft power**
- **Optimized ship handling**
- **Optimum trim**
- **Optimum ballast**
- **Optimum propeller and propeller inflow considerations**
- **Optimum use of rudder and heading control systems (autopilots)**
- **Hull maintenance**
- **Propulsion system**
- **Propulsion system maintenance**
- **Waste heat recovery**
- **Improved fleet management**
- **Improved cargo handling**
- **Energy management**
- **Fuel Type**

Other options

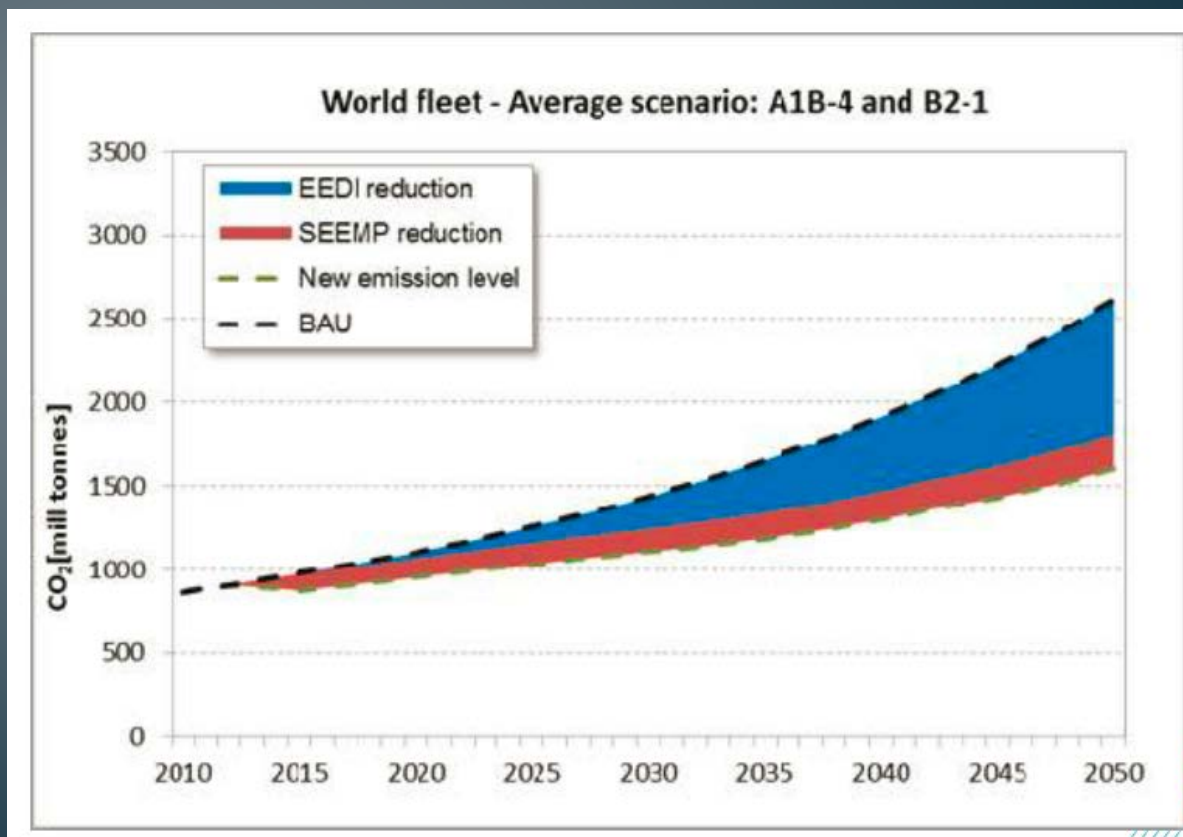


What about nuclear power? Great potential great fears



Future...looks very challenging

- Gains in efficiency will not be enough





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