

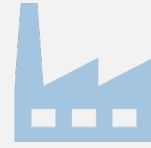
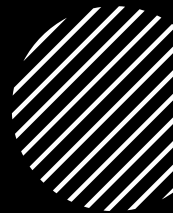


SHIPBUILDING IN A NEW ERA OF ENERGY & INFORMATION

Martin Stopford – Senior Maritime Forum, Marintec, Shanghai 2023



The Agenda




The challenge of maritime transport with no carbon emissions



The four “best” options for achieving net zero as soon as possible



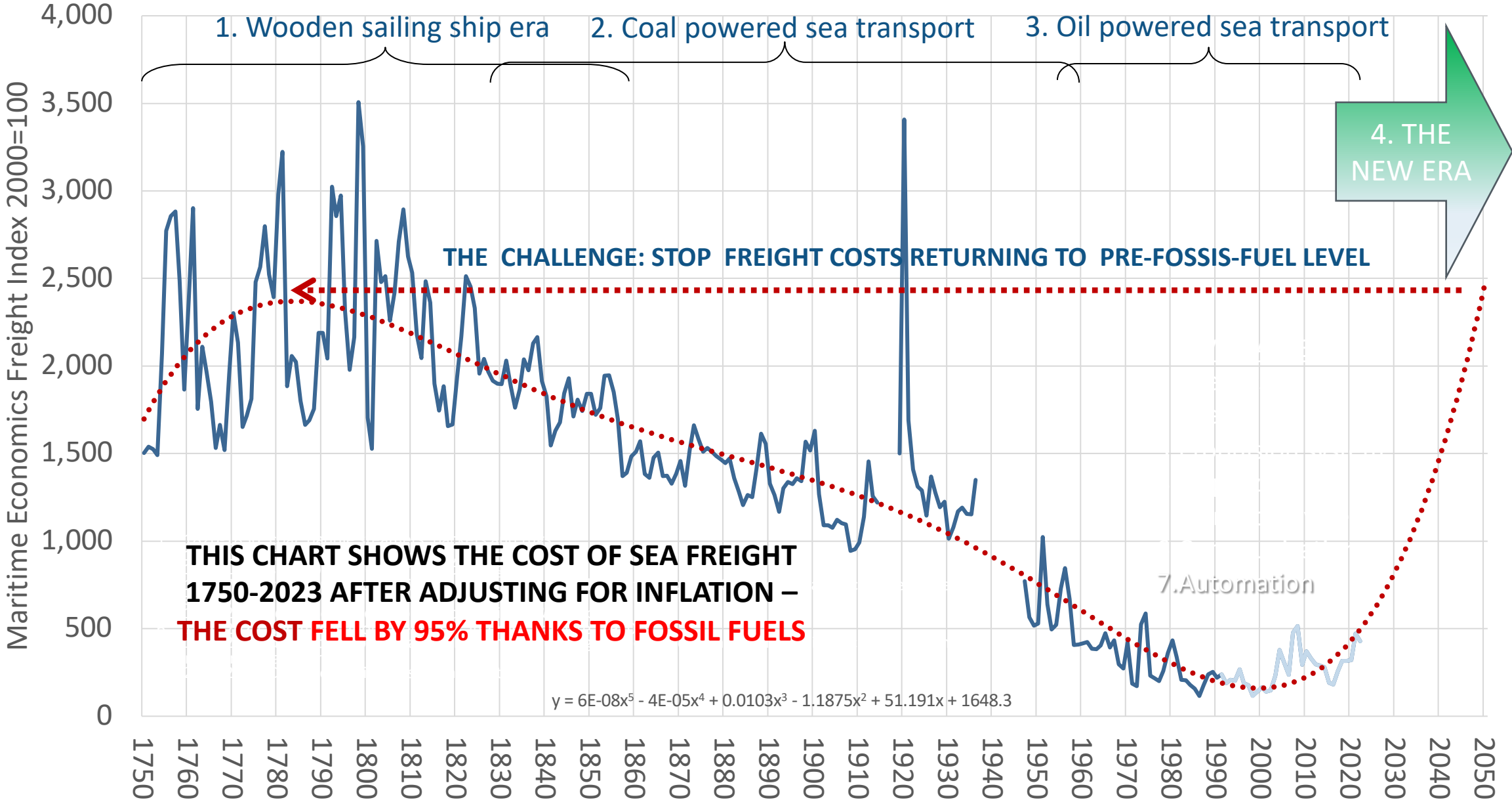
Fleet Development by CO2 technology & the Shipbuilding Scenario



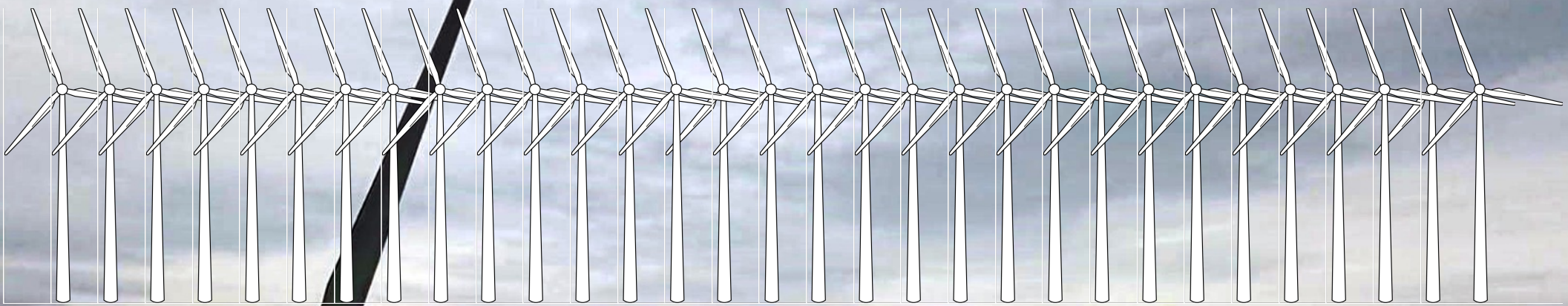
1. The challenge of maritime transport with no carbon emissions

DO NOT UNDERESTIMATE THE SCALE OF THE CHALLENGE.

Slide 1. THE CARBON CHALLENGE: Phase out CO2 without increasing sea transport costs



Slide 2: Green energy requires big up-front investment and is expensive



EXAMPLE: 30 12 MW wind turbines needed to provide electricity to produce 400 tonnes a day of green methanol (synthesising the methanol & delivery to ship is extra)

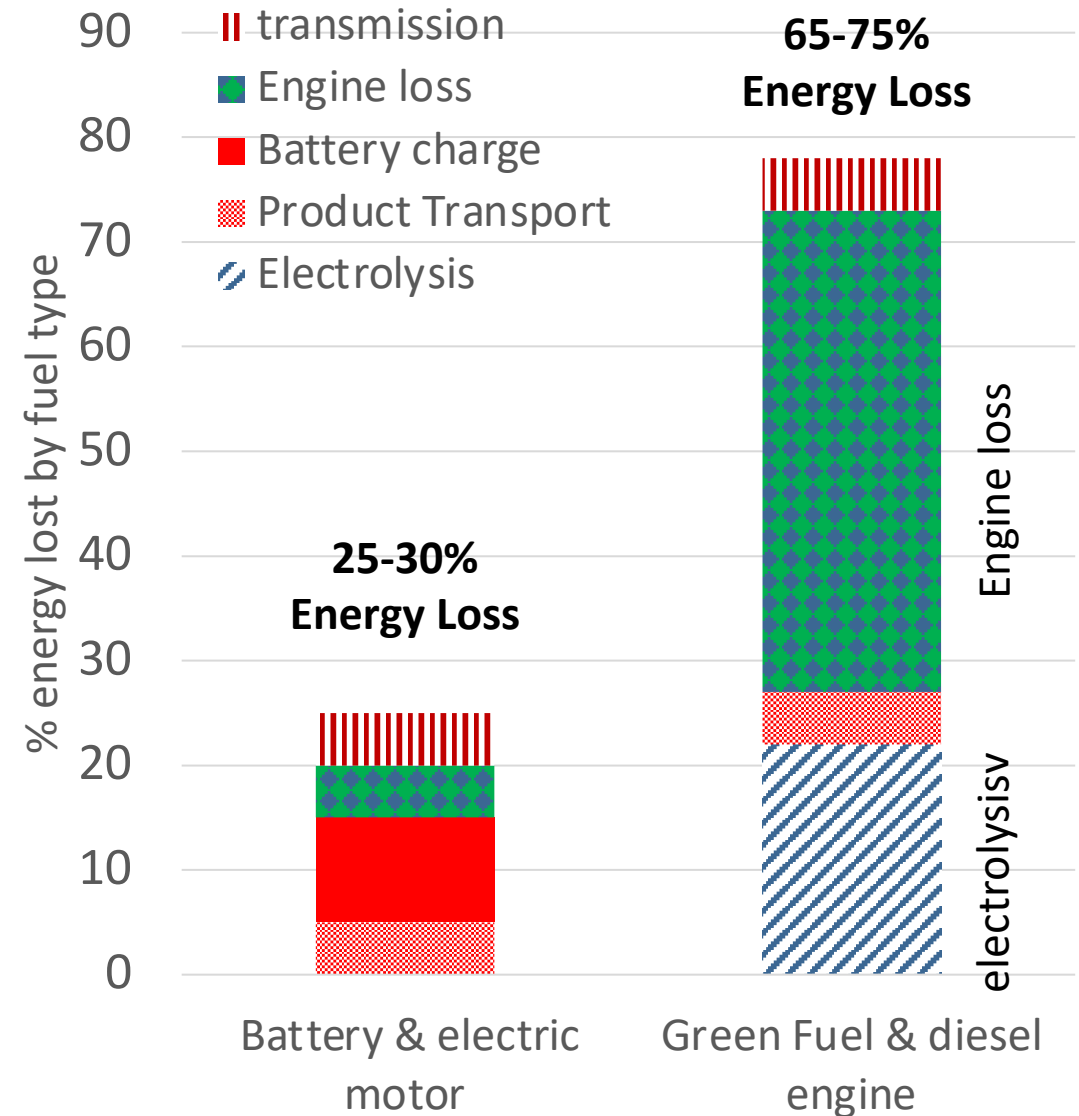
Diesel engine burning 200 TPD of VLSFO at \$550/tonne costs \$76/MW hour


30 offshore turbines cost about \$790 million and \$60k/day to run. Electricity costs about \$60/MW hour to produce



Slide 3: Electric & battery much more efficient than green fuel & slow speed diesel

- Energy loss for battery driven vehicle is only about 25%, but internal combustion engines or fuel cells loss is over 70%.
- The big losses for green fuels are: -
 1. electrolysis to produce H₂ (c.0%)
 2. Synthesis of green fuel (?)
 3. Engine losses (c. 50%).





2. The four “best” options for achieving net zero as soon as possible

The big problem for investors in the timing and
limitations of green technology

Slide 3: The four best low carbon options?



2. GREEN LIQUID FUELS: Hydrogen, Ammonia, green methanol delivered to ship: best early option in deep sea trades (nuclear reactor later?).



3. HEAVY FUEL OIL & CARBON CAPTURE (CCS); use HFO, capture CO₂ and offload. Needs system for using carbon. Best retrofit option.



1. GREEN ELECTRICITY & BATTERIES: best option in the short sea trades



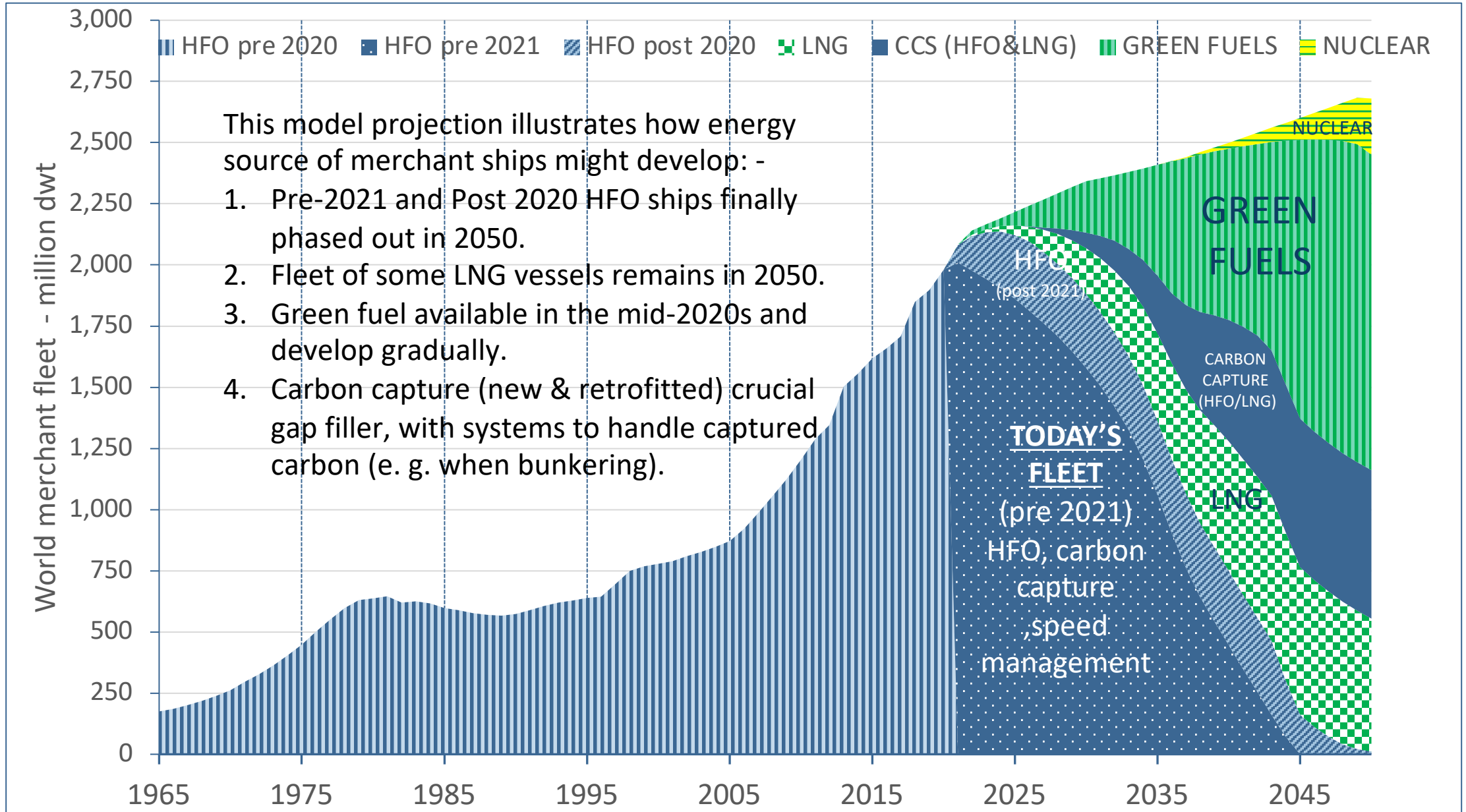
4. DIGITAL TECHNOLOGY & SPEED: smarter on-board operations, logistics & speed. Best companies' option.



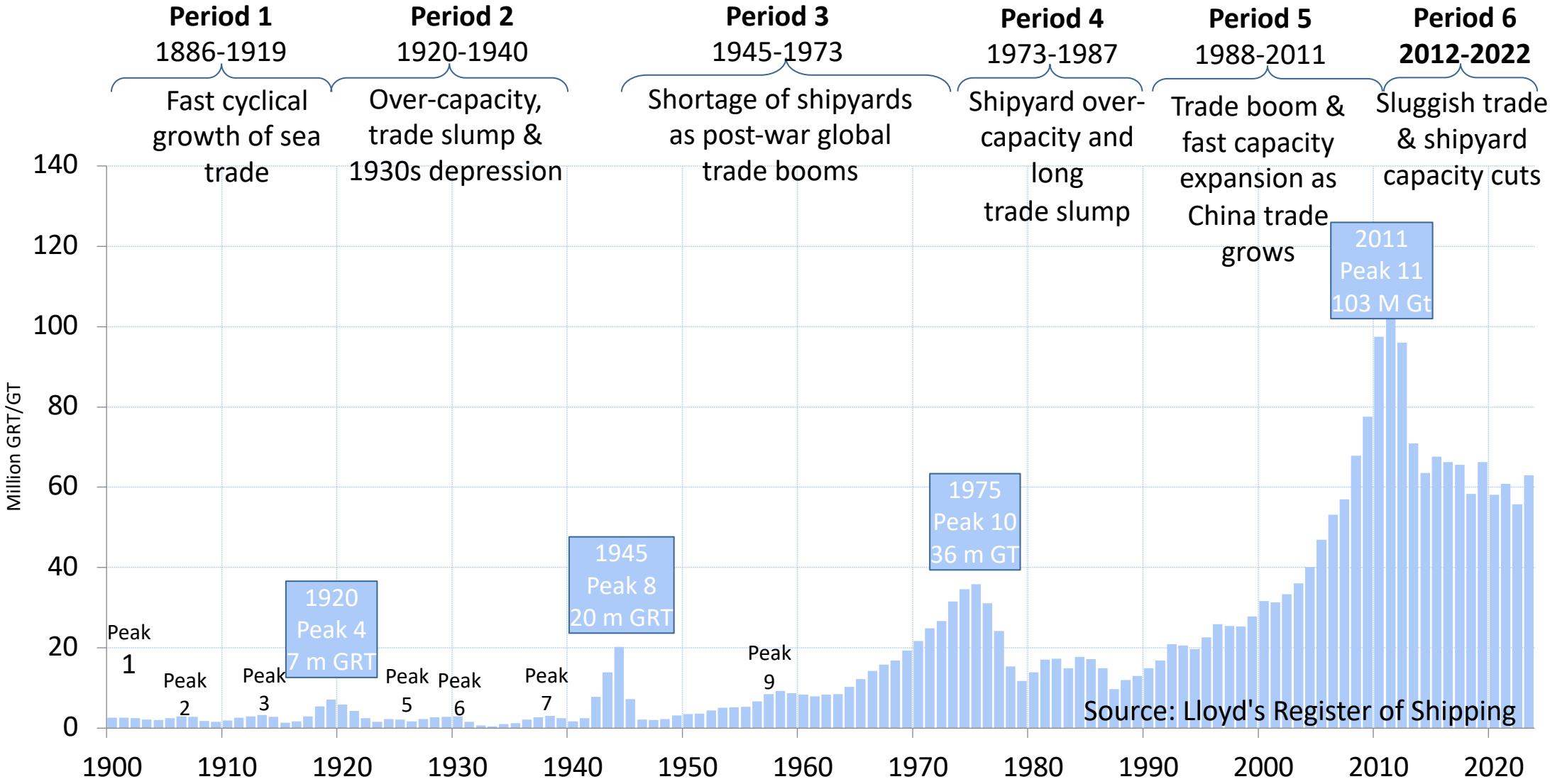
3. Fleet Development - CO2 technology & the Shipbuilding Scenario

HOW WILL THE MARKET HANDLE THE NEW TECHNOLOGY?

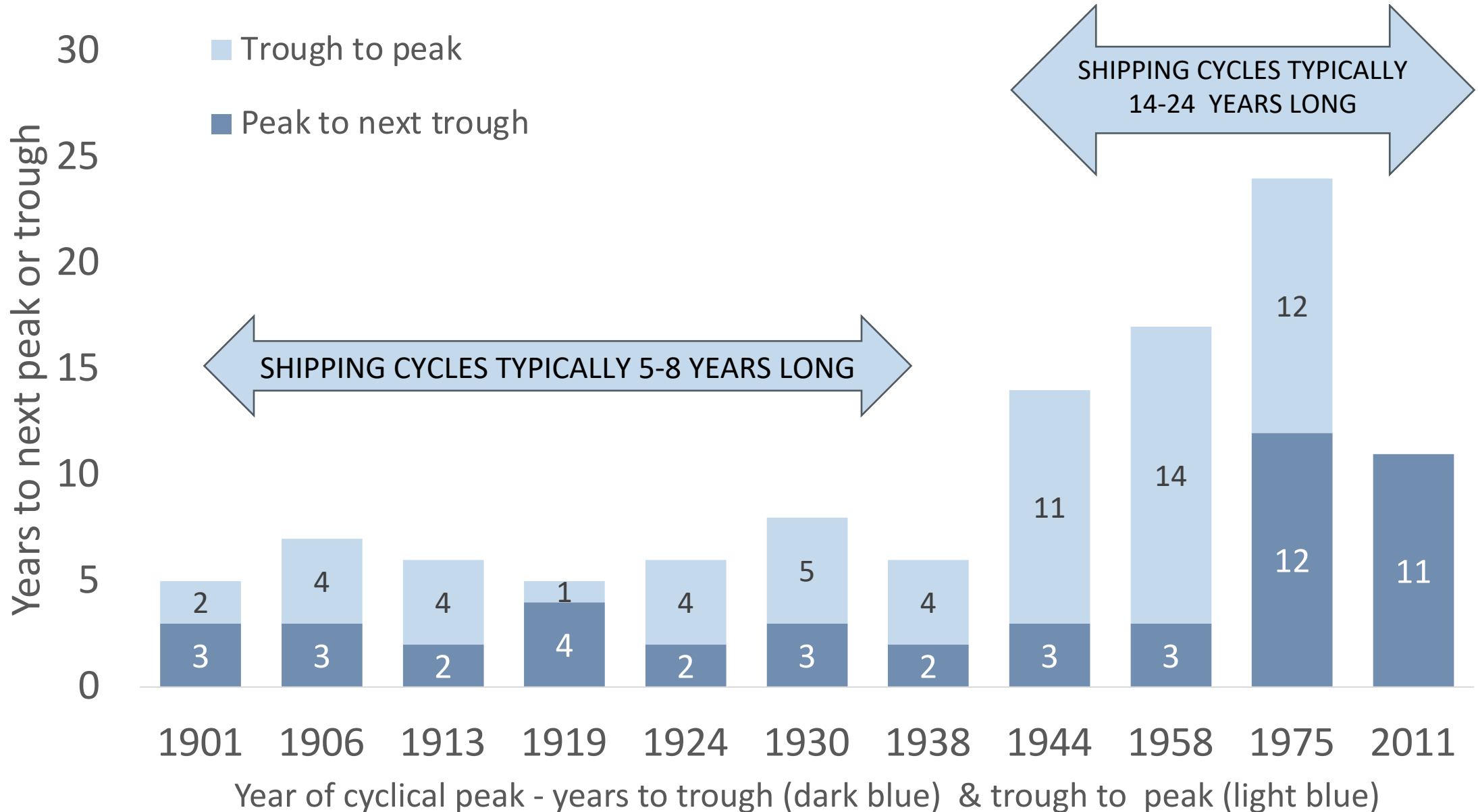
Slide 4: World Fleet Scenario – a course to zero carbon?



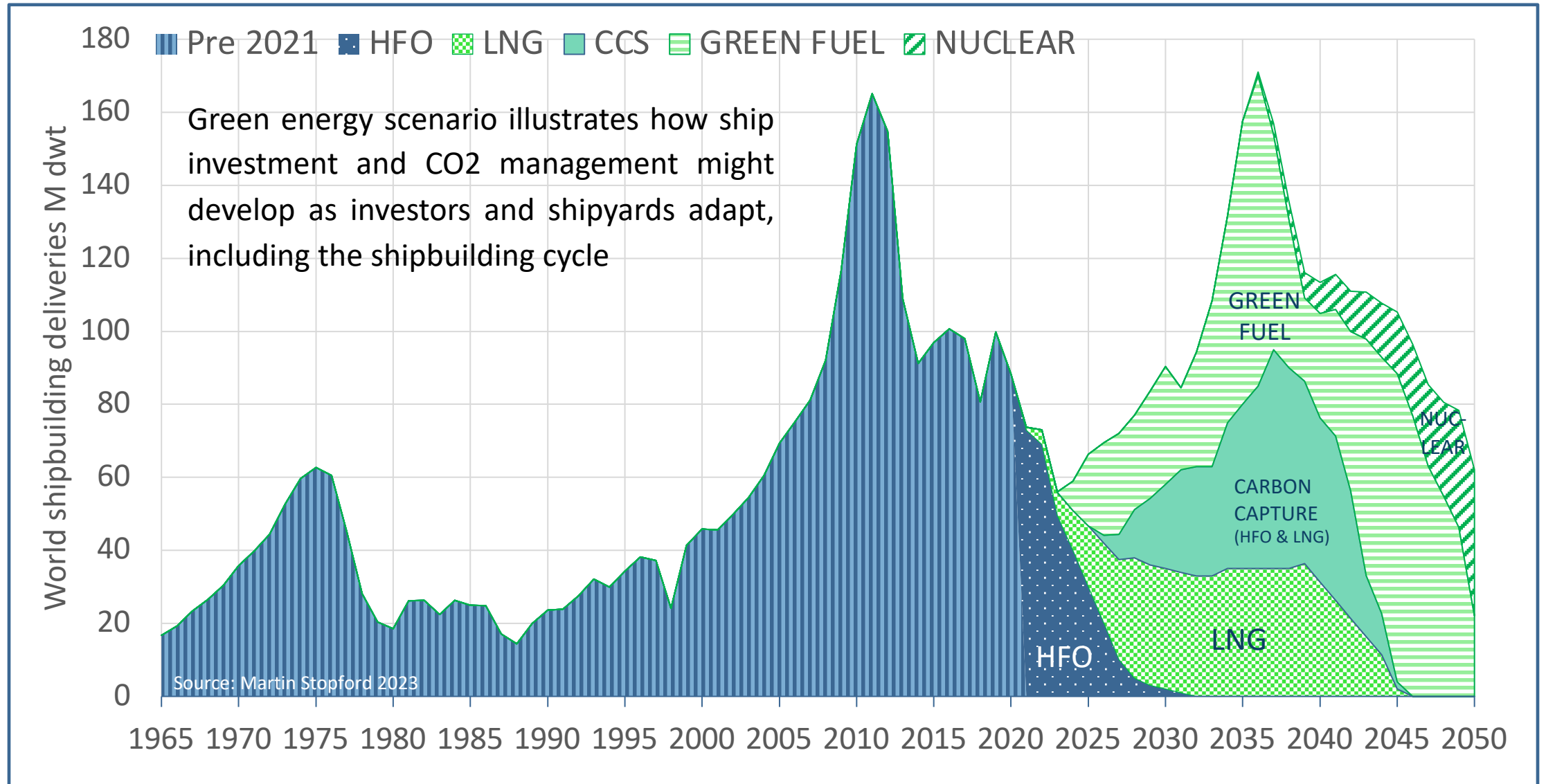
Side 5: Shipbuilding cycles - will play a big part in the green investment program



Side 6: the cycles are getting longer



Slide 7: Maritime energy investment scenario 2020-2050

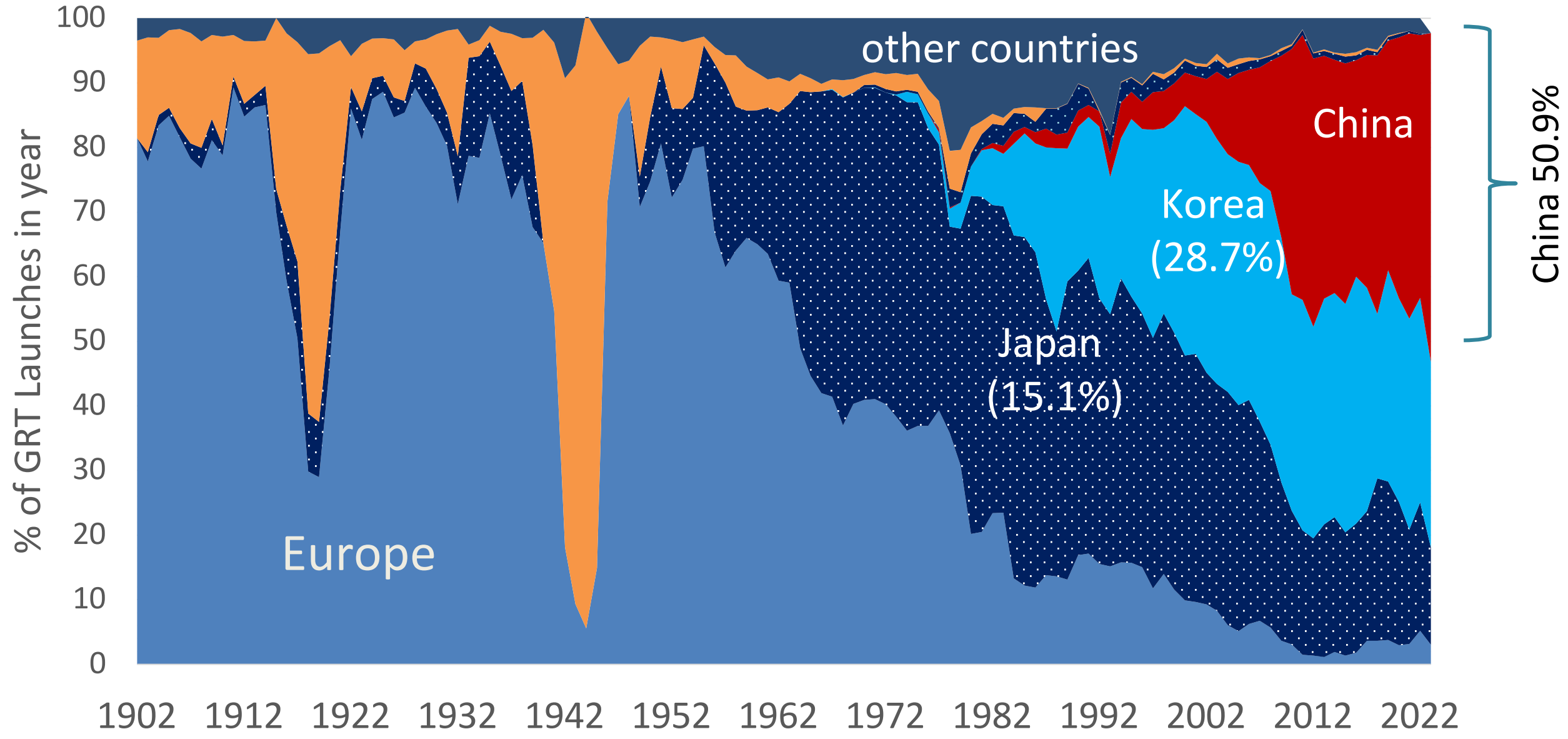




4. Conclusion

In an uncertain world change
will not be easy!

Slide 8 Shipbuilding market shares 1902-2023 – in a new technology era cooperation needed on green technology, protocols and standards

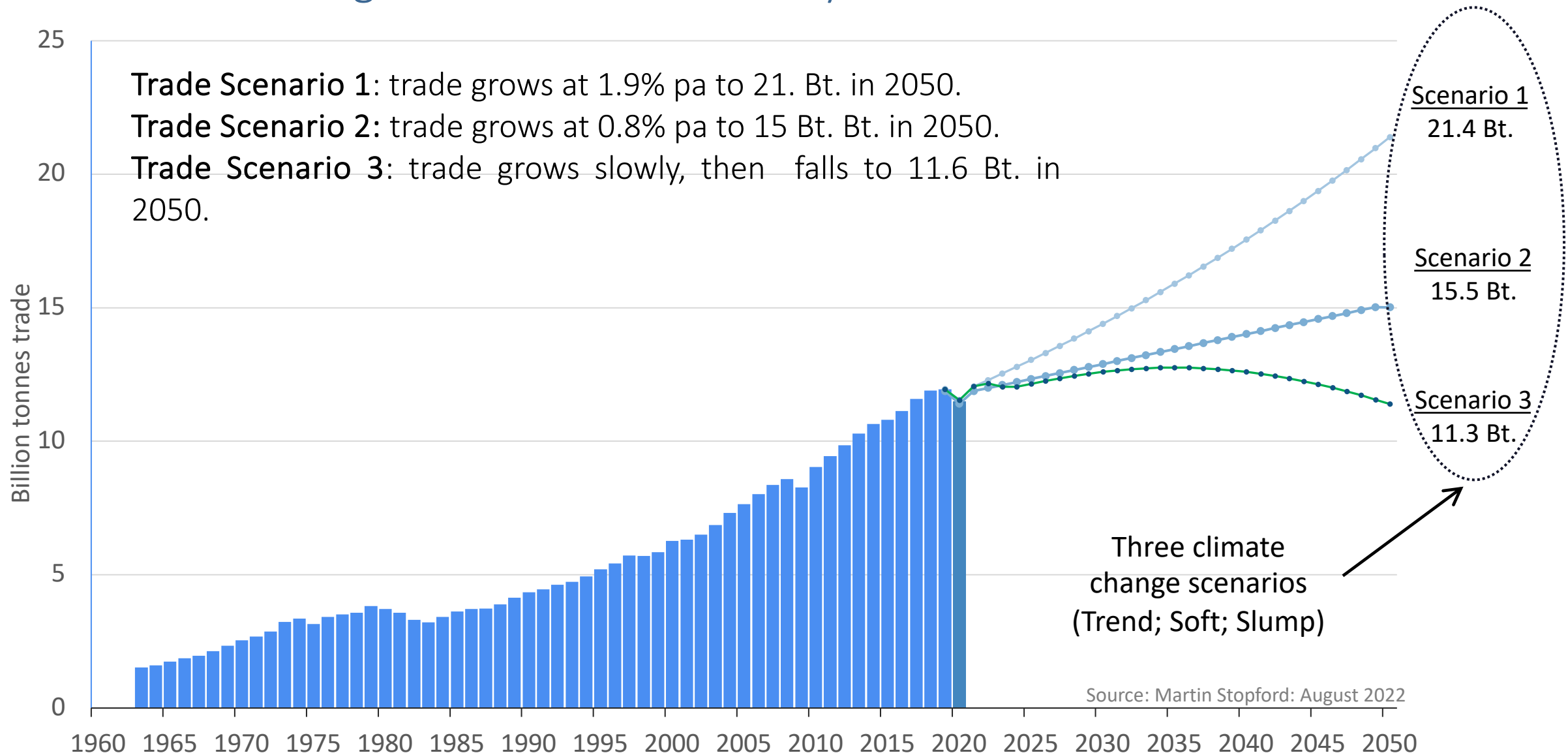


THE END

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*Maritime Economics for
Professionals 6 December 2023*



Slide 12: Sea trade growth rates remain very uncertain –which scenario?



SCENARIOS JANUARY 2023 – revised to reflect progress of pandemic and changing world economic outlook