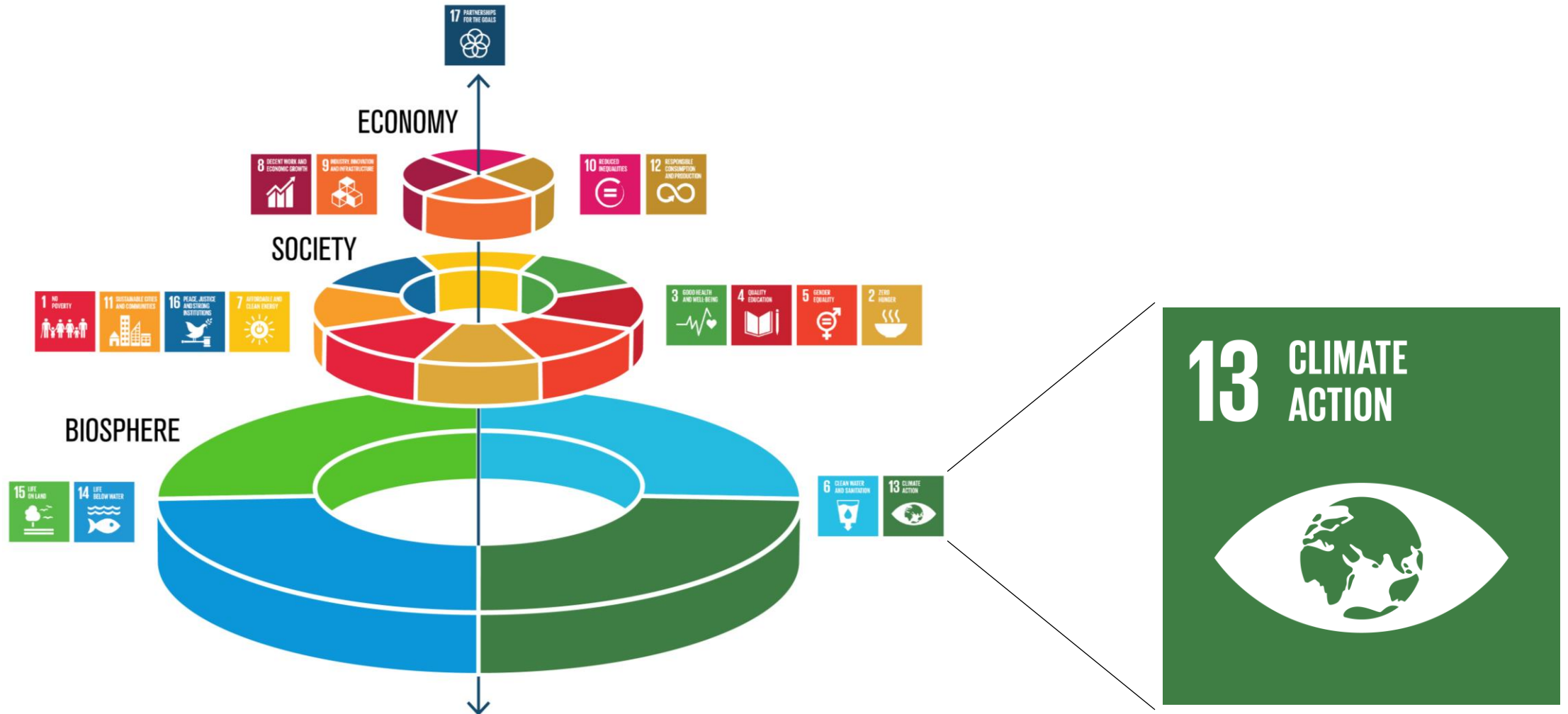


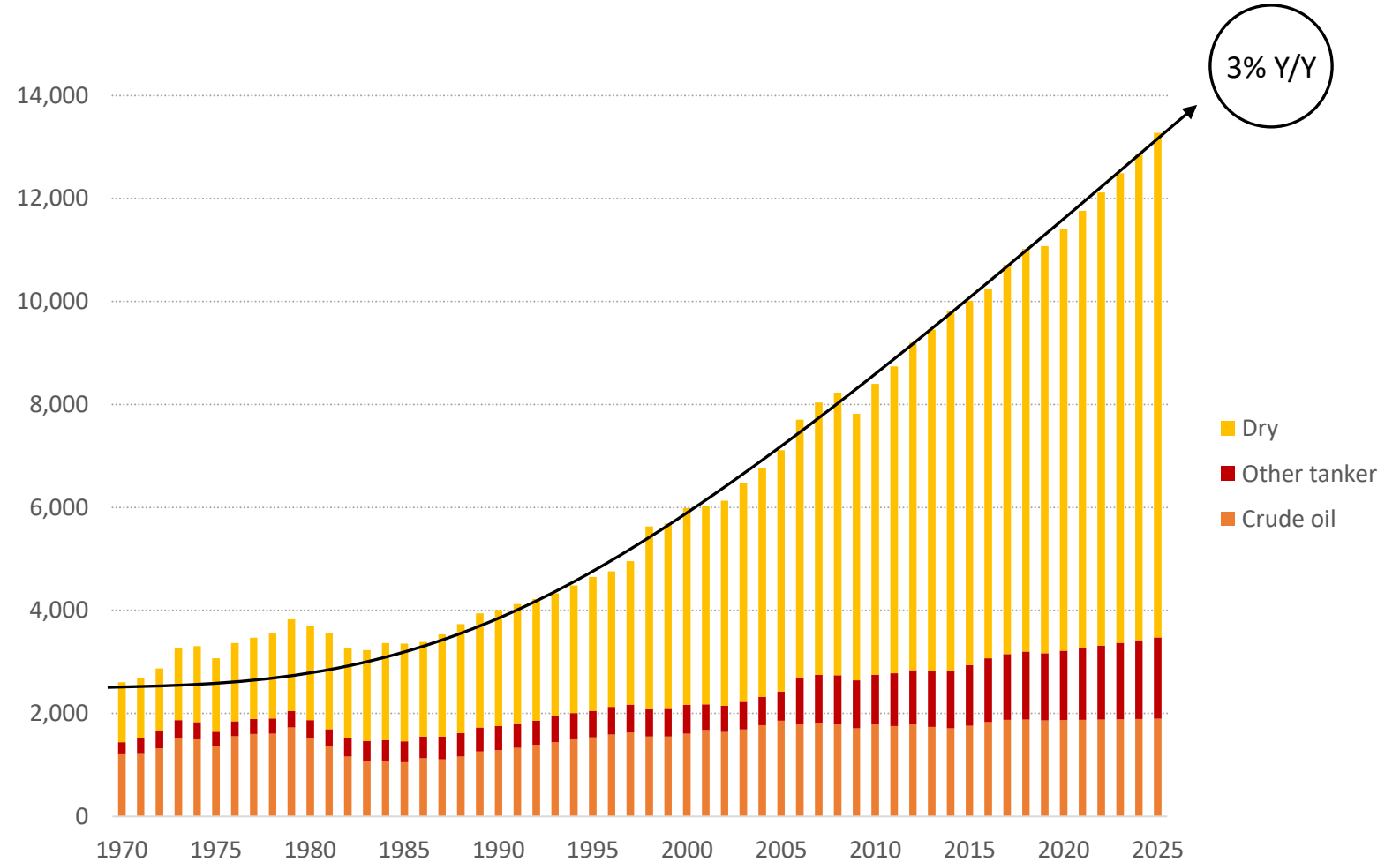
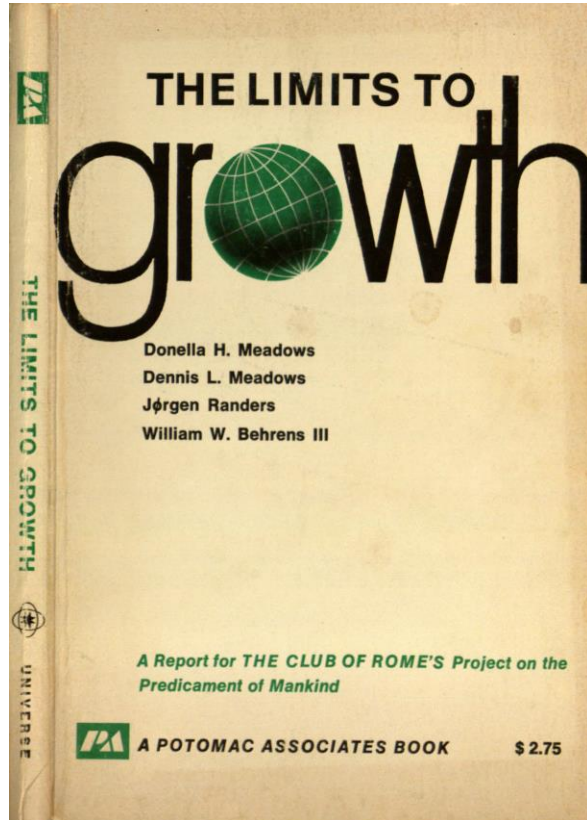
Sustainability > environment > climate





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Green shipping in a world with growth



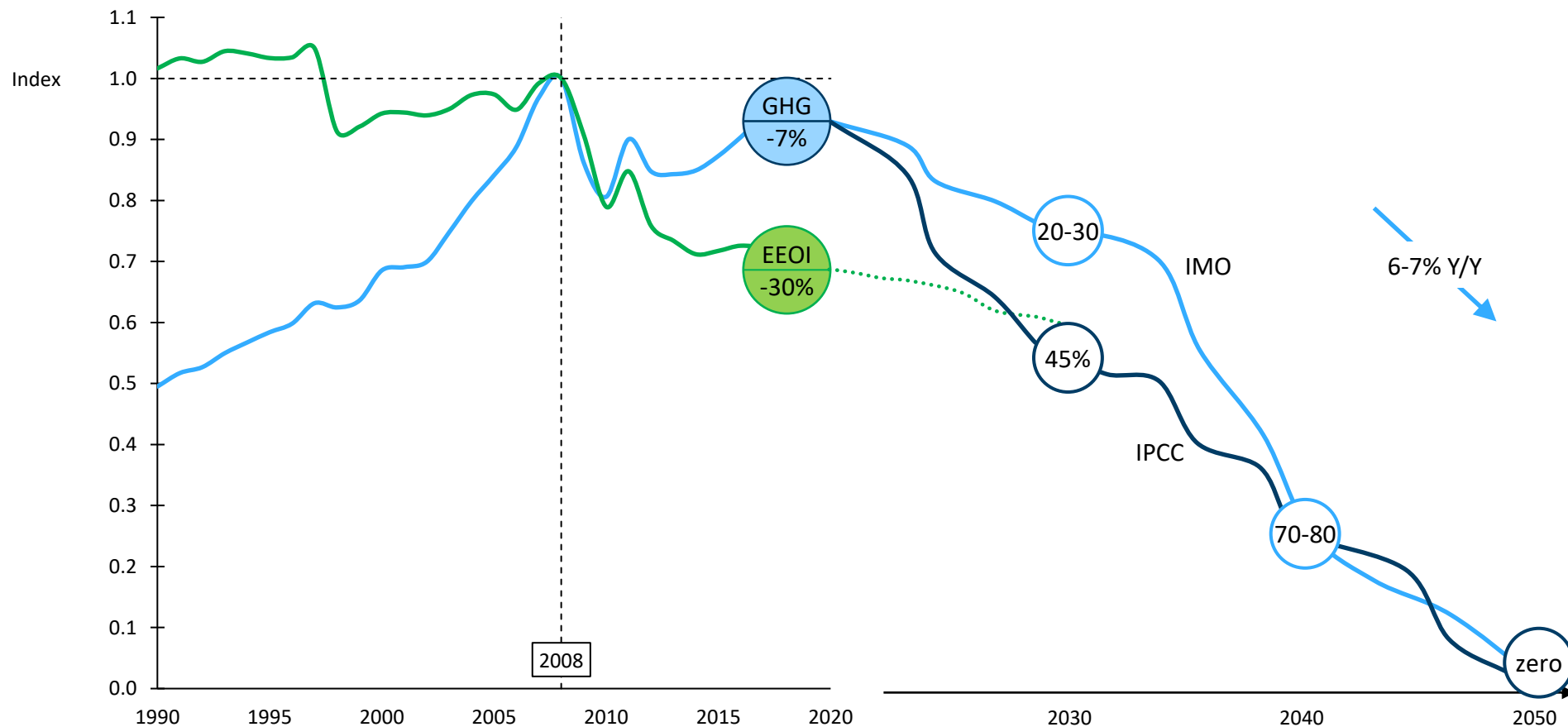
Sources:

Meadows et al (1973), UNCTAD UNCTAD review of seaborne trade,



SINTEF

Deep emission cuts by multiple measures



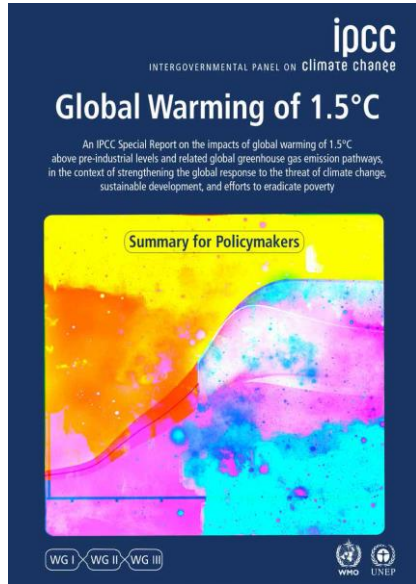
Note: Blue: Absolute emissions. Green: Carbon intensity measured by EEOI (energy efficiency operational index).

Source historical emissions: IMO 4th GHG-study. GHG goals: light blue IMO per the revised strategy (July 2023). Dark blue: Emission trajectory acc. to IPCC

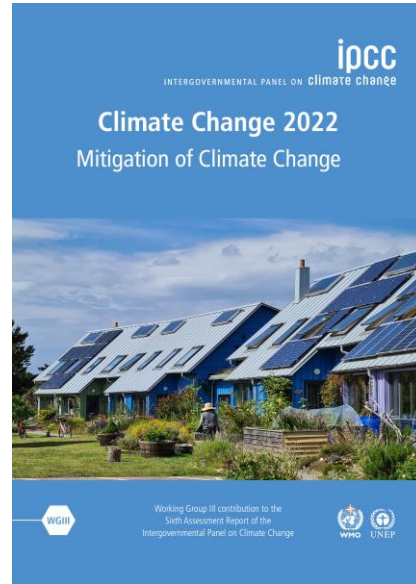


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Macro: Deep, rapid and sustained emission cuts



GHG: 45% reduction from 2010 to 2030 necessary to limit global warming to 1.5°C.



GHG must peak before 2025 to limit global warming to 1.5°C with no or limited overshoot.

"Deep, rapid and sustained"



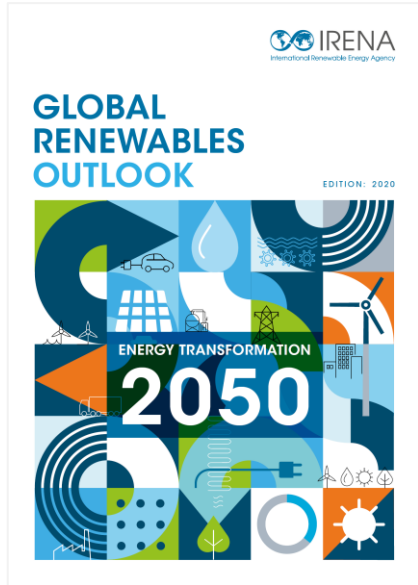
Tipping points can be exceeded even between 1 and 2°C warming.



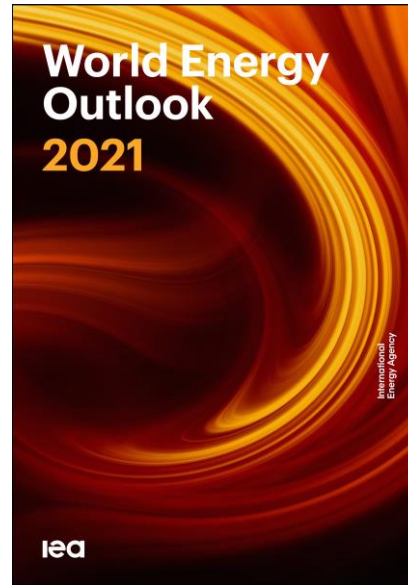
Sources:
IPCC SRR1.5 (2018), AR6 WG3 (2022), Lenton and Rockstrom (2022),



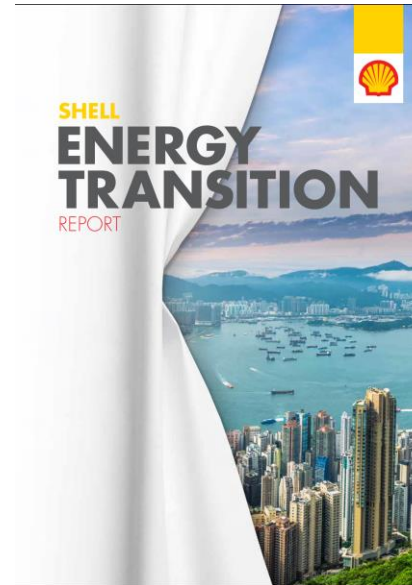
Macro: Energy efficiency, renewable energy scarcity, clean air



Improvements in energy efficiency must triple. So far, growth in renewables is cancelled by growth in energy demand.



Energy efficiency delivers > 40% of the reduction in energy-related GHG over the next 20 years.



Renewable energy overtakes fossil fuels as the primary source of energy in the 2050s.

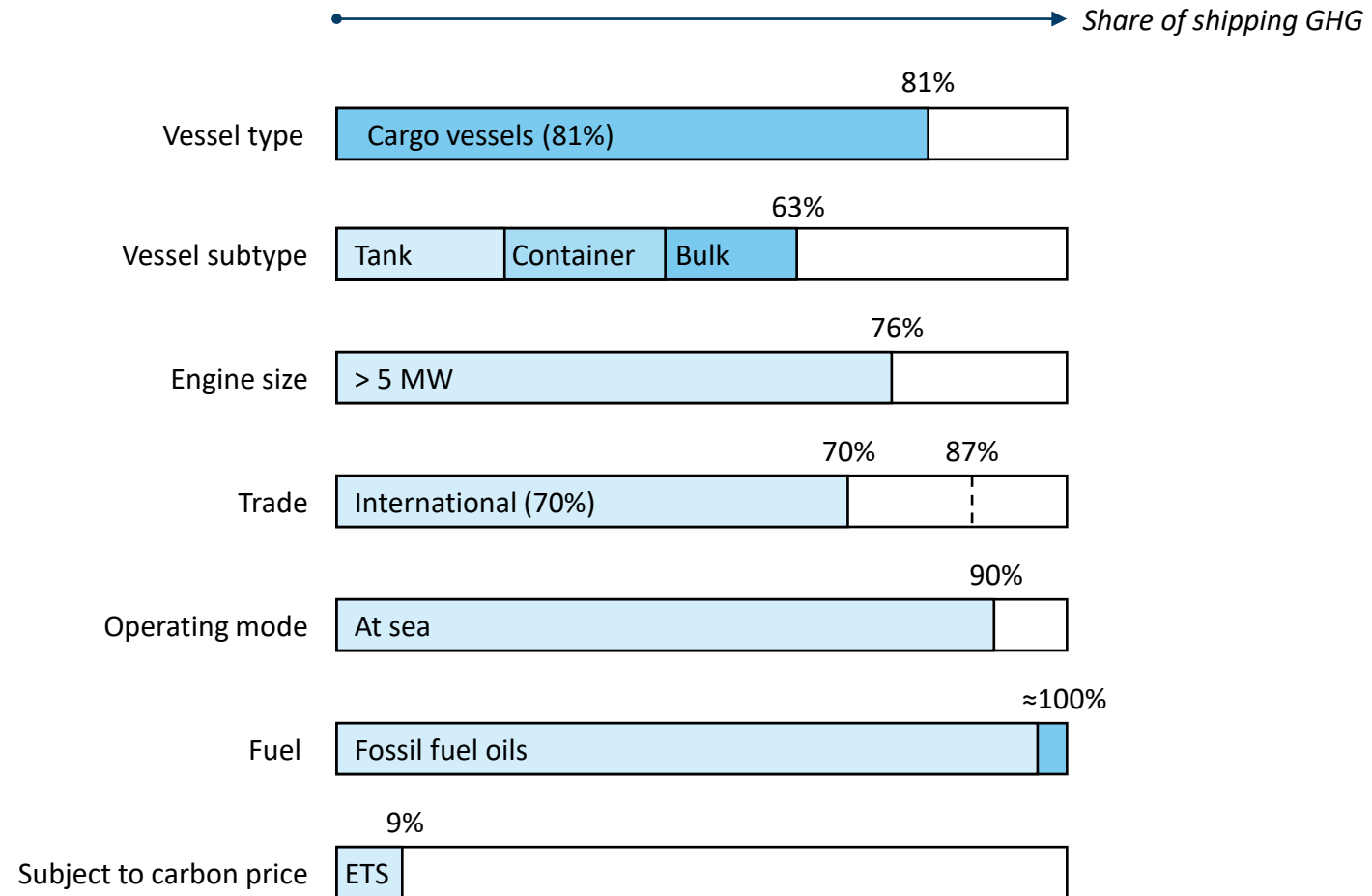


97.3% live in areas where air pollution exceed the WHO threshold ($PM_{2.5} > 5 \mu g/m^3$) and PM shortens the average life expectancy by 2.2 years worldwide,



Sources: IRENA (2020), IEA world energy outlook 2021, Shell Sky scenarios, Greenstone et al (2022) Uni. Of Chicago,

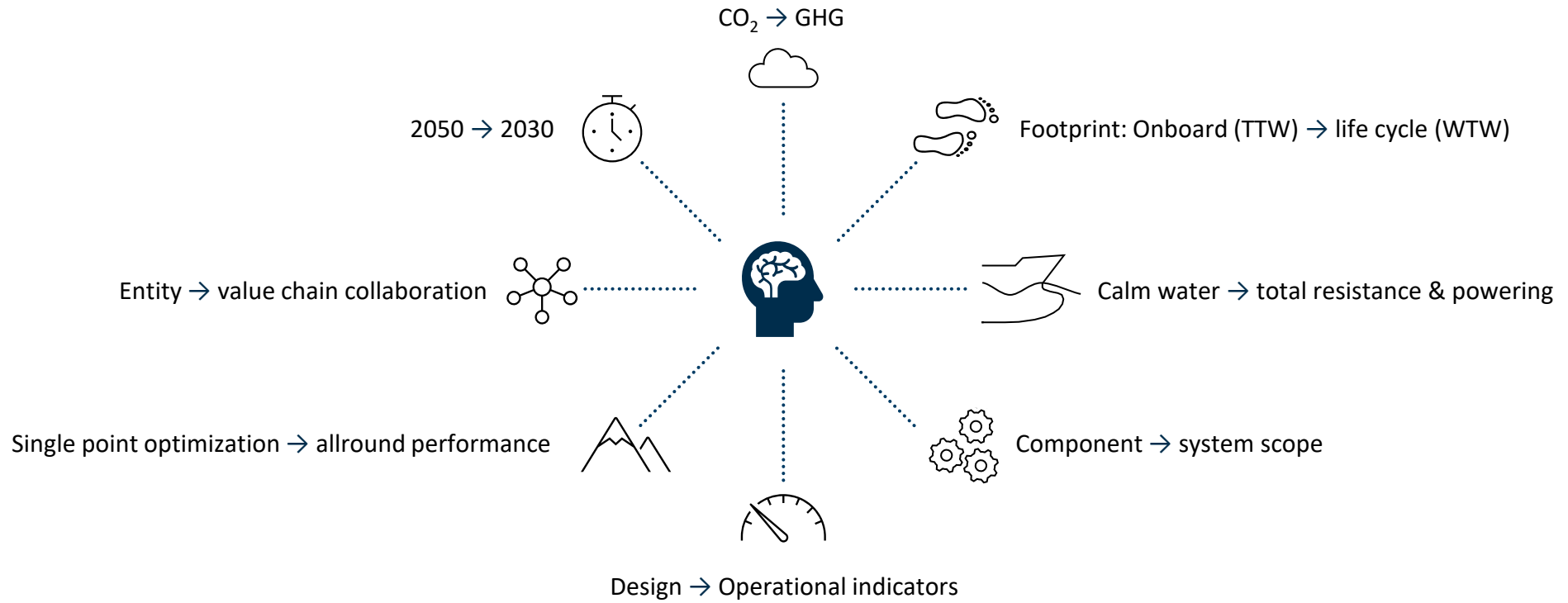
Where to focus?



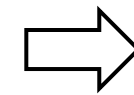
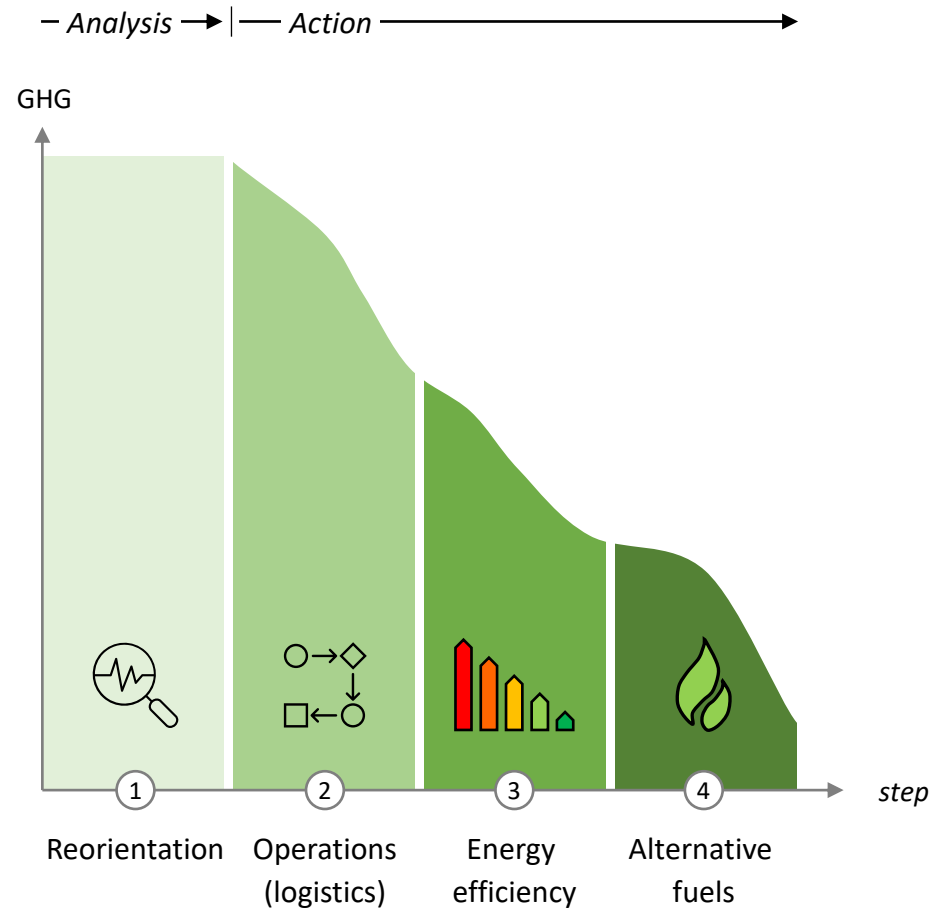
Source: IMO 4th GHG-study.

Note: Approximate percentages, from summary of emission inventories per vessel type and vessel size (IMO 4th GHG-study, table 81, page 446).

Reorientation



Four steps to green(er) shipping



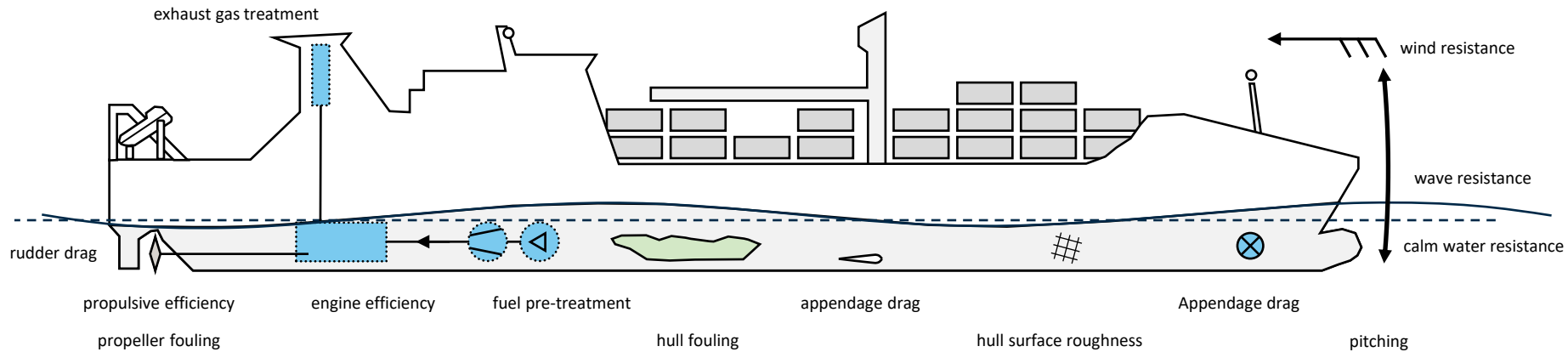
Technology neutral

Open, curious approach to decarbonization

Variety of solutions reflecting fleet diversity

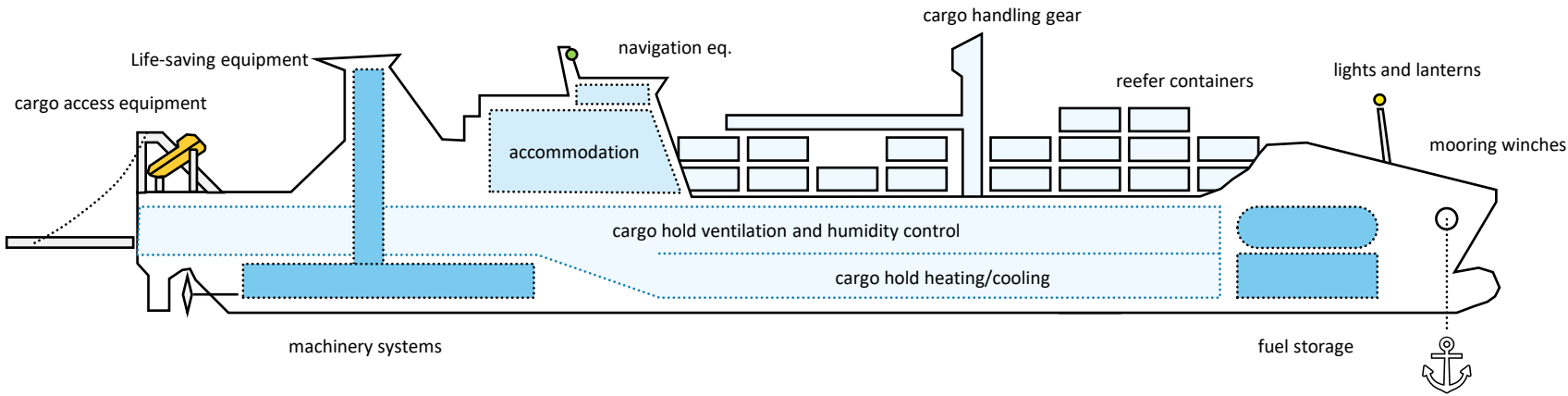


Energy efficiency: A 1000-piece jigsaw puzzle



Propulsion

Ancillary systems

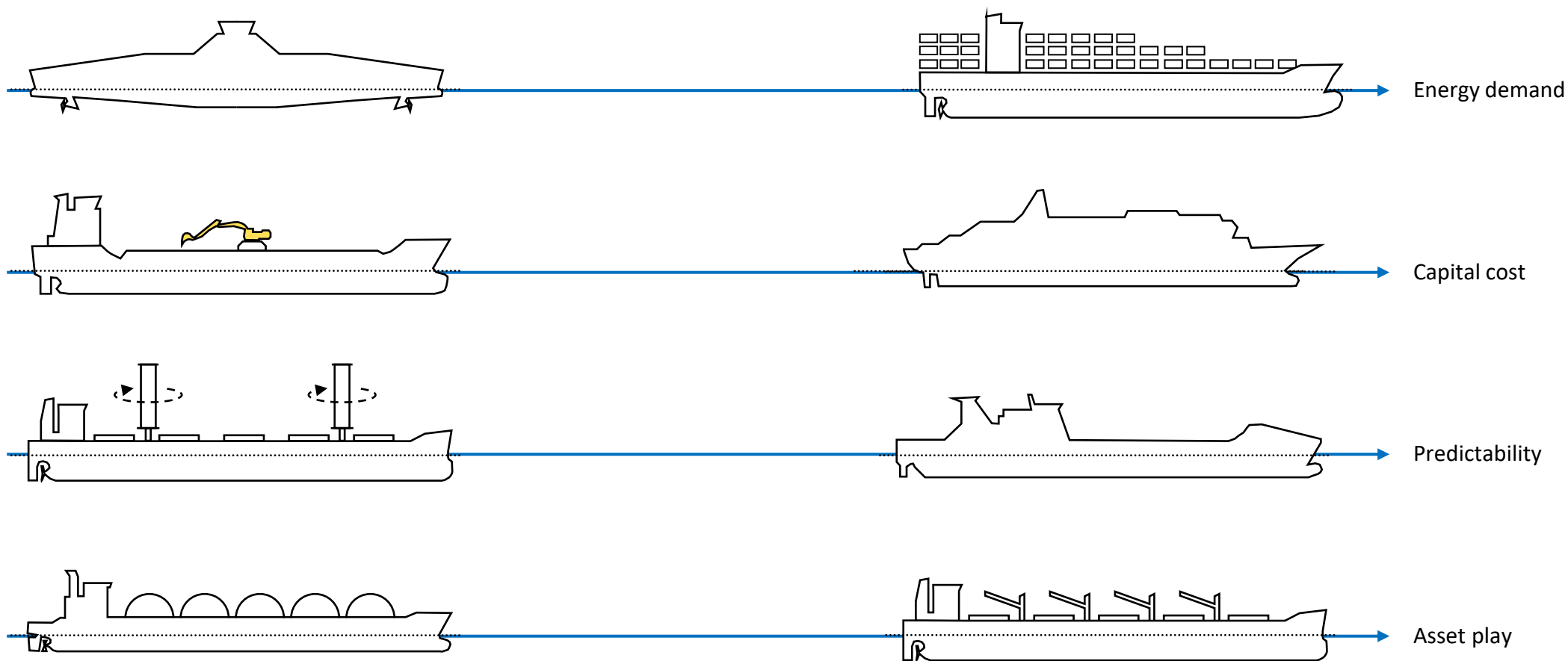


NOTES
 Non-exhaustive overview of energy consumers onboard and factors determining the propulsive power.



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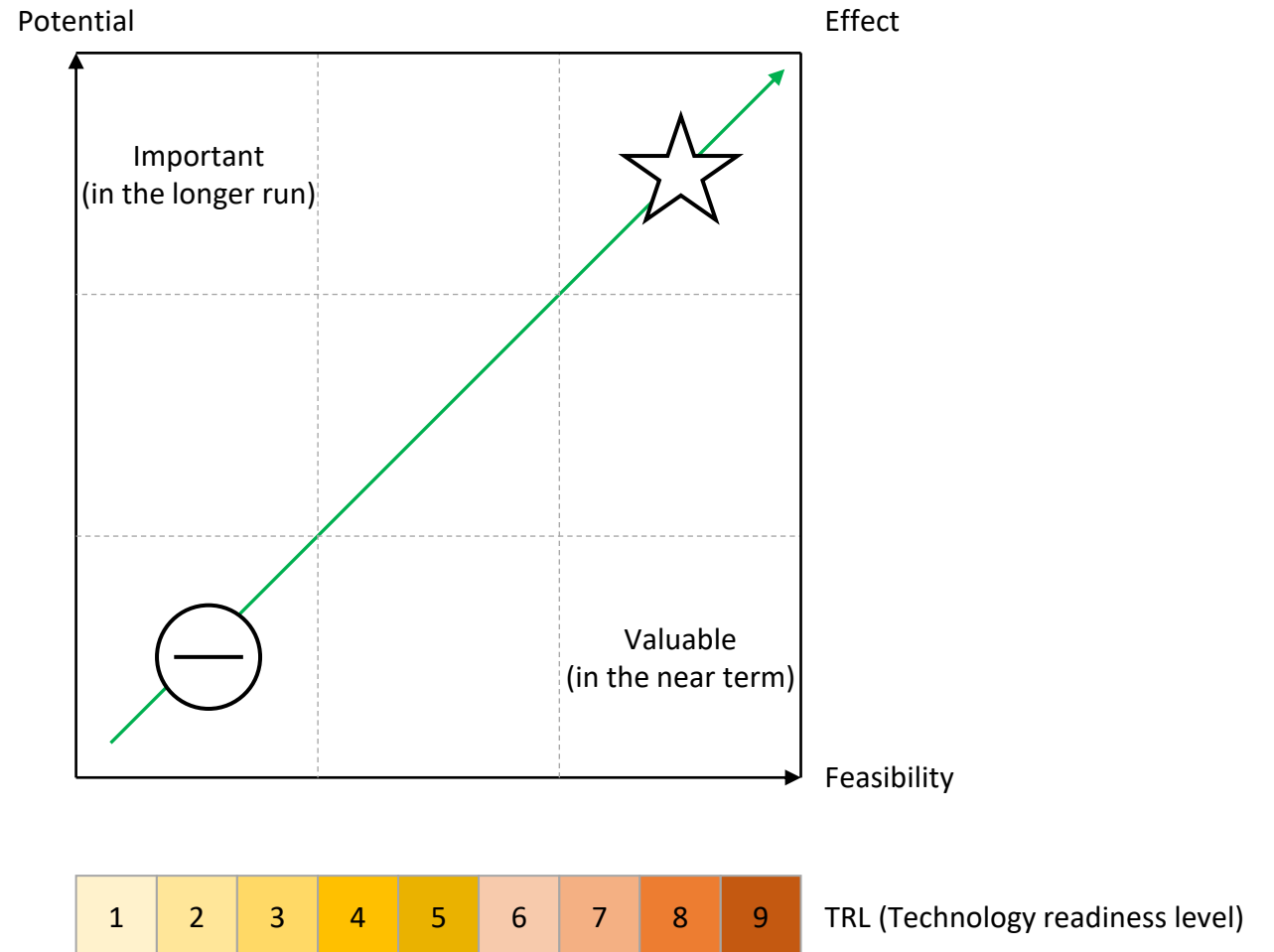
Diversity means many solutions / technologies are needed



Note:
Author's subjective opinion

Time matters!

Deep, rapid and sustained emission reductions necessary (IPCC, AR6)





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Technology for a better society