MARITIME

IMO GHG STRATEGY - CHALLENGES FOR SHIPPING

GreenShipping Niedersachsen

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14 June 2018

SAFER, SMARTER, GREENER

AGENDA

- CLIMATE CHANGE AND IMO GHG STRATEGY
- OTHER DRIVERS
- TECHNOLOGIES AND OPTIONS
- CONSEQUENCES FOR SHIPPING

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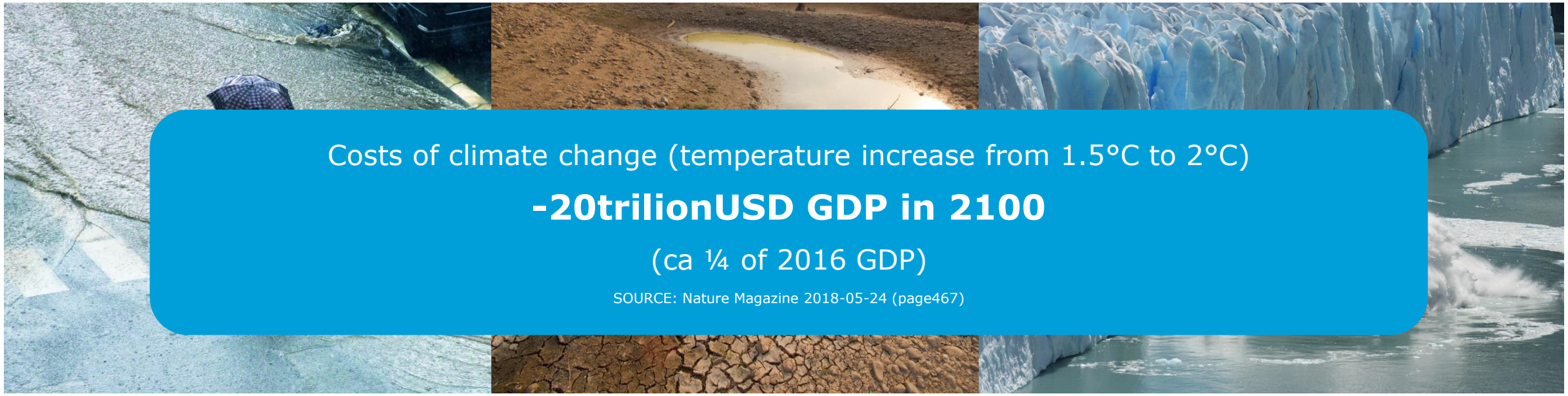
MOTIVATION: CONSEQUENCES OF CLIMATE CHANGE



Costs of climate change (temperature increase from 1.5°C to 2°C)

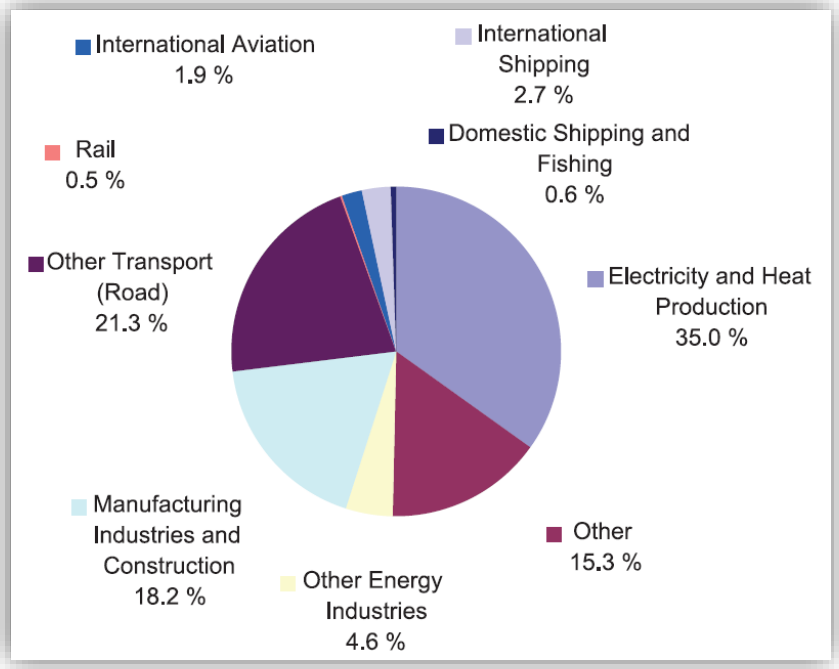
-20trilionUSD GDP in 2100

(ca ¼ of 2016 GDP)

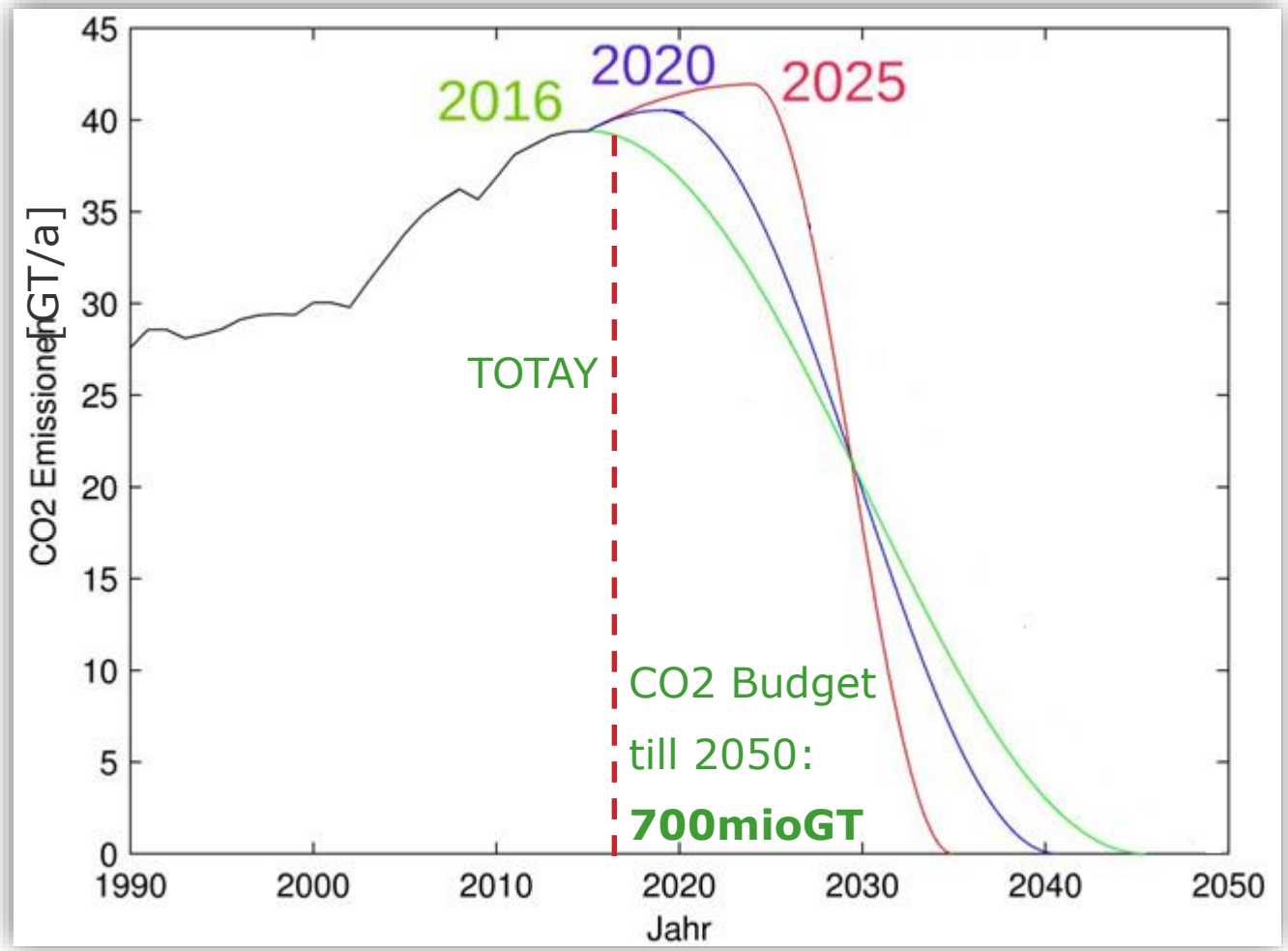
SOURCE: Nature Magazine 2018-05-24 (page467)

CONSEQUENCES FOR INDUSTRY IN GENERAL / CONTRIBUTION OF SHIPPING

- Peak CO2 till 2020
- Zero CO2 till 2050
- Active absorption before 2050



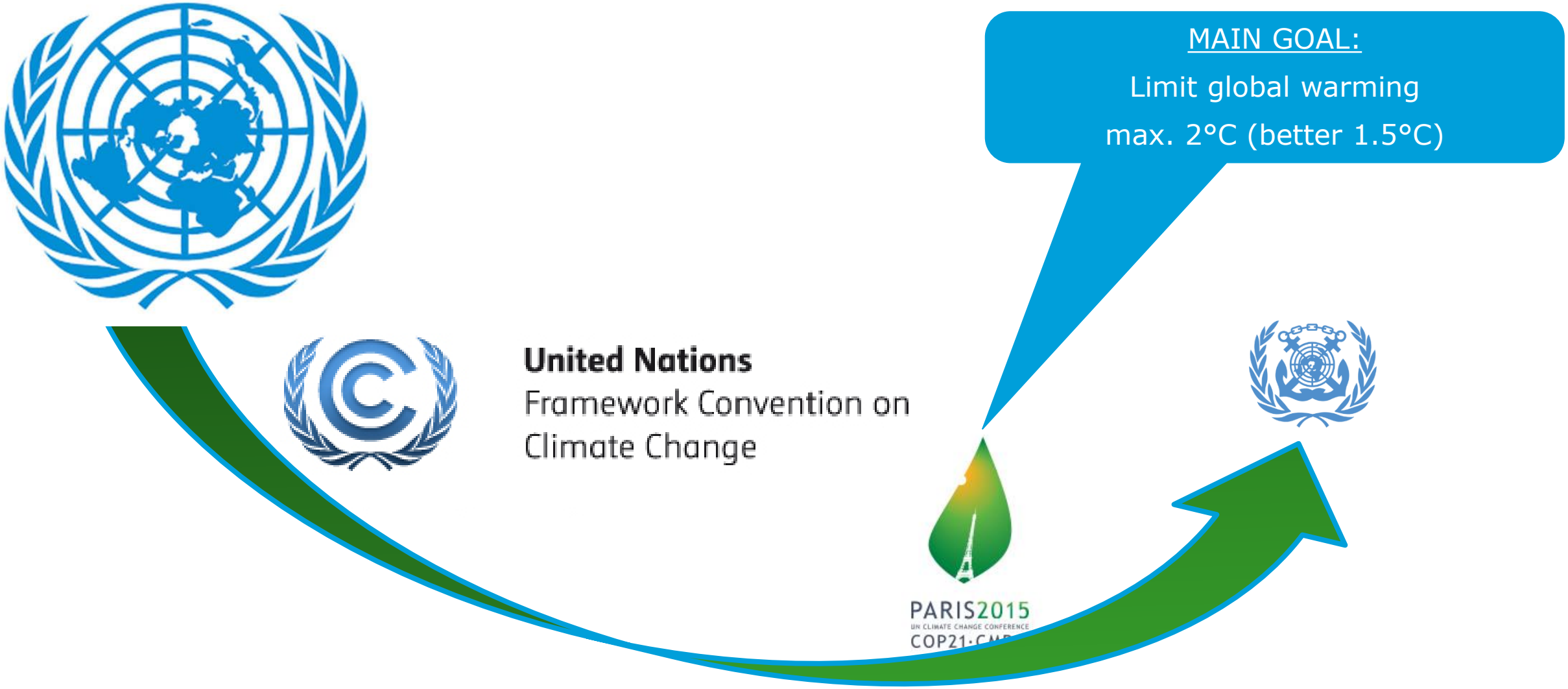
SOURCE: 3dr IMO GHG Study 2009



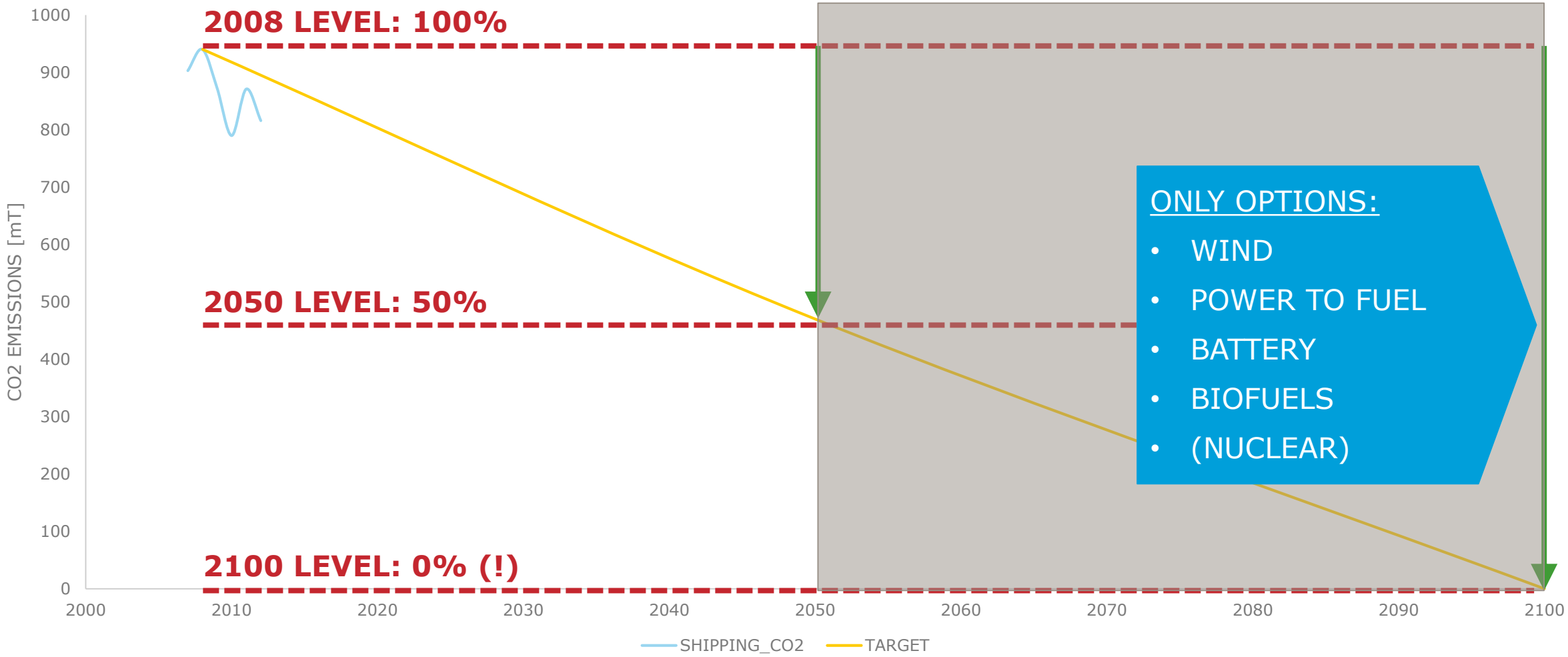
SOURCE Based on: Prof. Stefan Rahmstorf, Creative Commons BY-SA 4.0.

and Johan Rockström, A roadmap for rapid decarbonization (Sience Magazine 2017-03-24)

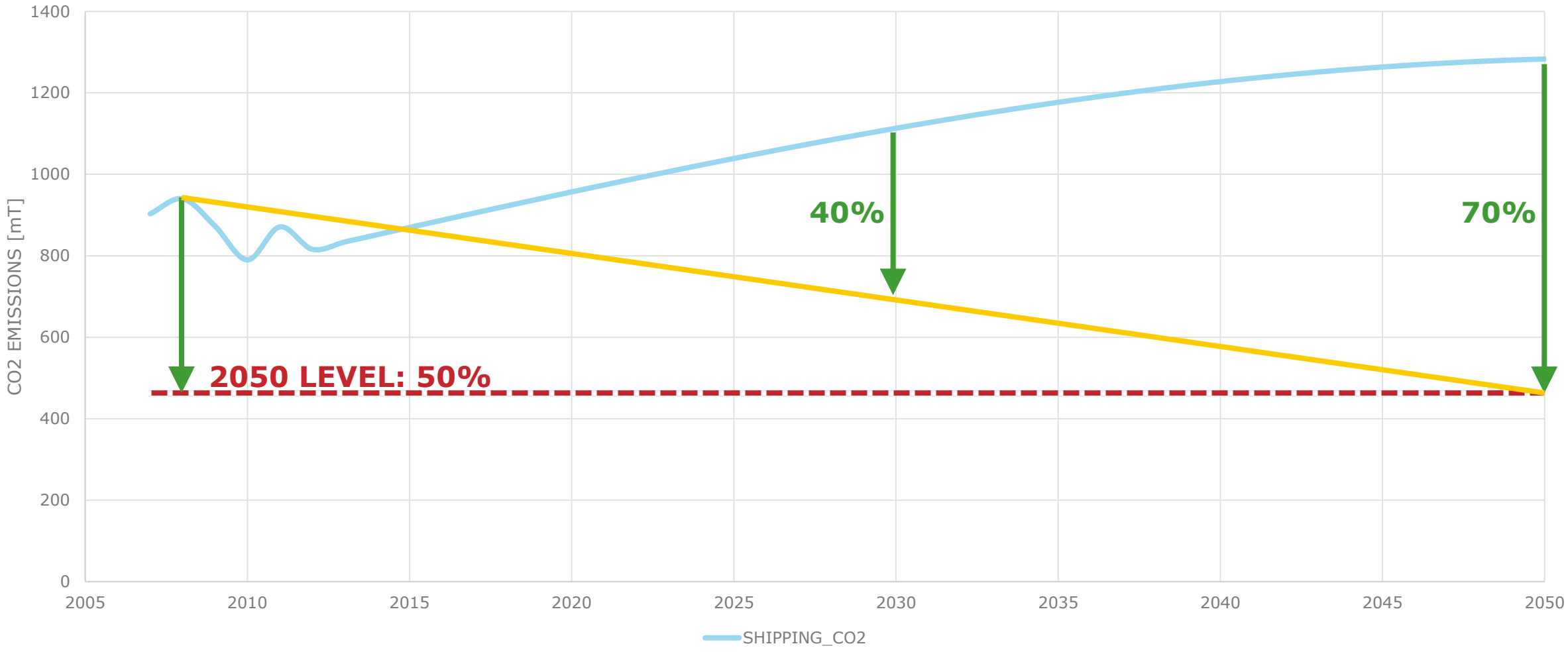
IMO IN A GLOBAL CONTEXT



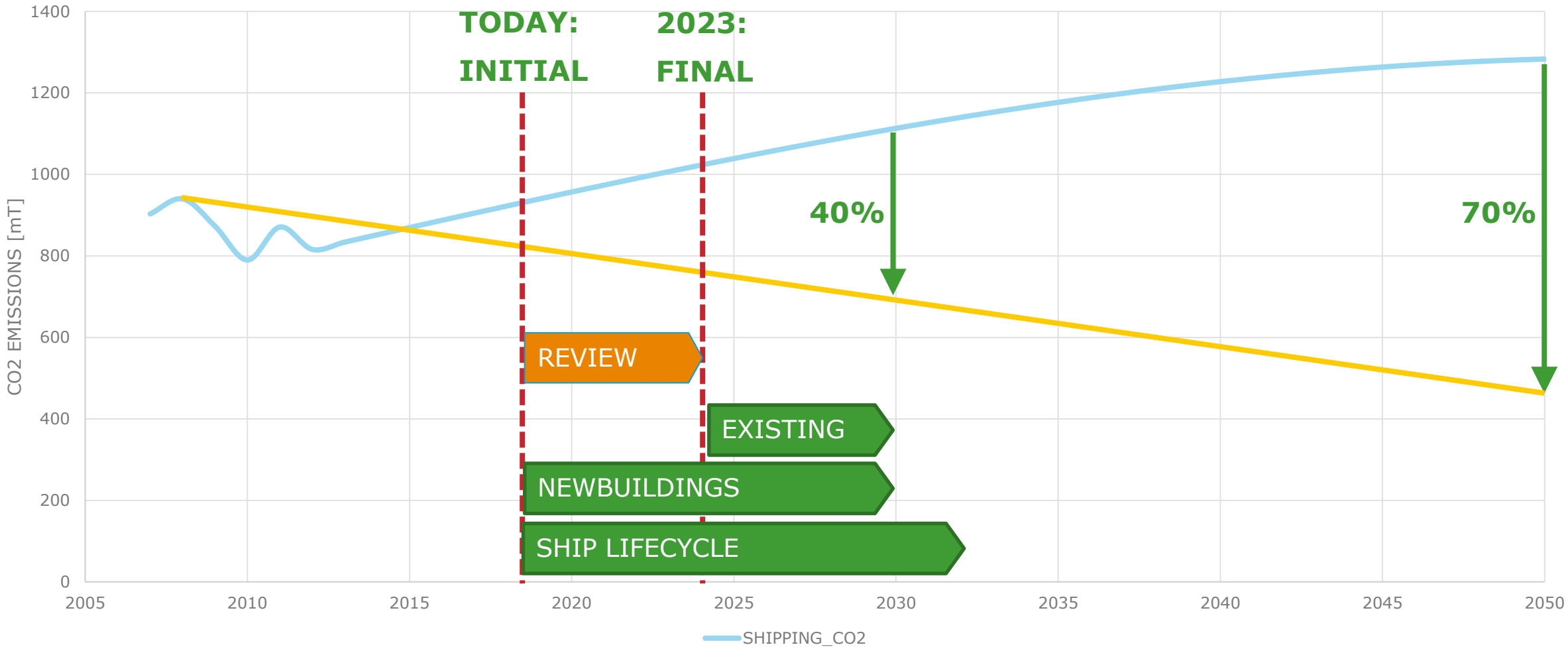
IMO REDUCTION TARGET: PHASE OUT CO2 EMISSIONS IN THIS CENTURY



IMO REDUCTION TARGET: REDUCE CO2/TRANSPORT WORK BY 70% BY 2050



IMO REDUCTION TARGETS: TIMELINE SHOWS RELEVANCE FOR TODAY



IMO INITIAL MEASURES (VAGUE)

2018 – 2023	2023 – 2030	2030 – 2XXX
SHORT TERM	MID TERM	LONG TERM
• PROMOTE ALTERNATIVE FUELS	• PROMOTE ALTERNATIVE FUELS	• PROMOTE ALTERNATIVE FUELS
• TECHNICAL COOPERATION + INNOVATION	• TECHNICAL COOPERATION + INNOVATION	• TECHNICAL COOPERATION + INNOVATION
• EEDI + SEEMP	• EEDI + SEEMP	• EEDI (PHASE 4)
• SPEED OPTIMIZATION	• SPEED OPTIMIZATION	
• ADRESS METHANE • PROVIDE OPS • INCENTIVES FOR FIRST MOVERS	• MARKET BASED MEASURES • FEEDBACK MECHANISM	

AGENDA

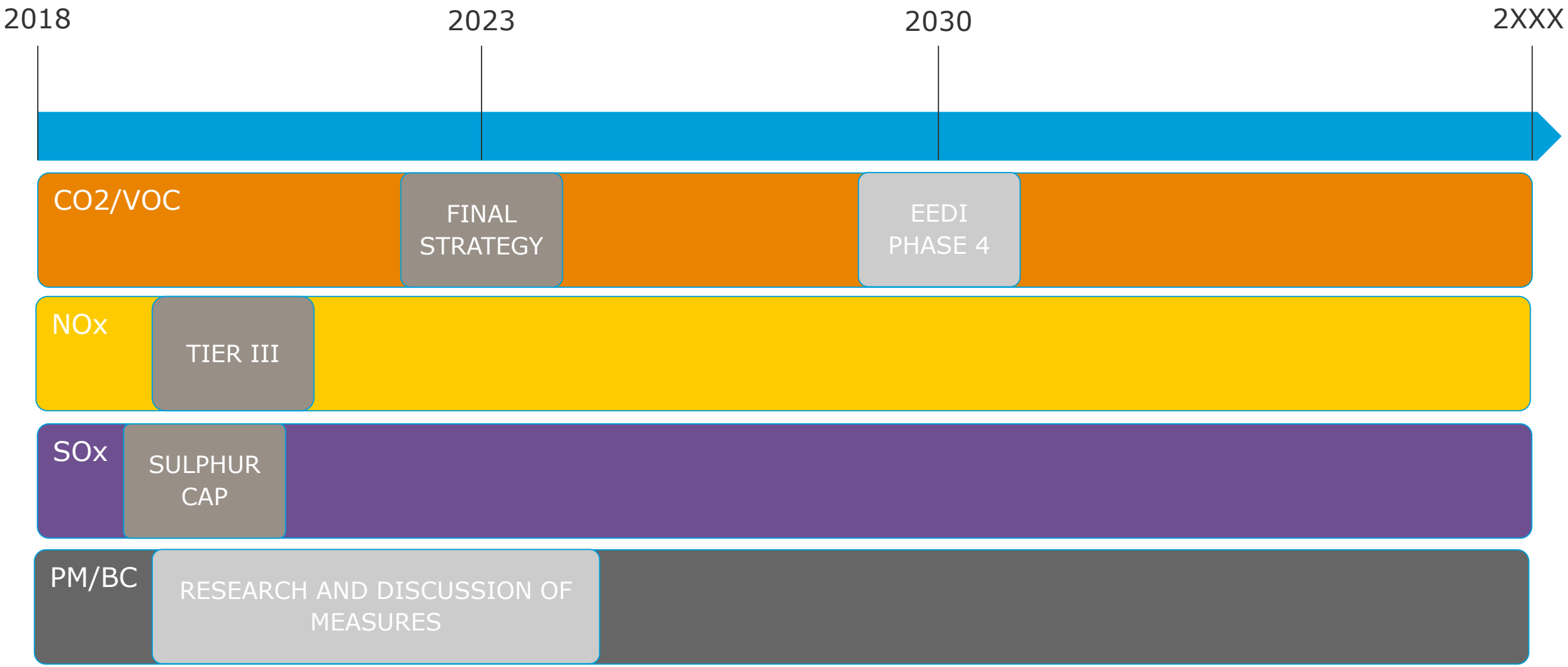
CLIMATE CHANGE AND IMO GHG STRATEGY

OTHER DRIVERS

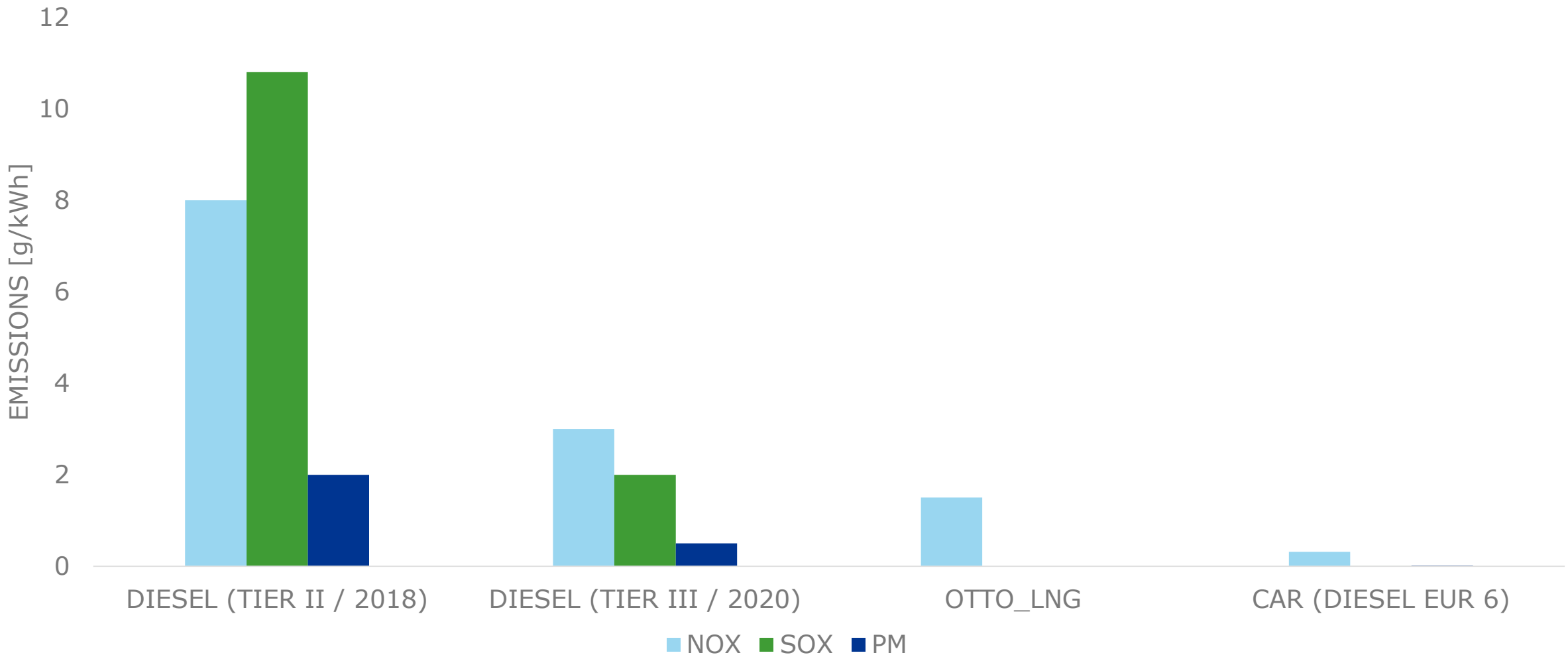
TECHNOLOGIES AND OPTIONS

CONSEQUENCES FOR SHIPPING

OTHER ENVIRONMENTAL DRIVERS: NOx / SOx / PM



TODAY KNOWN LIMITS WILL NOT BE THE FINAL ONES – FOR SURE!



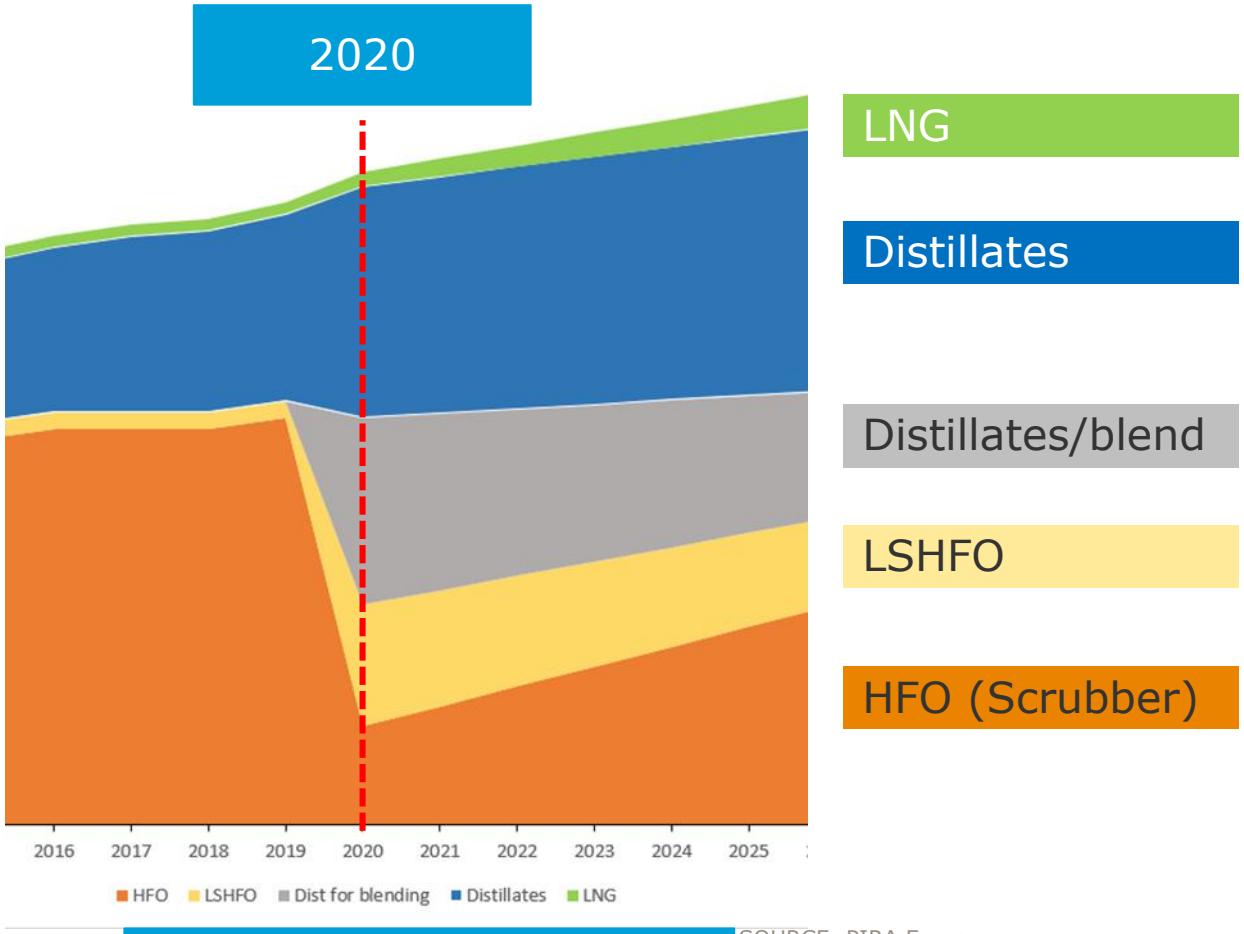
THE 2020 0.5% S EFFECT ON GLOBAL BUNKER DEMAND

- High S HFO will drop dramatically

- LNG will not play a major role
- Distillates and LSHFO will take the role of high sulphur HFO

- Uncertain: Development beyond 2020
- Certain: Average bunker costs will increase!

- Allows alternative technologies/fuels to enter the stage



One possible global bunker demand

SOURCE: PIRA Energy.

Demand for high sulphur fuel oil is expected to take a big dive in 2020 with the new IMO sulphur cap.

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FUTURE OPTIONS: 4 ACES IN THE GAME

2030 TARGETS

2050 TARGETS

LOGISTICS & DIGITALIZATION

- Speed reduction
- Vessel utilization
- Vessel size
- Alternative routes

ca. 20%

HYDRODYNAMICS

- Retrofit (existing)
- Optimize (new)
- Air lubrication
- Cleaning

ca. 15%

MACHINERY

- Machinery improvements
- Waste heat
- Technology

0-100%

ENERGY SOURCES AND CARRIERS

- LNG
- Biofuel
- Power to Fuel
- Wind
- Nuclear

0-100%

TECHNOLOGY AND SOURCES / CARRIERES (ALL POSSIBLE)

MACHINERY

- Diesel engines
- Otto engines
- Turbines

- Fuel cells
- Batteries
- Sails

ENERGY SOURCES AND CARRIERS

- Diesel
- Natural Gas (LNG or Methanol)
- LPG
- Bio: Diesel / Methanol / Gas
- PTF: Methanol / LG / Diesel / H2

- Electricity
- Wind
- Nuclear

TECHNOLOGY AND SOURCES / CARRIERES (REASONABLE FOR DEEP SEA)

MACHINERY

- Diesel engines
- Otto engines
- Turbines

- Fuel cells -> Infancy
- Batteries -> Only Short Sea Shipping
- Sails -> Potential for slow ships, difficult

ENERGY SOURCES AND CARRIERS

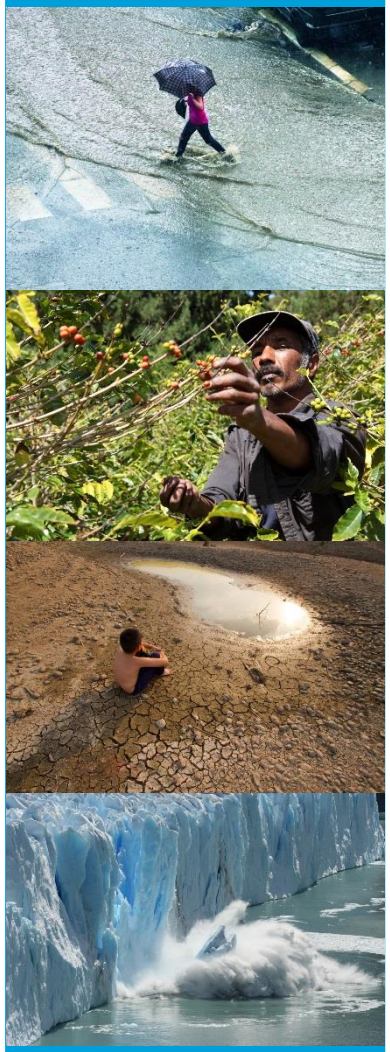
- Diesel
- Natural Gas (LNG or Methanol)
- LPG
- Bio: Diesel / Methanol / Gas
- PTF: Methanol / LG / Diesel / H2

- ~~Electricity~~
- Wind
- ~~Nuclear~~

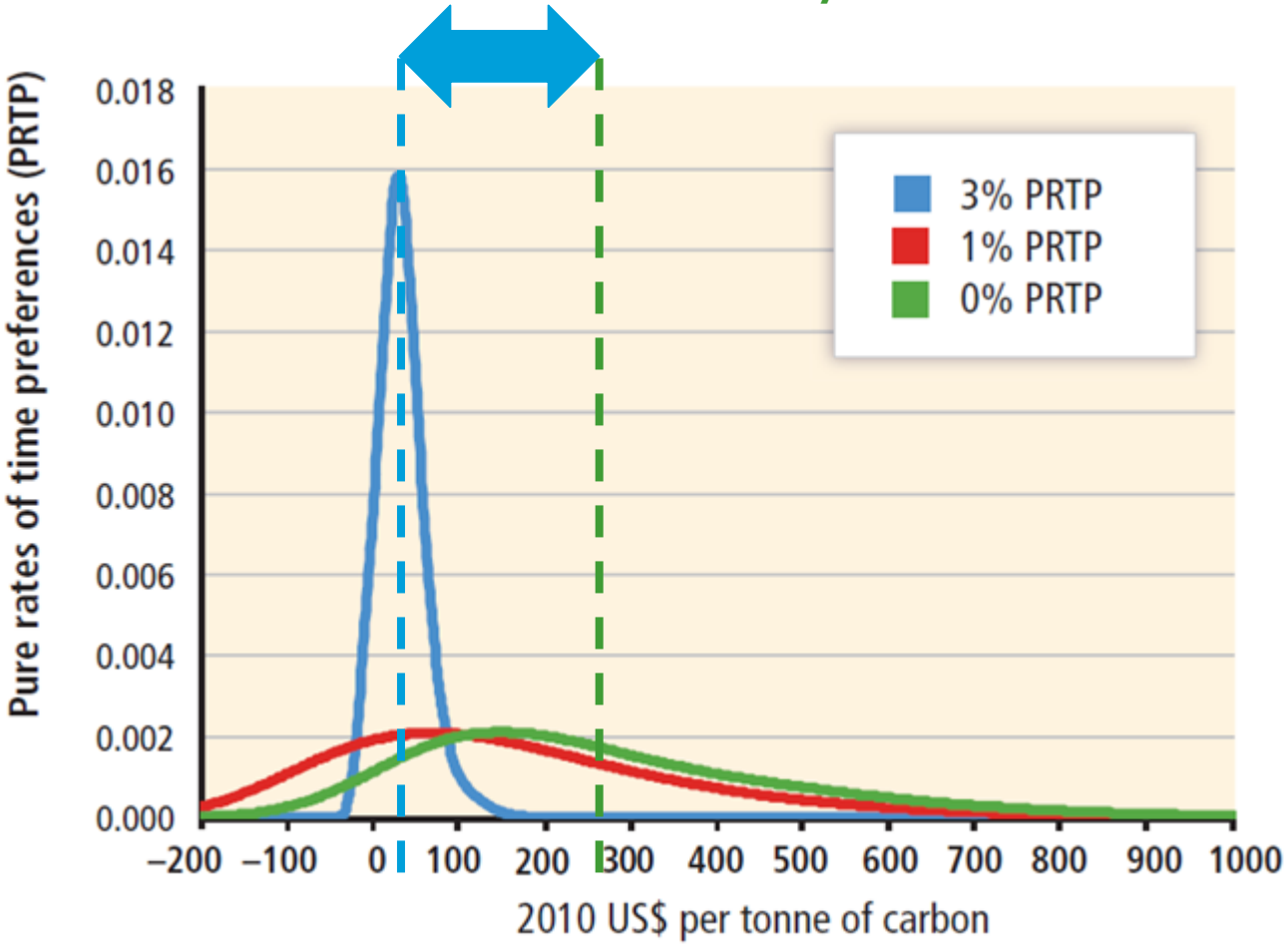
ALTERNATIVE COMBUSTION MACHINERY

		HFO	LSHFO/MGO	LNG (fossil fuel with lowest CO2)
DIESEL	SOx	SCRUBBER	COMPLIANCE	FUTURE PROOF
	NOx	Tier III: EGR/SCR	Tier III: EGR/SCR	Tier III: EGR/SCR
	CO2	HIGH CARBON	HIGH CARBON	Reduced CO2
OTTO	SOx			FUTURE PROOF
	NOx			FUTURE PROOF
	CO2			Reduced CO2 (CH4 SLIP)
TURBINE	SOx		COMPLIANCE with 0,1 MGO	FUTURE PROOF
	NOx		FUTURE PROOF	FUTURE PROOF
	CO2		HIGH CARBON	Reduced CO2 (NO CH4 SLIP)

ALTERNATIVE PERSPECTIVE: SOCIO-ECONOMIC COSTS OF CO2



ESTIMATES: 33 – 270 USD/t



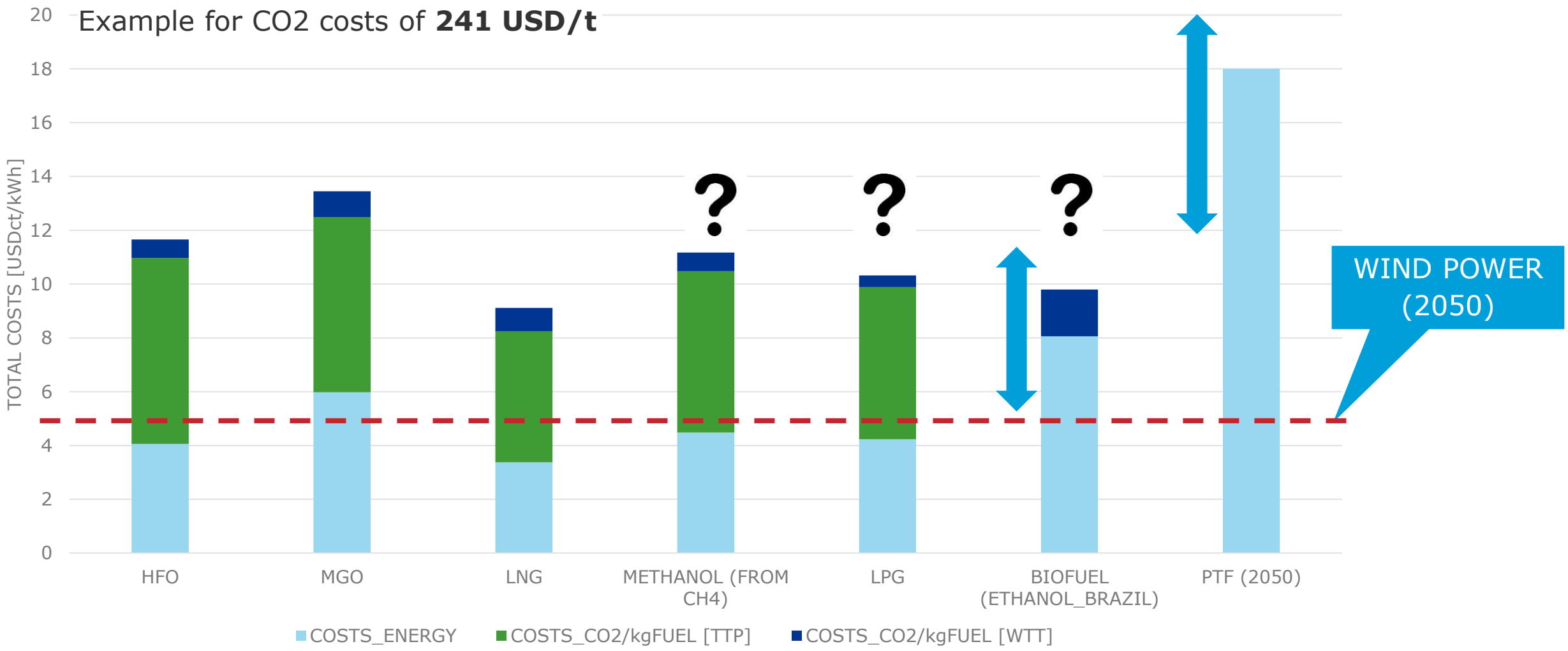
AVERAGE: **241 USD/t**

Number of Studies: 35

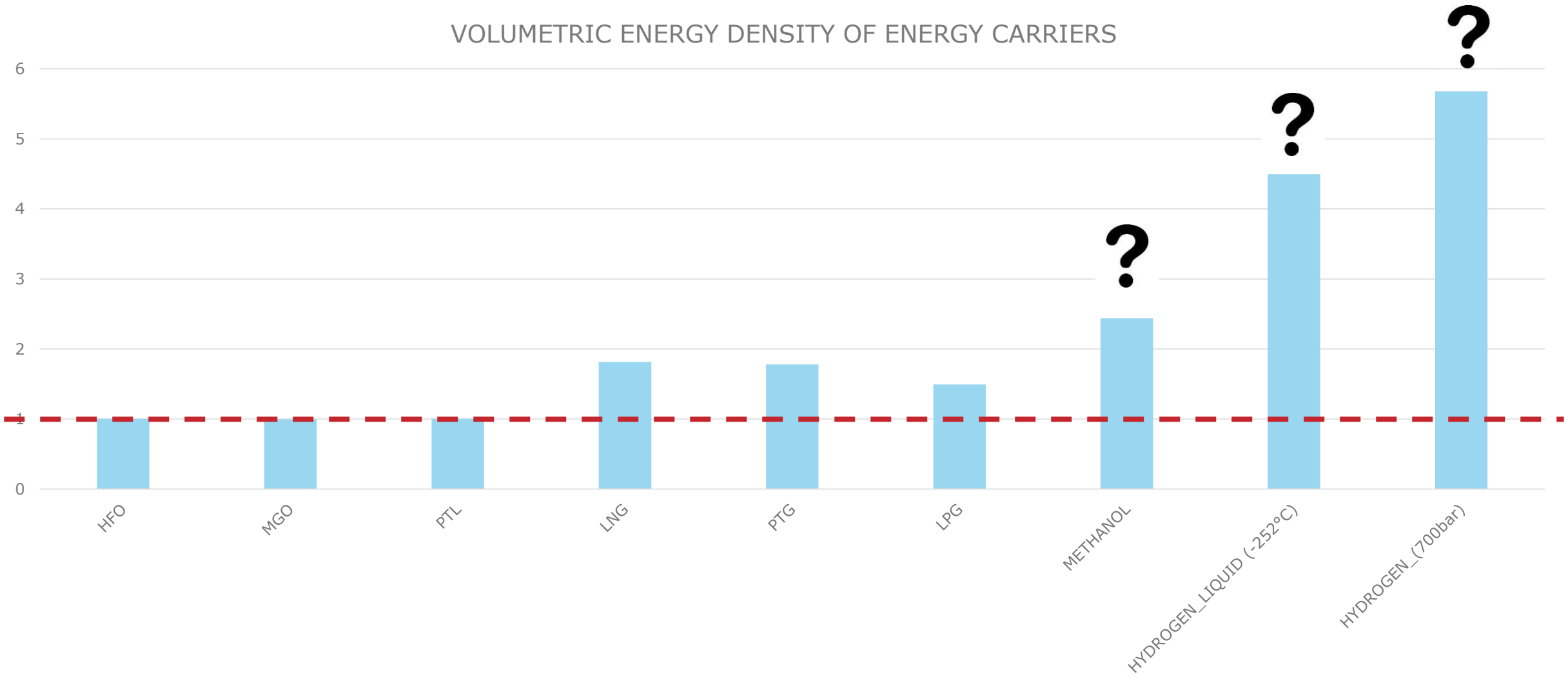
SOURCE: 5th IPCC Report

(Climate change 2014) Page 691

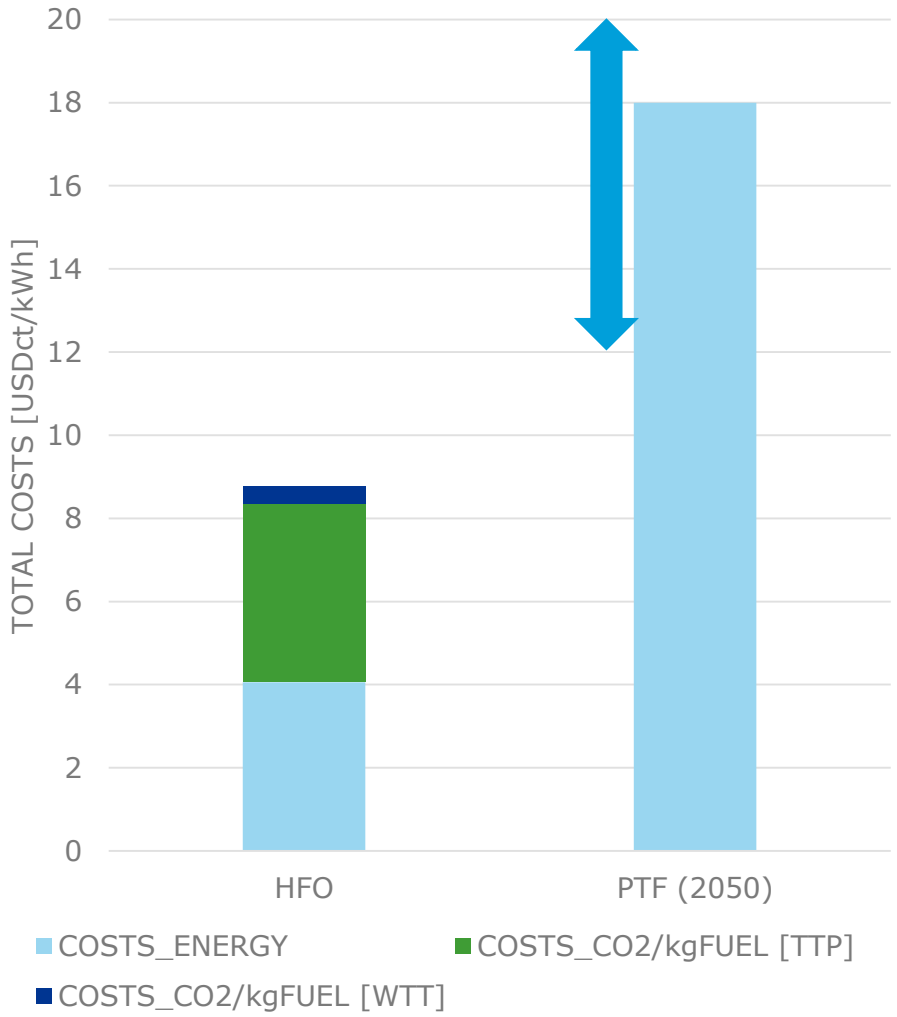
TOTAL COSTS OF FUELS

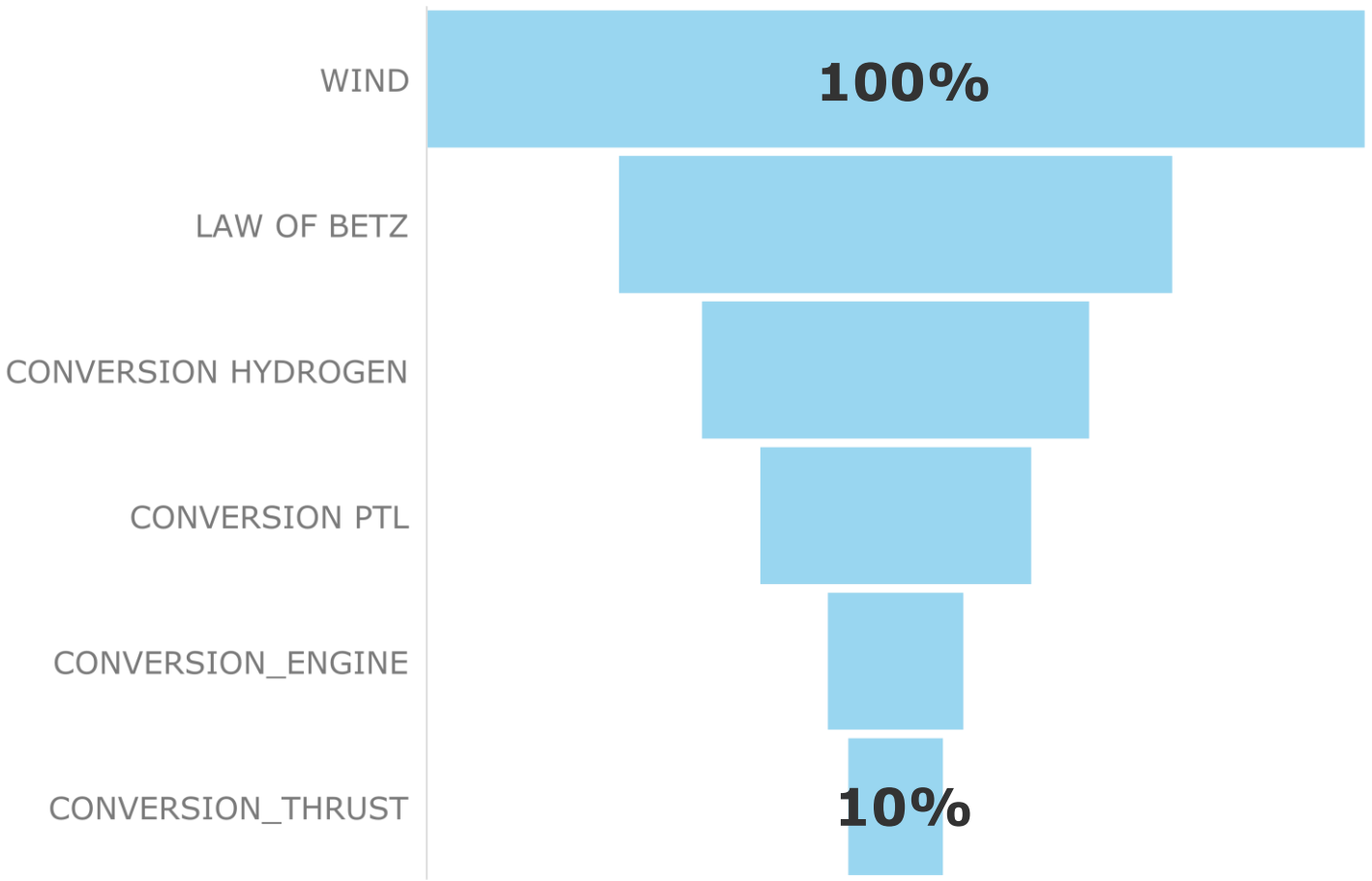


FUEL VOLUMETRIC ENERGY DENSITY (DIESEL EQUIVALENT)

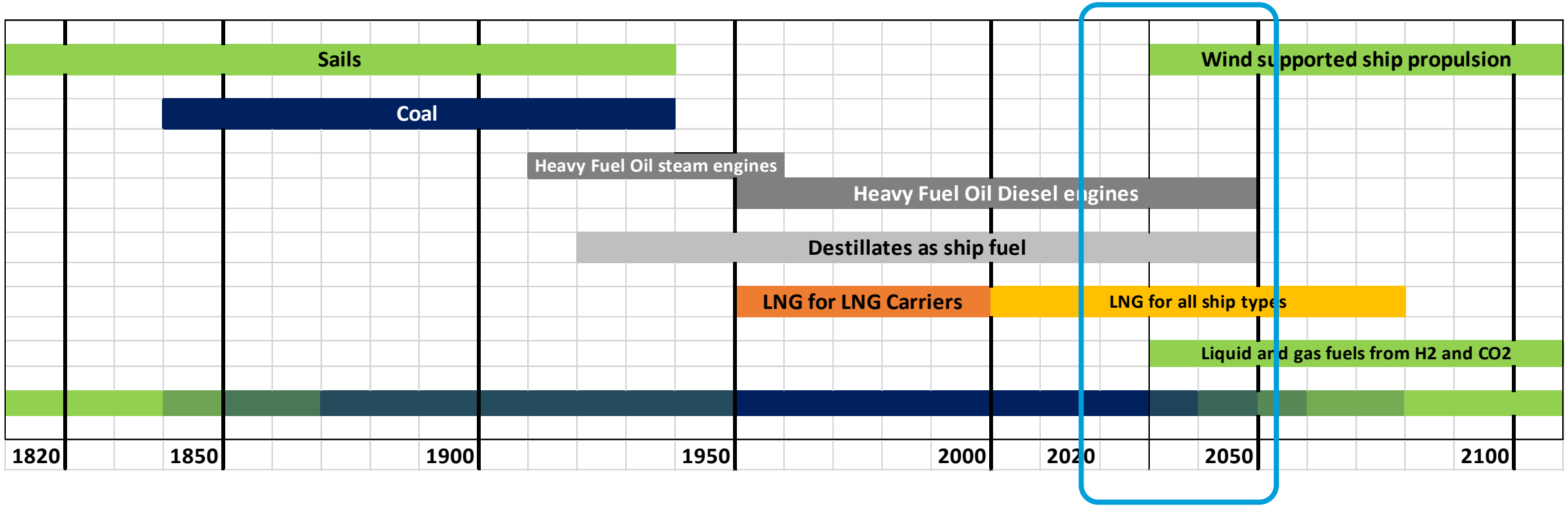


A DIFFERENT VIEW ON WIND PROPULSION? CONVERSION EFFICIENCY!





POSSIBLE STORYLINE (DEEP SEA SHIPPING)



INTERESTING PERIOD

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GENERAL PROJECTION

1. Fuels will get more expensive on the long run
2. Environmental footprint of fuels and ships will be more and more in focus
3. Ships will sail slower
4. All these aspects will allow new technologies and fuels to enter the market
5. Market and technologies will become more diverse

CONSEQUENCES FOR NEWBUILDINGS: ALLREADY CONSIDER 2030 TARGETS

1. Invest in measures **increasing energy efficiency** (consider lower design speed)
2. Fuel question will not be decided by shipping alone
3. NOTE: **LNG alone will not be sufficient** to meet IMO 2030 target!
4. Battery systems, fuel cell systems and wind-assisted propulsion have **reasonable potential** for ship applications

CONSEQUENCES FOR EXISTING SHIPS: EMISSION REDUCTION IS KEY

1. Be prepared for locally and internationally **strengthened environmental regulations**
2. Consider retrofits **improving ships efficiency/environmental footprint**
3. Find a proper **fuel strategy** (very different for different ships)
4. All technologies are in principle capable of meeting the emission limits when using the right fuel
5. In the end the fuel **market will decide** on the right way for existing ships

Thank you for your attention!

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