Analyzing approaches to set GHG reduction target in anticipation of potential 'further measures' for international shipping

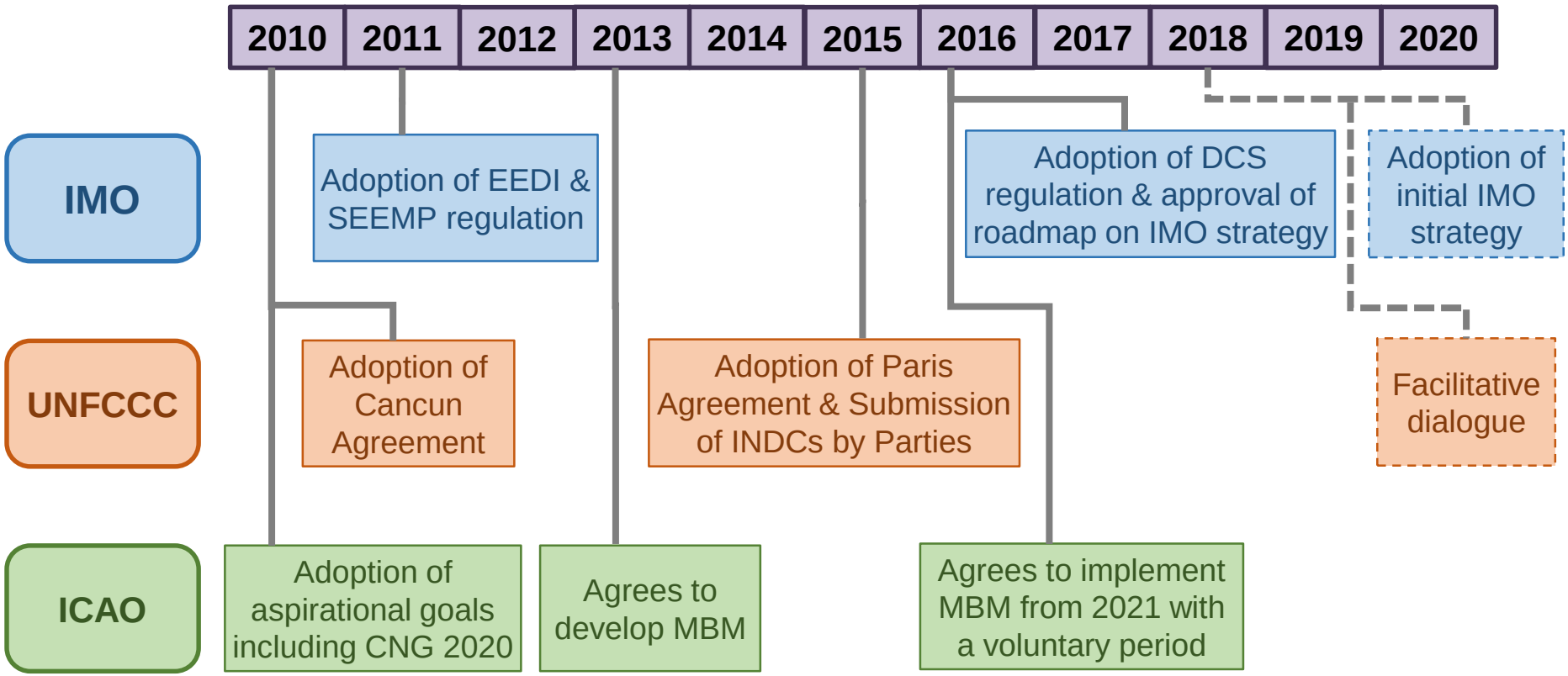
The International Conference on Maritime Energy Management (MARENER 2017)

24-25 January 2017

Seijiro Morimoto
Researcher, Japan Maritime Center

Background

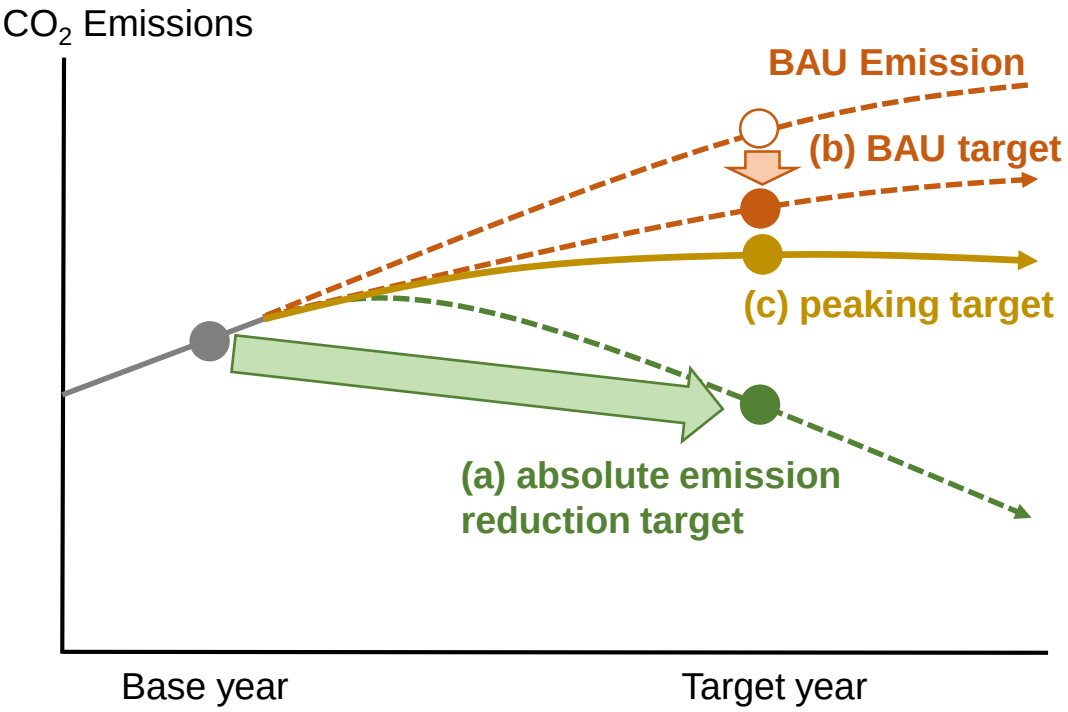
- IMO is facing an ever-increasing challenge to set a GHG emission reduction target for international shipping, due to progress in developing reduction targets in other sectors.
- A roadmap to develop an IMO strategy for GHG reduction was approved at MEPC70. In the roadmap, the initial IMO strategy is scheduled to be adopted in spring of 2018.



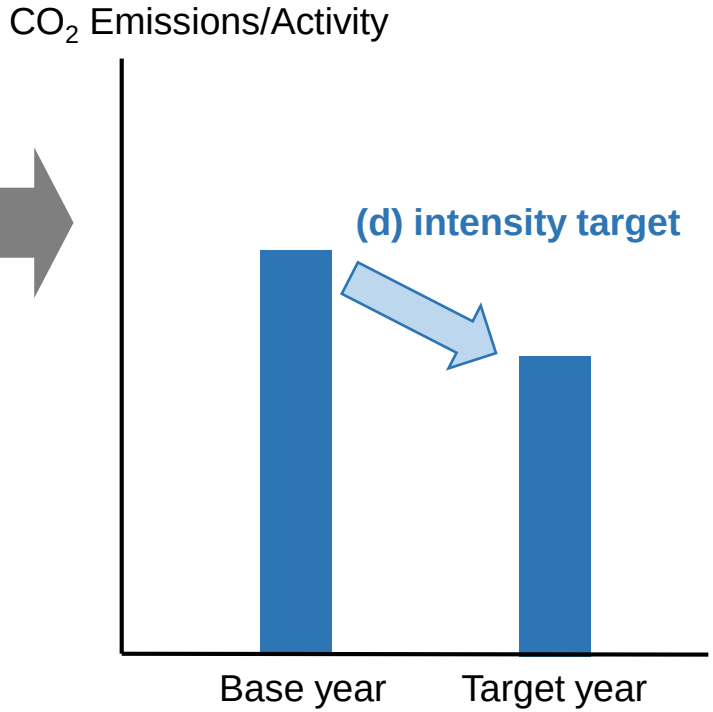
Types of reduction targets

- There are mainly four types of quantified emission reduction targets included in the INDCs: (a) absolute emission reduction target, (b) reduction target relative to business-as-usual (BAU) emission, (c) peaking target, and (d) intensity target.
- Absolute emission target (a, b & c) shows the development of absolute emission level, while intensity target (d) shows the development of intensity (emissions per activity) level. An absolute emission target can be converted to an intensity target and vice versa.

Absolute emission target



Intensity target



Characteristics of absolute target & intensity target

- Absolute emission target, which factors in the activity level, has higher certainty of the outcome of the absolute emission level, while the intensity target, which does not factor in the activity level, has higher certainty of the outcome of the intensity level and abatement costs.
- There is a trade-off between the certainty of absolute emission level and the certainty of intensity level and abatement costs, depending on whether the target factors in the activity level.

Assessment criteria	Absolute emission target	Intensity target
Certainty of the outcome of absolute emission level	higher	lower
Certainty of the outcome of intensity level	lower	higher
Certainty of abatement costs to achieve the target	lower	higher

$$CO_2 \text{ emission} = \text{Activity} \times \frac{CO_2 \text{ emission}}{\text{Activity}} \quad \text{(Carbon intensity)}$$

$$= \text{Activity} \times \frac{\text{Energy}}{\text{Activity}} \times \frac{CO_2}{\text{Energy}}$$

(Energy intensity) (Fuel mix)

Activity

Intensity

Absolute emission target

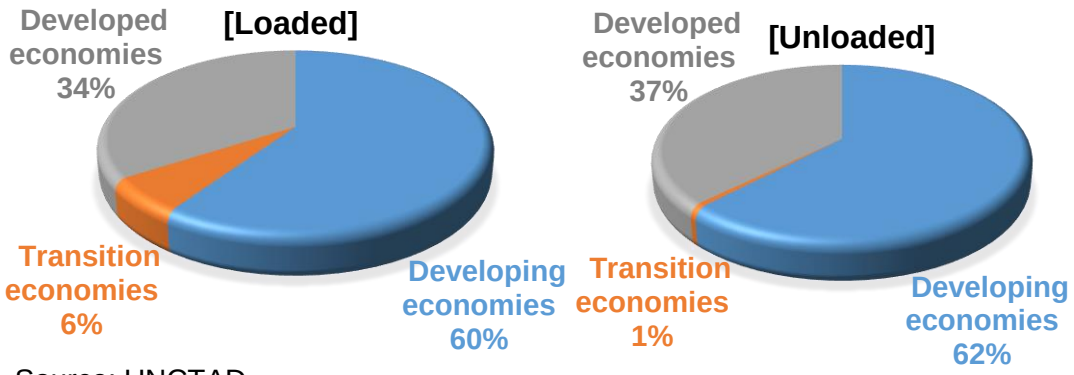
Intensity target

Appropriate type of target for international shipping

公益財団法人 日本海事センター
Japan Maritime Center

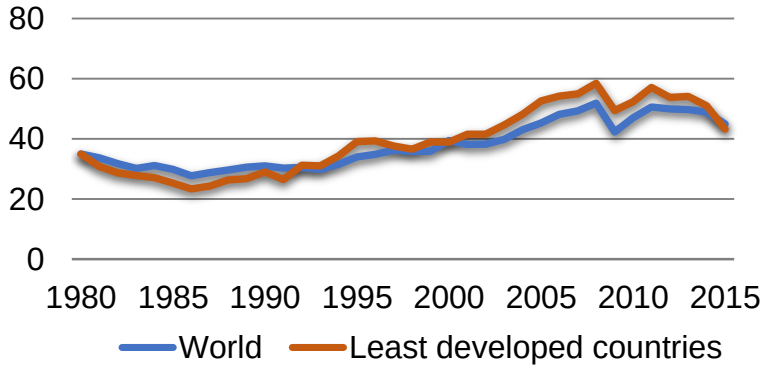
- International shipping is the backbone of global trade and plays a vital role for the sustainable development of world economy, in particular developing countries. It is also the most efficient mode of transport and modal shift is an effective measure to reduce global CO_2 emission.
- Intensity target would be more appropriate to accommodate growth of trade and modal shift. It is also useful as a measure of progress to improve sustainability of international shipping.

Total Goods Loaded and Unloaded in 2015



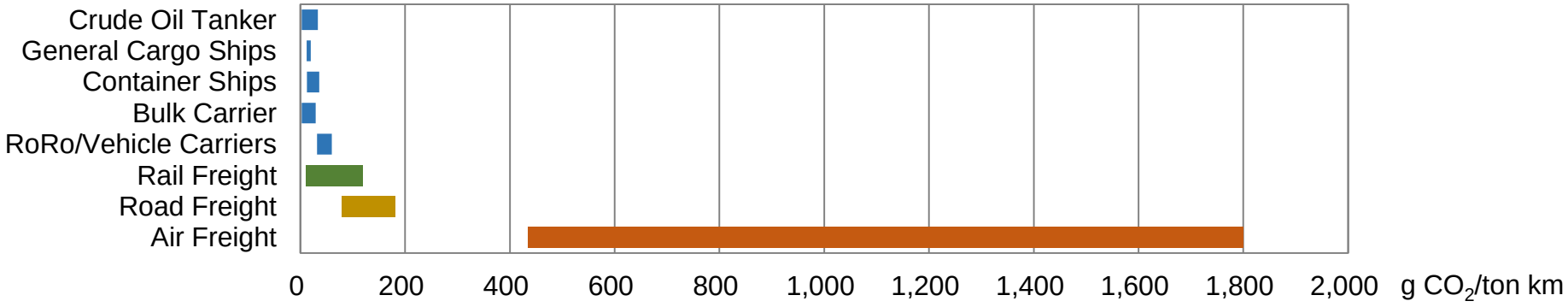
Source: UNCTAD

Merchandise Trade (% of GDP)



Source: World Bank

Range of Typical CO_2 Efficiencies for Various Transport Modes



Source: Second IMO GHG Study 2009

Approaches for target-setting (1) Carbon budget

公益財団法人 日本海事センター
Japan Maritime Center

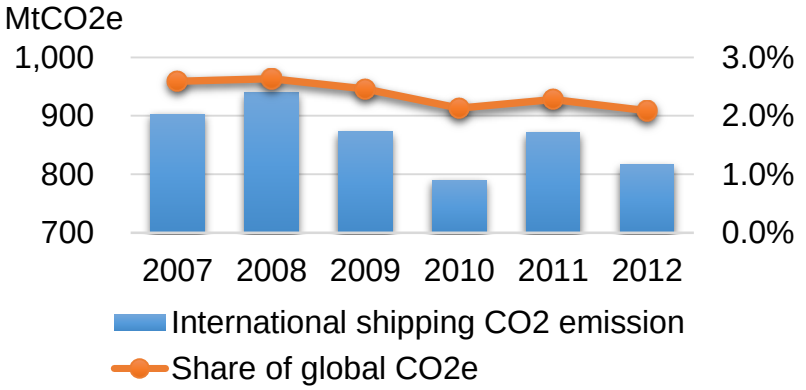
- Carbon budget approach: setting an absolute emission reduction target, based on the carbon budget for the shipping sector, which is derived from the remaining cumulative global CO_2 emission budget to limit global warming to 2ºC (or 1.5ºC), assuming shipping's share of global emissions remains constant.

Cumulative global CO_2 emissions under 2ºC scenario

CO_2 concentrations in 2100 [ppm CO_2eq]		Cumulative CO_2 emissions (2011-2100) [GtCO_2]	Likelihood of staying below 2ºC over the 21st century
450 (430-480)	Total range	630-1180	Likely
500 (530-580)	No overshoot of 530	960-1430	More likely than not
	Overshoot of 530	990-1550	About as likely as not

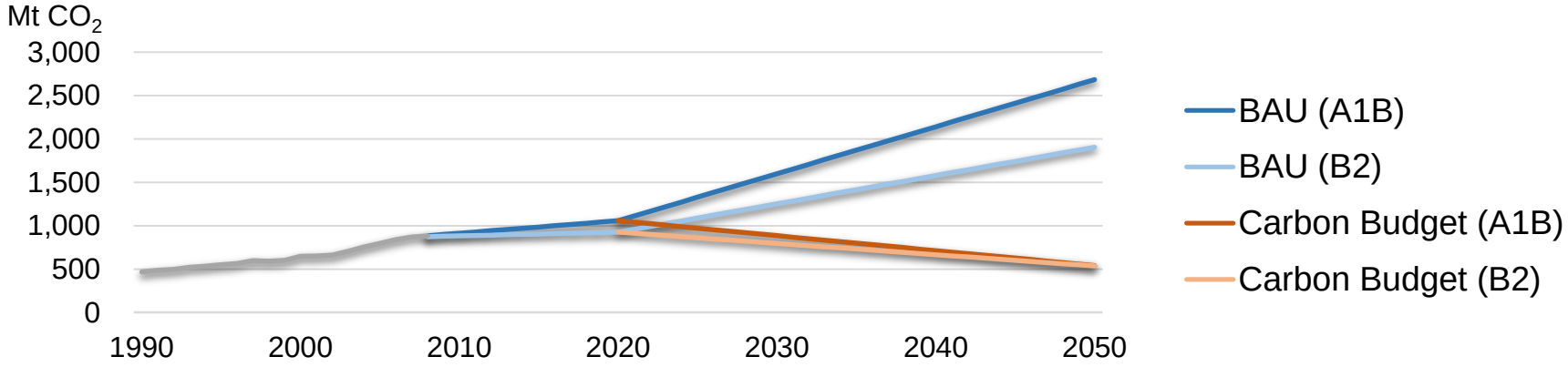
Source: IPCC AR5 WGIII

Shipping's share of global CO_2 emissions



Source: Third IMO GHG Study 2014

CO_2 trajectories based on carbon budget approach (only for illustrative purpose)

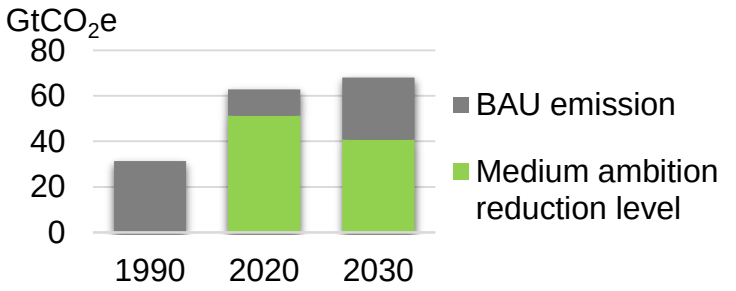


Source: Smith et al. (2015), Second IMO GHG Study 2009, author's own calculation.

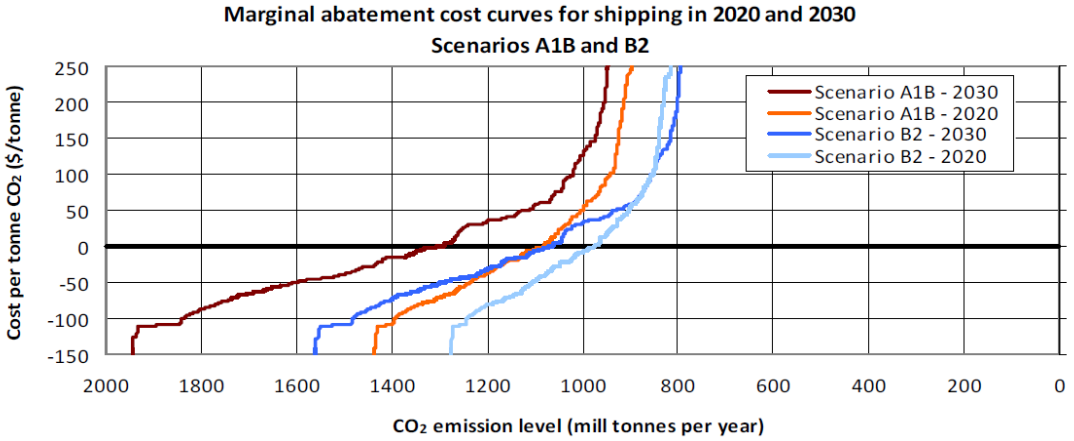
Approaches for target-setting (2) Similar reduction

- Similar reduction approach: setting a target at a level in which reduction efforts of the shipping sector would be the same as other sectors.
  - ➢ Aggregating reduction targets of Parties to UNFCCC and transferring it to the shipping sector.
  - ➢ Applying the marginal abatement costs (MAC) to achieve the global emission target to the shipping sector (‘Equal MAC approach’).

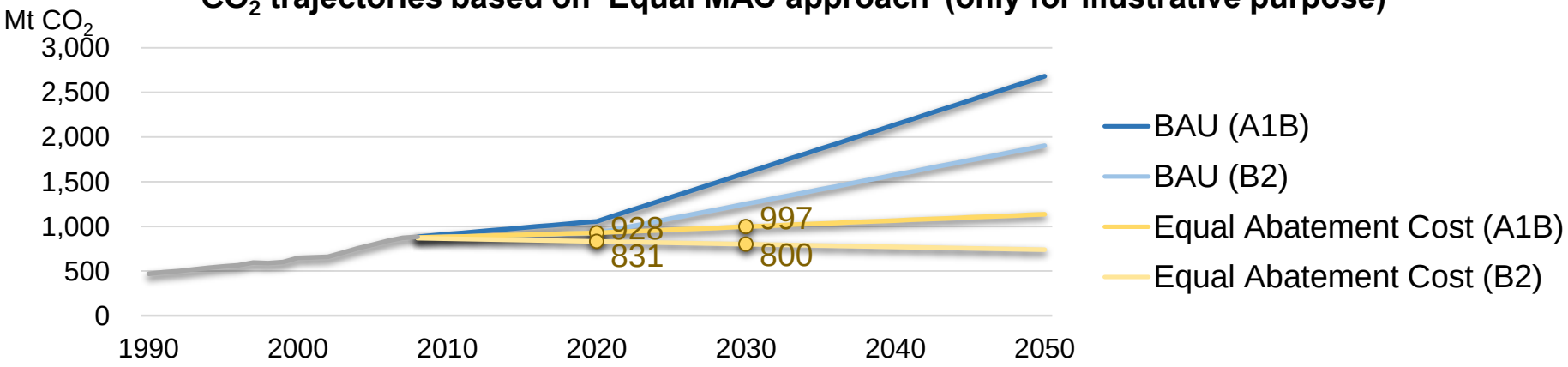
Global CO_2 emission and ambition level to achieve 2ºC target (A1B scenario)



Source: Norway’s proposal at MEPC60 (MEPC60/4/23)



CO_2 trajectories based on ‘Equal MAC approach’ (only for illustrative purpose)



Source: Norway’s proposal at MEPC60 (MEPC60/4/23), Second IMO GHG Study 2009, author’s own calculation.

Approaches for target-setting (3) Efficiency based

公益財団法人 日本海事センター
Japan Maritime Center

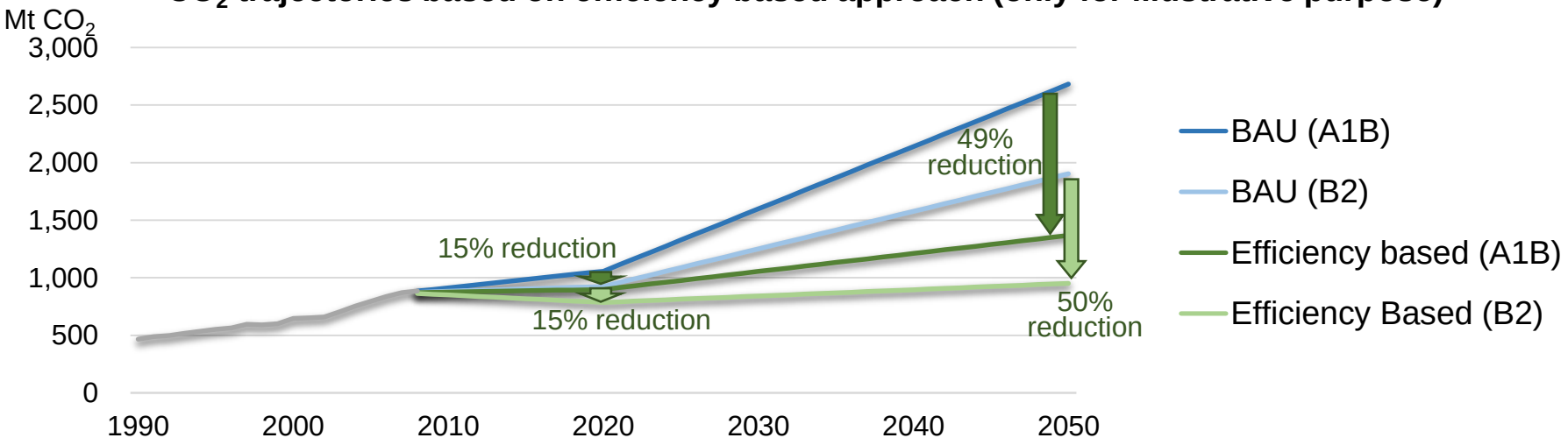
- Efficiency based approach: setting a reduction target based on levels of efficiency improvement that are technically achievable. Efficiency (intensity) target developed could derive absolute emission trajectories as an 'expected outcome'.

Efficiency improvement of different ship types

Contract Delivery	2012-16 2015-19	2017-21 2020-24	2022-26 2025-29	2027-31 2030-34	2032- 2035-
Bulk/General cargo	25%	40%	45%	50%	50%
Tanker	35%	40%	55%	55%	55%
VLCC	40%	50%	60%	60%	60%
Container	35%	45%	55%	65%	70%
Coastwise shipping	20%	25%	30%	30%	30%

Source: Japan's proposal at MEPC59 (MEPC59/4/35)

CO_2 trajectories based on efficiency based approach (only for illustrative purpose)



Source: Japan's proposal at MEPC59 (MEPC59/4/35), Second IMO GHG Study 2009, author's own calculation.

Preliminary assessment of different approaches

- Carbon budget approach will likely have higher environmental effectiveness, while similar reduction approach and efficiency based approach seems to be more equitable.
- A hybrid approach, in which consideration is based on the analysis of the reduction potential and the extent to which the stringency of the efficiency level could be strengthened to meet the objectives of the UNFCCC, taking into account the reduction efforts of other sectors and characteristics of international shipping, would be appropriate to set a fair, ambitious and achievable target.

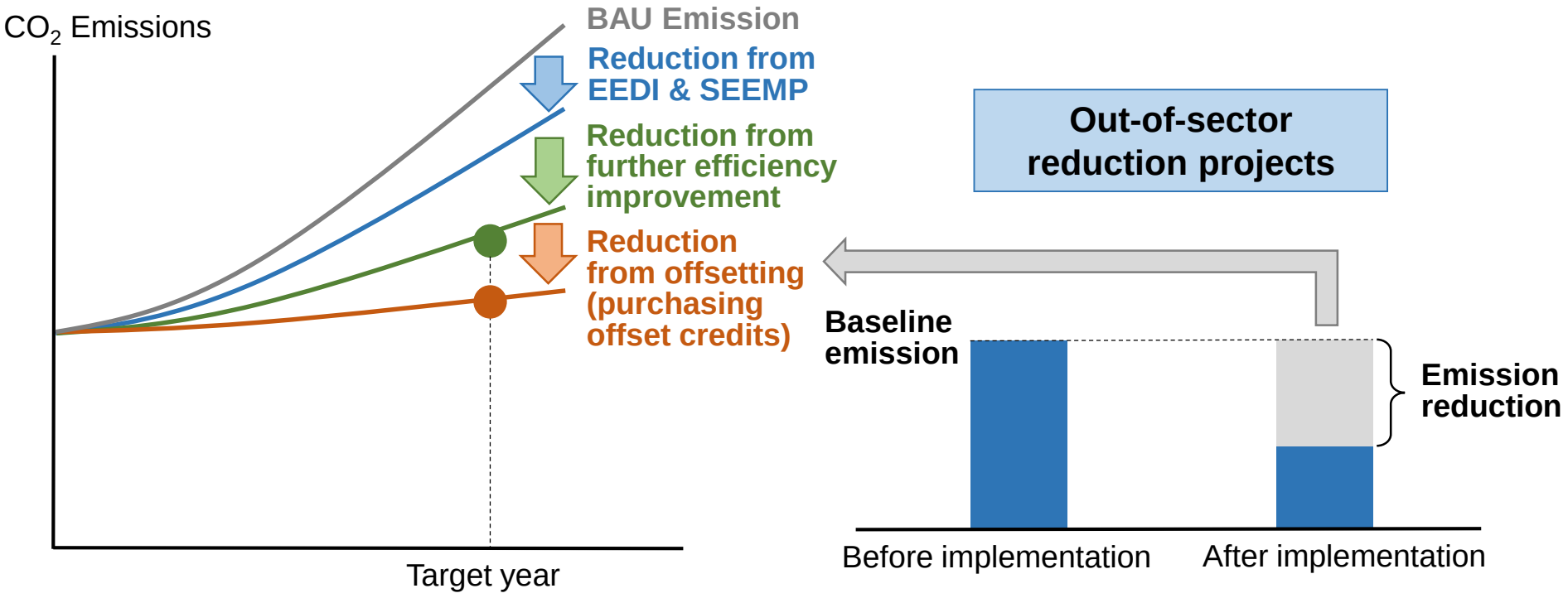
Assessment criteria	Carbon budget approach	Similar reduction approach	Efficiency based approach
Environmental effectiveness	Likely to be higher	Likely to be lower (depends on the efforts of other sectors)	Likely to be lower (depends on stringency of efficiency level)
Economic performance		‘Equal MAC approach’ aims for cost-effectiveness	
	Depends on economic efficiency and cost effectiveness of measures		
Distributional & social impacts	Less equitable (if capability is not taken into account)	‘Equal MAC approach’ aims for fair distribution of costs	More equitable (reduction potential is taken into account)
Institutional & political feasibility	Depends on environmental effectiveness, economic performance, and distributional & social impacts		

Source: Assessment criteria are drawn from IPCC AR5 WGIII, author’s own analysis.

Reduction target and ‘further measures’

- Setting a reduction target in anticipation of ‘further measures’ may require consideration on whether the target assumes offsetting or not.
- Offsetting has cost-saving potential but uncertainty remains as to its environmental effectiveness and economic performance. It would also not be a sustainable solution because it does not lead to efficiency improvement in the shipping sector. Offsetting should therefore not be considered as a major component in the reduction target.

Emissions from international shipping and offsetting mechanisms



Conclusion

- Careful consideration is necessary, taking into account the science-based required reduction level, reduction efforts in other sectors, reduction potential of international shipping and its distinctive role for sustainable development, in order to set a fair, ambitious and achievable reduction target for international shipping.
- Such consideration should also take into account what would be appropriate for the industry, whose support is critical for actions to reduce GHG emissions in the shipping sector.