Low Carbon Logistics in a Climate-changed World

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Kühne Logistics University
Hamburg

Colloquium on Green Logistics

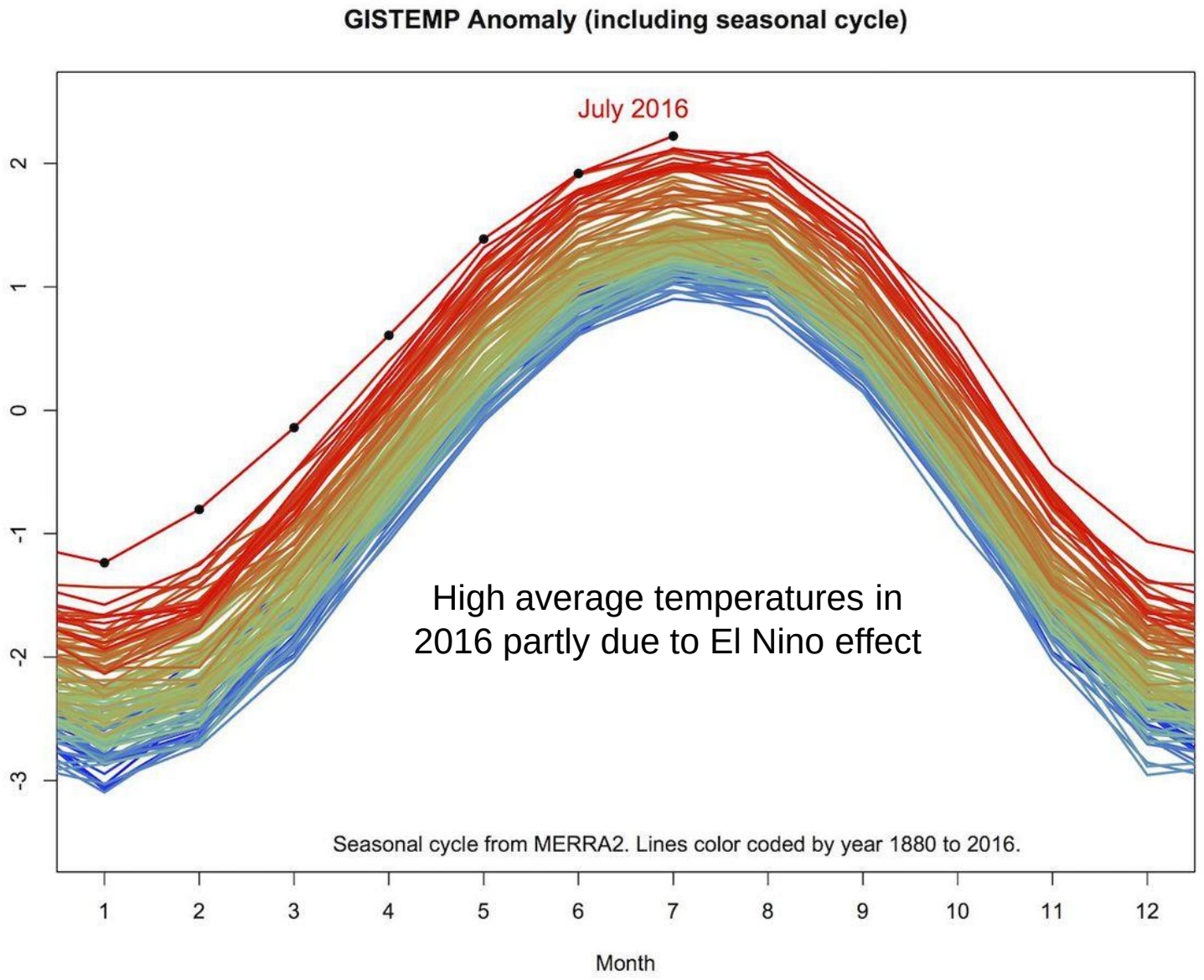
Green logistics management: balancing environmental and shareholder priorities

Naples
29th September 2016

Increase in average global temperature 1880 - 2016

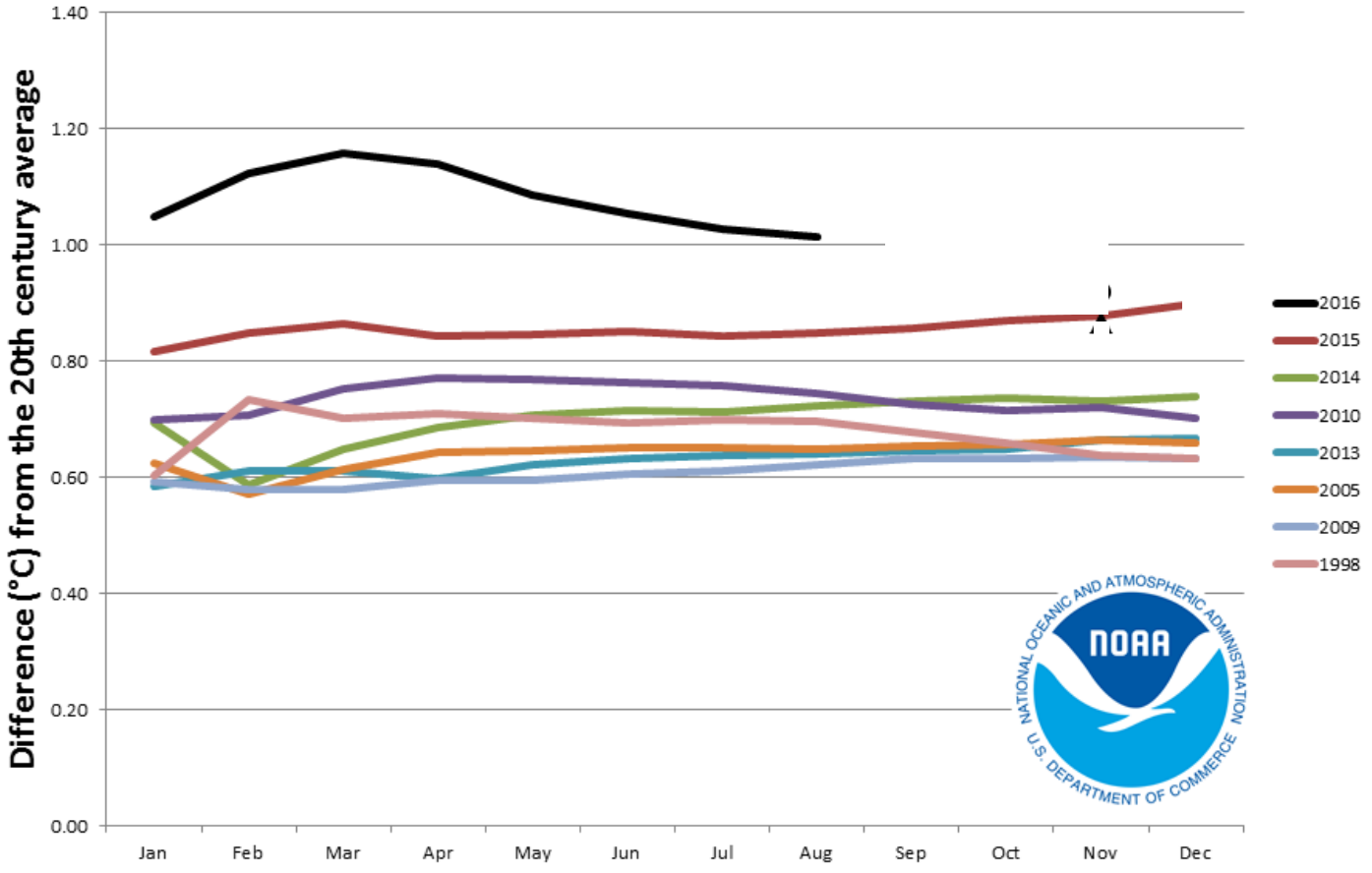
Global average temperature anomaly relative to 1980-2015 mean

^{O} Centigrade

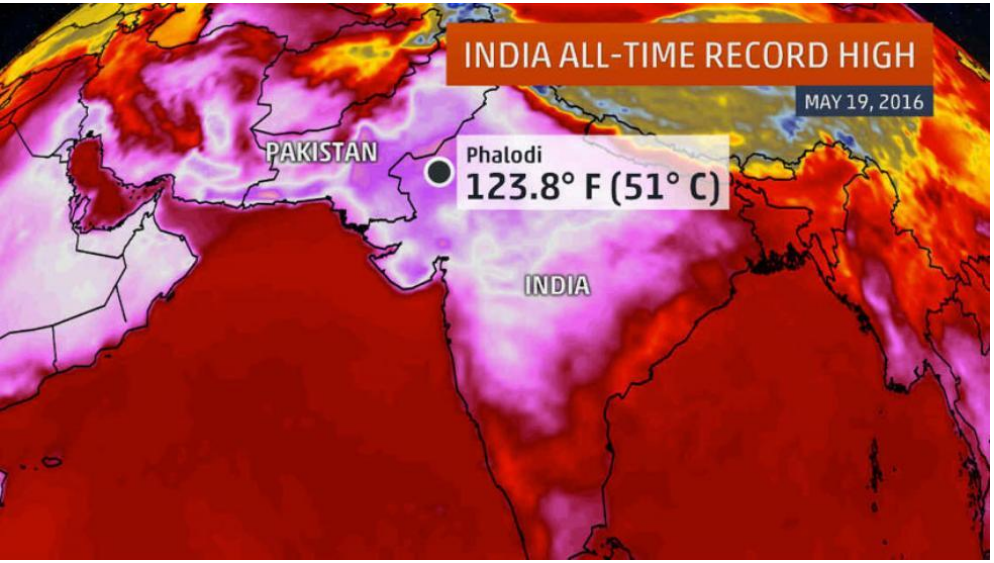


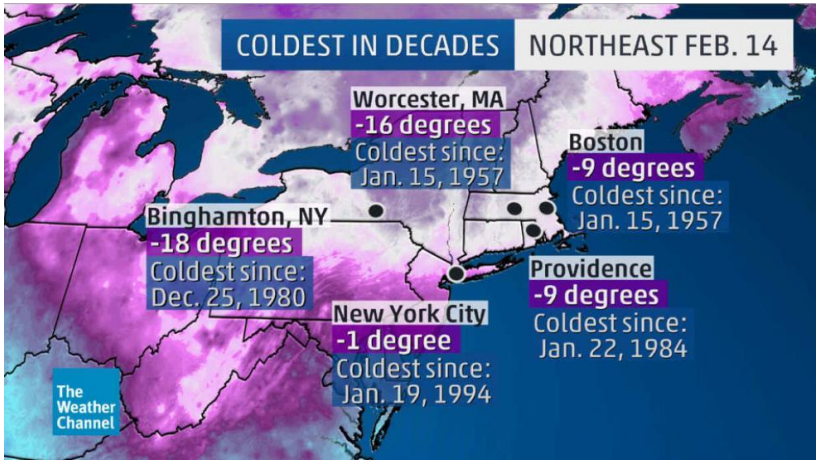
Year-to-Date Global Temperatures

for 2016 and the other seven warmest years on record

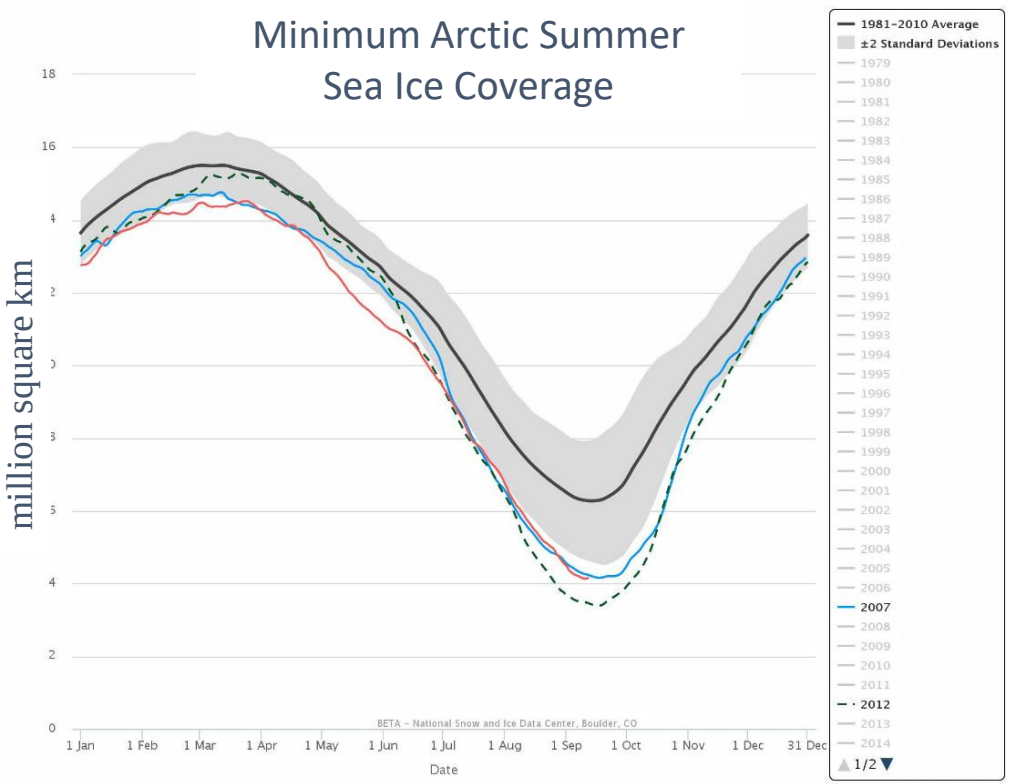


Weather Extremes 2016





Fort McMurray

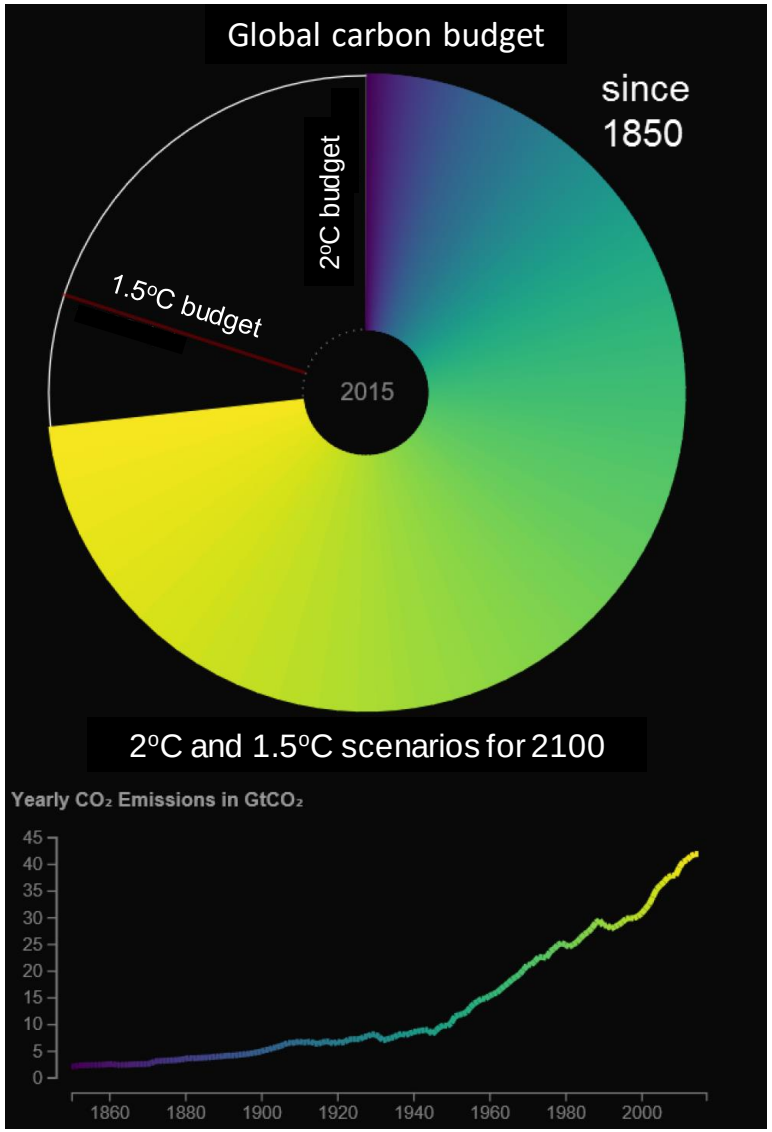


UNFCC COP 21 Conference on Climate Change
December 2015

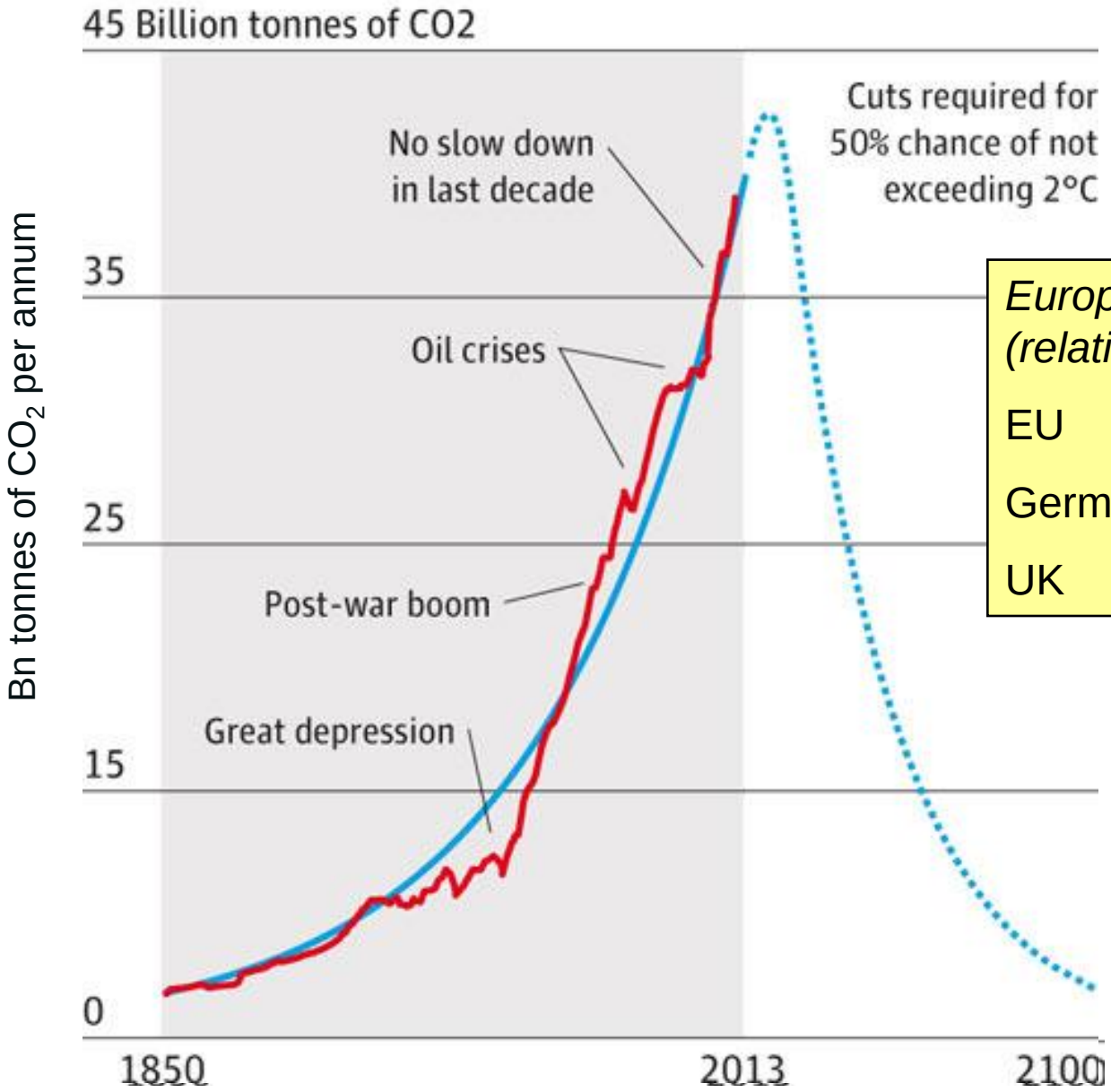
PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21·CMP11

Bottom-up rather than top-down approach to securing country commitments: *Intended Nationally Determined Contributions* (INDCs)

International agreement to keep average global temperature '*well below*' 2°C above pre-industrial times and '*endeavor to limit*' them to 1.5°C



The Scale of the Climate Change Challenge



European climate change targets (relative to 1990 base line):

EU

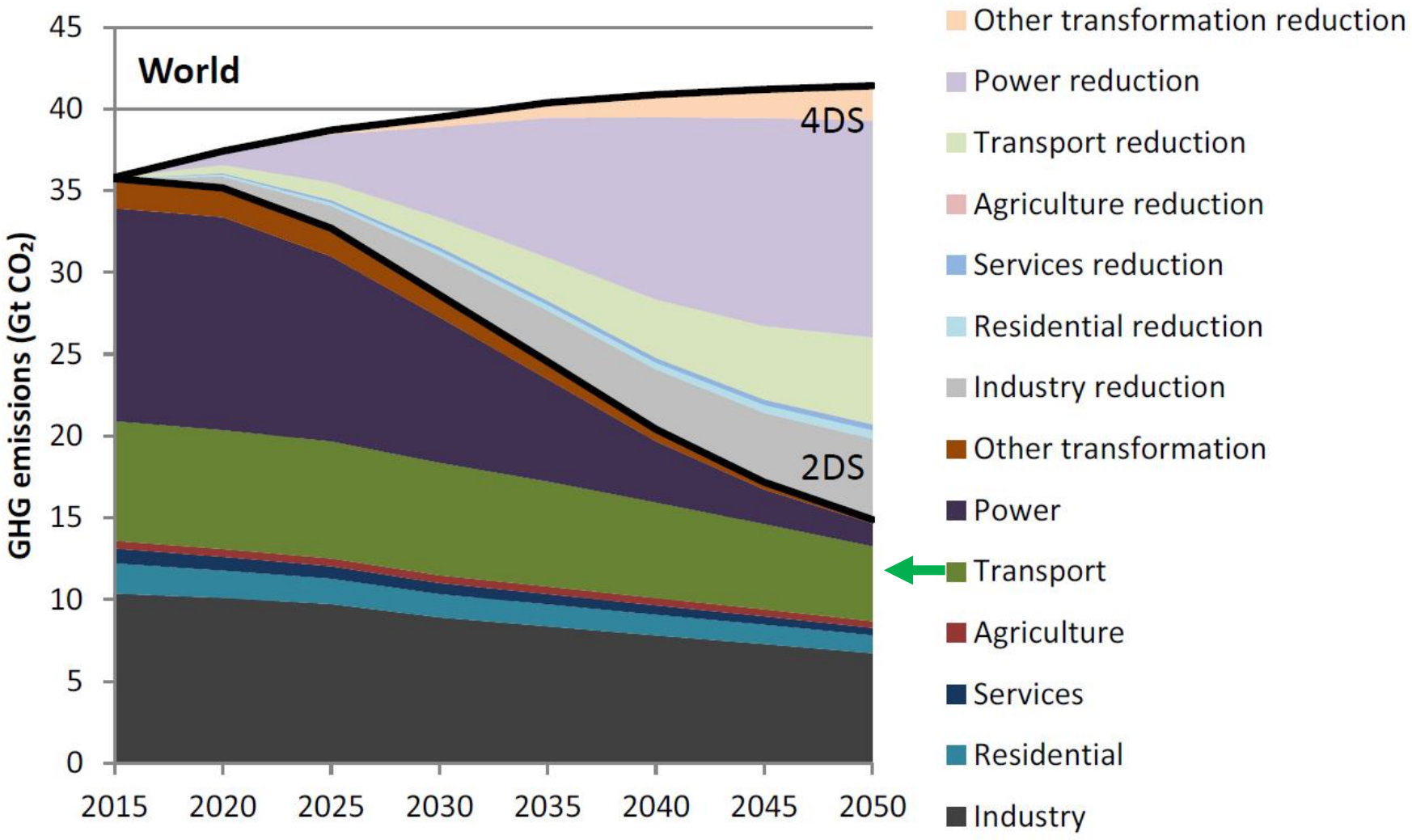
Germany

UK

*80% reduction in **total** CO_2 emissions by 2050*

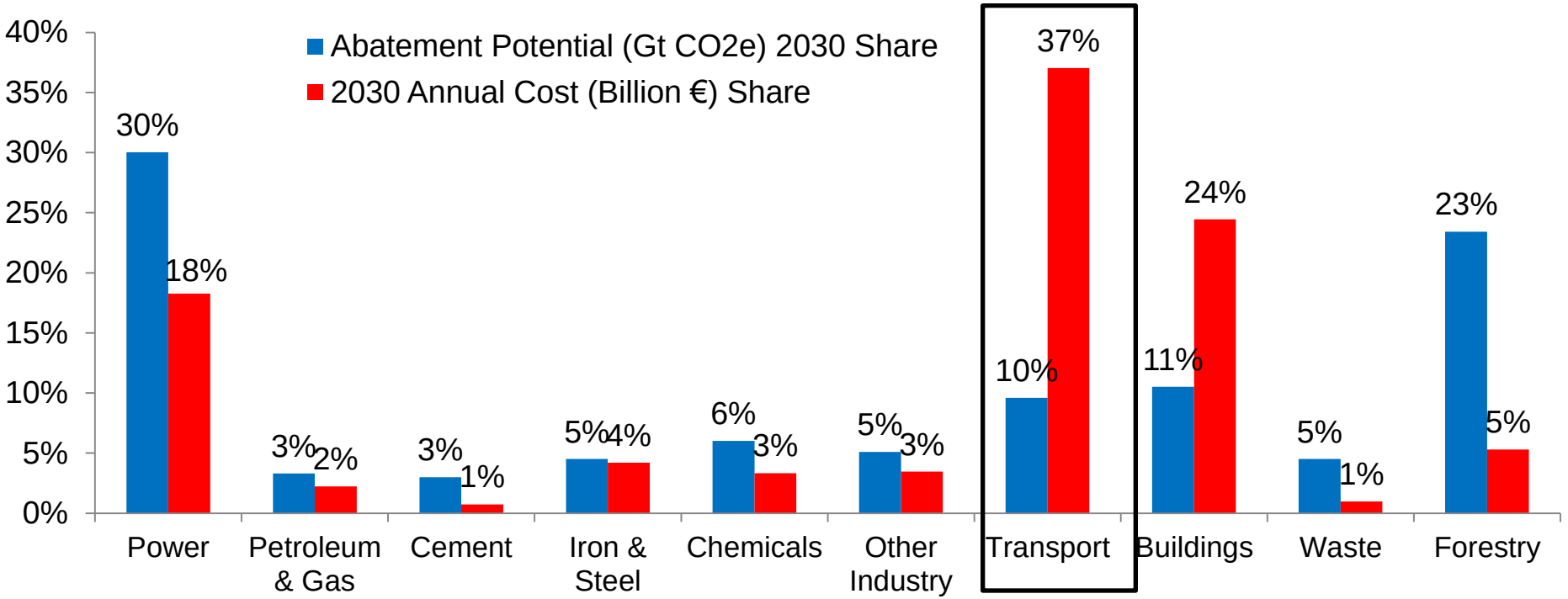
Source: Clark, 2013

Moving from 4 degree to a 2 degree scenario



Source: IEA Energy Technology Perspective scenario

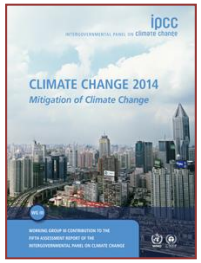
Comparison of the Relative Costs of Cutting Carbon Emissions in Different Sectors by 2030



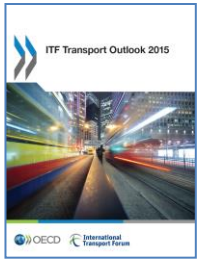
Source: McKinsey (2009) Pathways to a Low Carbon Economy

- transport is more difficult and costly to decarbonize than most other sectors
- freight transport is more difficult to decarbonize than passenger transport
- should be reflected in lower carbon reduction target for freight transport

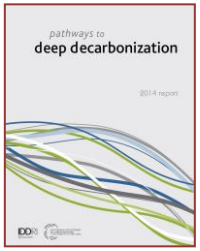
Scale of the Climate Change Challenge for Freight



Transport:
- 2010: 6.5 bn tonnes of CO_{2e}
- 2050: BAU 12 bn tonnes of CO_{2e}
- 2050: Limit CO_{2e} from all activity to 20bn
- 2050: 14% transport share = 2.8 bn tonnes



Freight share of total transport emissions:
- 2010: 42%
- 2050 60%



Freight share of total GHG emissions:
- 2010: 7%
- 2050: 16% (BAU)

One of the 'most challenging sectors' in which to achieve 'deep emission reductions'

Only 13% of 158 INDCs specifically refer to freight transport

Only 10% of transport mitigation measures relate to greening of freight transport

Freight tonne-kms forecast to increase between 2.5 and 4.5-fold between 2010 and 2050

Given current freight forecast, to achieve 60% reduction in freight-related CO_2 emissions in EU by 2050, average carbon intensity must fall to **a fifth** of its 1990 level.

Adapting the Kaya Indentity to Freight Transport

Kaya Identity (IPCC 1990)

Total CO_2 Emissions = Population x GDP/ Population x Energy/GDP x CO_2 / Energy

Freight application of the Kaya Identity

Freight CO_2 Emissions = GDP x tonne-km / GDP x vehicle–km / tonne-km x energy / vehicle-km x CO2 / energy

transport intensity | asset utilisation | energy efficiency | carbon content

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road — transport intensity — asset utilisation — energy efficiency — carbon content

Freight CO_2 Emissions = GDP x tonne-km / GDP x vehicle –km / tonne-km x energy / vehicle-km x CO2 / energy

rail — transport intensity — asset utilisation — energy efficiency — carbon content

Freight CO_2 Emissions = GDP x tonne-km / GDP x vehicle –km / tonne-km x energy / vehicle-km x CO2 / energy

waterborne — transport intensity — asset utilisation — energy efficiency — carbon content

Freight CO_2 Emissions = GDP x tonne-km / GDP x vehicle –km / tonne-km x energy / vehicle-km x CO2 / energy

aviation — transport intensity — asset utilisation — energy efficiency — carbon content

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Freight application of the Kaya Identity

modal split

Freight CO_2 Emissions = GDP x tonne-km / GDP x vehicle –km / tonne-km x energy / vehicle-km x CO2 / energy

road

transport intensity | asset utilisation | energy efficiency | carbon content

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aviation

transport intensity | asset utilisation | energy efficiency | carbon content

→ total freight-related CO_2 emissions

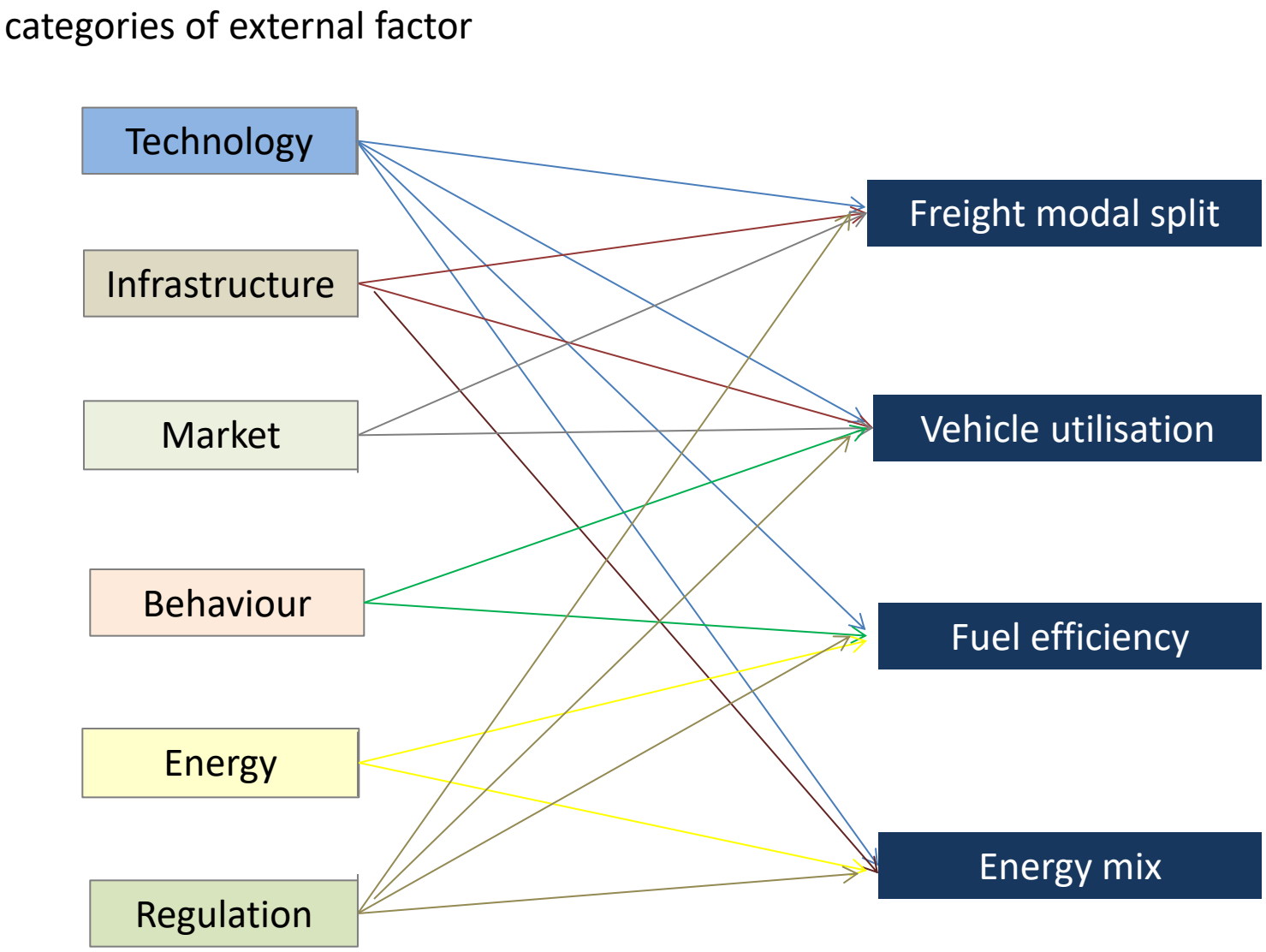
Potential for Decarbonising Freight Transport in 15 Countries: *2010 - 2050*

decoupling of freight tonne-km from GDP	Decoupling energy use from freight t-km	Decoupling freight energy use from related emissions
↓	↓	↓
freight transport intensity	energy intensity of freight transport	carbon intensity of freight energy

Source: IDDRI / SDSN (2014) 'Pathways to Deep Decarbonisation

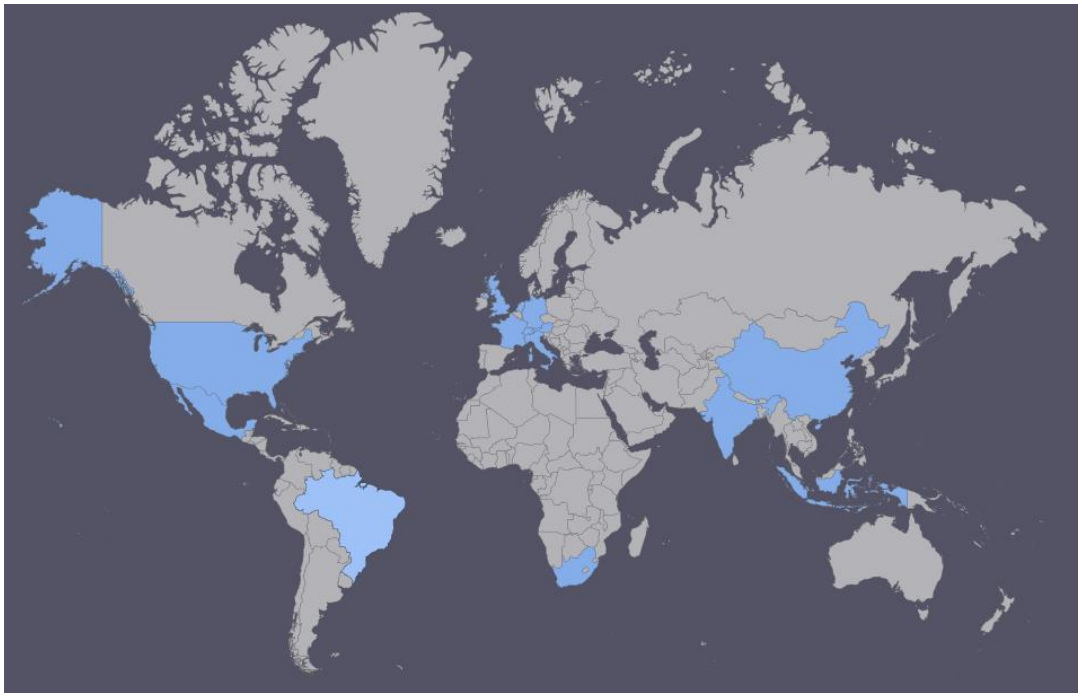
Assessing the effect of **external** factors on the decarbonisation of logistics

TIMBER framework



Assessment of the Influence of **External** Factors on Logistics Decarbonisation

Europe:	*Germany / Austria / Switzerland, UK, Netherlands, France, Italy*
North America:	*US, Mexico*
Asia:	*China, India, Indonesia*
Africa:	*South Africa*



Publication of final report as book in mid-2017

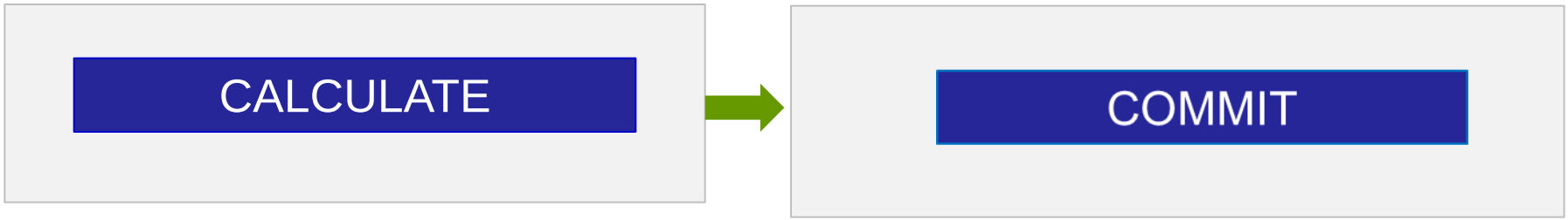
Developing a Carbon Management Strategy for Logistics

7 C approach

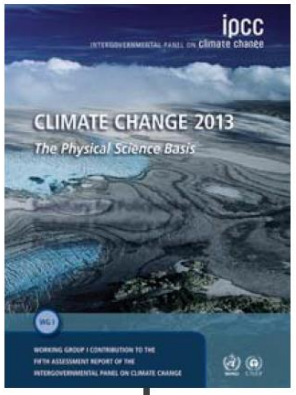
CALCULATE

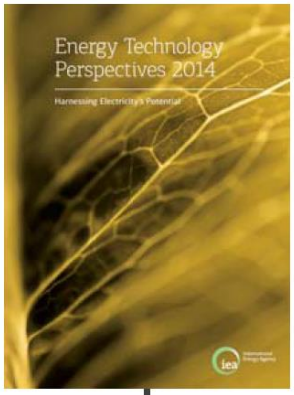
Developing a Carbon Management Strategy for Logistics

7 C approach



Derivation of Science-based Targets for Businesses





Temperature increase threshold

Representative concentration pathway

Global carbon budget

Sectoral carbon budget

Sectoral activity projections

Sectoral intensity

SDA

Input entered by the company

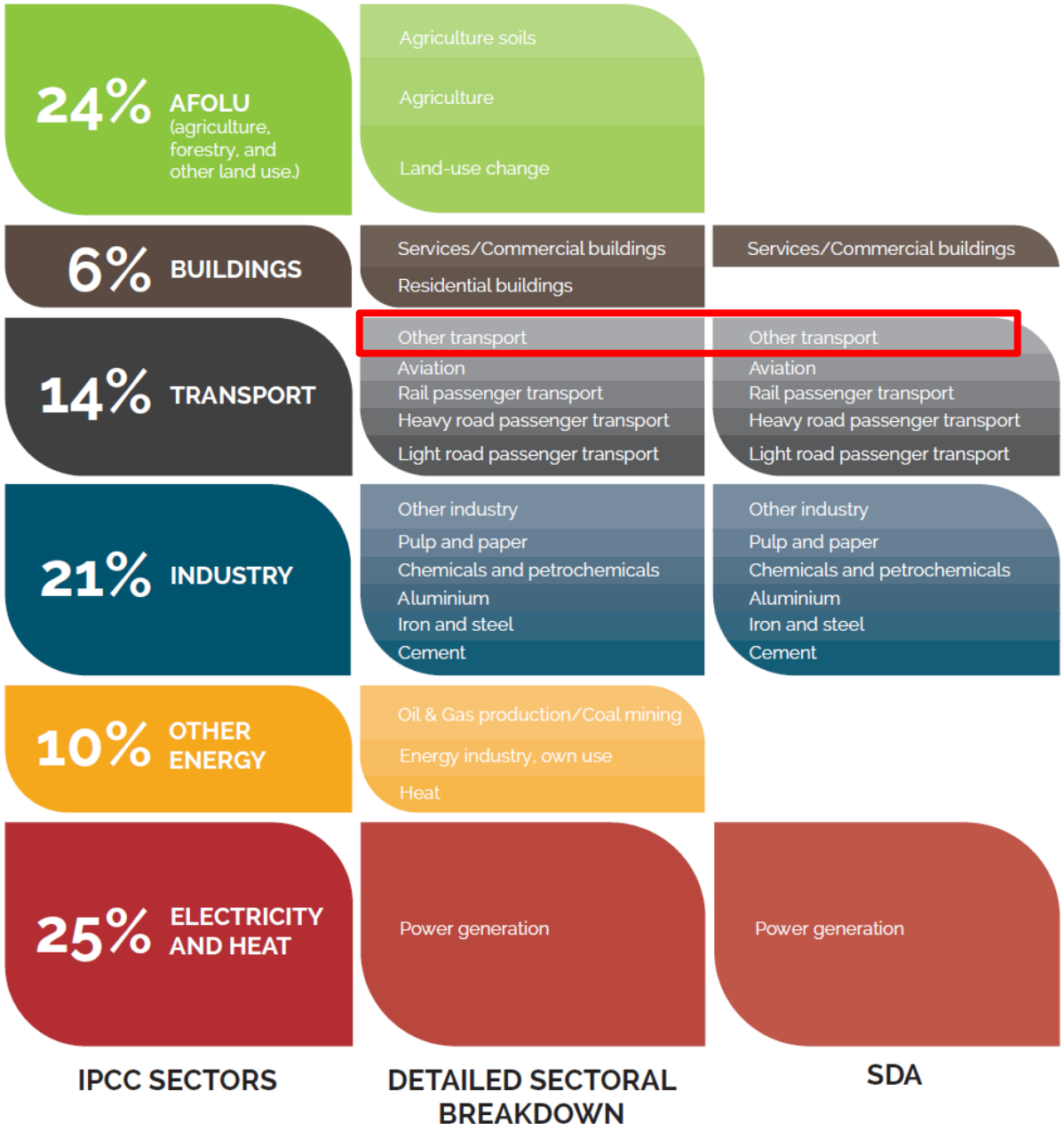
Science Based Targets

SCIENCE BASED TARGETS

DRIVING AMBITIOUS CORPORATE CLIMATE ACTION

SDA: Sectoral Decarbonisation Approach

Sectoral Disaggregation of Science-based Targets



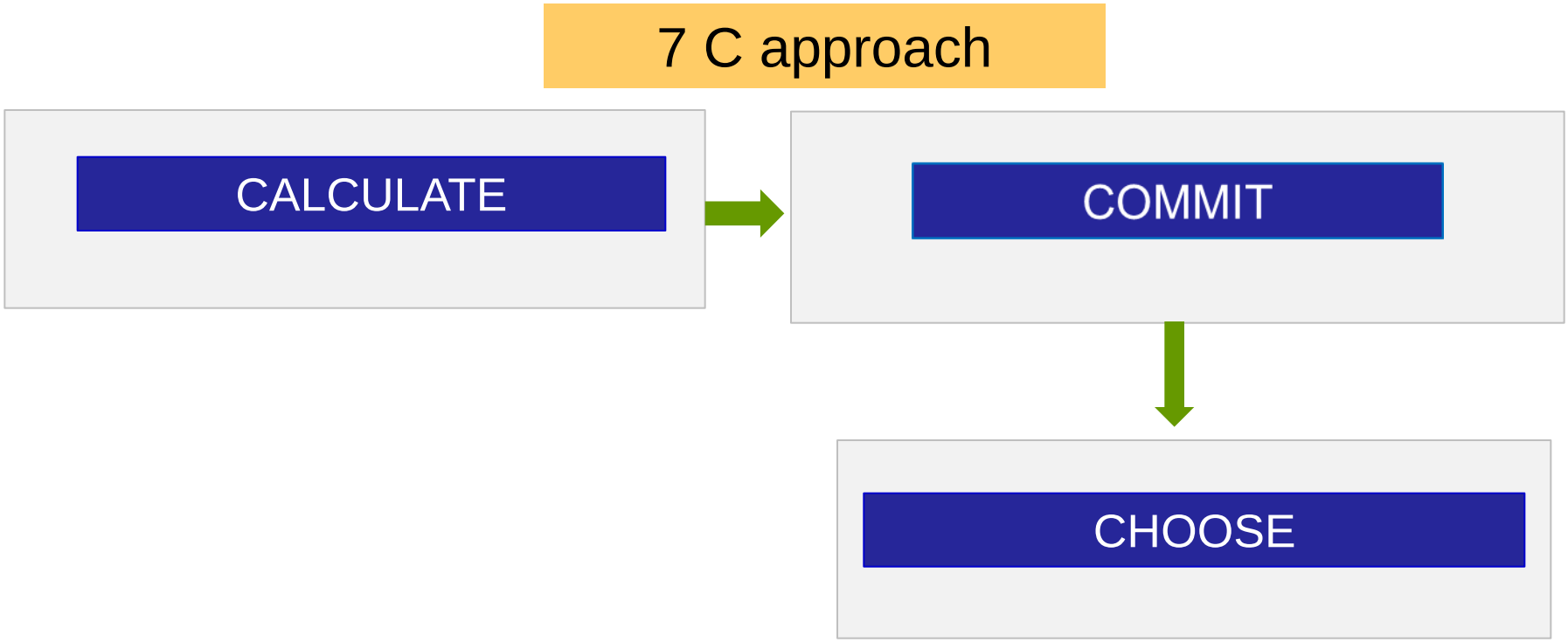
Freight is in the residual 'Other transport' category

Definition of Trucking

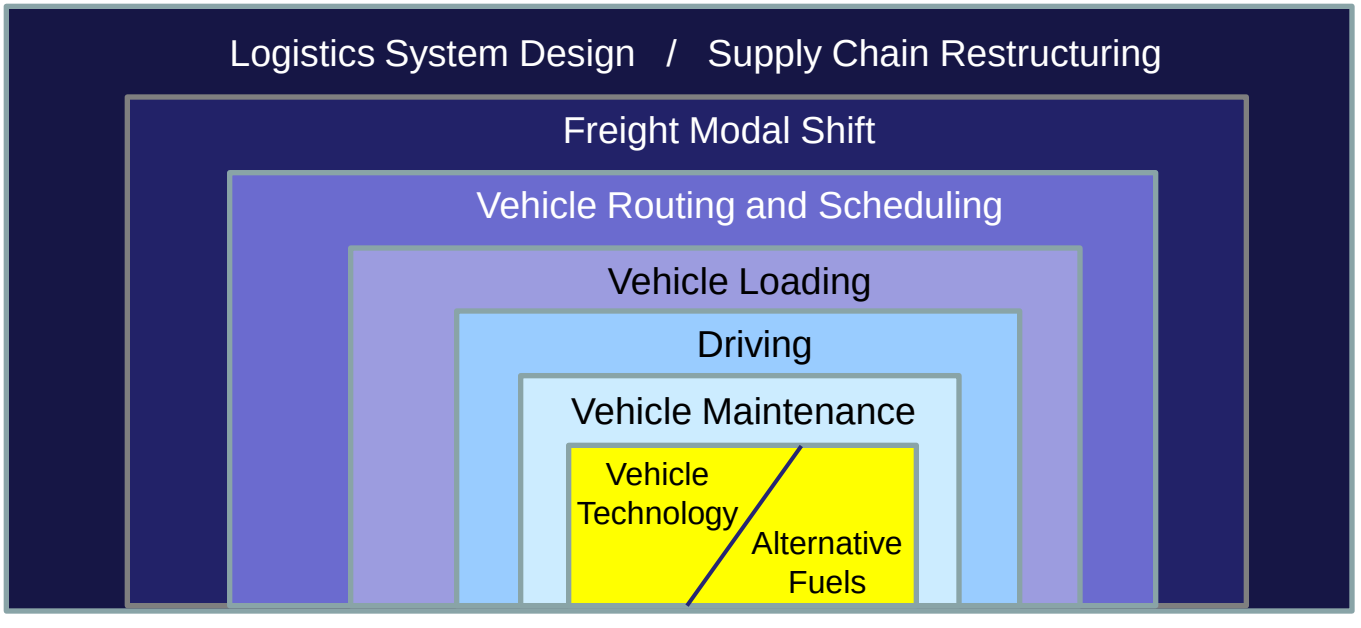
Companies providing primarily goods and passenger land transportation. Includes vehicle rental and taxi companies.

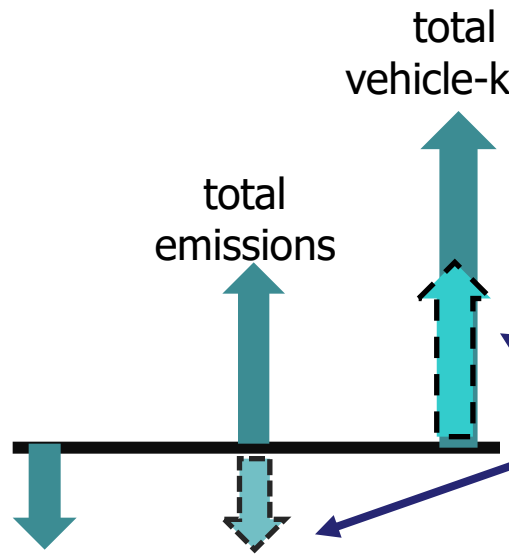
SBT team could find '*no activity information*' for freight in the IPCC and IEA reports – relied on monetary surrogates

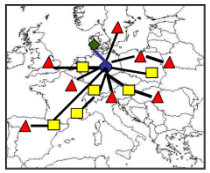
Developing a Carbon Management Strategy for Logistics

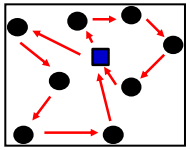


Scoping the Decarbonisation of Logistics





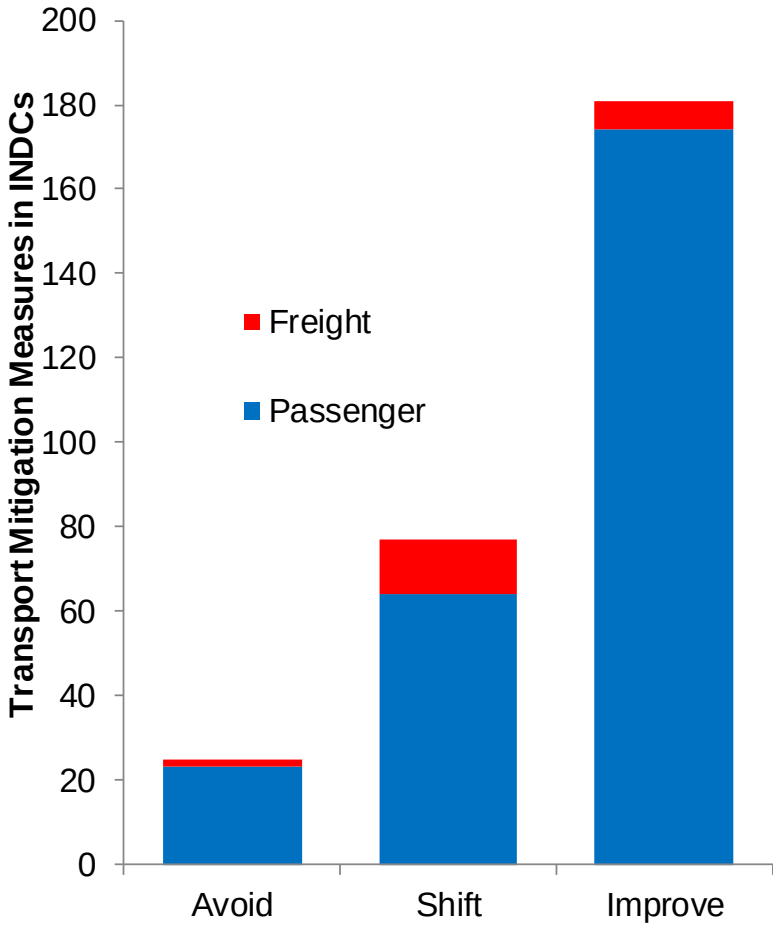


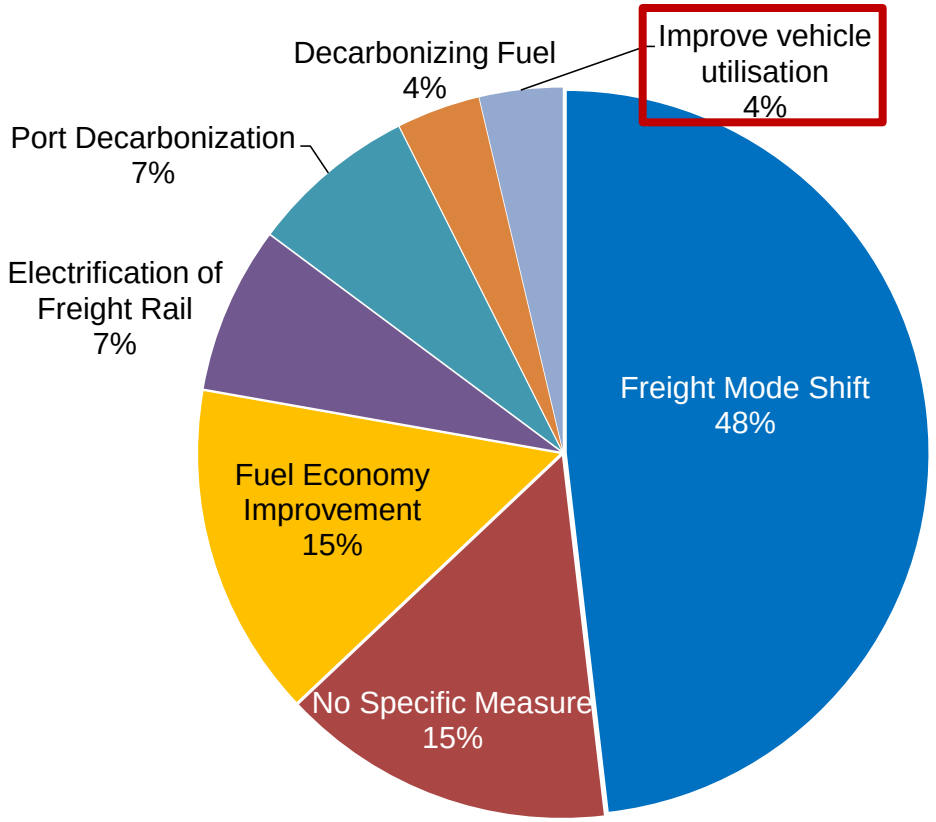


Climate Change Mitigation Measures Specified for Freight in INDCs

Content of 158 INDCs for185 countries analysed
43% explicitly refer to passenger transport
13% explicitly refer to freight transport

Analysis by Sudhir Gota



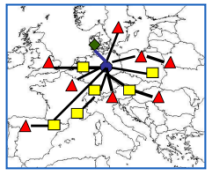


% of INDCs specifying particular green freight measures

Opportunities for Decarbonizing Freight Transport at Corporate Level

reduce transport intensity

restructure supply chains



- relocalize / decentralize
- reversal of business trends
- high carbon-mitigation costs

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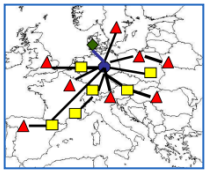

- relocalize / decentralize
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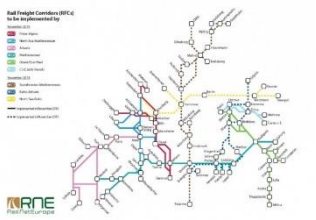
- high carbon-mitigation costs

shift freight to lower carbon modes

- potentially large reduction in average carbon intensity
- reversal of past modal trend
- emphasis on corridor strategies and intermodality
- avoid long term logistical ‘lock-in’ to high carbon modes



Unilever ‘ice-cream’ train from Naples

Opportunities for Decarbonizing Freight Transport

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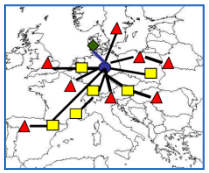

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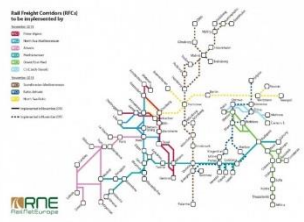
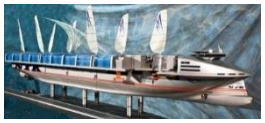


improve asset utilization

- logistical collaboration – *transport asset sharing*
- diffusion of online load matching to emerging markets
- relaxation of vehicle / vessel size and weight constraints

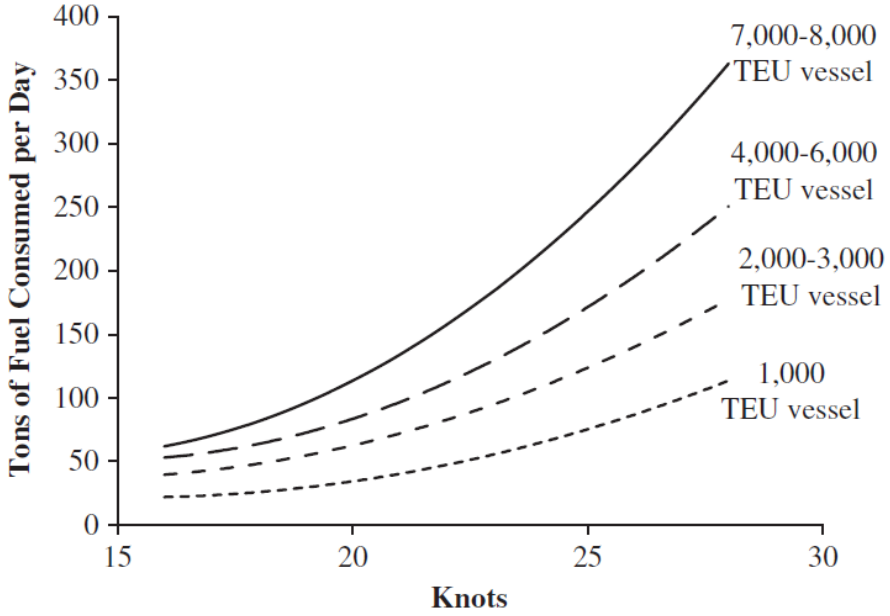
raise energy efficiency



- energy-saving technologies – *new build + retrofits*
- fuel economy standards: *applied to trucks and ships*
- vehicle operation: *eco-driving, IT, platooning etc.*
- business practice: *deceleration of freight movement*

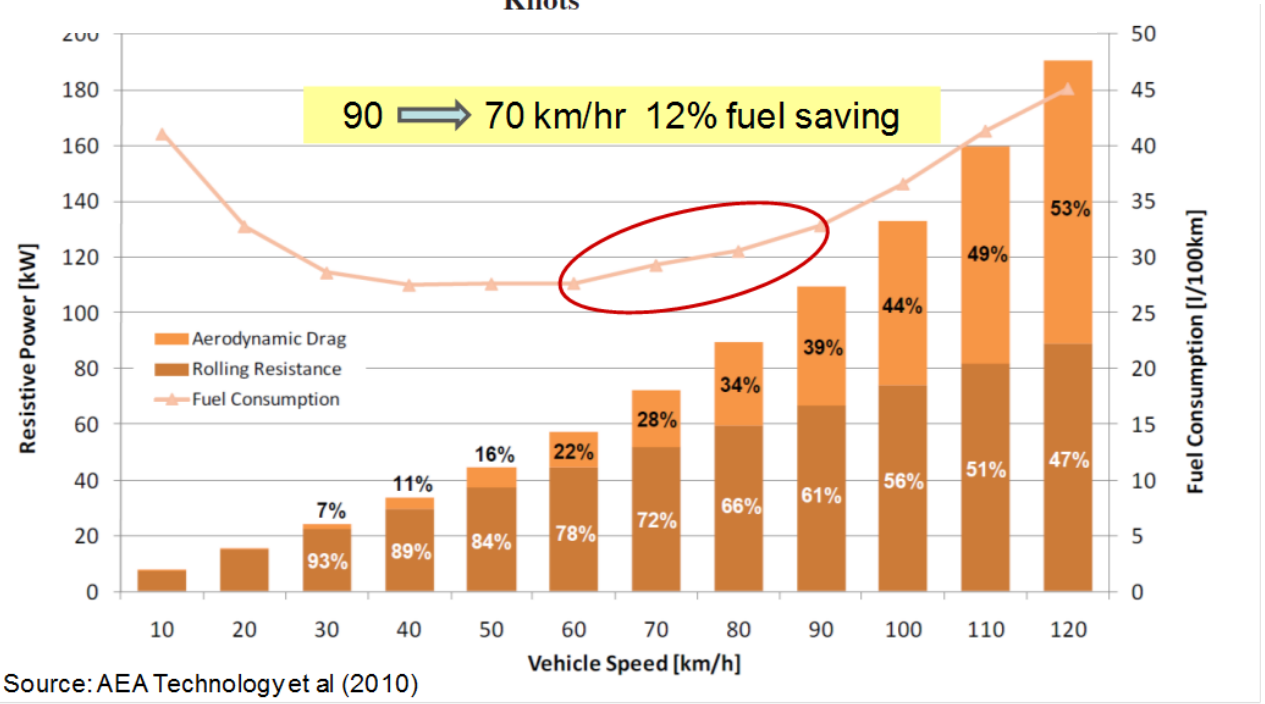
Decelerating Freight Transport: *Energy Saving*

slow steaming



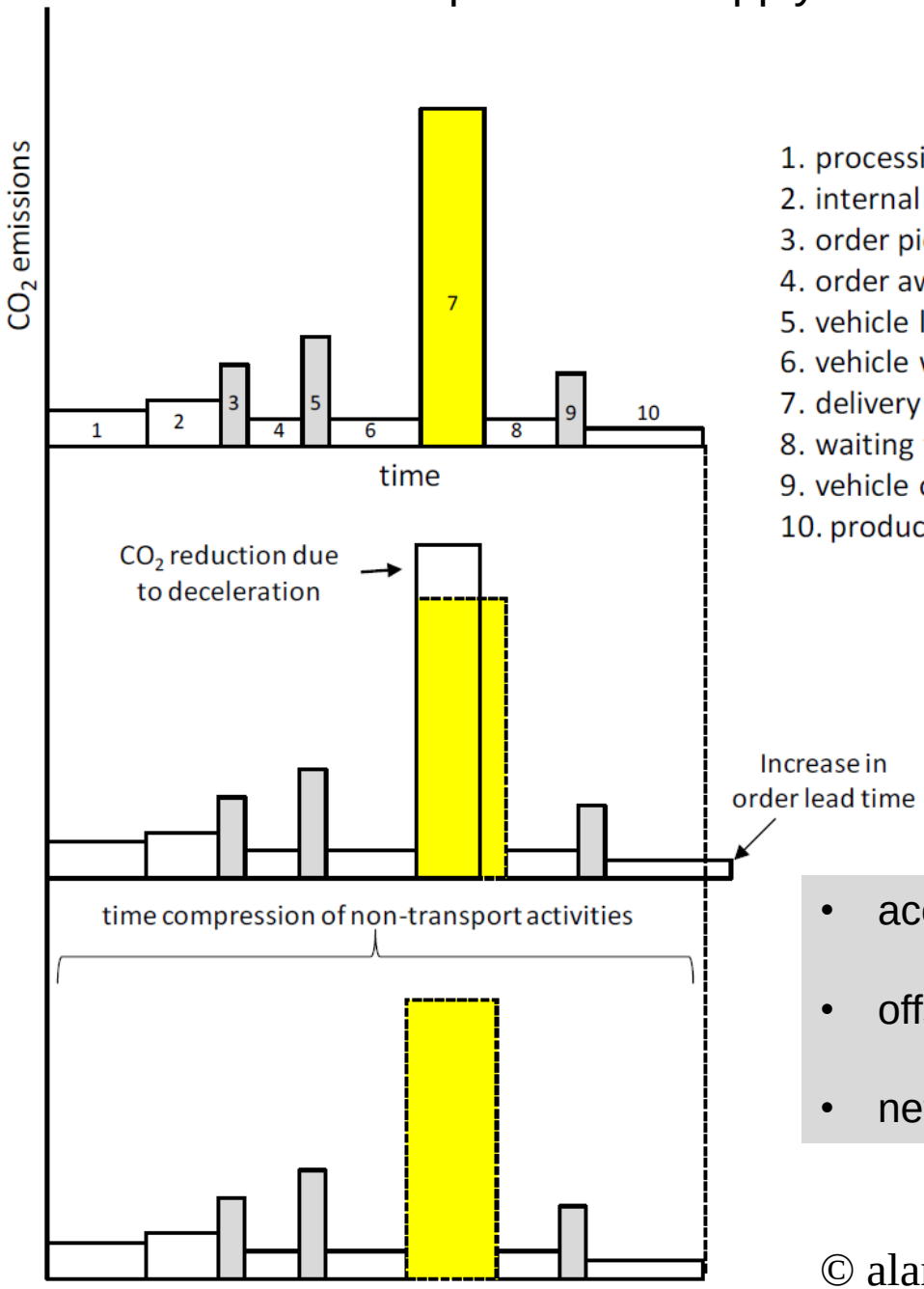
Soure: Miloni, Paul and Gligor, 2013

slow driving



Source: AEA Technology et al (2010)

Relationship between Supply Chain CO_2 Emissions and Time

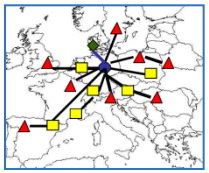


1. processing of inbound order
2. internal administration / checks
3. order picking
4. order awaiting loading
5. vehicle loading
6. vehicle waiting time
7. delivery
8. waiting time at reception point
9. vehicle off-loading and put-away
10. product storage prior to use / sale

- accelerate internal processes
- offsets longer transit times
- net energy / CO_2 saving within fixed lead time

Opportunities for Decarbonizing Freight Transport

restructure supply chains



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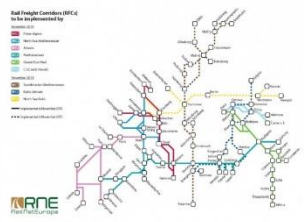

improve asset utilization

- relax JIT – *net CO_2 impact on a full life cycle basis?*
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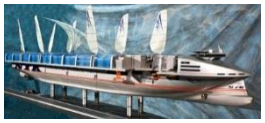
raise energy efficiency



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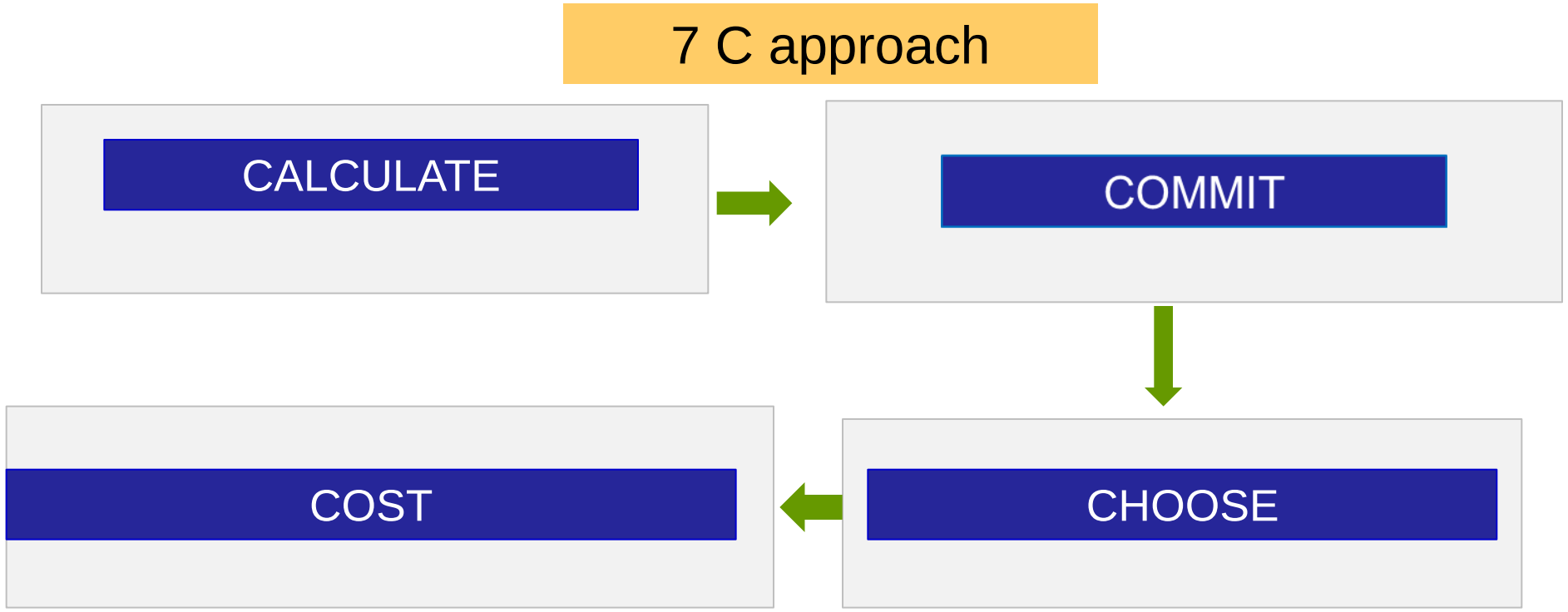
- fuel economy standards: *applied to trucks and ships*
- vehicle operation: *eco-driving, IT, platooning etc.*
- business practice: *deceleration of freight movement*

alter the energy mix

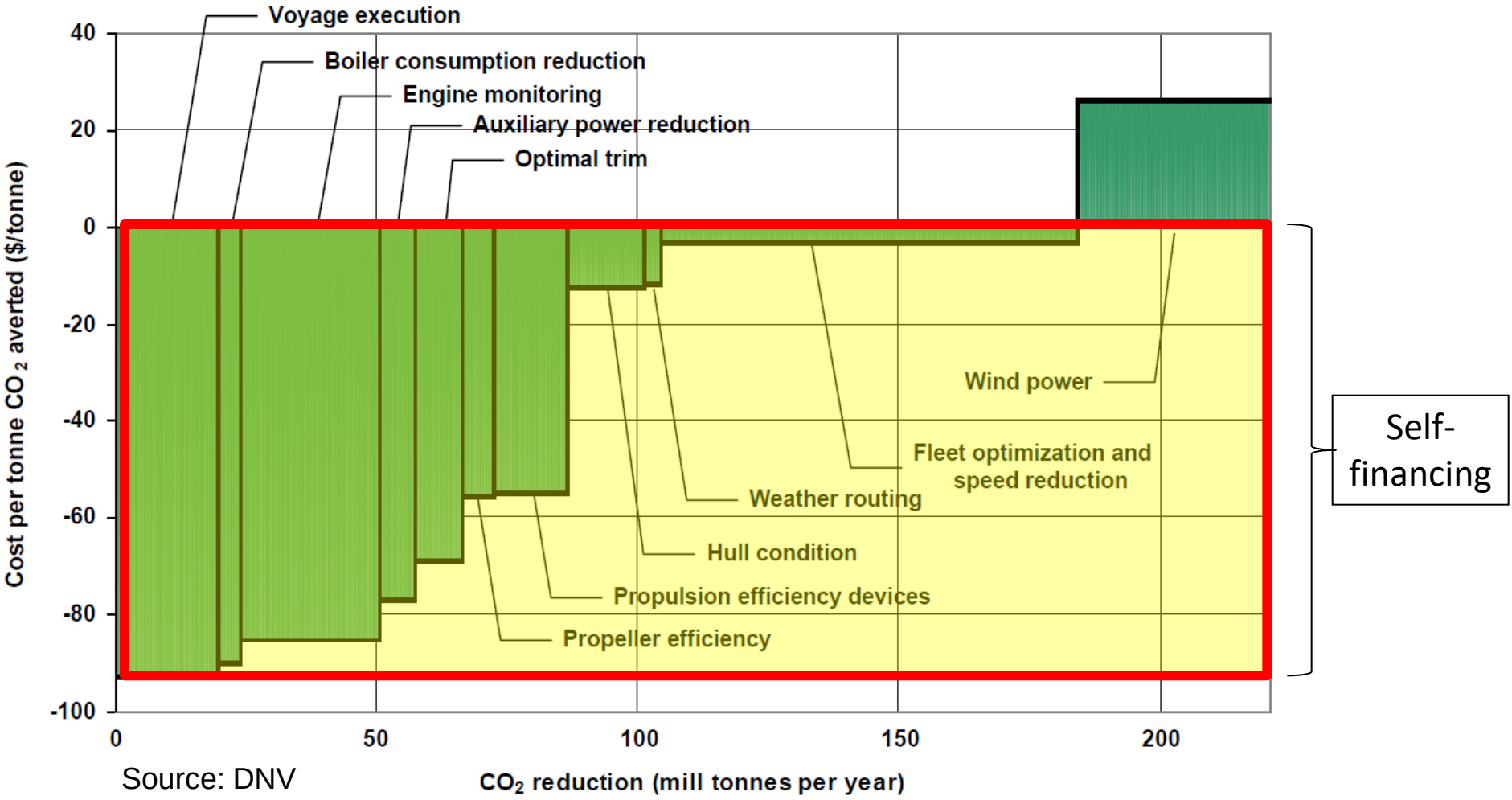
- repowering with low carbon electricity: *grid dependent*
- switch to bio-fuels: *slow uptake / net carbon benefits?*
- development of refuelling / recharging infrastructures

Developing a Carbon Management Strategy for Logistics



Cost effectiveness of decarbonization initiatives in the logistics sector

Marginal Abatement Cost Analysis of Shipping Decarbonisation Measures

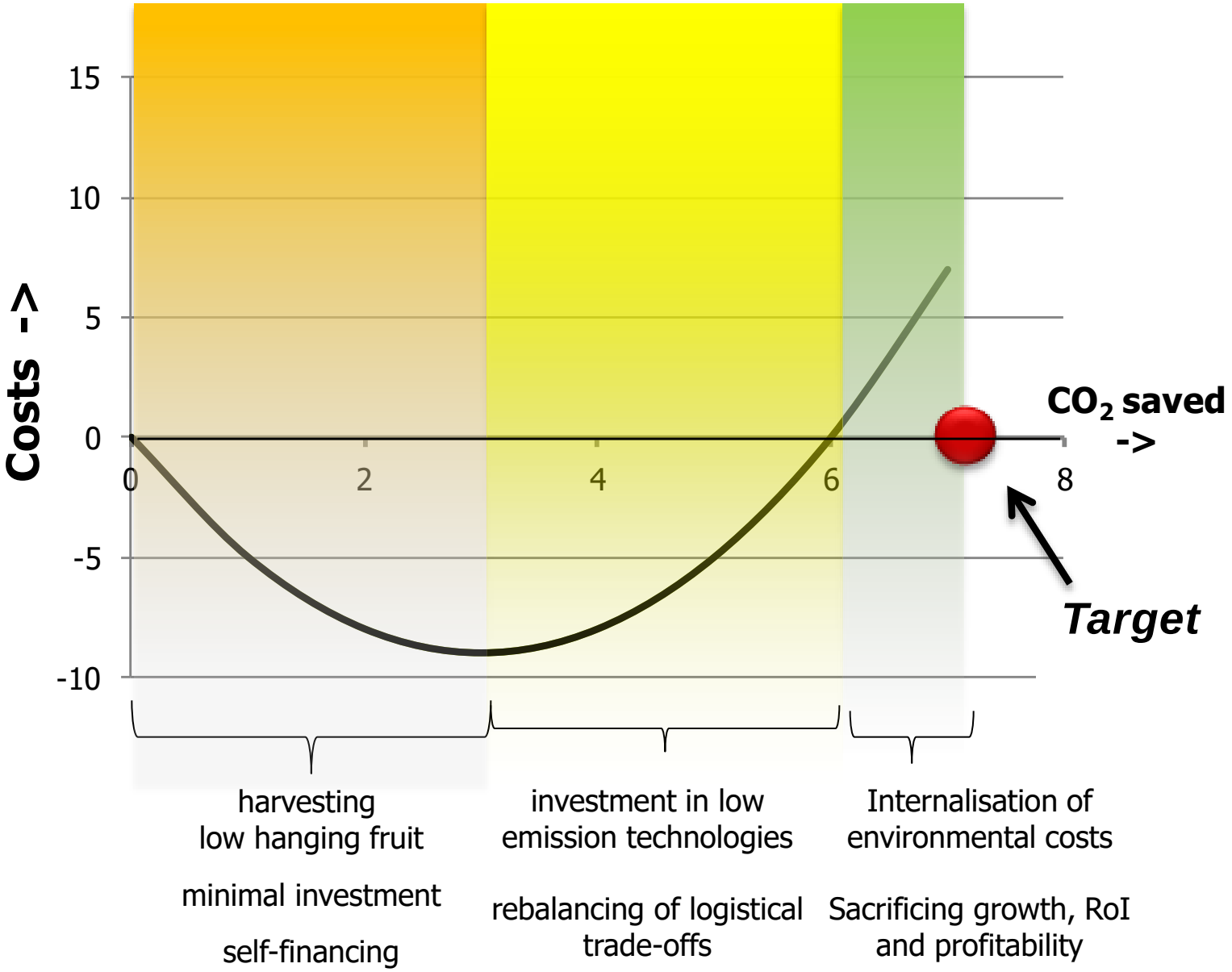


Source: DNV

Close correlation between cutting carbon emissions and saving money

Harvesting low-hanging-fruit ➡ new 'climate-centric' business paradigms

Future economics of greening logistics activities?



Adapted from Tavasszy (2014)

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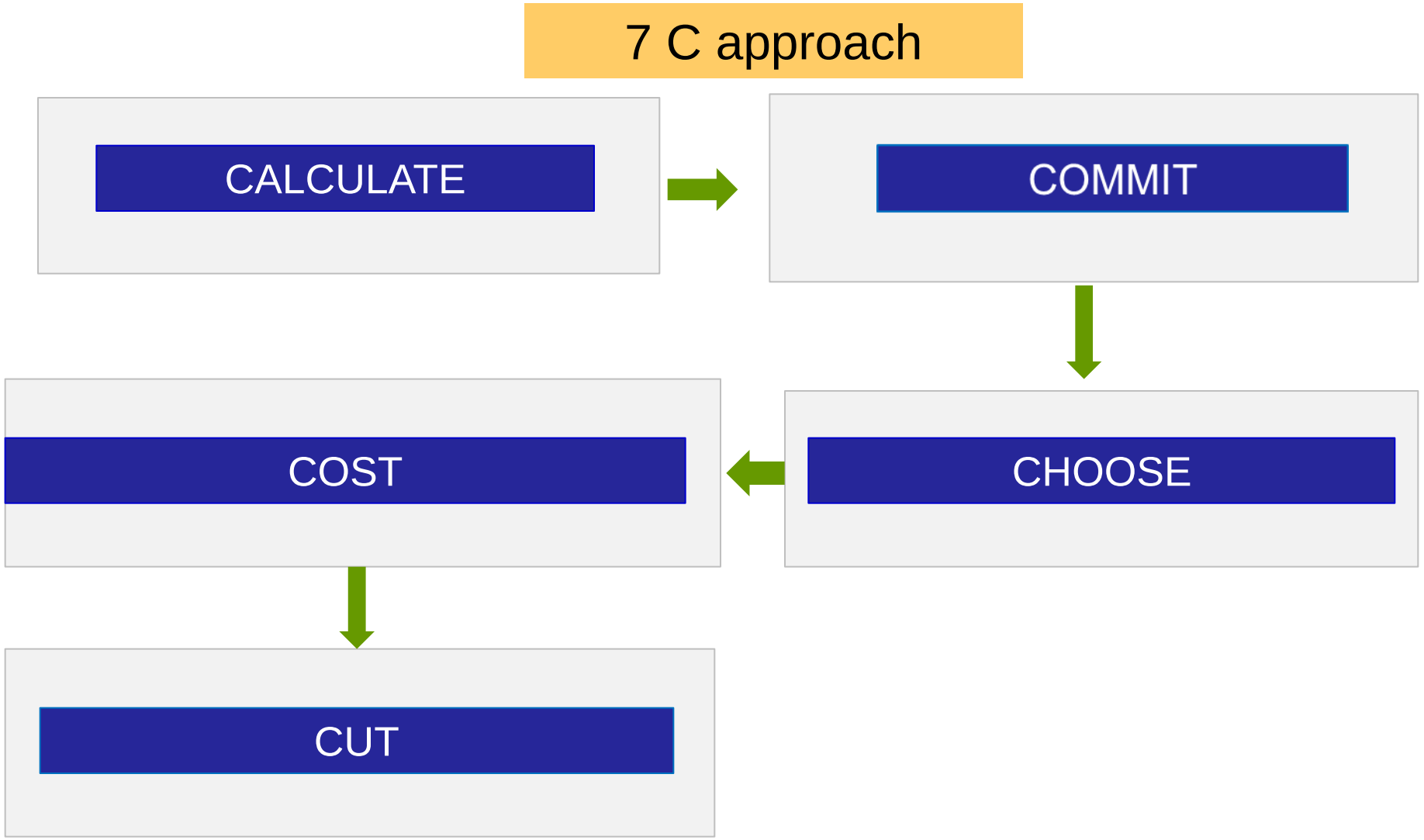
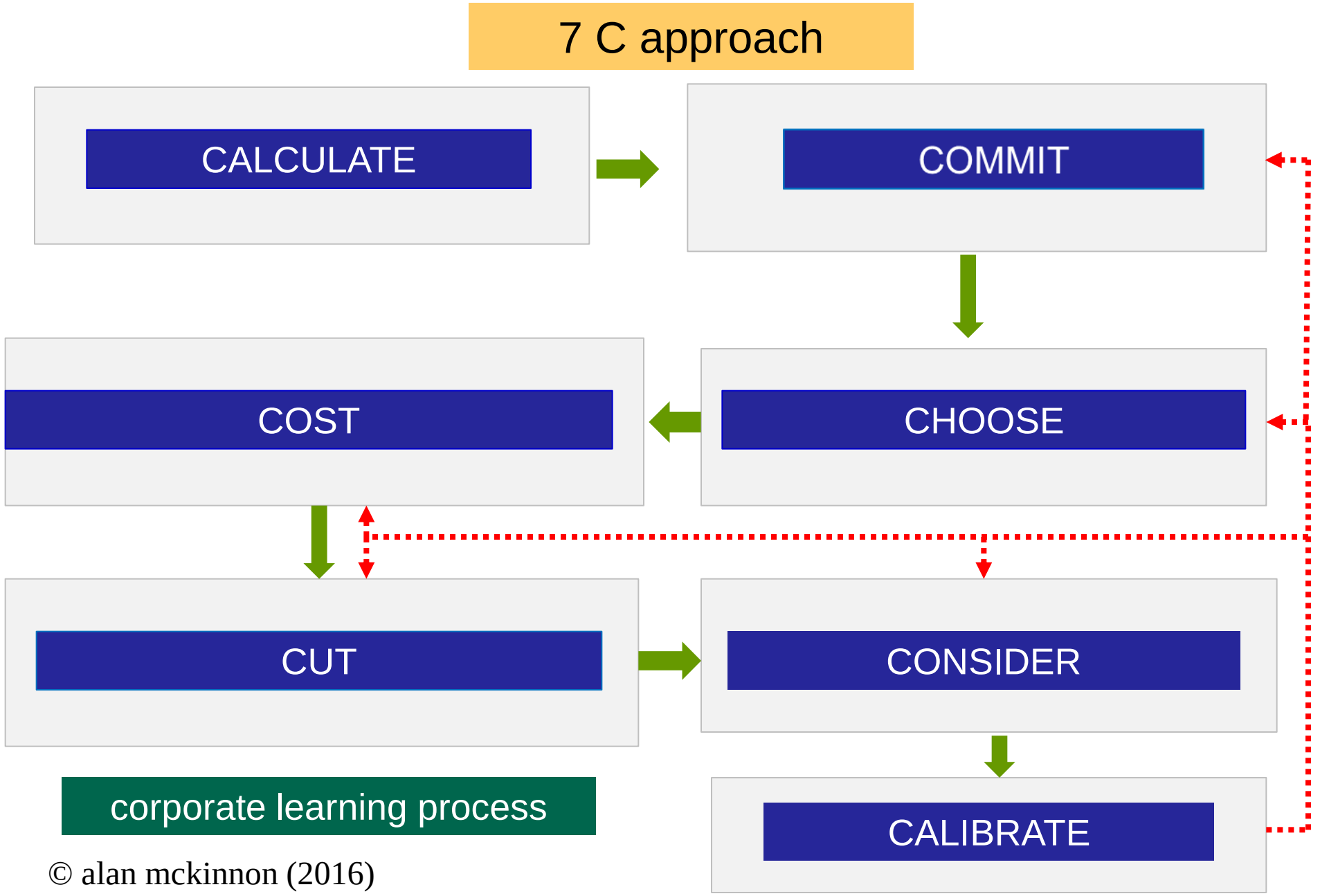
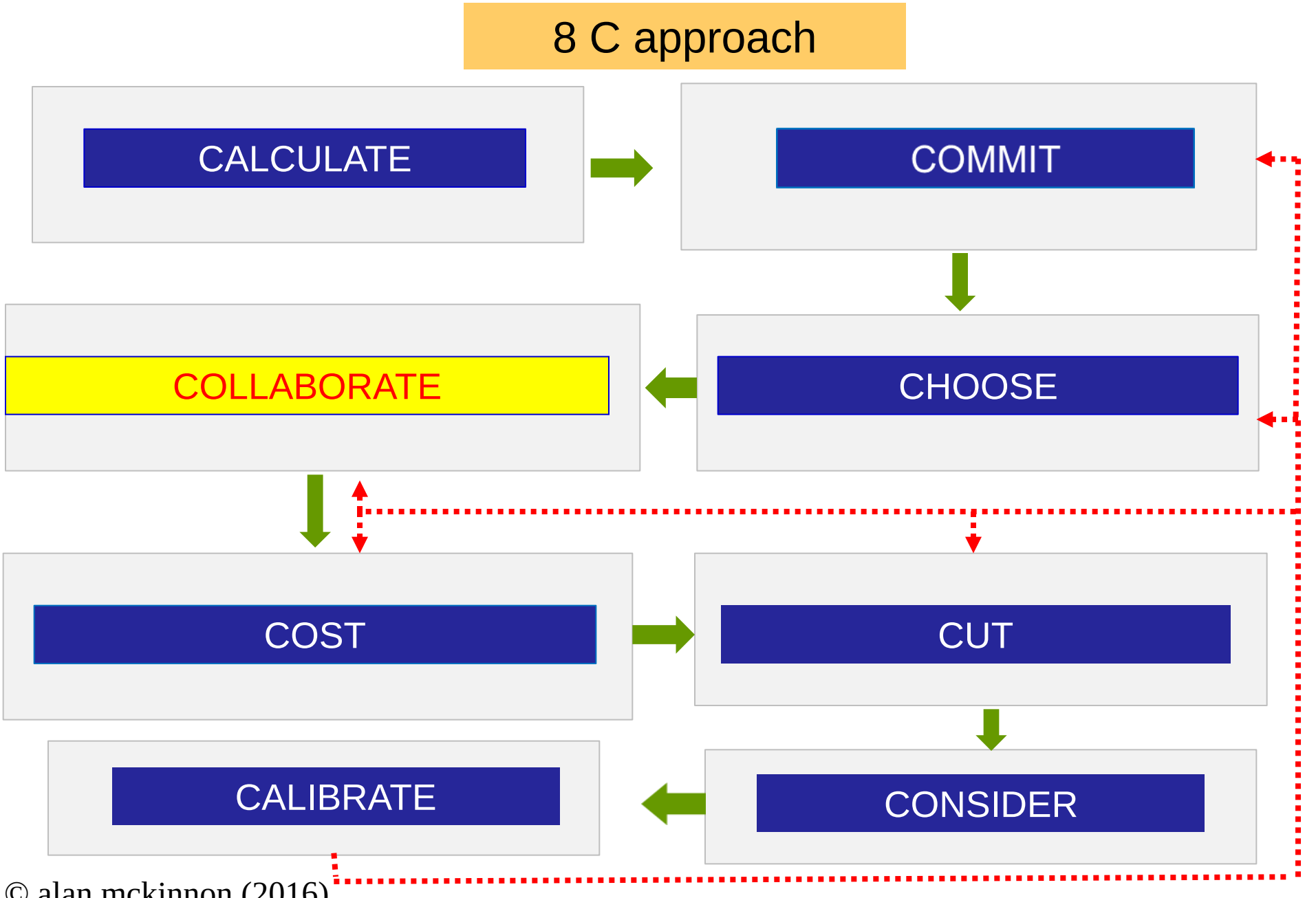


Developing a Carbon Management Strategy for Logistics



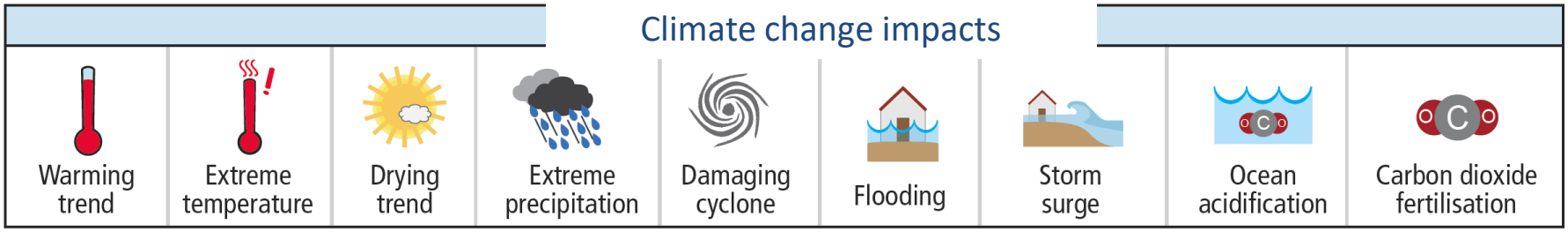
Developing a Carbon Management Strategy for Logistics



Relationship between Climate Change Mitigation and Adaptation

'Many adaptation and mitigation options can help address climate change, but no single option is sufficient by itself.'

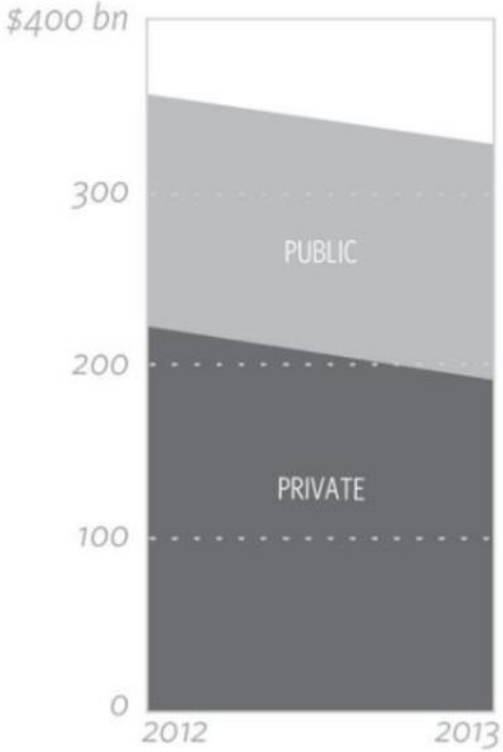
IPCC 5AR Synthesis Report 2014

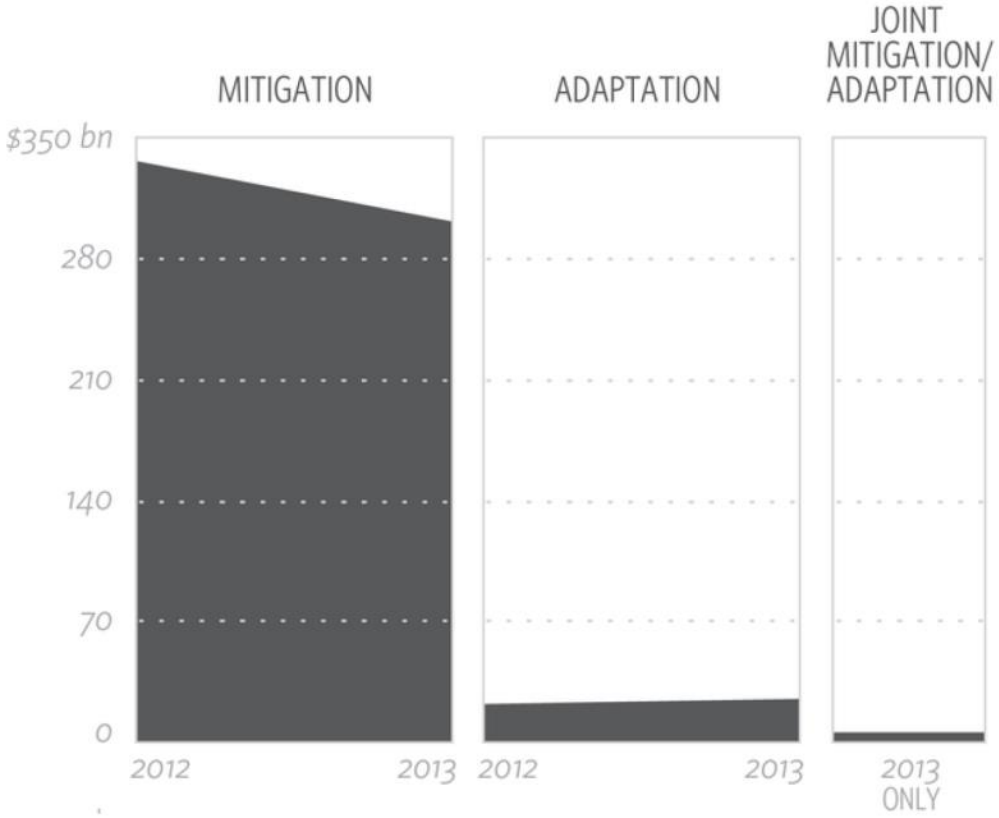


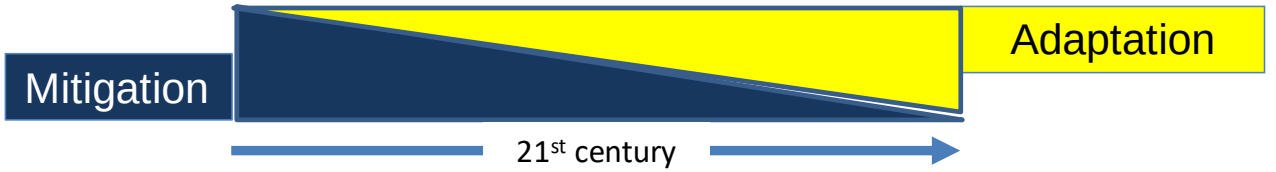
Climate change likely to prove to be non-linear, requiring more rapid adaptation

May be grossly under-estimating the amount of effort, time and resources that will be required for adaptation and climate proofing

Global Climate Finance

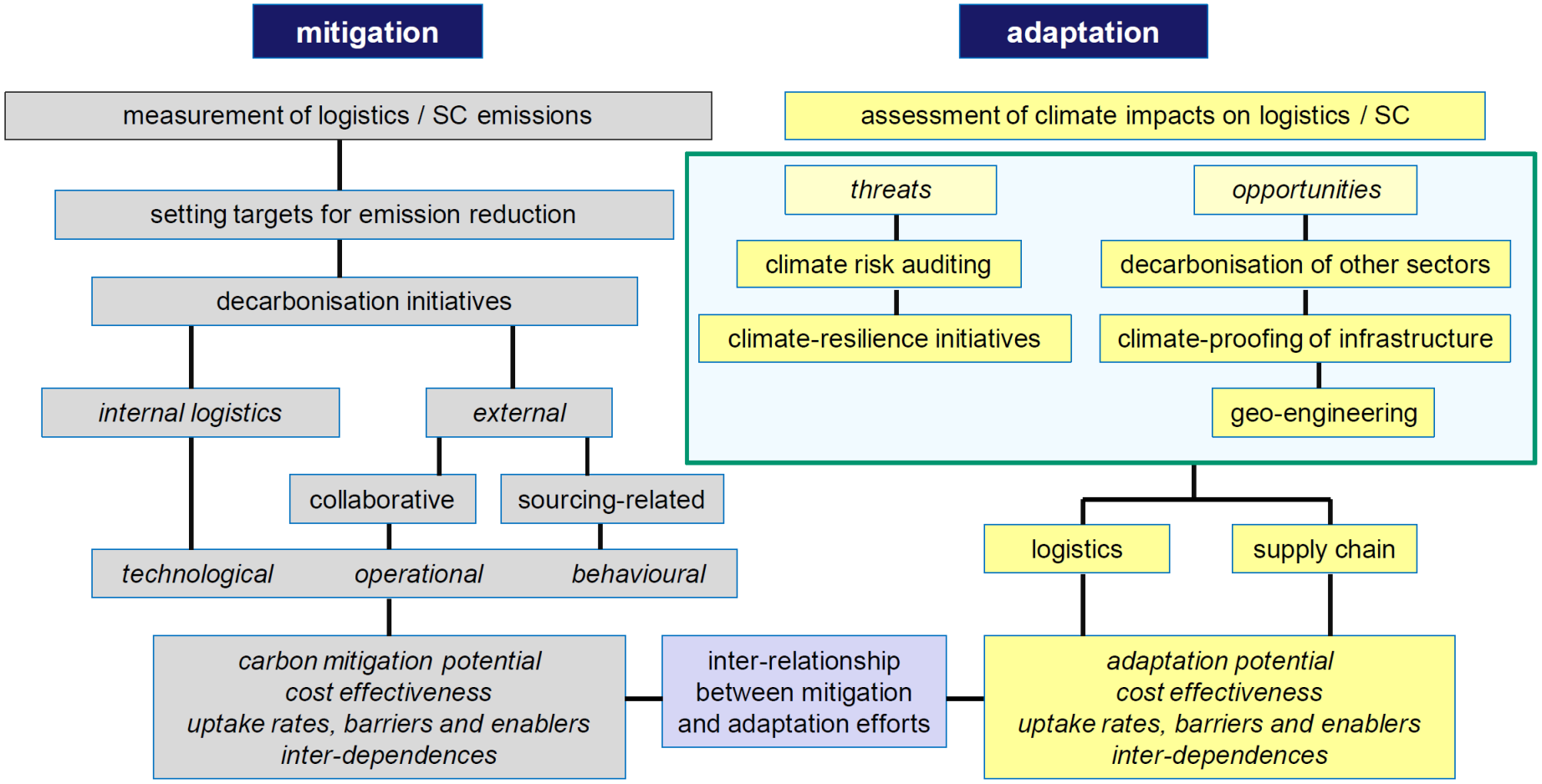






Logistics Climate Research: *Holistic Approach*

'Little research has so far been conducted on the inter-relationship between adaptation and mitigation strategies in the transport sector' IPCC AR5 vol 3



Examples of Future Research Questions?

To what extent will climate change adaptation increase the level of logistical activity / generate additional freight traffic and related CO_2?

How can we minimize logistics-related CO_2 emissions from:

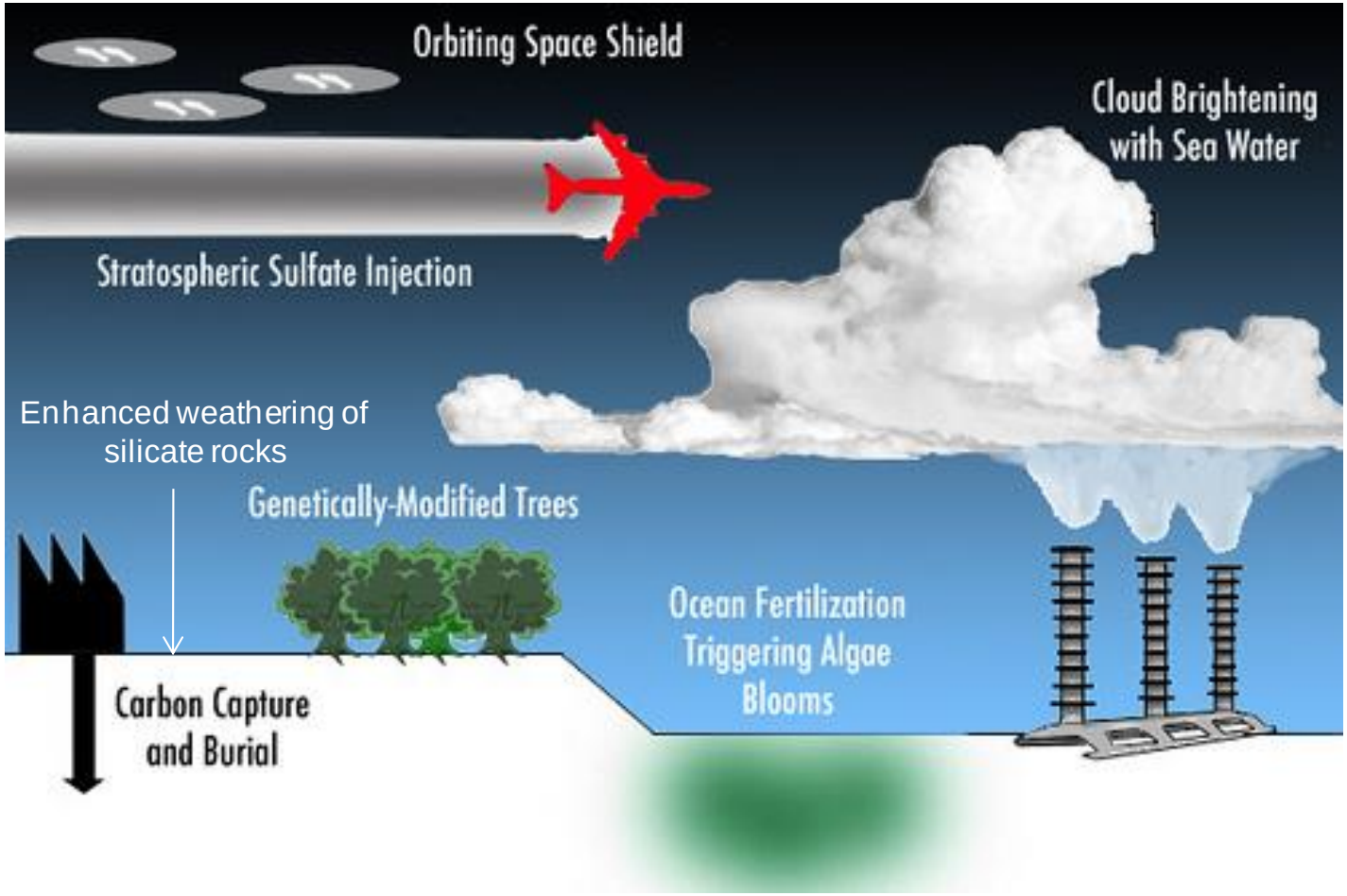
- *climate-proofing*
- *redistribution of population / construction of new settlements*
- *movement of materials for the decarbonisation of other sectors*

Will carbon mitigation efforts increase / reduce vulnerability of supply chains to climate change:

e.g. modal shift to rail / inland waterways

How should future resources be allocated between mitigation and adaptation efforts in the logistics sector?

Last resort: *geo-engineering to the rescue*



How much material would have to be moved to keep the planet habitable?

Professor Alan McKinnon

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