Cutting Carbon Emissions from the Deep-sea Container Supply Chain

the Role of the Shipper

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SIET Annual Conference 2013

Venice

20th September 2013

KÜHNE LOGISTICS UNIVERSITY HAMBURG

- A private, independent, state- recognized university – founded in 2010
- A university with expertise in logistics and management
- 2 MSc, a Bachelors, an executive MBA and a PhD program – 160 students
- 15 resident faculty plus contributions from a group of external professors
- 7th place in the 2012 Handelsblatt research ranking for business institutions in the German-speaking world

Climate Change is Topical

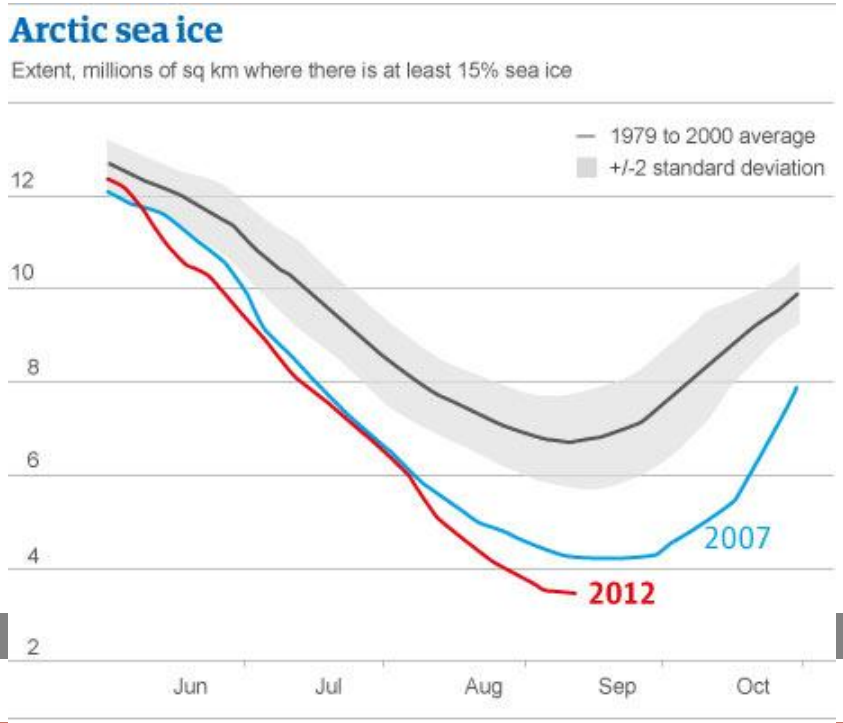
5th Assessment Report of the Inter-governmental Panel on Climate Change (IPCC) published next week (Volume 1)

Tony Abbott elected Prime Minister of Australia – pronounced that *'Climate change is absolute crap'*

Venice is one of the most vulnerable cities in the world to climate-induced sea-level rise

20th September is typically the day of maximum summer ice melt in the Arctic

Contraction of the Arctic Summer Sea Ice Cover



Average minimum summer ice cover during the 1970s: 8 million square kms

Minimum ice cover in 2012: c. 4 million sq.km

Source: Guardian, 14 Sept 2012

Alarming Arithmetic of Climate Change

Since 1850 roughly 2000 billion tonnes of CO_2 emitted by Mankind

Aim : achieve 75% chance that rise in average temperature kept below 2^o C by 2050

Need to limit future CO_2 emissions to 700 billion tonnes for the rest of this century

Currently emitting around 37 billion tonnes of CO_2 (steadily rising)

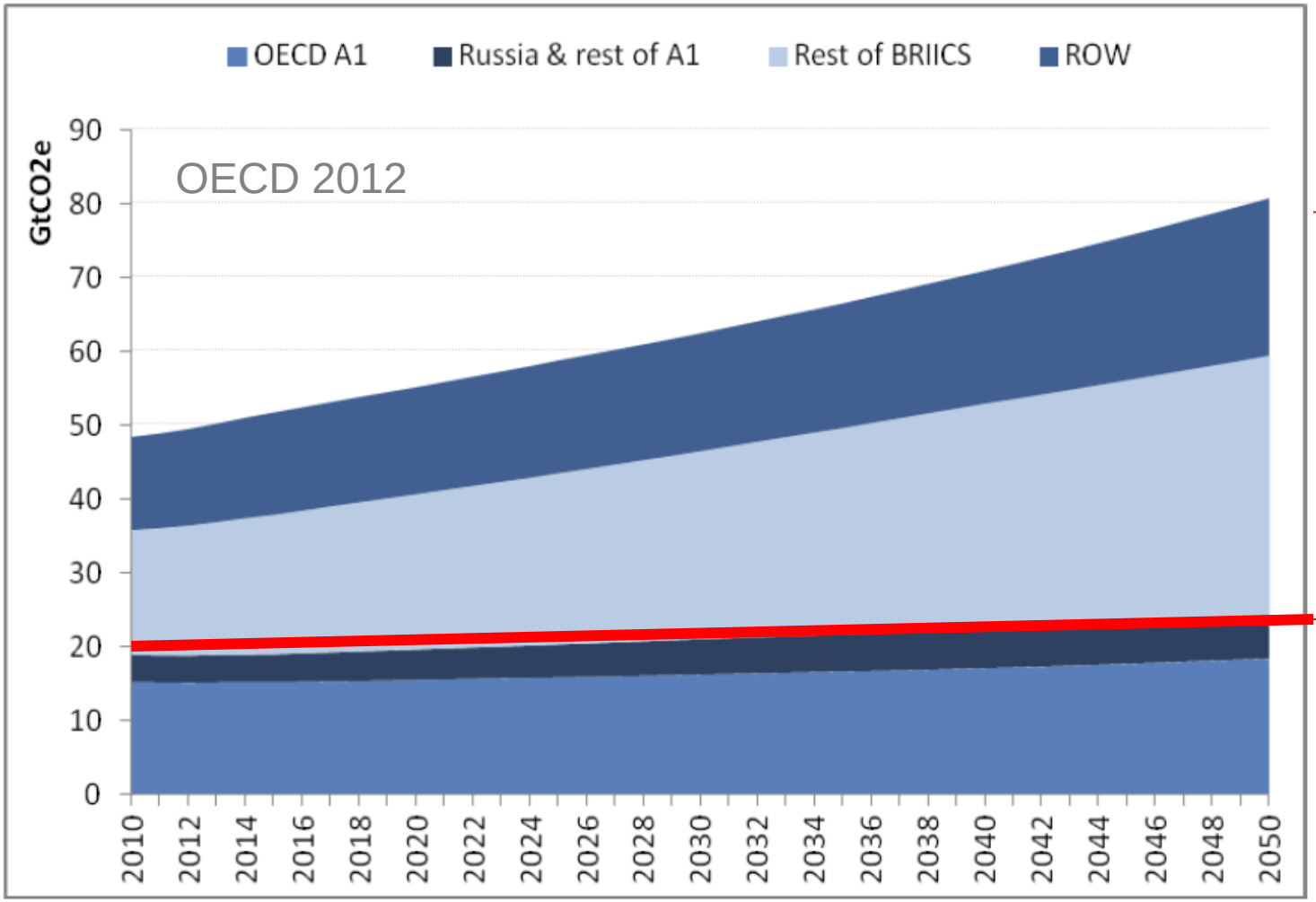
We are on a trajectory that will lead to 4-6^o C of warming by 2100

Catastrophic in ecological and human terms

Sources: Berners-Lee and Clark, 2013, Lynas, 2010

Projected Trend in Greenhouse Gas Emissions

all global warming gases expressed as CO_{2e}

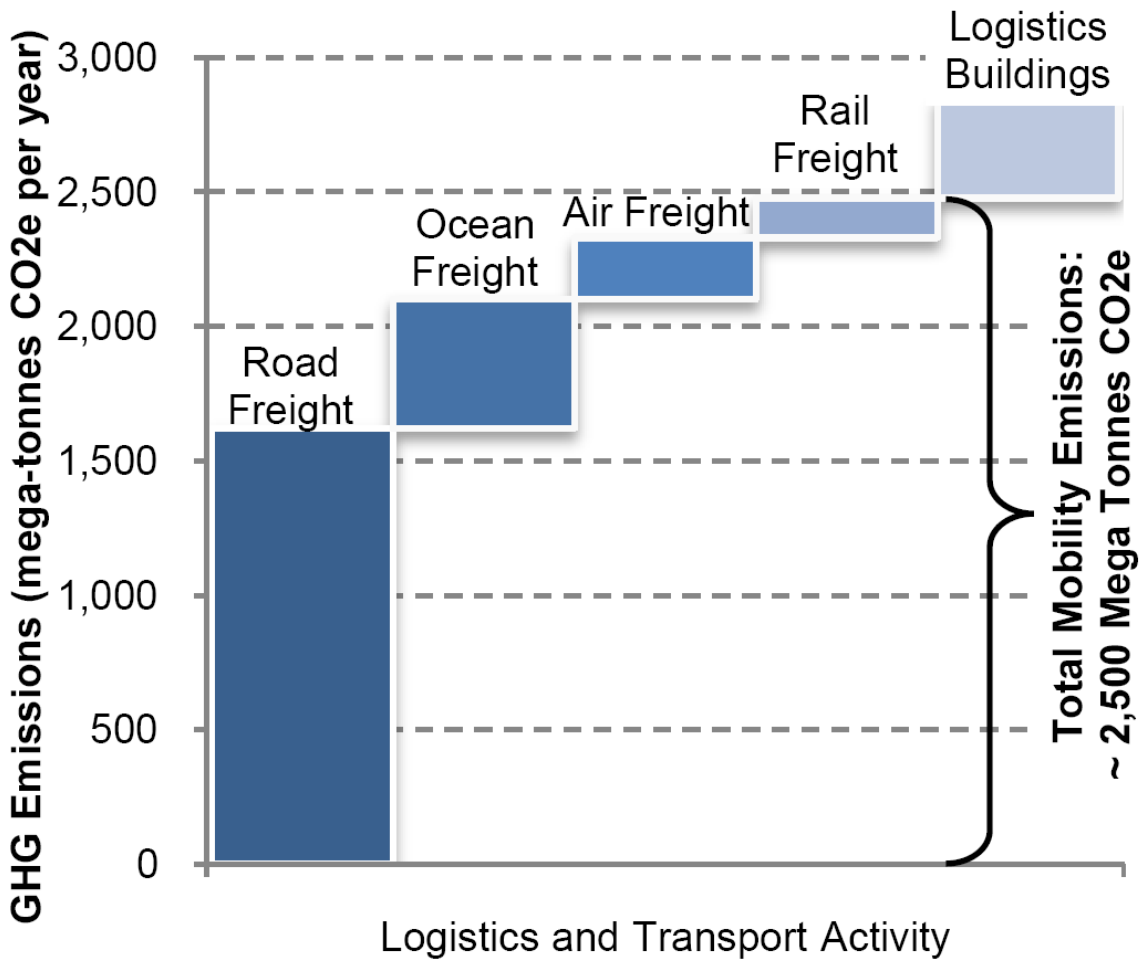


carbon challenge

Emission of greenhouse gases from freight transport / logistics

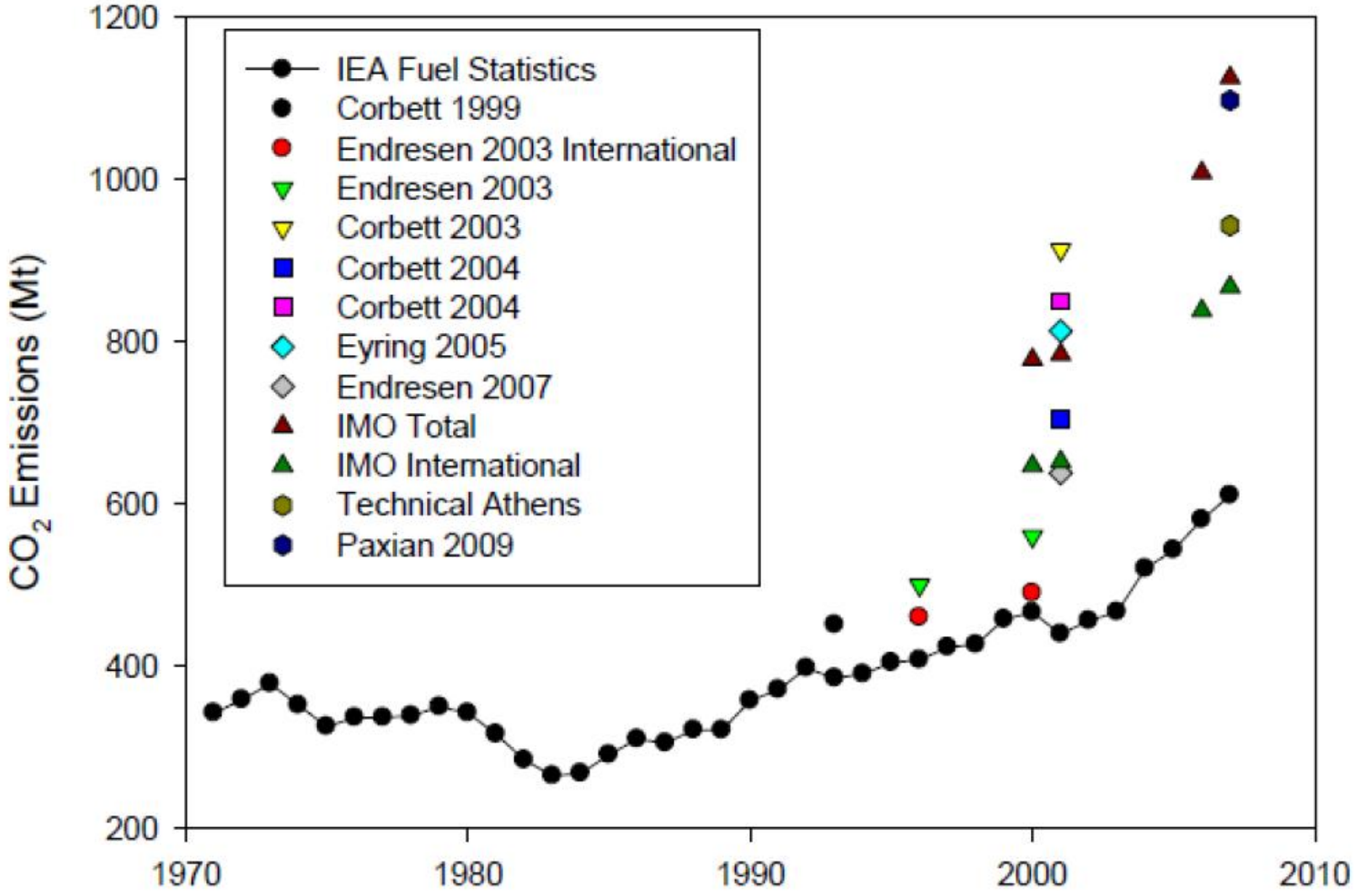
Logistics accounts for 2,800 giga-tonnes of CO_{2e}

5.5% of total GHG emissions

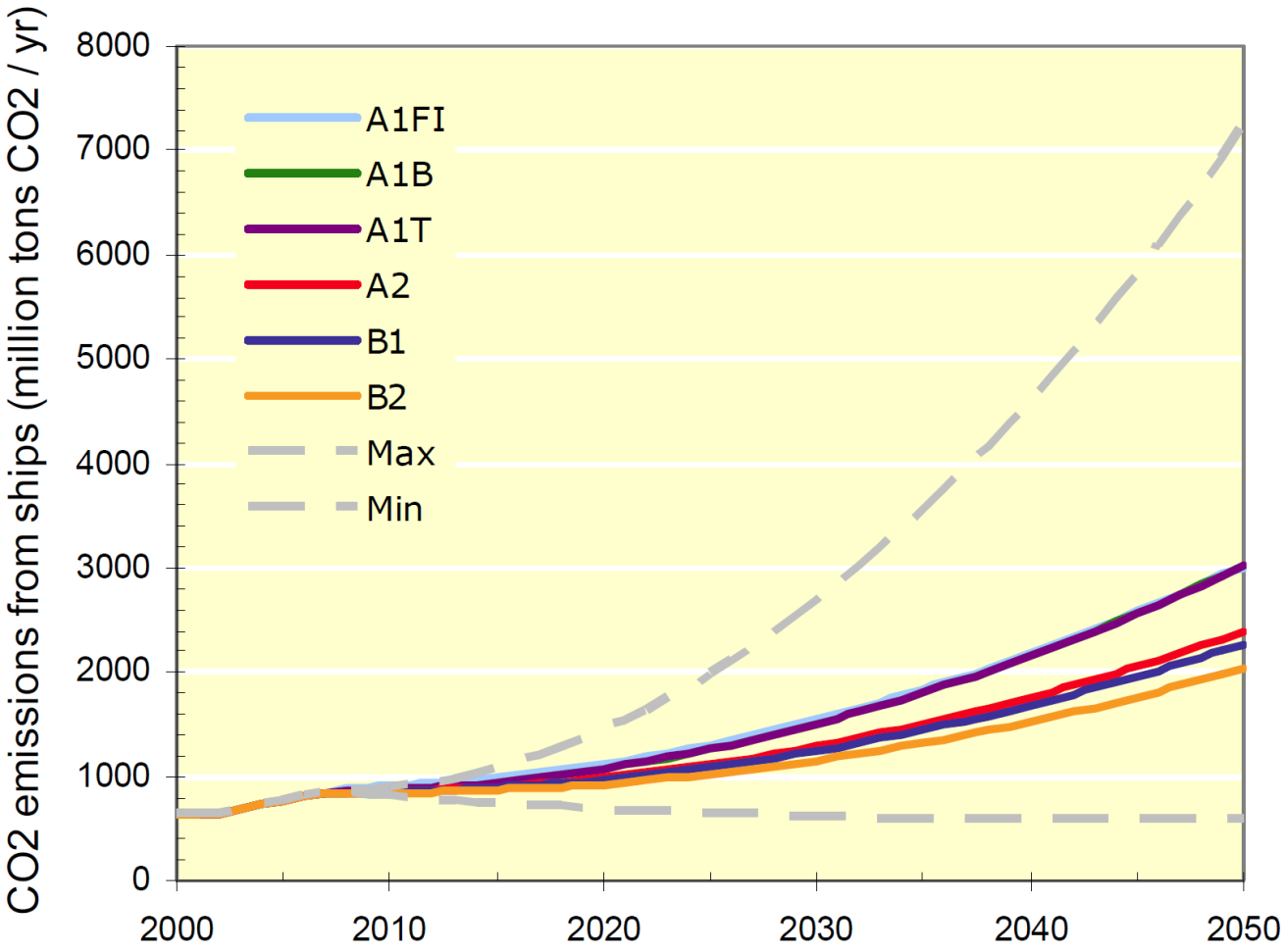


Source: World Economic Forum / Accenture

Uncertainty about Recent Levels of CO_2 Emissions from Shipping



Projected Growth of Shipping Emissions to 2050

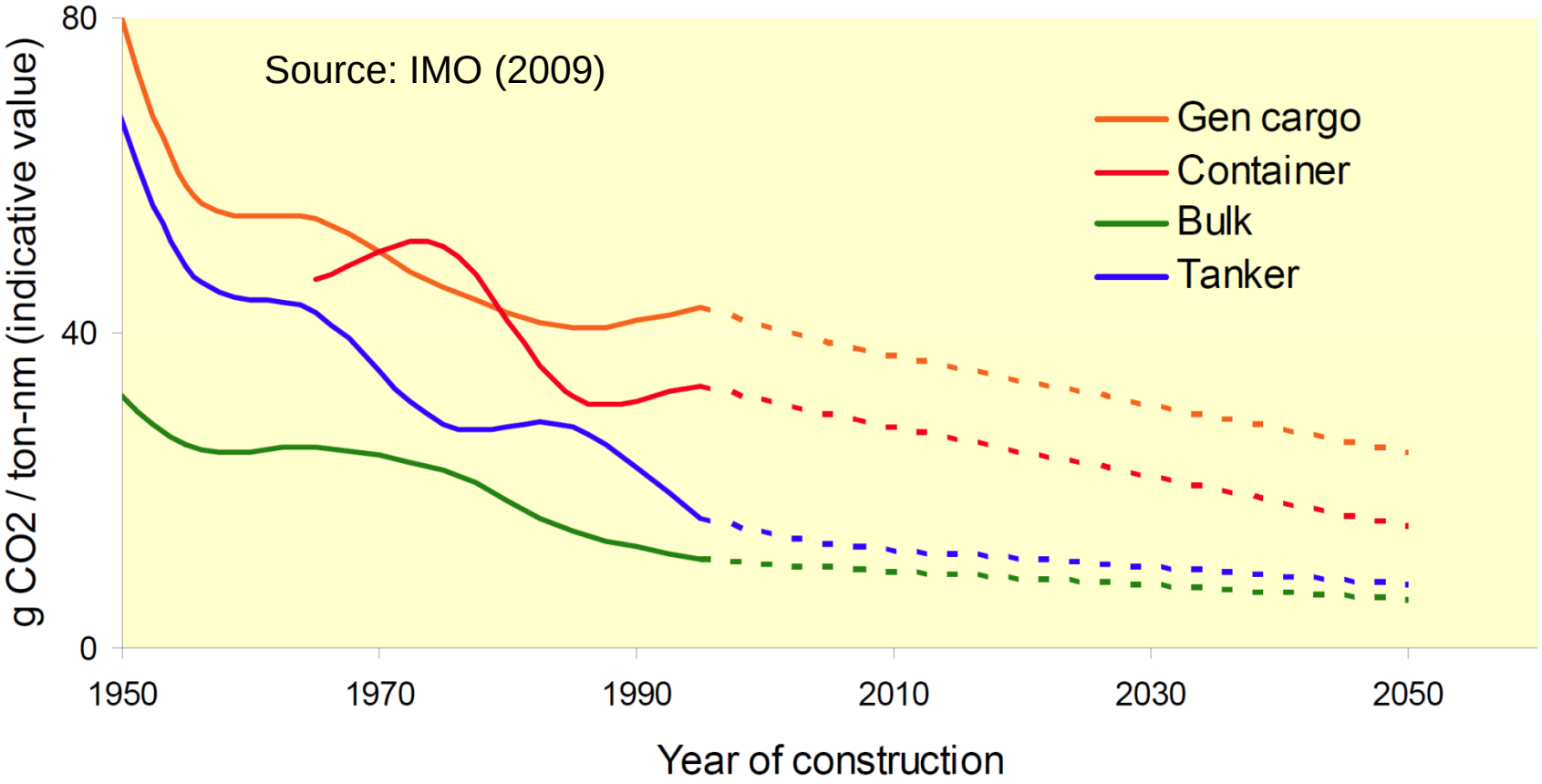


IMO: 150 -250% increase in CO_2 emissions relative to 2007

3% of CO_{2e} emissions today ⇨ 15% in carbon constrained world of 2050 ?

UK Committee on Climate Change 2008

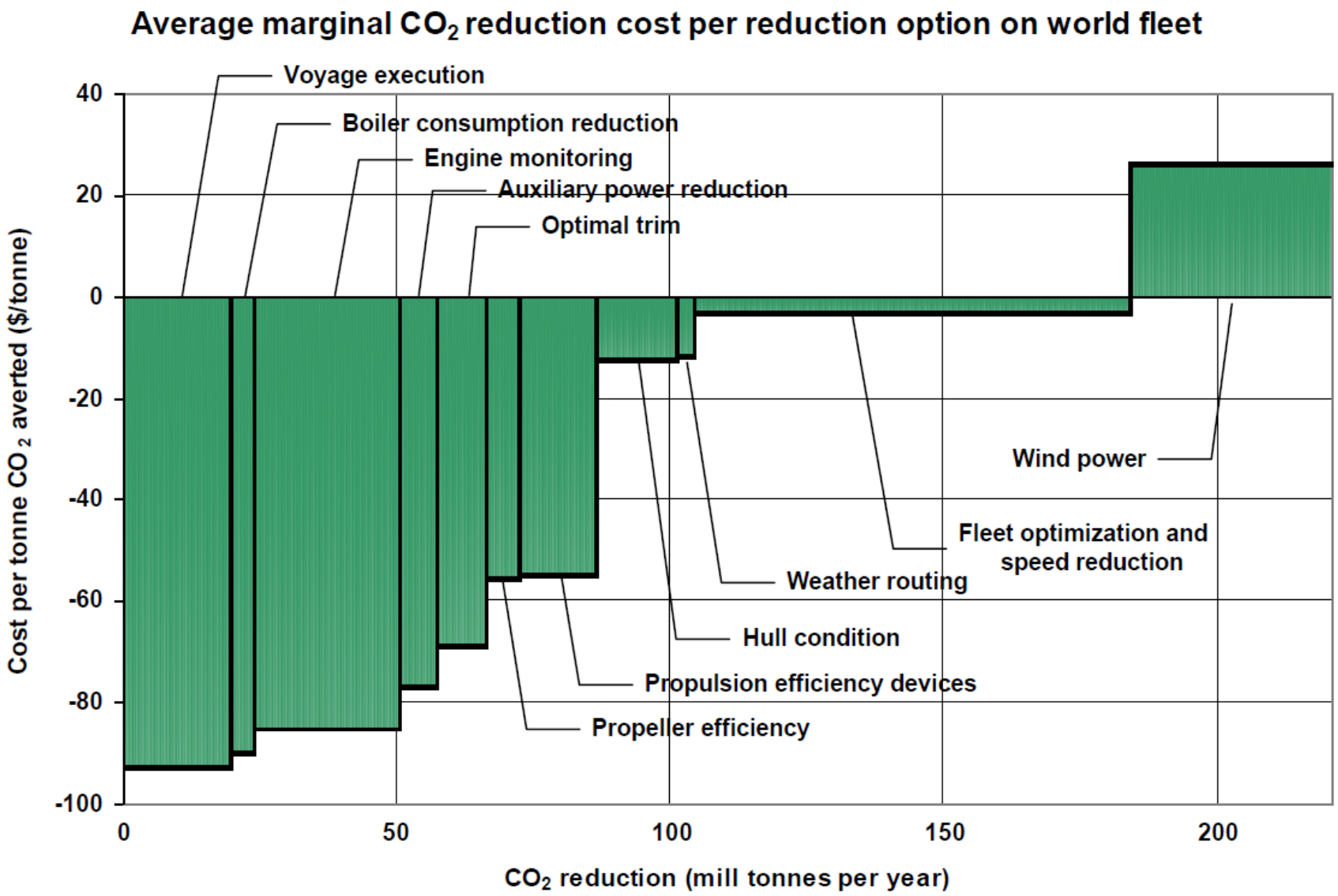
Baseline Trend and Projections



69% reduction in CO_2 per container carried relative to current average container ship

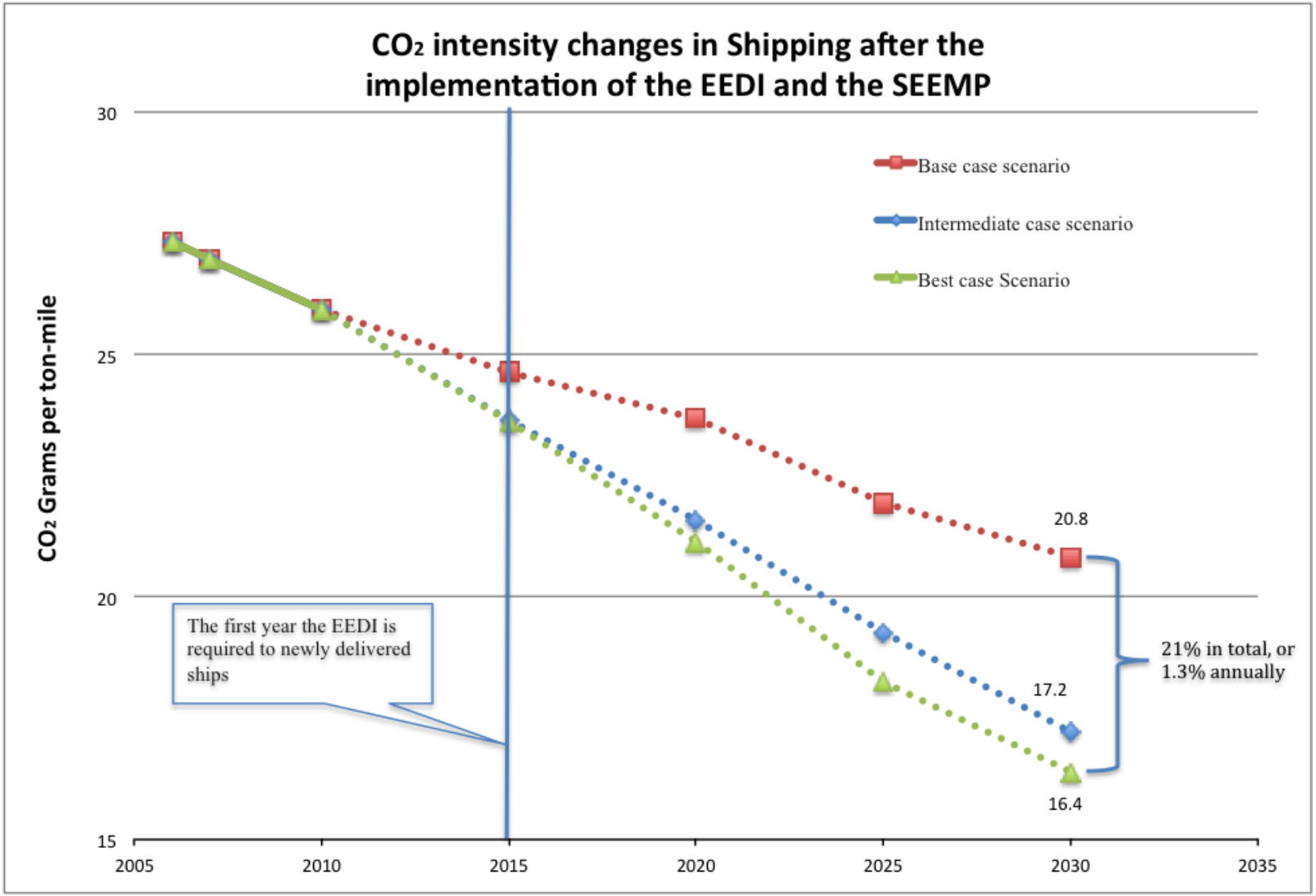
NYK – Super-Eco Ship 2030

Marginal Abatement Cost Analysis of Shipping Decarbonisation Measures



Source: DNV

IMO Initiatives: *Energy Efficiency Design Index (for new vessels)*
Ship Energy Efficiency Management Plan (all vessels)



Source: International Council for Clean Transportation

http://www.theicct.org/blogs/staff/cutting-carbon-ships

Role of the Shipper in Decarbonising the Maritime Supply Chain

Sole Reference to the Shipper in 285 page Second IMO GHG Study (2009)

Depending on the type of shipping, the list of involved parties may include:

.1 owner (including bareboat charterer/operator);

.2 charterer;

.3 multi-modal transport operators (MTOs);

.4 shipper and receiver of the goods;

.5 cargo buyer/seller (the original source of the transport demand);

.6 transport agents/brokers;

.7 port authorities; and

.8 terminal operators.

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Supplier → Collection system → Consolidation of supplies → Deep-sea shipping → De-consolidation in import market → Delivery → USA & Europe

'maritime supply chain' = door-to-door freight delivery containing at least one sea movement

Focus on movement of deep-sea containers

% of CO_2 Emissions from Container Movement from China to Scotland

40' container 15 tonne payload Wuhan to Glasgow

Based on average carbon intensity values for modes and specific per container figures for ports

Road feeder in UK	% of CO_2	Intermodal feeder in UK	% of CO_2
Road to Shanghai port	28.2%	Road to Shanghai port	31.2%
Port - Shanghai	0.2%	Port - Shanghai	0.3%
Deep-sea leg	58.5%	Deep-sea leg	64.7%
Port - Felixstowe	0.3%	Port - Felixstowe	0.3%
Road to Glasgow	12.8%	Rail to Coatbridge	3.1%
		Road to Glasgow	0.4%

Carbon intensity values:	road in China	120g / tonne-km
	road in UK	75g / tonne-km
	deep-sea container vessel	12g / tonne-km
	rail in UK	31g / tonne-km
	ports	16-18kg / container

Methodology

Focus Group Discussion with 27 senior managers from five stakeholder groups

Online questionnaire survey

Emails distributed by Global Shipper's Forum to 125 member companies with UK operations

35 completed questionnaires
27% response rate

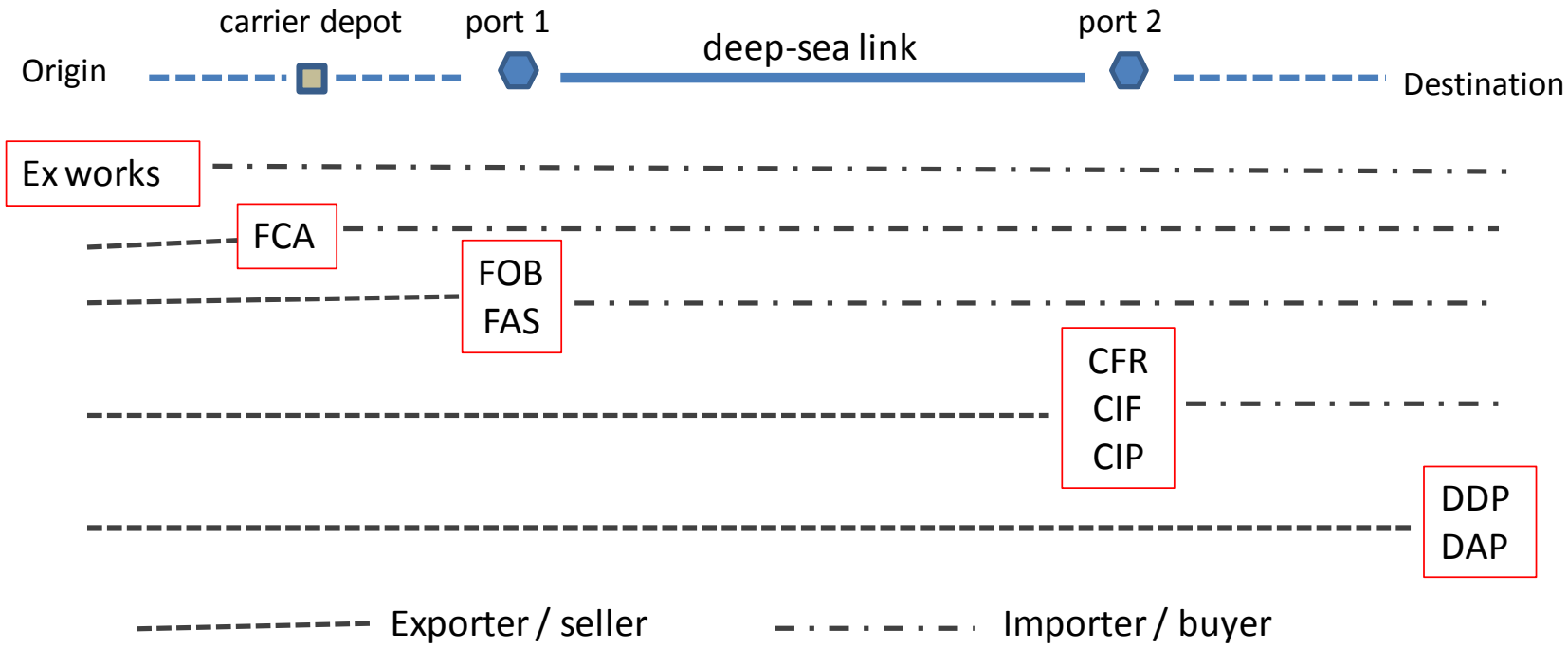
Approx 400,000 imported containers and 80,000 exported containers annually

13% of loaded containers passing through UK ports (2010)

Interview survey of 20 shippers, port operators and logistics service providers

Key Factors Affecting Degree of Shipper Influence

INCOTERMS



Nature and Extent of Reliance on Freight Forwarders

% of UK Shippers Identifying Particular INCOTERMS as their Main Terms of Trade

Incoterms	Importers	Exporters
FOB - foreign port	72%	24%
FCA - named place	28%	18%
Ex Works	16%	24%
DDP	16%	12%
FAS	8%	
CFR	8%	18%
DAP	8%	24%
CIF		18%
CIP		12%

Prevalence of Different Methods of Purchasing Deep-Sea Container Transport Services

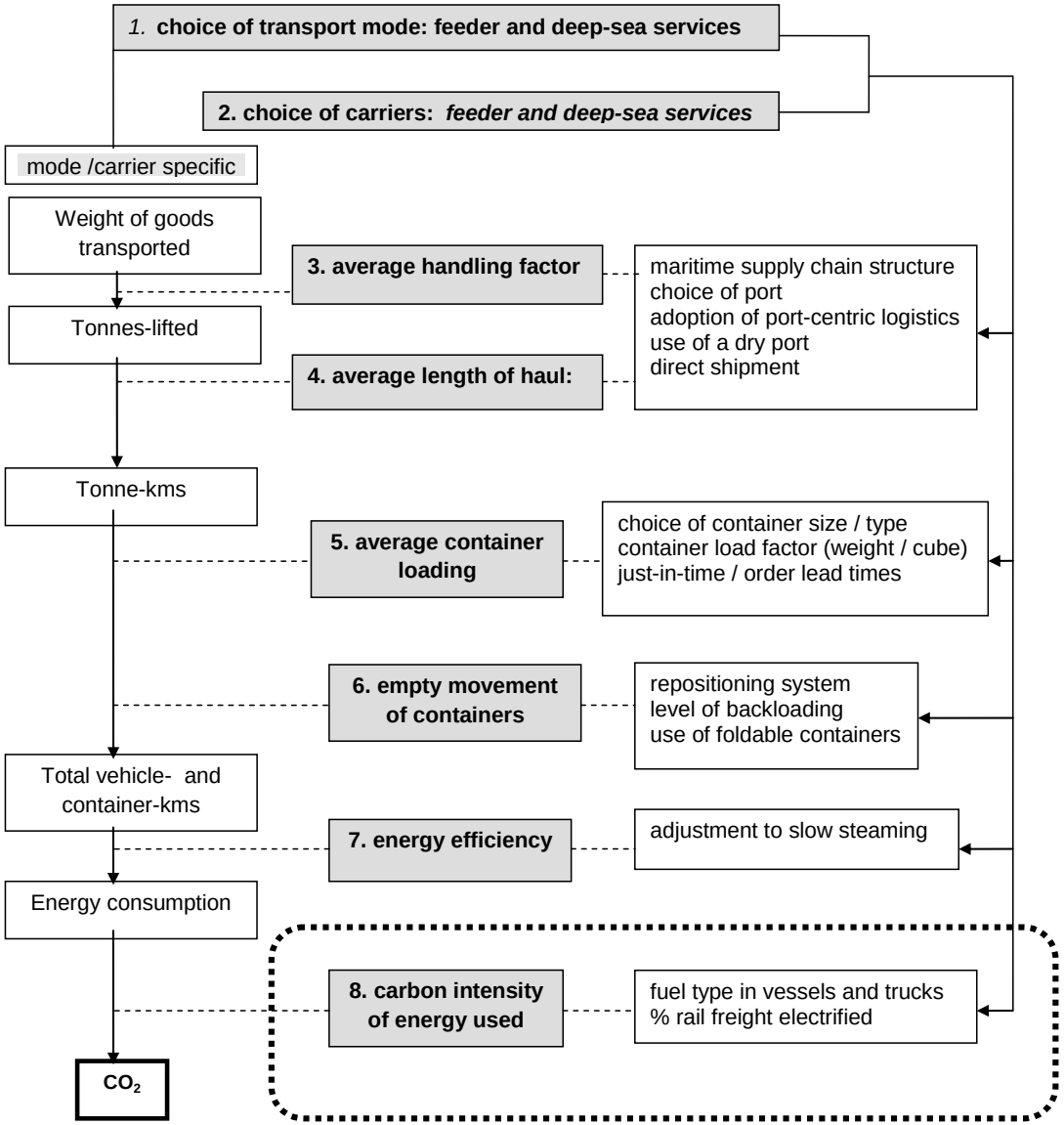
	Importers		Exporters	
	normally / always	never	normally / always	never
Use a freight forwarding service for the entire movement	48%	13%	58%	16%
Use a freight forwarder for the deep-sea shipping operation only	15%	30%	18%	65%
Direct purchase of deep-sea container services from shipping line	76%	19%	41%	41%
Direct purchase of hinterland transport from road haulier	48%	24%	12%	59%
Direct purchase of hinterland transport from railfreight operator	10%	65%	6%	88%
Direct purchase of hinterland transport from short-sea operator	16%	53%	6%	76%

Not mutually exclusive

Source: McKinnon, 2012

Conceptual Framework

Adapted from earlier Green Logistics project

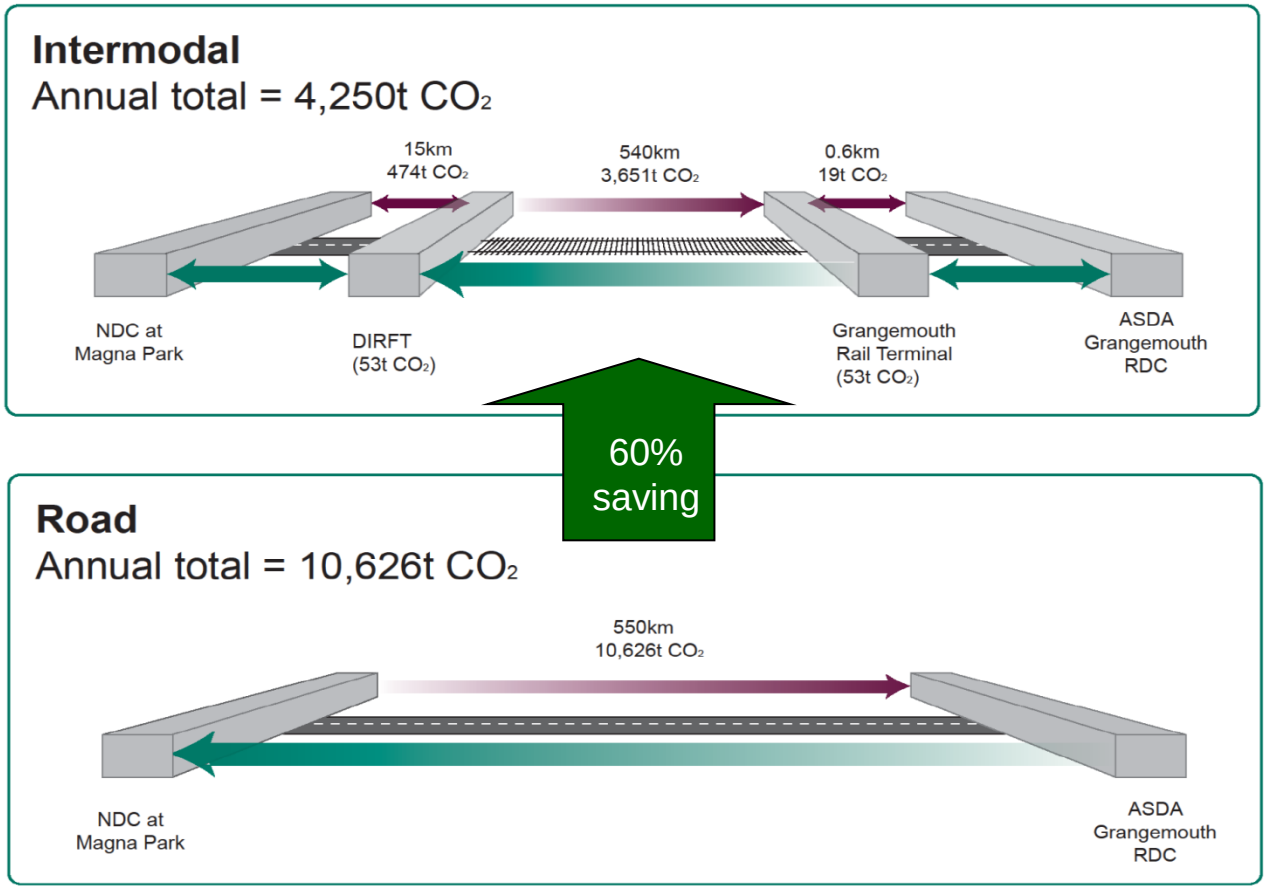


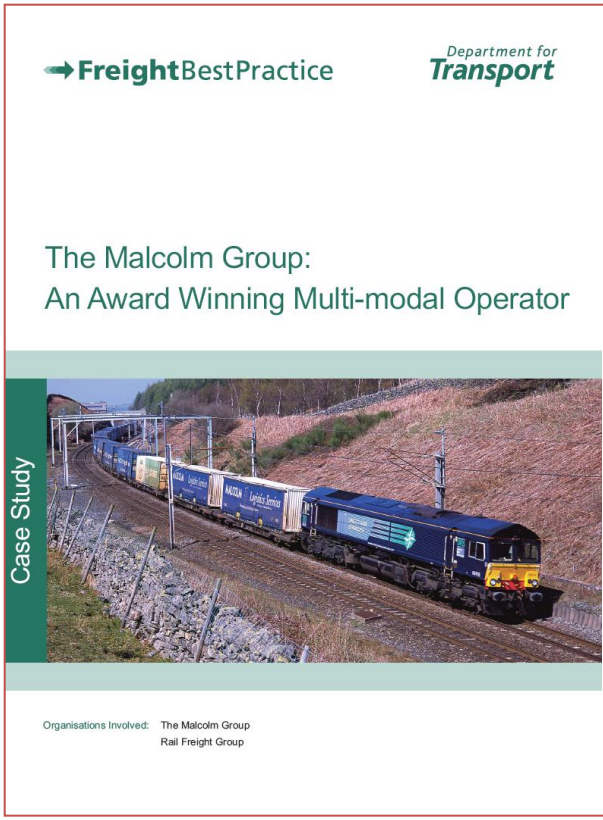
Decarbonisation Options for Shippers

- **Switch to lower carbon transport modes for hinterland feeder service**

Carbon Savings from Switching from Road to Intermodal Road-Rail Service

UK study: CO_2 emissions per 40 ft container –km by rail = 1/3 of emissions by road



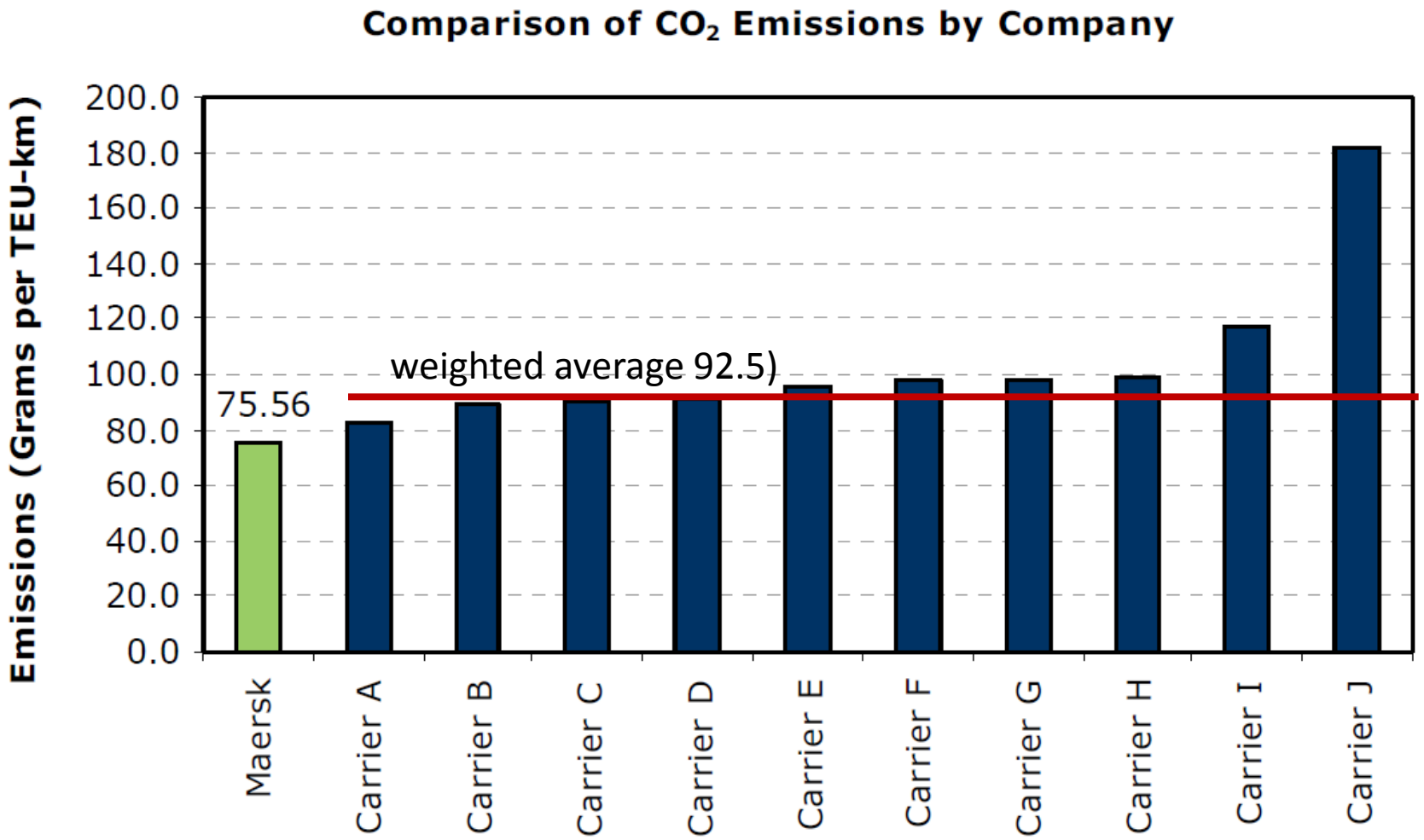


www.freightbestpractice.org.uk

Decarbonisation Options for Shippers

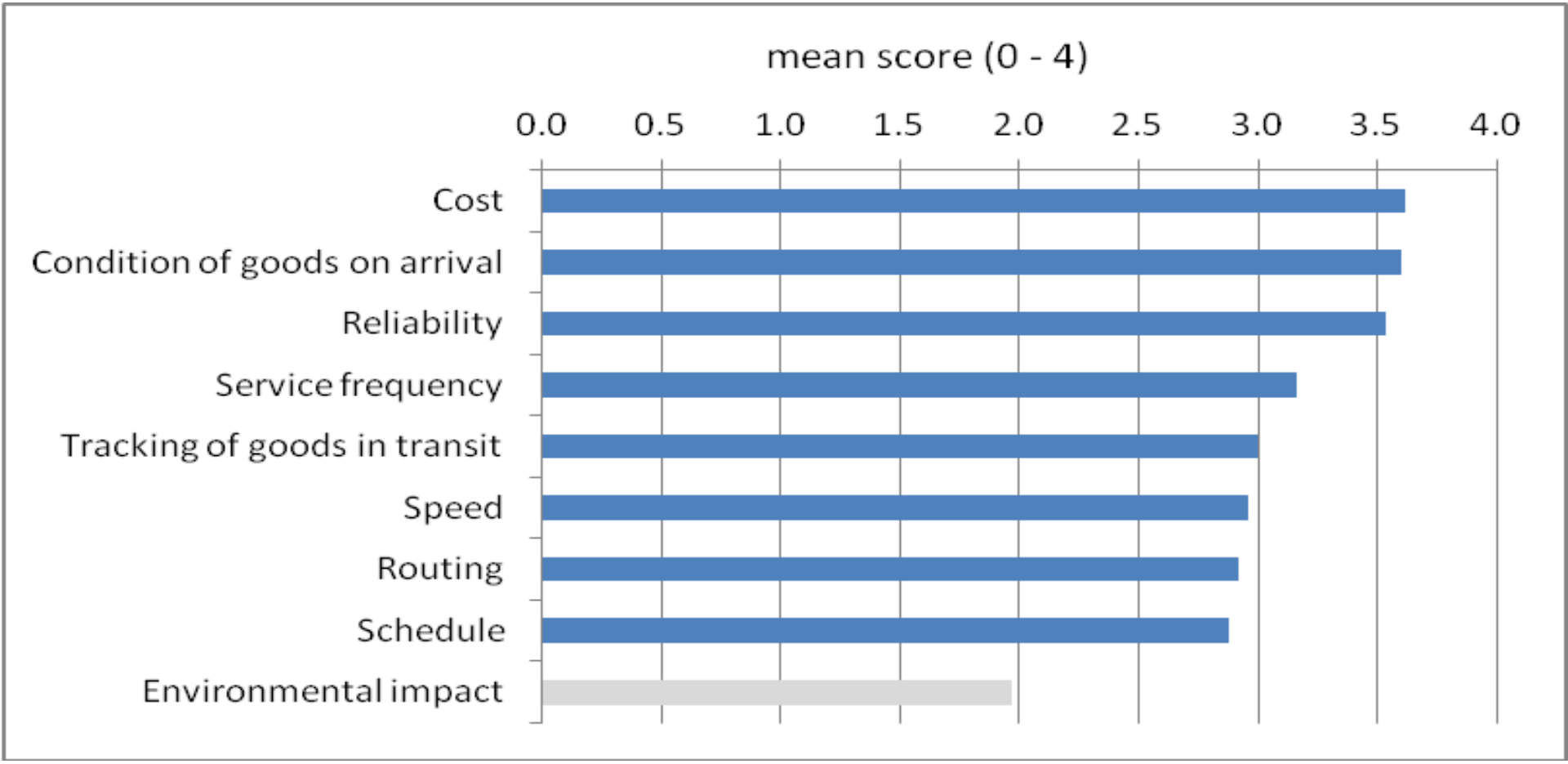
- Switch to lower carbon transport modes for hinterland feeder service
- **Switch to carriers with lower carbon-intensity values on feeder and deep-sea services**

Variations in Carbon Intensity of Deep-sea Container Lines
(gCO2 per TEU-Km)



Source: Clean Cargo Working Group / BSR

Relative Importance of Factors Affecting Shippers' Choice of Deep-Sea Container Service



Decarbonisation Options for Shippers

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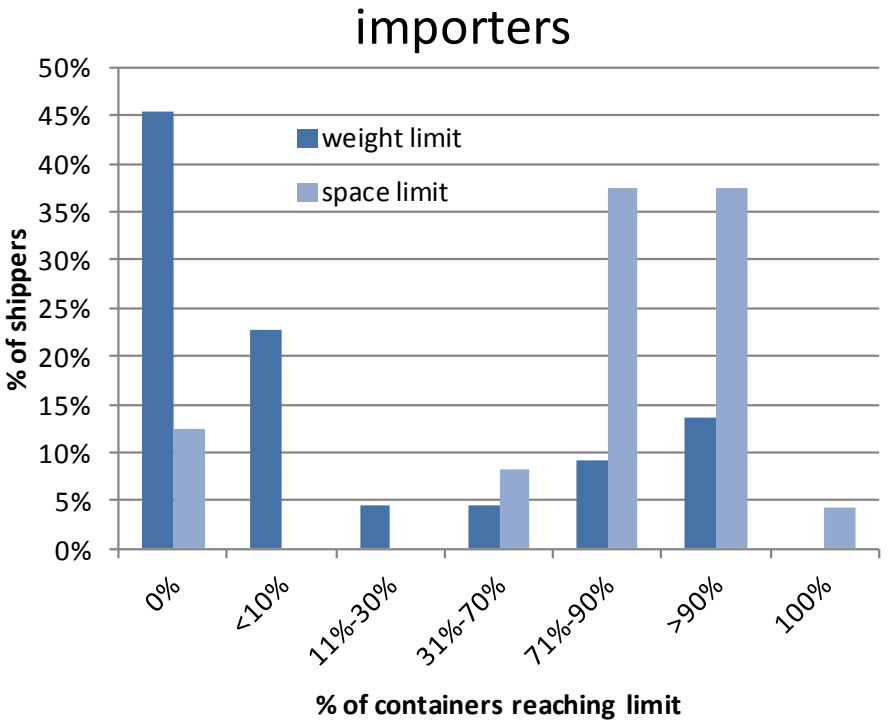
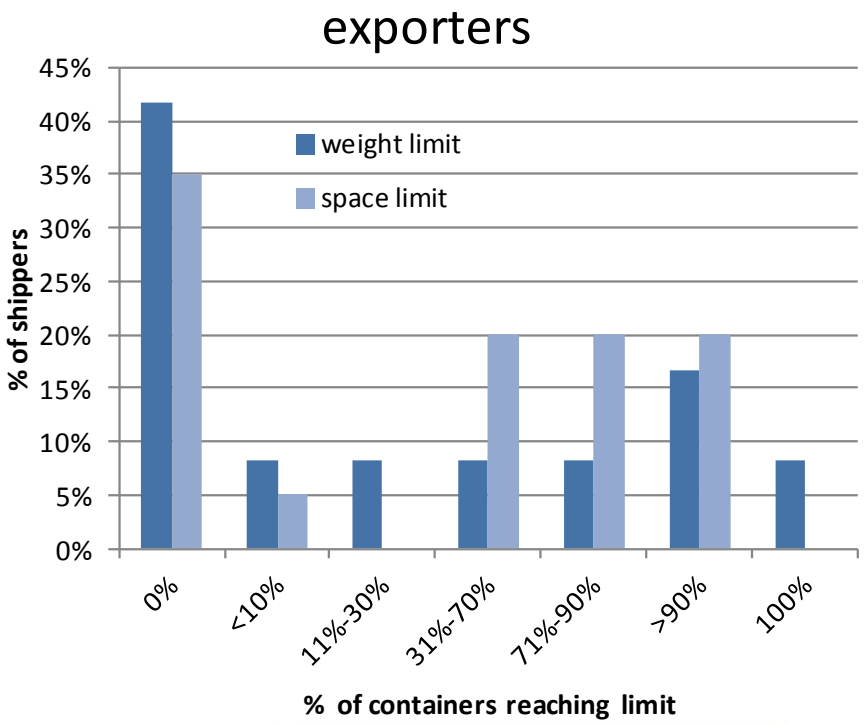
- Switch to carriers with lower carbon-intensity values on feeder and deep-sea services
- **Improve container loading both on export and import consignments**

Utilisation of Imported and Exported Containers by Weight and Volume

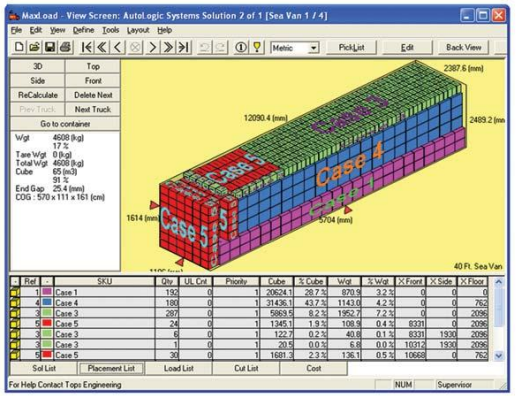




Handballing by low cost labour in Far East

Very strong economic incentive to maximise loading

Software tools e.g. Max Load



UK retailer ASDA container cube fill initiative –
reduced annual number of container from Far East by 1200

Decarbonisation Options for Shippers

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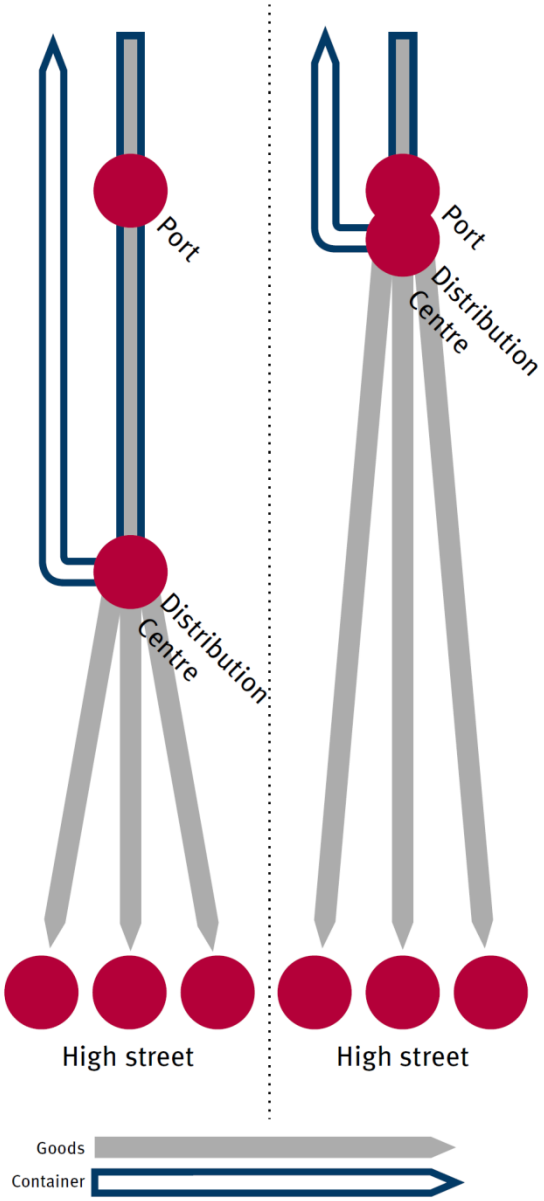
- Improve container loading both on export and import consignments
- **Reroute containers to minimise CO_2 emissions from feeder services, deep-sea leg and port operations**
  - reconfigure the maritime supply chain
  - choose nearer port
  - choose ports with better rail and short-sea feeder links
  - adopt Port Centric Logistics model – claimed to yield CO_2 benefits

Port Centric Logistics



‘The provision of distribution and other-value adding logistics services at a port’ (John Mangan)

Transformation of a port from being a freight terminal to a logistics hub

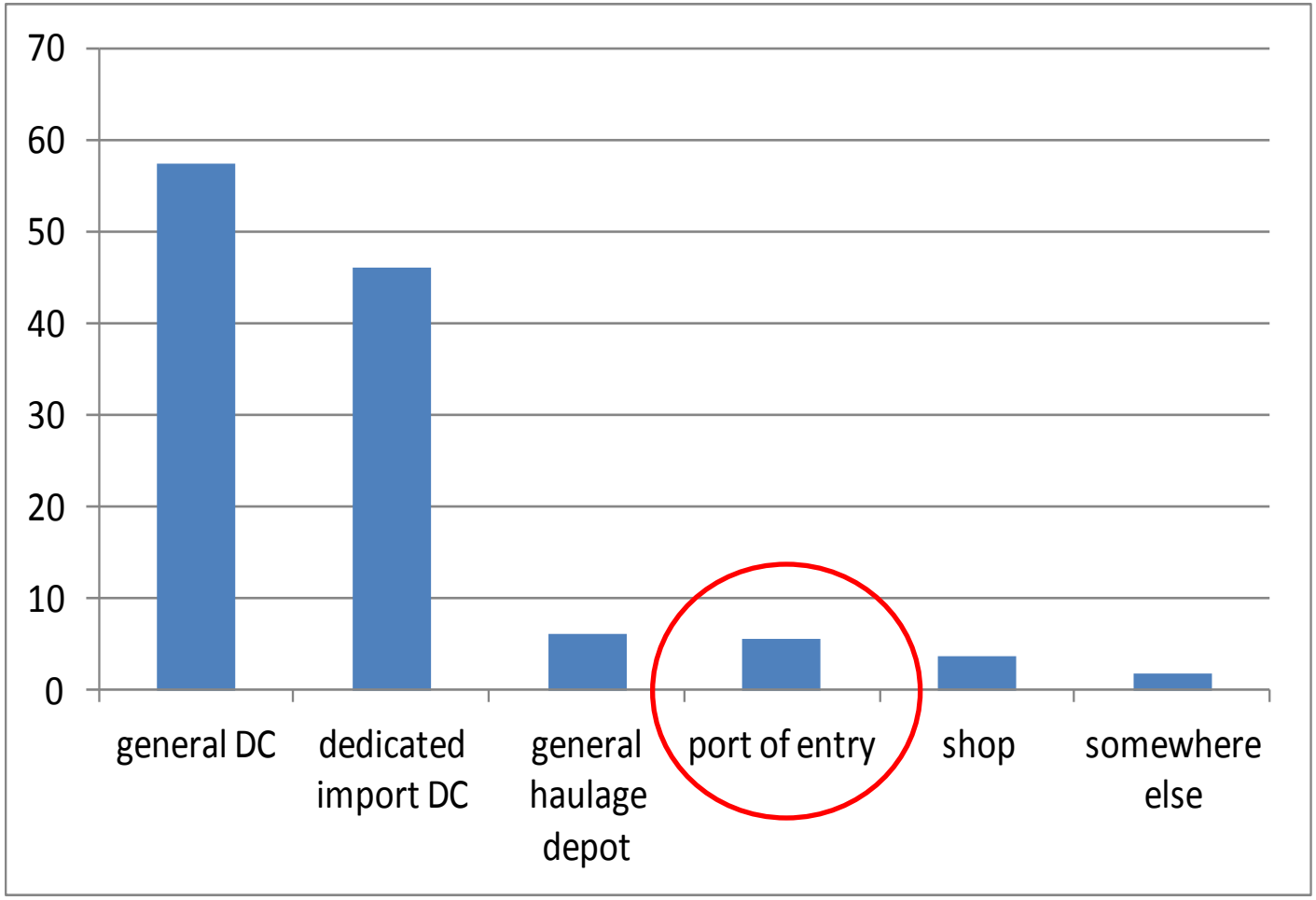
Restructuring of inbound logistics systems

Predominantly for inbound flows of containerised goods

In the UK reflects large containerised trade imbalance: 2 :1 through major deep-sea ports

Source: Lloyds List

% of inbound containers emptied at differing locations in the UK



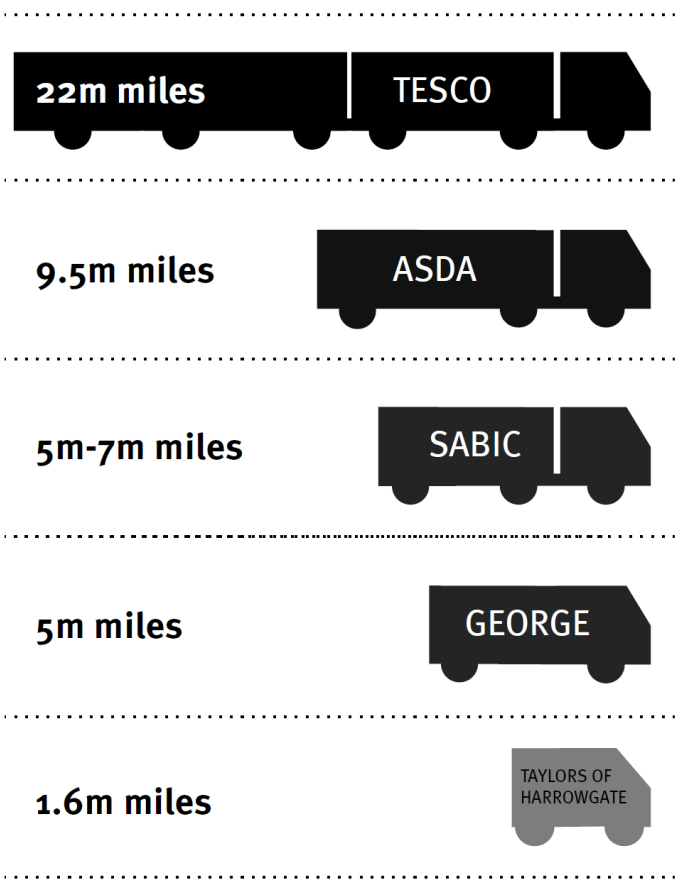
Based on sample of 20 large shippers

London Gateway port

'the game changer ?

Estimated distance and CO_2 savings from PCL

Source: Van Marle, 2011



	CO_2 reductions
22m miles TESCO	31,000 tonnes
9.5m miles ASDA	13,000 tonnes
5m-7m miles SABIC	7 -10, 000 tonnes
5m miles GEORGE	7,000 tonnes
1.6m miles TAYLORS OF HARROWGATE	2,000 tonnes

London Gateway to remove 65 million truck-kms from UK roads annually

92,000 tonnes of CO_2 saved annually

Analysis of the potential CO2 savings from Port Centric Logistics

Comparison of PCL with Distribution via Centralised DC locations

THE KLU

Deep-sea ports:

Felixstowe
Southampton
Tilbury / London Gateway

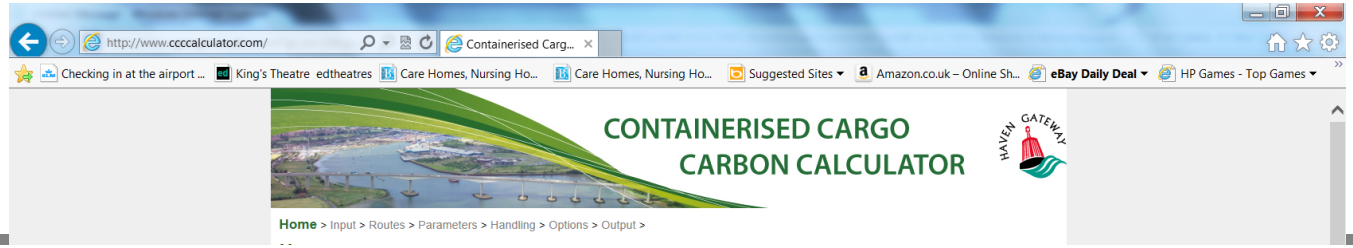
Inland Distribution Centres:

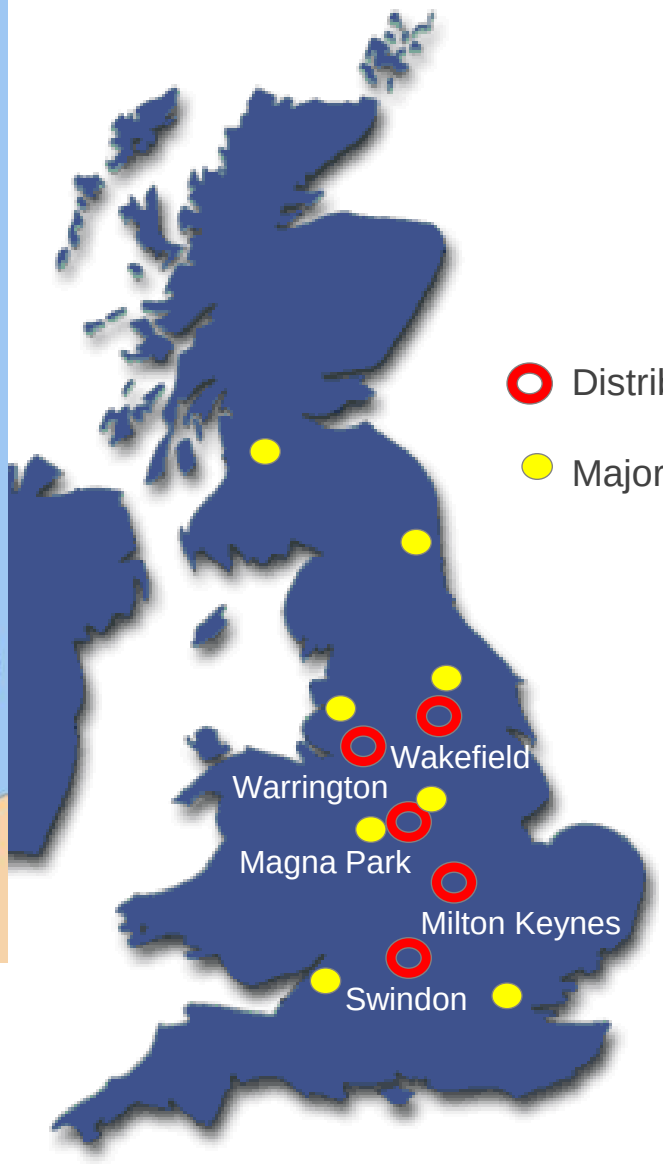
Milton Keynes
Magna Park
Swindon
Wakefield
Warrington

Shops

London
Birmingham
Bristol
Nottingham
Leeds
Manchester
Newcastle
Glasgow

Parameters: 40 foot / 9' high container 13.6 m trailer on articulated truck containers carry, on average, 11 tonne payload





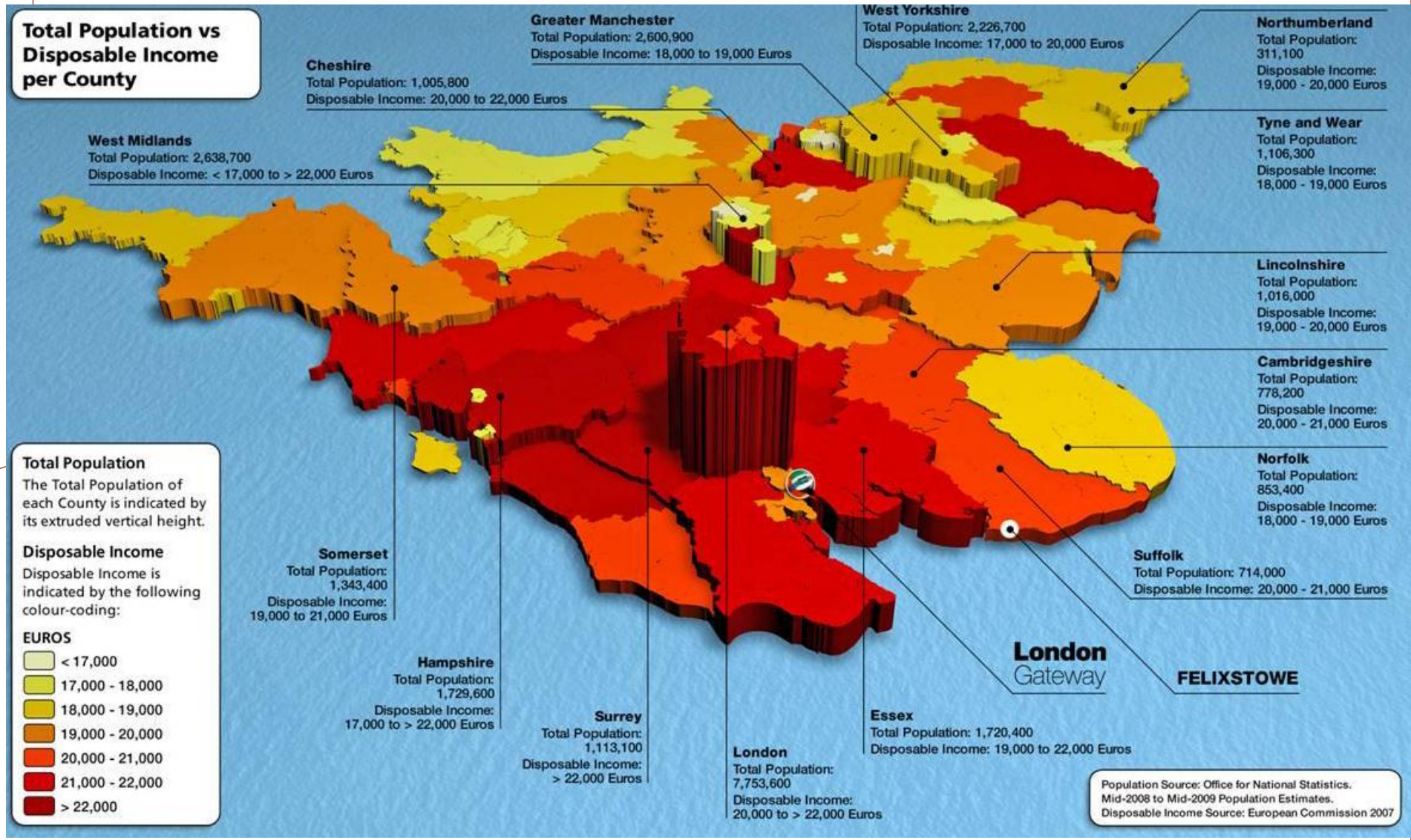
Distribution centre cluster

Major retail centre

London Gateway 11km from Tilbury

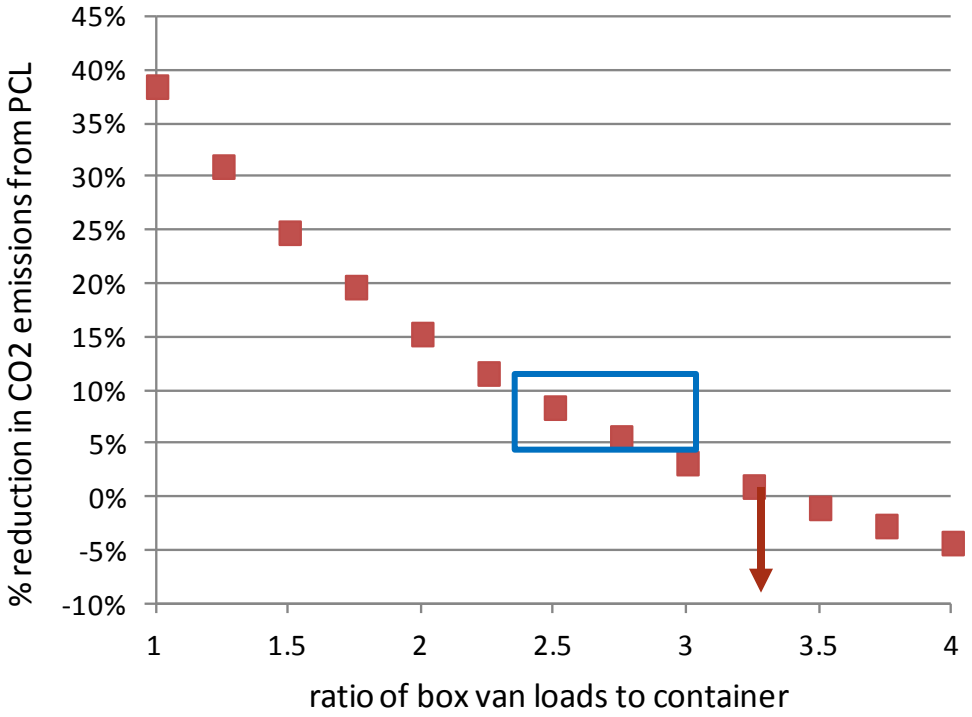
Retail centres weighted with disposable income in regional economic planning region

Distribution of disposable income in the UK



Relationship between Transloading Ratio and % Change in CO_2 Emissions

Transloading Ratio



Decarbonisation Options for Shippers

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- Switch to carriers with lower carbon-intensity values on feeder and deep-sea services
- Improve container loading both on export and import consignments
- Reroute of containers to minimise CO_2 emissions from feeder services, deep-sea leg and port operations
- **Reconfigure supply chains to exploit container backloading opportunities**

Backloading of Inbound Containers I

1. Backloading of inbound containers with export loads from the same location

Rare occurrence due to numerous constraints: **main reasons**

- Use of different shipping lines - no pooling of containers within the port hinterland
- Inbound container of the wrong size and type for export consignment
- Difficult to synchronise inbound and outbound schedules
- Incoterms can be misaligned: e.g imports purchased on DPP basis
- Internal ‘silo’ structure – lack of co-ordination between procurement and inbound logistics department
- Shipping line concern about cross-contamination e.g. in the food supply chain

Backloading of Inbound Containers II

2. Backloading of inbound containers with domestic supplies bound for premises on route back to the port:

e.g. deliveries to shops or transfers between distribution centres

Constraints

1. Organising the store delivery within the demurrage-free period can be difficult given shop replenishment cycles

2. Inability of ISO containers to accommodate as many of the handling units used in retail logistics, particularly roll cages, as the box trailer of a conventional articulated truck.

3. Reception facilities at the rear of shops are unsuited to the handling of containerised loads.

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- **Adjust logistical schedules to accommodate ‘slow steaming’**

Logistical Adaptation to Slow Steaming

11% reduction in CO_2 emissions from container shipping 2008-2010 (Cariou, 2011)

Imposed on shippers by shipping lines and financially motivated.

Companies able to adjust their logistics operations to slow steaming with little disruption or extra cost.

Relatively small % of deep-sea containerised orders are time-critical

Against 3-6 month order lead time, extra 3-4 days transit time is very marginal

Additional intransit-inventory cost small relative to additional bunker fuel charges that would be imposed

Some evidence of service reliability improving

Logistical responses

Increasing visibility of deep-sea container movements

Prioritising hinterland movement and inbound reception of more time-sensitive orders

Some adjustment of production schedules and re-engineering of processes

Switch from transhipment service (via Rotterdam) to direct service to UK deep-sea port

No evidence of 2nd order effects offsetting the carbon savings
e.g. switch from rail to road on port feeders to accelerate hinterland movement

Conclusions

After allowance made for Incoterms and use of freight forwarders, large shippers still make many 'carbon-sensitive' decisions in planning and managing their deep-sea supply chains

Numerous examples of shipper-led initiatives reducing carbon emissions

Carbon-reducing measures all motivated primarily by financial considerations: *CO_2 savings a bonus*

No instances found of companies trading-off higher costs / lower profits for CO_2 savings in their use of deep-sea container services

Port-centric offers the potential to cut CO_2 emissions from inbound container movements

Limited opportunities for improving container fill – *especially on inbound flows*

Shippers have adapted global logistics operations to slow steaming at minimal cost and disruption - *potentially greatest contribution to maritime decarbonisation in recent years.*

Professor Alan McKinnon

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