Transitioning to Low Carbon Shipping Module

Sustainable Sea Transport Solutions for SIDS: Pacific Island Countries Case Studies

1. The International Shipping Context

http://unctadsftportal.org/sftftoolkit/transitioningtolowcarbonshippingmodule/chapter1/

Summary

This chapter provides an overview of international shipping, its recent and future growth, how it is regulated, as well as its relationship with trade, energy consumption, emissions, and climate change.

Key Themes: History – Growth – Regulation – Energy Sources – Climate Change

UNCTAD views maritime transport as the backbone of globalisation. The efficiency of shipping as a mode of transport and increasing economic liberalization means the industry is likely to continue to grow. The increasing billions of people moving out of poverty and entering the global economic market will drive this growth. The question of how the expected environmental impact from increased shipping should be mitigated remains hotly debated. Due to the international environment of the industry, regulating and enforcing standards of shipping is complex and logistically difficult. Increasing measures to regulate and control emissions from shipping to mitigate global warming will add to this regulatory burden and compliance costs. However, there is no masking that overall emissions of ships are predicted to increase beyond quantities that would allow climate targets to be achieved.

1. The International Shipping Context

Around 80% of world trade by volume (about 55% of global trade by value) (UNCTAD Review of Maritime Transport 2015) is moved by sea. Without shipping the import and export of goods on the scale necessary to maintain the modern world would not be possible. Maritime transport is often described as the servant or conduit of world trade. UNCTAD has described it as the backbone of globalization and the driver of the global trade-led economic expansion.

The international shipping fleet is incredibly diverse in terms of vessel types, the purposes for which they are used, and the conditions under which they operate. Vessels range from container ships that carry up to 20,000 TEUs and Ultra Large Crude Carriers (ULCC) to much smaller ships of 500 tonnes or less carrying break bulk cargoes between small countries. Different types of dry bulkers carry the world's raw resources of coal, metal ores, timber and grains, specialist tankers carry liquids, chemical and gases. There are giant ships for carrying cars to market, drilling ships and oil extraction support vessels, ocean-going tugs and barges, Ro-Ro passenger ships and ferries of every size and the fast growing cruise liner industry.

As the industry operates in an international environment, with the flag registration of a ship being easily changed and often bearing no relationship to the country of ownership or service, regulating and enforcing standards of shipping is complex and logistically difficult. The ownership and management chain surrounding any ship can embrace many countries, and ships spend their economic life moving between different jurisdictions, often far from the country of registry. The growth in registration of ships to independent registries, more than 68% of world tonnage is now so flagged, is one of the hallmarks of the modern shipping era. Many Least Developed Countries (LDCs) and Small Island Developing States (SIDS) are host to such registries. In 2014 the three largest independent registries were, in order of size: Panama, Liberia, and the Marshall Islands.

1.1 Shipping – A Short History

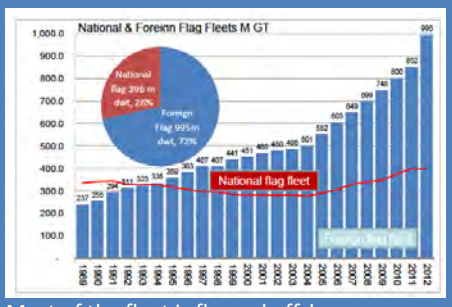
Shipping is as old as our relationship with the ocean and as old as trade. Until the last four centuries it was largely a local affair, conducted for the main in sight of land. It grew regionally and, mirroring the industrial and technological revolutions, is now truly global. The revolutions in shipping scale and technology advancement have mirrored advances in propulsive energy. Shipping has traditionally moved both goods and people. It is only recently that air transport has edged out marine as the main mover of people crossing seaways.

The arrival of the stream ship in the 1800s brought shipping into

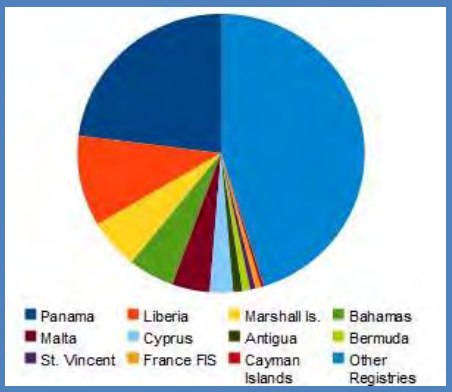
The following images are selected from "Appendix D: Chapter 1."

Please refer to this appendix for full size images and sources.

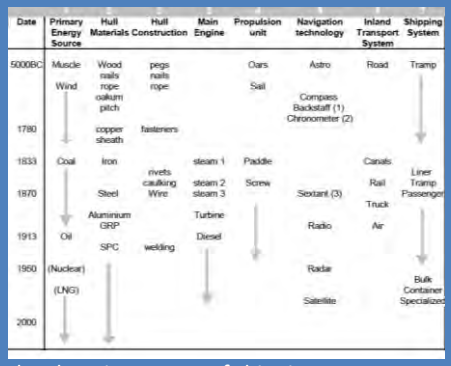
Global fleet.



Most of the fleet is flagged offshore.



Independent flag registries.



The changing nature of shipping.

the fossil fuel era. For the first time ships could move large loads without reliance on the wind. The opening of the Panama and Suez canals shortened and changed world trade routes forever. The world quickly became smaller. Today the shrinking Arctic ice cap is again redesigning shipping routes.

Shipping and trade have grown hand in hand. The world's first oil tankers appeared in the late 19th century carrying kerosene for lighting, but the invention of the motorcar fuelled demand for oil. During the Second World War, the standard oil tanker was 16,400 tonnes deadweight (dwt). Tankers grew rapidly in size from the 1950s and by the mid-1960s, tankers of 200,000 dwt - the Very Large Crude Carrier (VLCC) - had been ordered. Today ULCCs carry more than 500,000 dwt.

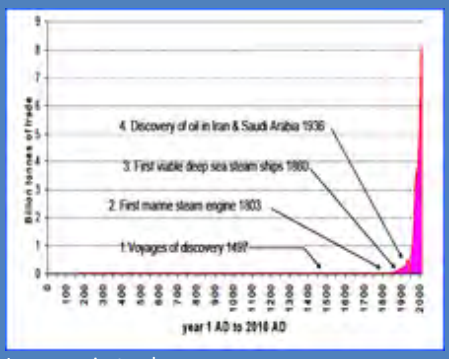
In the 1950s international shipping was dominated by a handful of traditional maritime countries: Europe, U.S. and Japan. The same companies built the ships, operated them, crewed them, and provided the goods that were carried on them. Shipping today has moved away from this small handful of developed world nations to an era where Southeast Asia is fast challenging this traditional hegemony. No longer do single companies handle all types and all aspects of the supply chain. We have entered the era of specialist ships and specialist shipping agencies.

Containerisation of cargo was a major game changer for the industry, arriving in 1955. From the first voyage, this method of transporting goods grew steadily and in just five decades, containerships would carry about 60% of the value of goods shipped via sea.

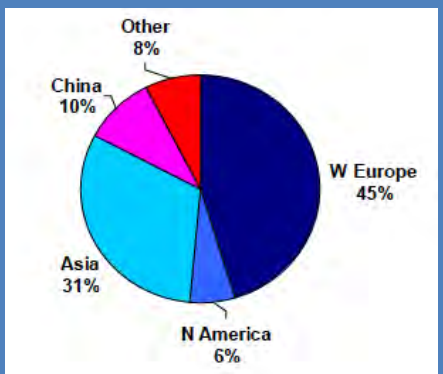
Prior to this the process of handling cargo was never easy. Loading and unloading of individual goods in barrels, sacks and wooden crates from land transport to ship and back again on arrival was slow, cumbersome and very labour intensive. However, break-bulk shipping was the only known way to transport goods up until the second half of the 20th century. A ship could easily spend more time in port than at sea while dockworkers manhandled cargo into and out of tight spaces.

In 1955 Malcolm McLean bought a U.S. steamship company with the idea of transporting entire truck trailers with their cargo still inside. His ideas were based on the theory that efficiency could be vastly improved through a system of "inter-modalism", in which the same container, with the same cargo, could be transported with minimum interruption via different transport modes during its journey. Implementing this idea led to a revolution in cargo transportation and international trade over the next 50 years. It has also lead to the emergence of hub-and-spoke transport networks and the development of the meta-port.

Between 1982 and 2005 containerized cargo trade grew three and a half times faster than world GDP. Today container shipping

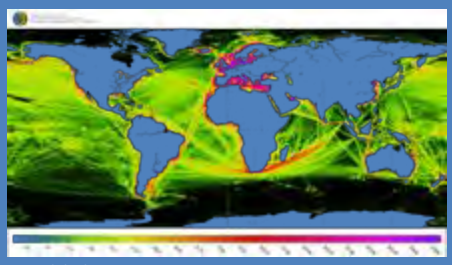


Increase in trade.



Rank	Nation	National	Foreign	Total
1	Japan	20	197	218
2	Greece	65	159	224
3	Germany	17	108	126
4	China	52	72	124
5	USA	7	47	55
6	S Korea	17	39	56
7	Taiwan	4	35	39
8	Bermuda	2	28	30
9	Norway	16	27	43
10	Denmark	13	27	40
11	Other			373
12	World	374	953	1,327

World fleet ownership in 2013.


World shipping in 2012.

is highly specialized. The invention of the reefer - or refrigerated container - allowed for a huge cargo boom in frozen and chilled produce of all descriptions. It has added greatly to the concept of "food-miles" as specialty goods can now be shipped to any corner of the world.

1.2 Recent Growth in Shipping

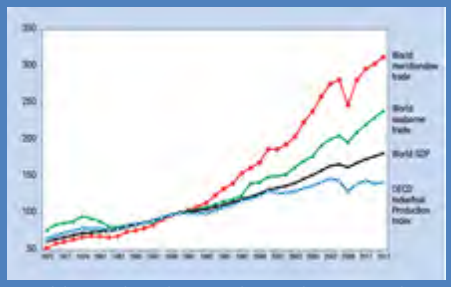
Since 1990 seaborne trade has more than doubled and all world trade nearly tripled. Today international shipping comprises nearly 90,000 ships collectively transporting more than 9 billion tonnes of every kind of cargo around the globe.

The financial value of the shipping asset is gargantuan. A single container vessel can cost USD 10 to 100+ million. To this must be added the operational costs (fuel, maintenance, crewing, etc.), infrastructure (ports, railheads, bunkering, shipyards, slipways, breaking centres, etc.), regulatory costs and all the related secondary and tertiary industry (from container manufacture to insurance). Buhaug et al (2009) used various industry-sourced data to calculate an *"annual turnover for marine activities of US$1.3 trillion in 2004 with an 8% increase compared to 1999 … about one-third is related to merchant shipping,"* but noted also that other studies *"value the world marine market at US$2.7 trillion, with the shipbuilding industry the largest global market value"*.

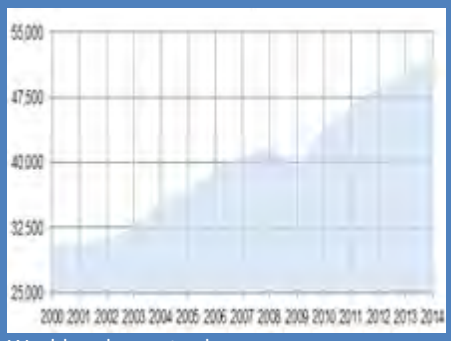
Seaborne trade continues to expand, bringing benefits to consumers across the world. Due to the efficiency of shipping as a mode of transport and increasing economic liberalization, the prospects for the industry's further growth continue to be strong. Despite the global financial crisis that began in 2006, shipping has continued to expand, albeit at a slower rate than a decade ago when shipping was going through its largest boom ever. Today shipping is undergoing a revolution, unprecedented in global history, driven by a search for operational and fuel efficiency, and ever increasing corporatization into mega-fleets.

For example, Triple E class container ships with a capacity of more than 18,000 TEU were the largest in the world when Maersk ordered a fleet of 20 from Korean shipbuilder Daewoo in 2011. They are heralded as one of the most energy efficient per container moved in the world. Today these have already been superseded in size by China Shipping Container Lines *CSCL Globe* and its four sister ships built by Hyundai Heavy Industries, as well as the MSC Oscar and its sister ships MSC Oliver and MSC Zoe built by Daewoo (listed as the largest containership in the world as of August 2015). As ships get bigger and companies aim at achieving economies of scale, there remain fewer companies in individual markets.

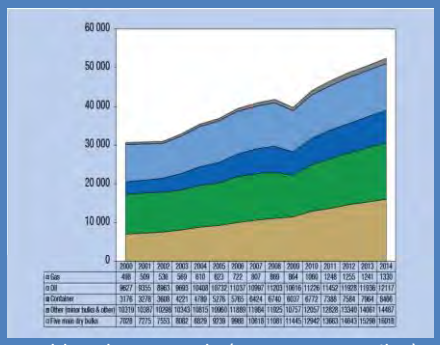
Generally, and especially in the case of the developed world, merchant navies are the strict preserve of private enterprise with governments performing regulatory functions. Shipping has a



World merchandise trade, seaborne trade, GDP and OECD industrial production.



World seaborne trade.



World seaborne trade (cargo tonne-miles) by cargo type.

Maersk Triple E Container Ship.

monopoly on bulk cargo. With the exception of airfreight which is exponentially more expensive, if you want to move any sort of bulk of goods or materials around the world you must use ships. Within the industry competition is extremely fierce and has become increasingly so due to the low and volatile maritime freight rates resulting from a poor world economic development, weak or hesitant demand and persistent supply overcapacity in global shipping market. The past decade has seen major changes and the rise of the "super-consortiums" of shippers and freight companies.

As of January 2015, the world's commercial fleet consisted of 89,464 vessels, with a total tonnage of 1.75 billion dwt, a growth of 3.5% from 2014, the lowest annual growth rate in over a decade. The slowdown reflects the turn in the largest ship building cycle in history that peaked in 2012. Global seaborne shipments have increased by 3.4% in 2014, that is at the same rate as in 2013. Additions to volumes exceeded 300 million tons taking the total to 9.84 billion tons or around four fifths of total world merchandise trade. Dry cargo was estimated to have accounted for over two thirds of the total (with container traffic making up 15%), while the share of tanker trade, including crude oil, petroleum products and gas was estimated at 28.7% in 2014 (UNCTAD 2015).

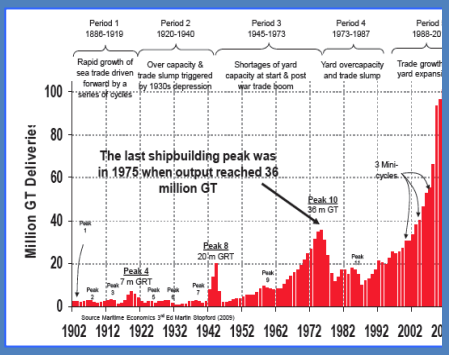
The container throughput growth rate for all countries in 2014 is estimated at 684.4 million TEUs, a rise of 5.1% over the previous year. Developing economies' share of world throughput increased by 0.2% to approximately 71.9%. Asian ports continue to dominate the league table for port throughput and terminal efficiency (UNCTAD, 2015).

1.3 Future Growth in Shipping

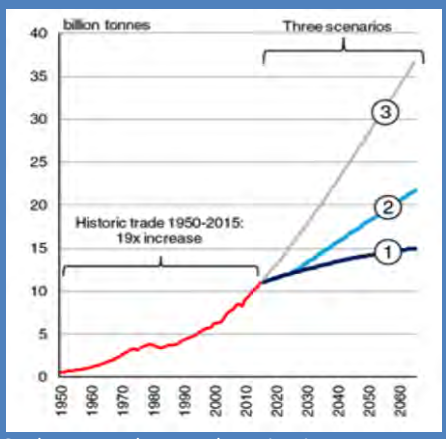
Growth in the maritime industry will mirror changing patterns in global trade. While international shipping is currently in a trough, the long-term demand for shipping is predicted to grow further, owing to the changing configuration of global production, the increasing importance of global supply chains and the expected growth in many economies. For the foreseeable future, seagoing ships will continue to carry the bulk of that trade.

Predicting long-term trade growth trends is a difficult art and dependent on many parameters. Recent research by Lloyds Register and Strathclyde University, *Global Maritime Trends 2030*, has modelled the meta-trend potential for maritime trade over the next decade and a half. They predict that as we enter the second quarter of the 21st century, the business environment will become more complex, global, and multi-polar. This development will be driven by many factors, some of them easily discernible and others subtler.

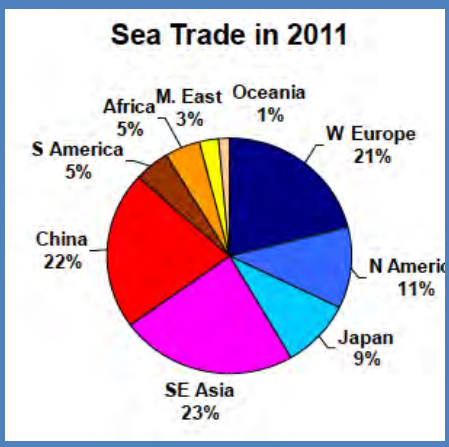
One of the principal driving forces is the aspirations of people in developing nations. These are behind massive dislocations and



The end of the greatest shipping boom in history.



Seaborne trade growth projections.



Sea trade by region.

upheavals in the BRICS countries (Brazil, Russia, India, China, South Africa), in the Middle East and elsewhere around the globe. Lloyds chart a new, multi-polar, world economic configuration emerging (in terms of resource demand and allocation, trade and consumption patterns, and a shift in the centre of economic activities from west to east). While this poses many challenges it also opens many new opportunities for marine industries. These will have profound impacts on commercial shipping requirements and natural resource exploitation, an emerging shift of geopolitical configurations where future competition and conflict between nations are more likely to involve future competition at sea.

The economic world is shifting on its axis and that shift is projected to increase. The voluntary opening up of China in 1978 and India in 1990 and their accession to the World Trade Organization (WTO) in 2001 and 1995 respectively have had enormous implications for the world. They together consist of nearly 40% of world population. Their impacts have been magnified by other countries like Brazil which has also rushed into development.

The increasing billions of people moving out of poverty and entering the global economic market, with their dreams of achieving earnings and lifestyles similar to the developed world, have gigantic impacts on world trade and the environment. These in turn change social attitudes, drive supply and demand for resources, technologies, goods and services. The effects have been particularly felt in the maritime sector: demands for additional new tonnage for container ships for transporting manufactured goods, bulkers and tankers for commodity trade; the demand for drilling for oil and gases into ever greater depths offshore, for example. Lloyds identify the major drivers of such change as economic and population growth, the ever increasing trend of urbanisation particularly in developing nations, resource demand, accelerated technological advances, and fast changing attitudes to environmental costs of development, in particular climate change.

1.4 Regulation of International Shipping

All sea transport, except for the very small and very local, is governed by international laws, conventions and regulations to which most SIDS are signatories. The international regulatory framework is complex and becoming more so. It is also becoming increasingly expensive to administer, both for national regulators at the country level and for the shipping operators themselves. Increasing measures to regulate and control emissions from shipping to mitigate global warming will add to this regulatory burden and compliance costs.

1.4.1 The IMO and the ILO

Two specialised UN agencies govern most aspects of shipping regulations: the International Maritime Organisation (IMO) and the International Labour Organisation (ILO).

The IMO guides regulation of the shipping industry. It aims to provide a regulatory framework covering safety, environmental concerns, legal matters, technical co-operation, maritime security and the efficiency of shipping.

Prior to World War II, regulation of international shipping operating outside of narrow territorial limits was poorly managed under a set of generally recognised but poorly defined principles called the "freedom of the seas." In 1948, an international conference in Geneva adopted a convention formally establishing the Intergovernmental Maritime Consultative Organisation (IMCO). The Convention entered into force in 1958 and the IMCO came into being in 1959. In 1982, the original name was changed to the International Maritime Organisation.

The IMO is headquartered in London and carries out its work in a series of meetings attended by member states. The work of the IMO is conducted through five main committees: the Maritime Safety Committee, the Marine Environment Protection Committee, the Legal Committee, the Technical Co-operation Committee, and the Facilitation Committee.

These meetings produce large amounts of documentation, such as circulars and resolutions, which IMO member states are encouraged to adopt and implement. The IMO has created a framework of technical regulations, in the form of international diplomatic conventions, governing safety of ships and protection of the marine environment. National governments, which form the membership of the IMO, are required to implement and enforce these international rules, and ensure compliance of ships registered under their national flags.

Membership of the IMO is open to all UN states which have ratified the Convention on the IMO. There are currently 171 Member States and three Associate Members. Member organisations of the UN organizational family may observe the proceedings of the IMO. Observer status is granted to qualified non-governmental organisations.

The ultimate decision-making body of the IMO is the Assembly of Members, which meets every two years. Financially, a Council of 40 Members elected from the Assembly administers the IMO and performs all functions of the Assembly, with the exception of some technical matters, between sessions of the Assembly.

The shipping industry is made up of a number of stakeholders: ship owners; charterers – the people that lease the ships for transporting cargo; freight forwarding companies; insurers, registries; etc. The "rules" for how these actors are regulated is largely the work of either the IMO or left to market forces. The exception to this is the relationship between shipping and labour – the human resource employed to operate the manual side of the industry. This comprises the sea-going workforce, mariners

IMO Headquarters, London.

ILO Headquarters, Geneva.

from deckhands and cooks to captains, engineers and specialists of every description, but also the construction, shore-side and ship breaking sectors. The "rules" for this critical sector are set under the auspices of another UN agency: the ILO. 185 of the 193 UN Member States are members of the ILO.

Shipping today is truly international and crews are drawn from every corner of the globe. The flagging of ships has meant that it can be difficult to apply nationally-controlled labour and employment conditions. The world fleet is registered in over 150 nations, and manned by over a million seafarers of virtually every nationality. In 2013 the worldwide population of seafarers serving on internationally trading merchant ships was estimated to comprise 466,000 officers and 721,000 ratings.

1.4.2 International Conventions - UNCLOS and the "Four Pillars"

The IMO's mandate is confirmed under **UNCLOS** – the overarching Convention on the Law of the Sea. UNCLOS is generally accepted as a codification of customary international law of the sea. It defines the rights and responsibilities of nations with respect to use of the world's oceans. Shipping regulation under UNCLOS is supported by four primary international conventions, often referred to as the "four pillars" under which shipping is regulated. **SOLAS** (Safety of Life at Sea), which was first adopted in 1914 following the *Titanic* disaster set basic standards for ship construction and safety equipment and procedures. **MARPOL** – the International Convention for the Prevention of Pollution from Ships was born out of the 1967 *Torrey Canyon* oil spill and controls all the various forms of pollution that affect shipping and that the industry contributes to. The ILO's **Maritime Labour Convention (MLC)** establishes minimum working and living standards for all seafarers working on ships flying the flags of ratifying countries. Widely known as the "seafarers' bill of rights" the MLC was adopted by government, employers' and workers' representatives at a special ILO Conference in February 2006. It is unique in that it aims to achieve decent work for seafarers and to secure economic interests through fair competition for quality ship owners. The **Standards of Training, Certification & Watchkeeping Convention** is the key to the work of ILO's maritime functions and sets the framework for qualifying mariners and sailors at all levels from deckhands to ship's masters.

1.5 Changing Energy Sources for Shipping

The energy source for the propulsion of ships has undergone significant transformation over the last 150 years, from an era dominated totally by sails (renewable energy) through the use of coal to marine diesel oil (MDO) and heavy fuel oil (HFO), now the dominant fuel for this sector. Despite ever increasing efficiency of marine motors, the total consumption of these fuels has been increasing over the years in line with rising demand for shipping. The IMO estimates that between 2007 and 2012, on average, the world's marine fleet consumed between 250 and 325 million tonnes of fuel

annually.

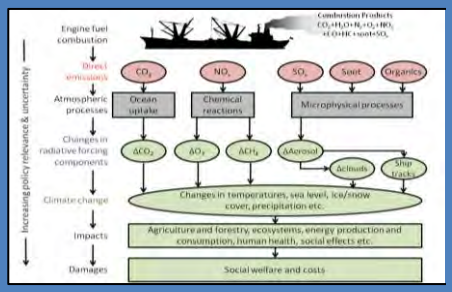
Shipping is undergoing an unprecedented drive for greater energy efficiency. It is too early to tell whether this will lead the industry on a pathway to decarbonisation but there is certainly a major search underway for diversification from diesel and HFO as the primary energy sources that propel shipping around the globe. New fuels, in particular LNG (liquefied natural gas) and methanol, are being touted as near future transition fuels for ships with hydrogen fuel cells being seen by many as the ultimate goal. However, there is also much dissent over the actual share of fleet propulsion these fuels will end up. The World Energy Council in 2011 was predicting that by 2050 the transport sector fuel mix will still depend heavily on gasoline, diesel, fuel oil and jet fuel.

Renewable energy solutions are increasingly being recognised as having a role to play in this revolution, although there is strong debate as to how effective they can be, especially in the short term. As discussed in more detail in chapter 5, the barriers to renewable energy uptake for the shipping sector are complex, and poorly understood or recognised. What is increasingly clear is that in the near future renewable energy use offers the greatest benefits at the small-scale end of the shipping spectrum. This is especially important, as this is the ship scale most prevalent in SIDS and many LDCs.

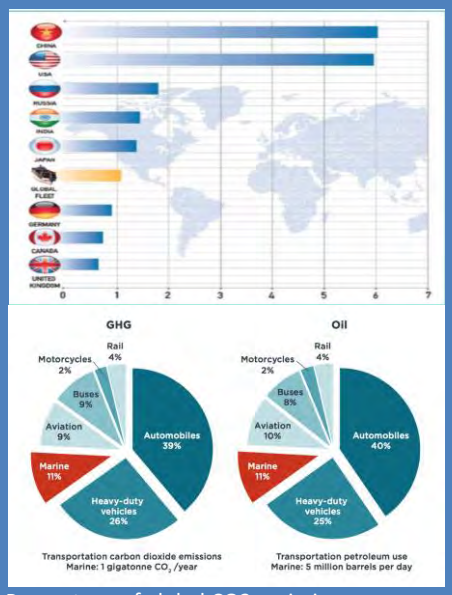
1.6 Shipping and Climate Change

Shipping is a substantial sector emitter of greenhouse gas (GHG), contributing between 2-3% of all global emissions. If it was a country, it would be an emitter on a par with Germany or Japan. For the year 2012, the IMO's 3rd GHG report (2014) found total shipping emissions were approximately 949 million tonnes CO_2 and 972 million tonnes CO_2 equivalent (CO_2e) for GHG combining CO_2, CH_4 and N_2O. International shipping accounts for approximately 2.2% and 2.1% of global CO_2 and GHG emissions on a CO_2e basis, respectively. Between 1990 and 2010, CO_2 from international shipping grew by around 80%, compared with growth closer to 40% from the rest of the global economy. Shipping's proportion of the overall global emissions total is predicted to increase between 50-250% by 2050 according to the 3rd IMO GHG report. Under all the scenarios modelled, shipping as a sector does not begin a downward trend in overall emissions until at least 2050.

For SIDS the growing impacts of anthropogenic climate change pose an extreme threat with its effects of sea level rise, ocean acidification and changing weather patterns. In the case of atoll nations such as the Maldives, Marshall Islands, Kiribati and Tuvalu, where the highest point of the entire county is often only a few metres above sea level, it threatens their very existence. Island peoples are in the front line of this challenge. The role of



Shipping emissions contribution.



Percentage of global CO2 emissions.

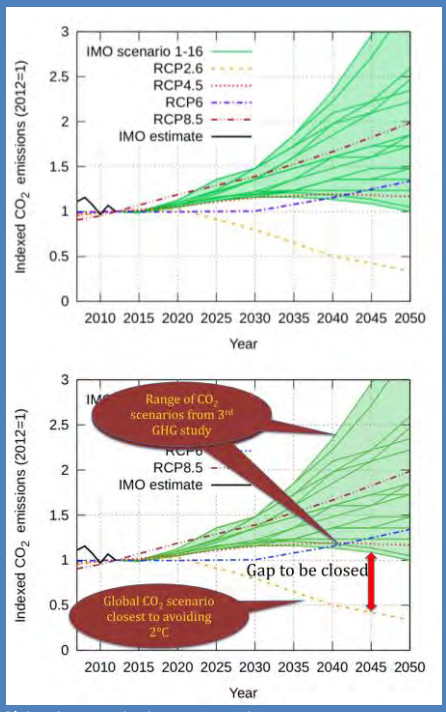
shipping in the context of the global discourse on combating climate change is a contested debate.

Global warming is a symptom not a source. Global warming and global inequity are linked, as global warming exacerbates poverty. As the Stern Review noted in 2006, global warming is the historic responsibility of a few rich countries that have produced 70% of all CO_2 emissions since 1850. The situation is now dire. Given that climate change affects all countries, and that the emerging economies of the developing world are becoming major emitters, it is obvious that a truly global approach is needed. All sectors must play their part.

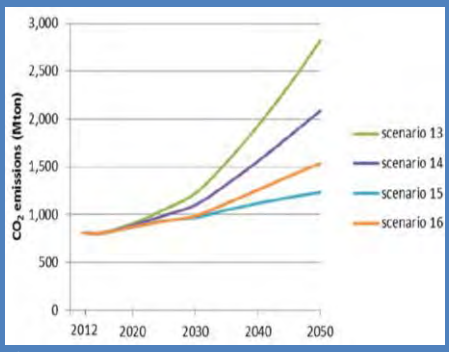
At Copenhagen in 2009, a global target of holding global warming below a threshold of no more than 2 degrees' increase was set. Many SIDS have called for this target to be lowered to 1.5 degrees. In Oceania, Pacific leaders have consistently identified climate change as the priority threat facing the region and have called on all actors to do all they can to limit emissions (Majuro Declaration, 2013).

At COP21 in Paris at the end of 2015, a new global accord was negotiated to replace the 1997 Kyoto Protocol. The resultant Paris Agreement is silent on the issue of international bunker emissions. Under Kyoto the world was divided into Annex 1 countries (those from the developed world that had historically benefited most from the historical emissions) and non-Annex 1 countries under the "common but differentiated responsibility" principle (CBDR). Responsibility for developing emissions reduction programmes for international shipping and aviation were transferred to the specialist UN agencies, the IMO and the International Civil Aviation Organisation (ICAO) respectively. Unlike Kyoto, the IMO operates on the principle of "no more favourable treatment" (NMFT) where all countries are treated alike. This reflects the international nature of the industry and the ability of ship owners to reflag to registries in the developing world if they perceive this would have greater benefit than maintaining flag status in first world countries. This lack of a CBDR in the IMO has led many developing nations, especially the BRIC states, to avoid engaging in the climate change debate within the IMO, preferring it take place within the confines of the United Nations Framework Convention on Climate Change (UNFCCC) processes.

There are widely diverging views on the effectiveness of current IMO measures – science says shipping must reduce its overall emissions to near nil by about 2050 or 2077 if we are to stabilise global warming at 1.5 or 2 degrees respectively, with shipping paying a "fair share" of reductions. The industry and the IMO stress that shipping is already a "green industry" compared with other transport modes, and point to the efforts of the industry to make new ships more efficient. Per tonne/km of cargo moved the reported results are impressive. But while progress is being made



Shipping emission scenarios.



Shipping CO2 projections.

at the large and new ship scale, there is also growing evidence that shipping's claim to be the most efficient sector is selective, especially when smaller ships are compared with modern rail. Much of the recent efficiency claims in the past decade are based on "slow steaming" regimes resulting from cost cutting measures since 2006 that are not necessarily going to be maintained in the long term.

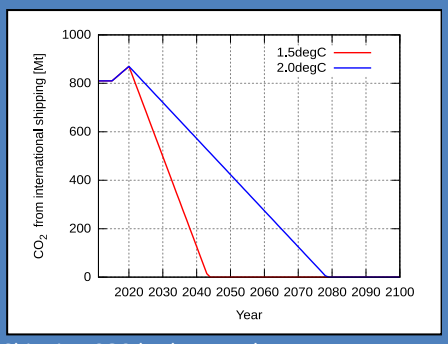
In 2011 the first global measure aiming to curb CO_2 from international shipping was agreed. This is a mandate on minimum efficiency levels for new ships implemented through an Energy Efficiency Design Index (EEDI). It aims to cut emissions from new ships by 30% by 2025, with overall efficiency gains dependent on fleet turnover. Complementary measures agreed to date include the Ship Energy Efficiency Management Plan (SEEMP) and the Energy Efficiency Operational Indicator (EEOI) to monitor the progress of the SEEMP. Debate around market-based measures (MBMs) and a climate levy are on-going but making little progress due to the perceived conflict between CBDR and NMFT.

The core difficulty with the approach to date is that it is focused on improving individual ship efficiency and doesn't look at the contributions from the sector as a whole. This ignores the reality that the sheer scale of increase in global shipping far outstrips individual gains made by single ships. An industry-wide and regulated reduction target is therefore needed. The counter to this from both the IMO and the industry is that such an approach presents a major threat to the role shipping plays as the "servant of world trade." If shipping makes cuts on a "fair share" basis the cost will be to dramatically inhibit potential for world development growth, essentially a global political decision the IMO has no mandate to make. In light of the consequences of the global financial crisis in the last decade, the subsequent decline in growth of the shipping industry and the centrality of seaborne transport to economic recovery, this line of argument has thus far proved persuasive.

However, there is no masking that overall emissions of ships are increasing and are predicted to continue to increase beyond quantities that would allow targets of no more than 1.5 or 2 degrees warming to be achieved. Either shipping as a sector must decarbonise dramatically or other sectors must subsidise sea transport emissions. In May 2015 the Marshall Islands submitted to the IMO that a clear unambiguous sector target was now immediately required. It is the first time such a direct request has been made. The IMO declined this submission although it has directed that the request can be revisited in the future.

There are two other facets of the relationship with climate change that are often underplayed but need to be borne in mind.

Firstly, there is the unique nature of shipping's emissions. While ships give rise to GHG emissions, shipping also gives off a disproportionate amount of SOx, as a result of the overall poor



Shipping CO2 budgets and targets.

quality of most maritime bunker. Regulating to improve the quality of bunker by requiring all maritime fuel burnt to drastically reduce its sulphur content in a stepped programme by 2020 is one area the IMO has progressed on. In the Special Emissions Control Areas (SECA) established around the EU and some of the US coastline, the sulphur content must be even lower. While this is good news for environmental and public health, it is likely to be detrimental to efforts to reduce global warming as sulphur has a cooling, not a warming, effect when released into the atmosphere. So cleaner maritime fuel, in terms of sulphur content, will ultimately contribute to increased global warming.

Ship entering Suva Port, Fiji.

Secondly there is the role that shipping plays in facilitating all major global sources of emissions. Unless you can connect to a pipeline, if you import oil most of it comes by sea. Most coal and ores are shipped by sea. The energy used to transform raw materials to merchandise cannot be expended unless both energy source and raw materials are transported to the same location, and the goods then moved to market. Shipping is central to this. Oil is increasingly sourced from ocean-based platforms and this cannot occur without shipping. While it is true that shipping is the servant of global trade, it is also the conduit that allows a large portion of emissions to occur.

eventual errors or omissions. The content and views expressed are those of the authors and do not purport to represent any organisation.

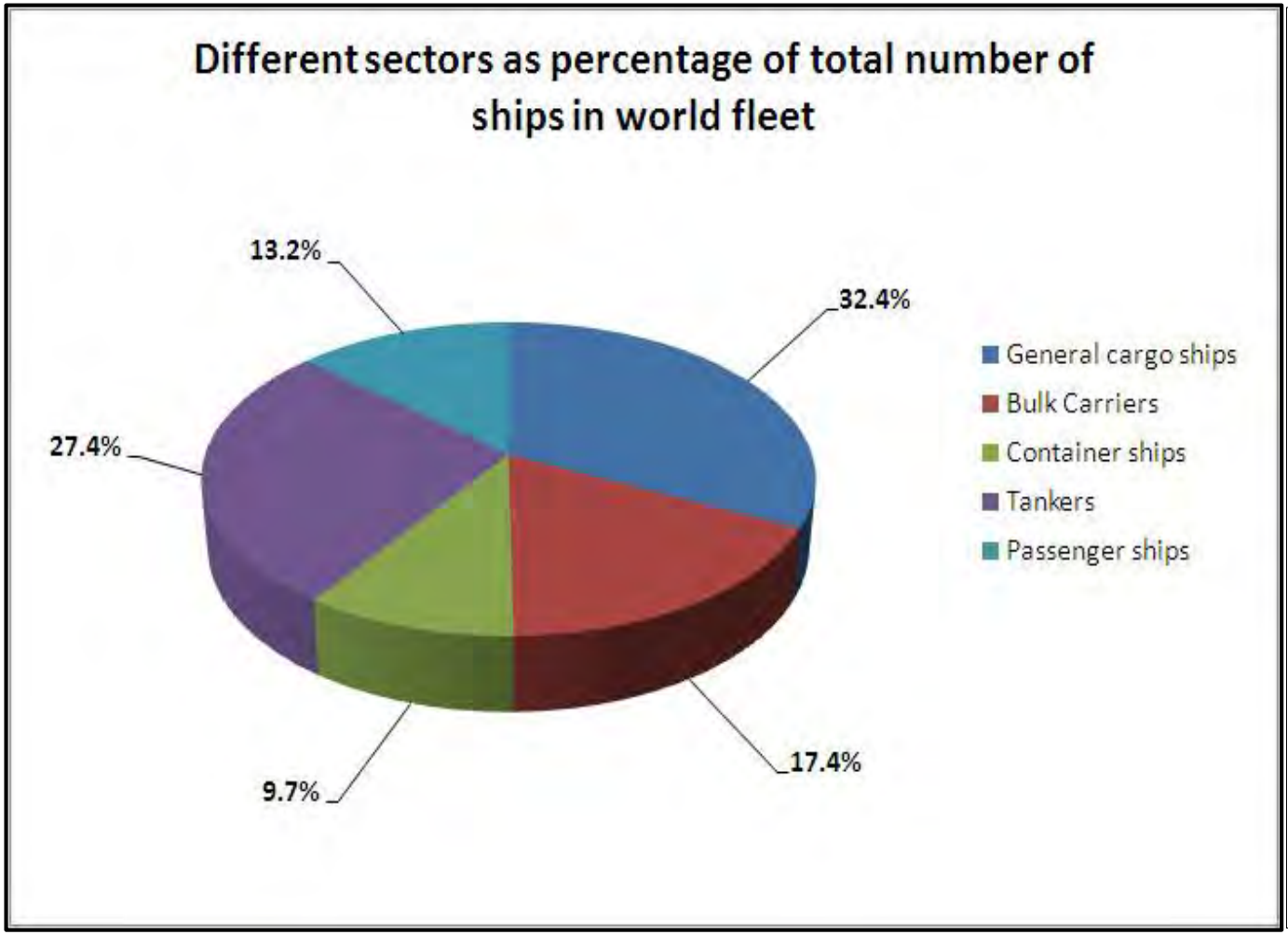
Chapter 1

The International Shipping Context

The International Shipping Context

- Around 90% of world trade by volume (over 70% of global trade by value) is moved by sea.
- Without shipping the import and export of goods on the scale necessary to maintain the modern world would not be possible.
- Maritime transport is often described as the servant or conduit of world trade.
- UNCTAD has described it as the backbone of globalization and the driver of the global trade-led economic expansion.
- The international shipping fleet is incredibly diverse in terms of vessel types, the purposes for which they are used, and the conditions under which they operate. There are over 50,000 commercial ships operating internationally today.

The International Shipping Context :
The world fleet is diverse in type and size



As of 31st October 2010, the world fleet was made up of 50,054 ships.

Figures in brackets are numbers of ships, by sector.

General Cargo Ships (16,224)

Bulk Carriers (8,687)

Container ships (4,831)

Tankers (13,175)

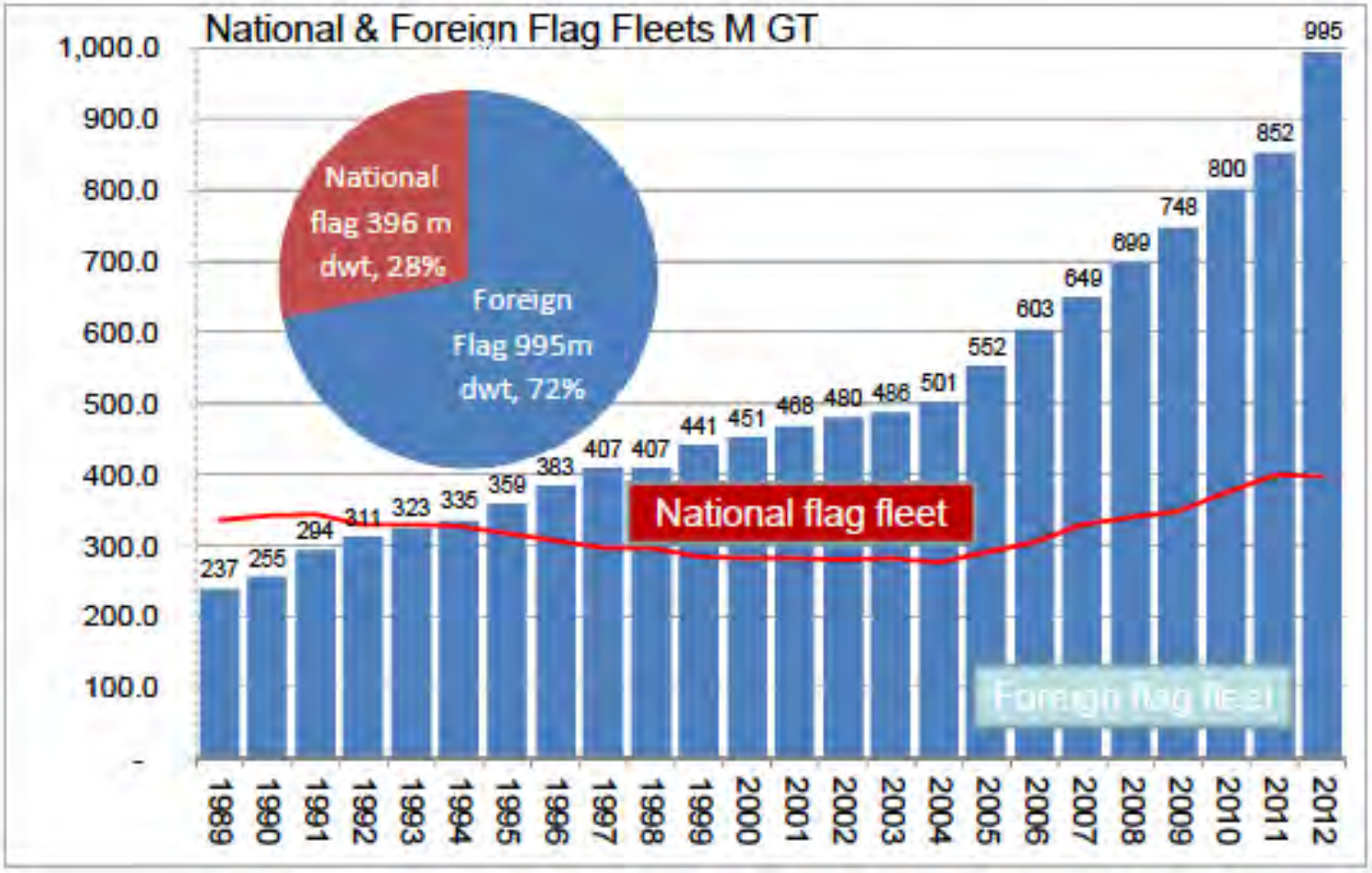
Passenger ships (6,597)

TOTAL (50,054)

Source: UNCTAD, 2014

Merchant Fleet Moving Offshore

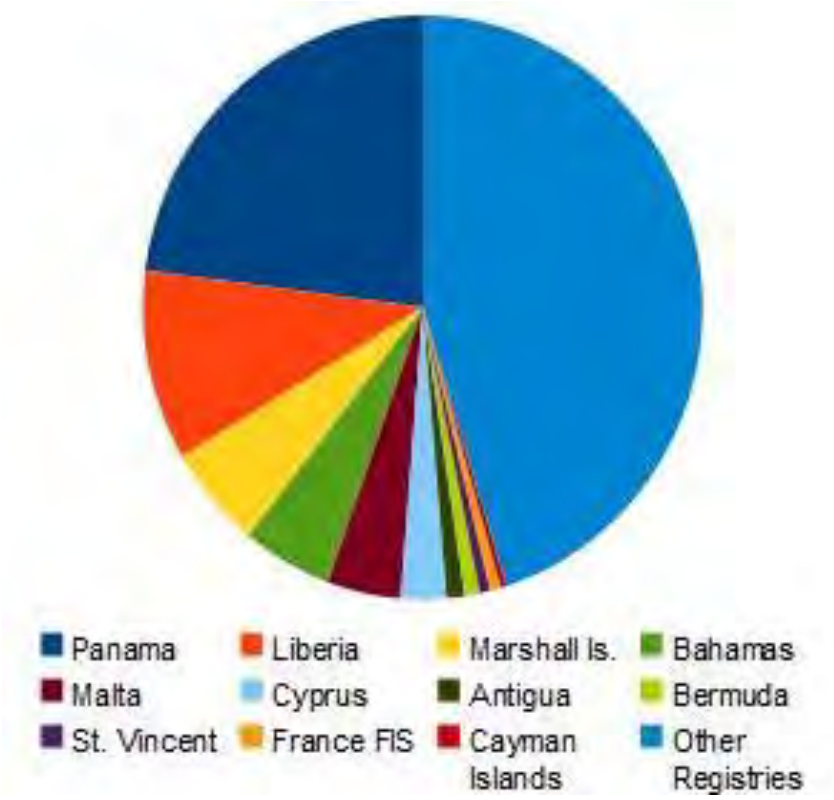
72% of the World fleet is flagged abroad and growing



Source: Martin Stopford, 2013

The Top 11 Open Registries

More than 68% of world tonnage is registered to independent or ‘open’ registries. Many SIDS are host to such registries.



As Percentage of World Fleet in DWT

Source: UNCTAD, 2014

Ship Energy, Design and Operation has Changed Dramatically Throughout History

Date	1 Primary Energy Source	2 Hull Materials	3 Hull Construction	3 Main Engine	4 Propulsion unit	5 Navigation technology	6 Inland Transport System	7 Shipping System
5000BC	Muscle	Wood	pegs		Oars	Astro	Road	Tramp
	Wind	nails rope oakum pitch	nails rope		Sail	Compass Backstaff (1) Chronometer (2)		
1780		copper sheath	fasteners					
1833	Coal	Iron		steam 1	Paddle		Canals	
			rivets caulking	steam 2	Screw		Rail	Liner Tramp
1870		Steel	Wire	steam 3		Sextant (3)	Truck	Passenger
		Aluminium GRP		Turbine		Radio	Air	
1913	Oil	SPC	welding	Diesel				
1950	(Nuclear)					Radar		Bulk Container Specialized
	(LNG)					Satellite		
2000								

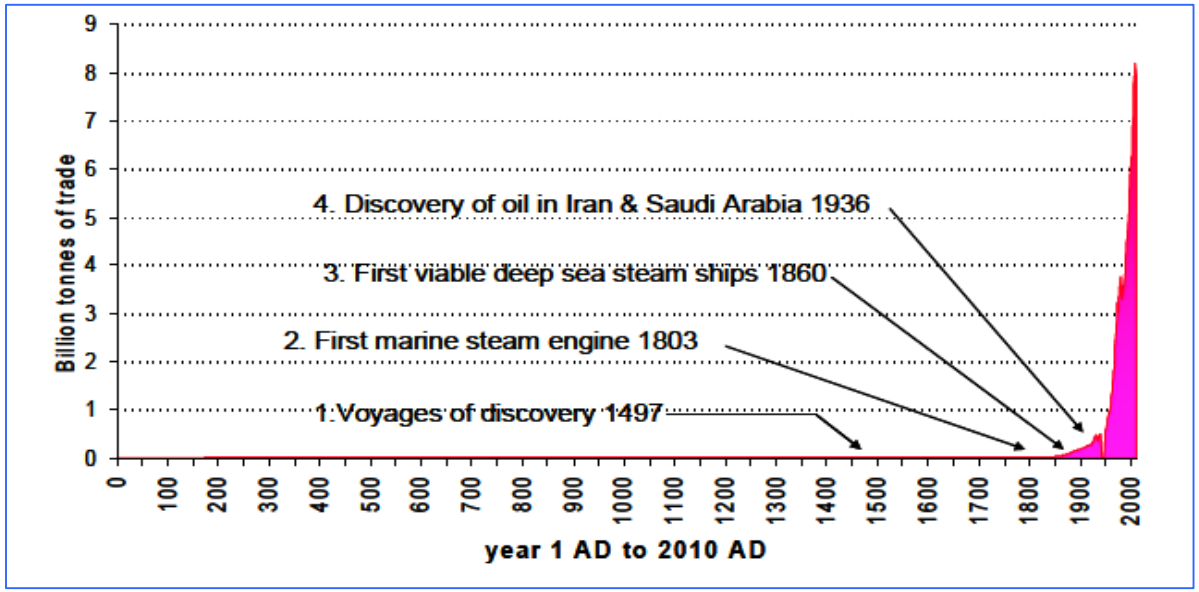
Source: Martin Stopford (2010) *How shipping has changed the world & the social impact of shipping*

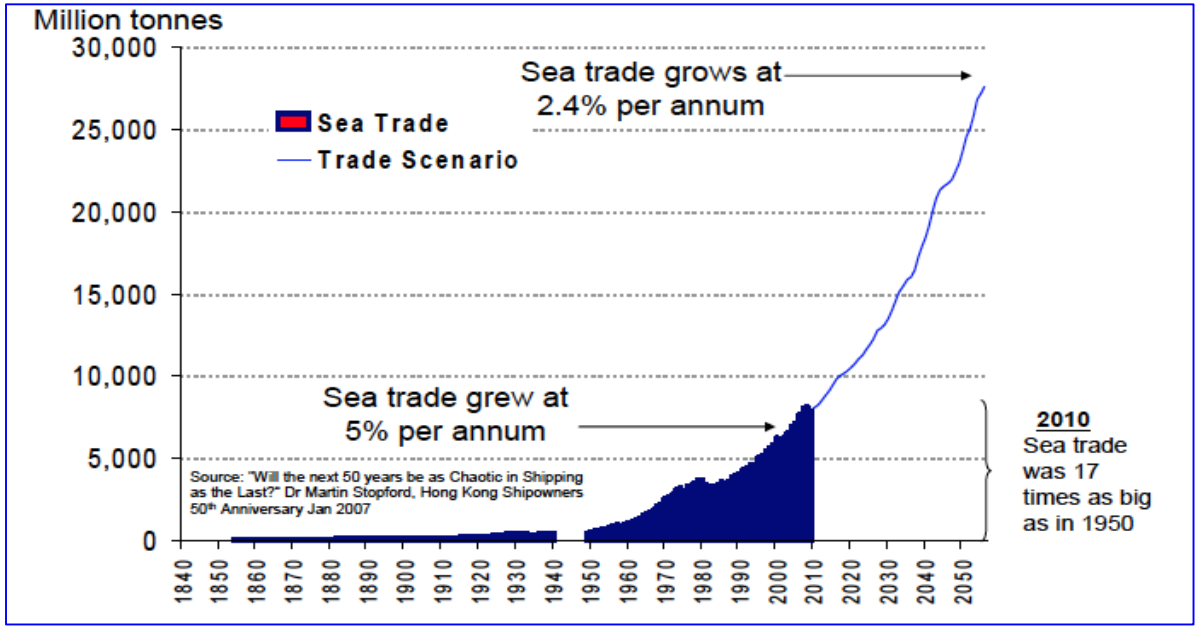
World cargo totals have accelerated continuously since the use of fossil fuels for ship propulsion.

Shipping has become increasingly specialised, with tankers and then containers revolutionising sea transport.

Long term growth predictions based on historical trend see growth of 250% by 2050.

For most cargo there is no other foreseeable transport mode in this period.



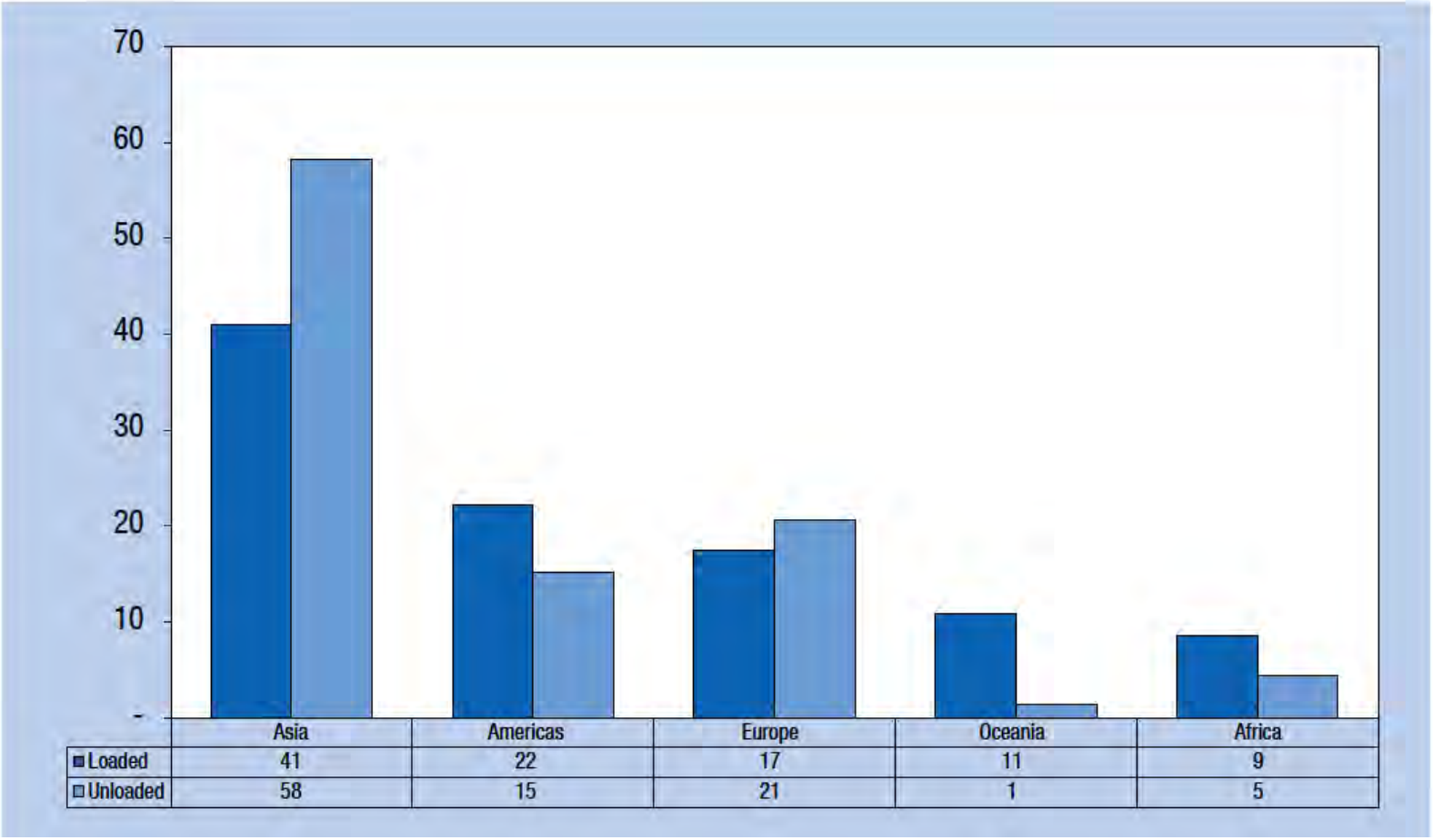


Source: Martin Stopford, 2013

Maersk Triple E Container Ship

Source: http://www.motorship.com/news101/industry-news/maersk-line-contracts-10-triple-e-vessels

World Seaborne Trade by Geographical Region 2013 (% share in world tonnage)



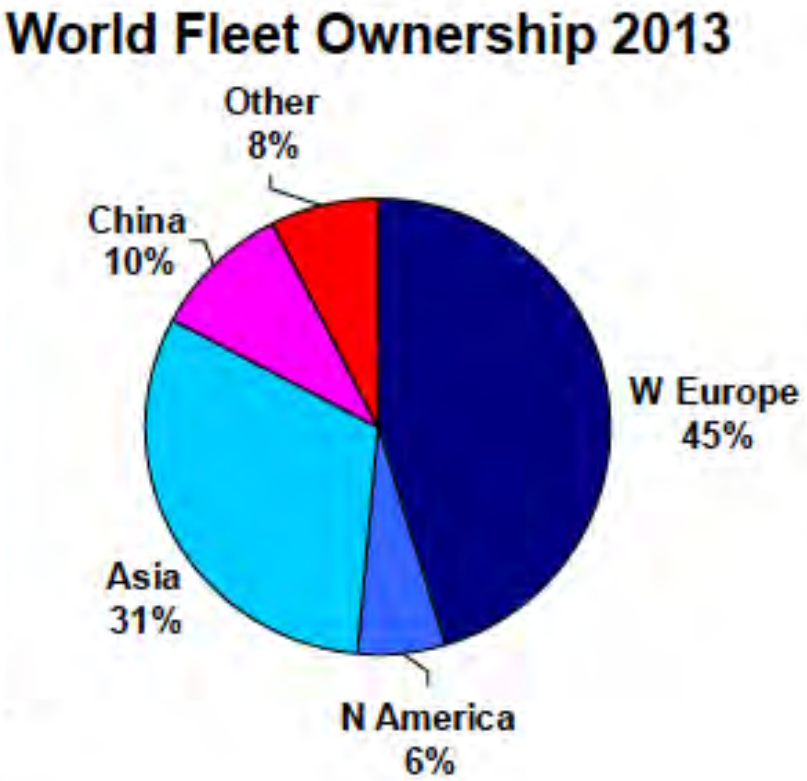
	Asia	Americas	Europe	Oceania	Africa
Loaded	41	22	17	11	9
Unloaded	58	15	21	1	5

Source: UNCTAD, 2014

The Top Ship Owning Nations

Ship ownership has been traditionally dominated by Europe and Japan. Today this position is being strongly challenged by China, S Korea and other emerging economies.

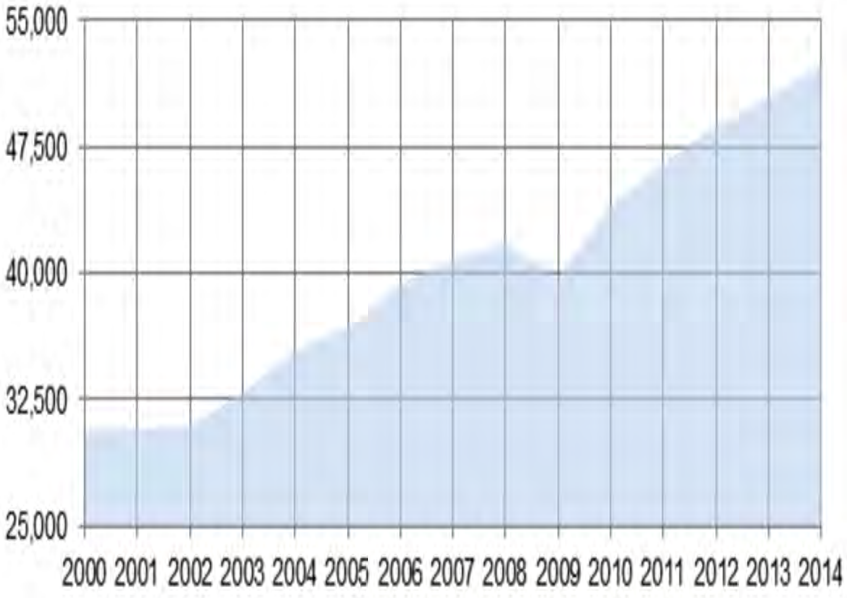
Rank	Nation	National	Foreign	Total
1	Japan	20	197	218
2	Greece	65	159	224
3	Germany	17	108	126
4	China	52	72	124
5	USA	7	47	55
6	S Korea	17	39	56
7	Taiwan	4	35	39
8	Bermuda	2	28	30
9	Norway	16	27	43
10	Denmark	13	27	40
11	Other			373
12	World	374	953	1,327



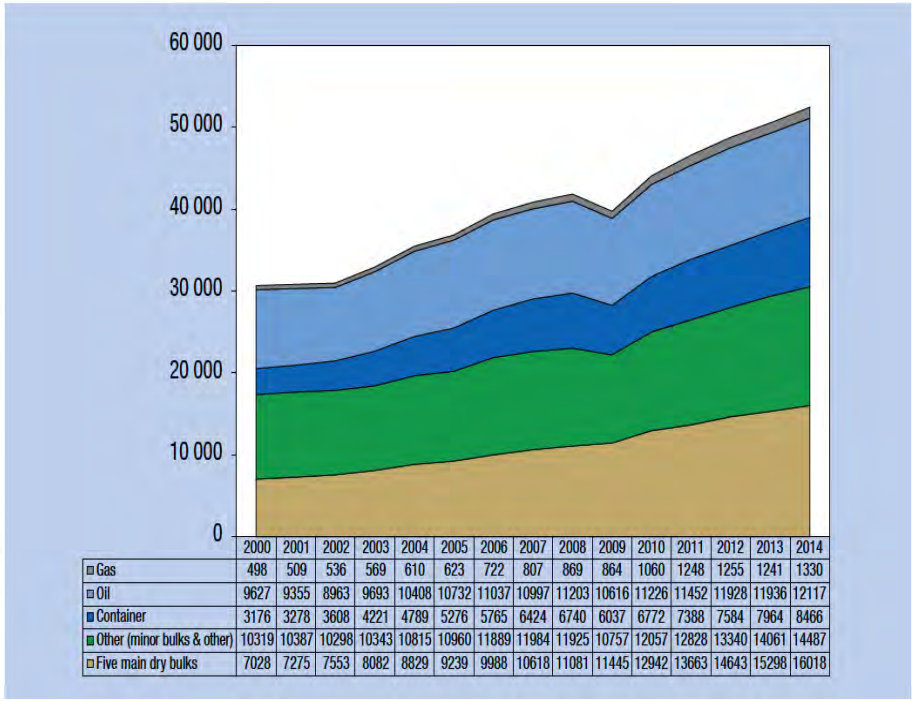
Source: Martin Stopford, 2013

World Seaborne Trade Continues to Grow

World Seaborne Trade (billion tonne-miles)



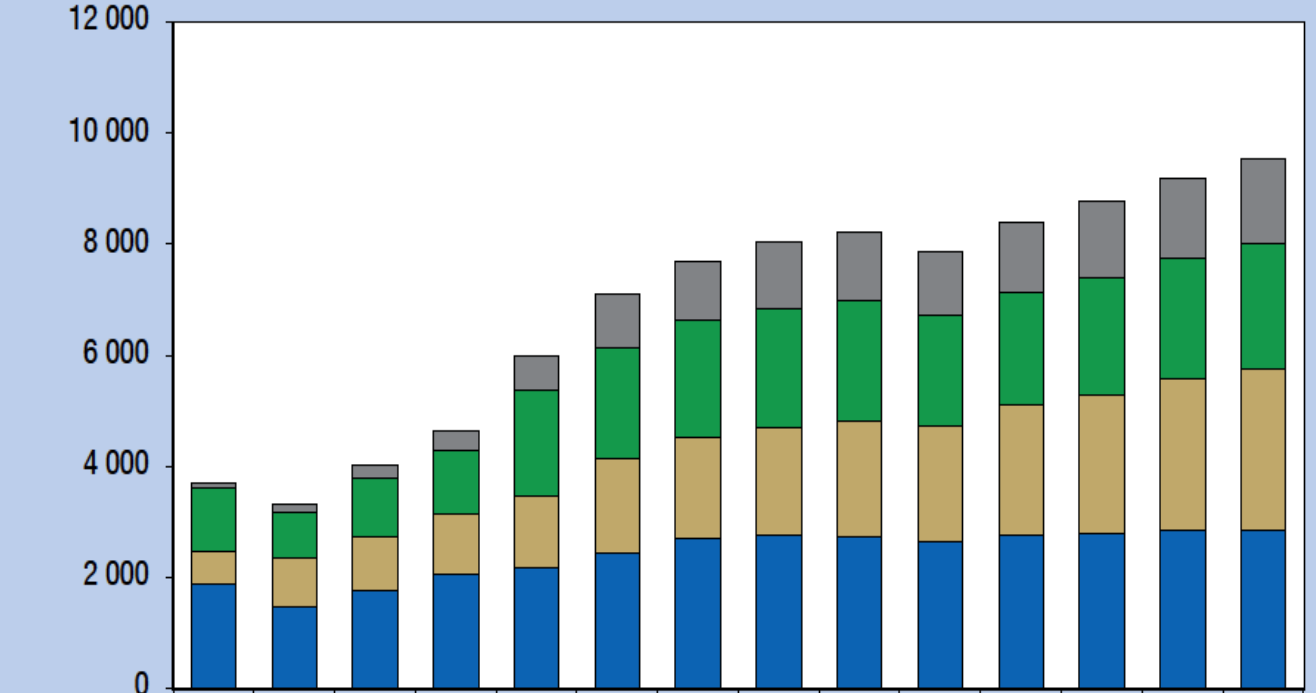
World Seaborne Trade (cargo tonne-miles) by Cargo Type



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Gas	498	509	536	569	610	623	722	807	869	864	1060	1248	1255	1241	1330
Oil	9627	9355	8963	9693	10408	10732	11037	10997	11203	10616	11226	11452	11928	11936	12117
Container	3176	3278	3608	4221	4789	5276	5765	6424	6740	6037	6772	7388	7584	7964	8466
Other (minor bulks & other)	10319	10387	10298	10343	10815	10960	11889	11984	11925	10757	12057	12828	13340	14061	14487
Five main dry bulks	7028	7275	7553	8082	8829	9239	9988	10618	11081	11445	12942	13663	14643	15298	16018

Source: UNCTAD, 2014

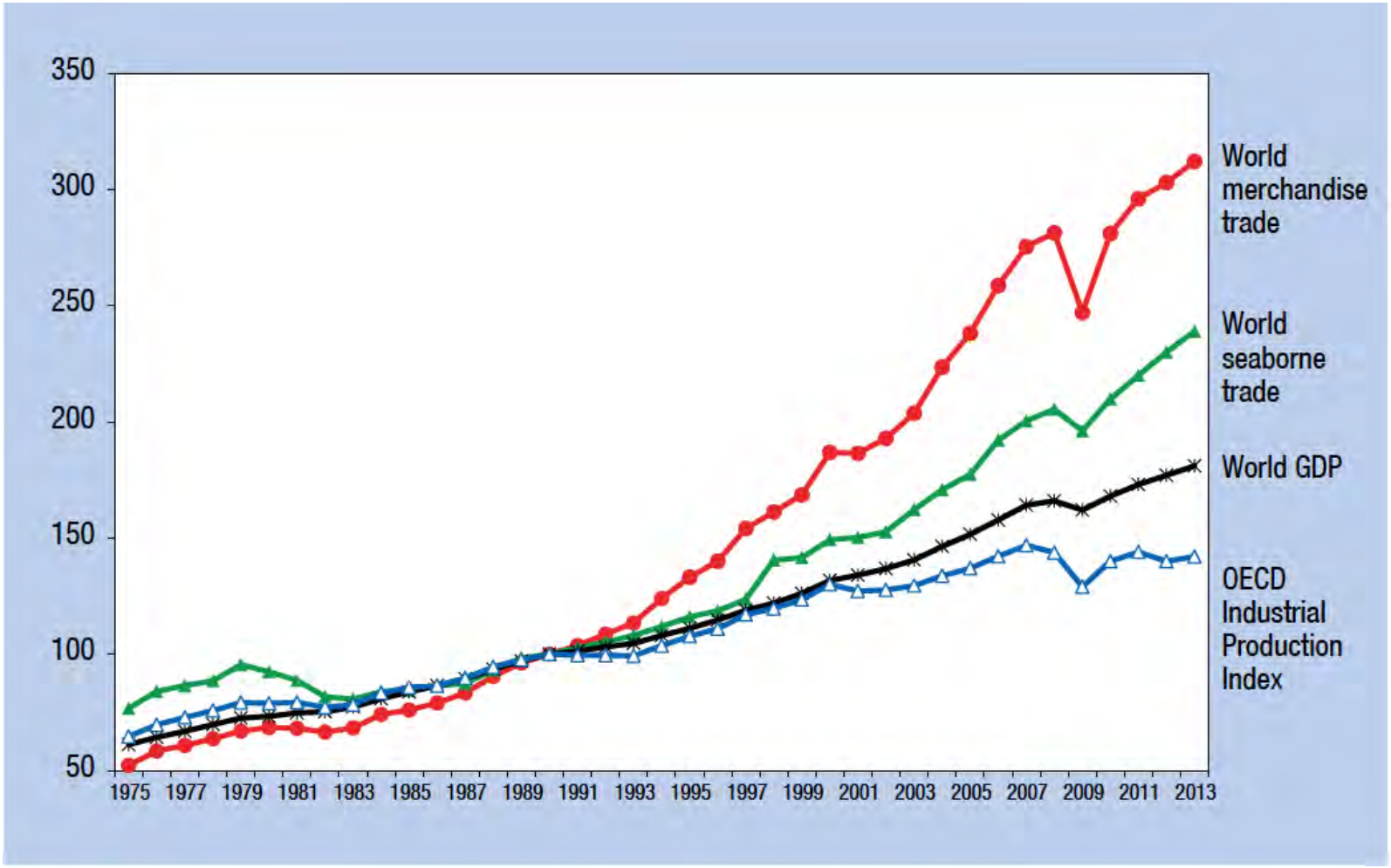
International Seaborne Trade (millions of tonnes loaded)



	1980	1985	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013
Container	102	152	234	371	598	969	1 076	1 193	1 249	1 127	1 280	1 393	1 445	1 524
Other dry cargo	1 123	819	1 031	1 125	1 928	2 009	2 112	2 141	2 173	2 004	2 022	2 112	2 169	2 260
Five major bulks	608	900	988	1 105	1 295	1 709	1 814	1 953	2 065	2 085	2 335	2 486	2 742	2 920
Oil and gas	1 871	1 459	1 755	2 050	2 163	2 422	2 698	2 747	2 742	2 642	2 772	2 794	2 841	2 844

Source: UNCTAD, 2014

OECD Industrial Production Index and Indices for the World

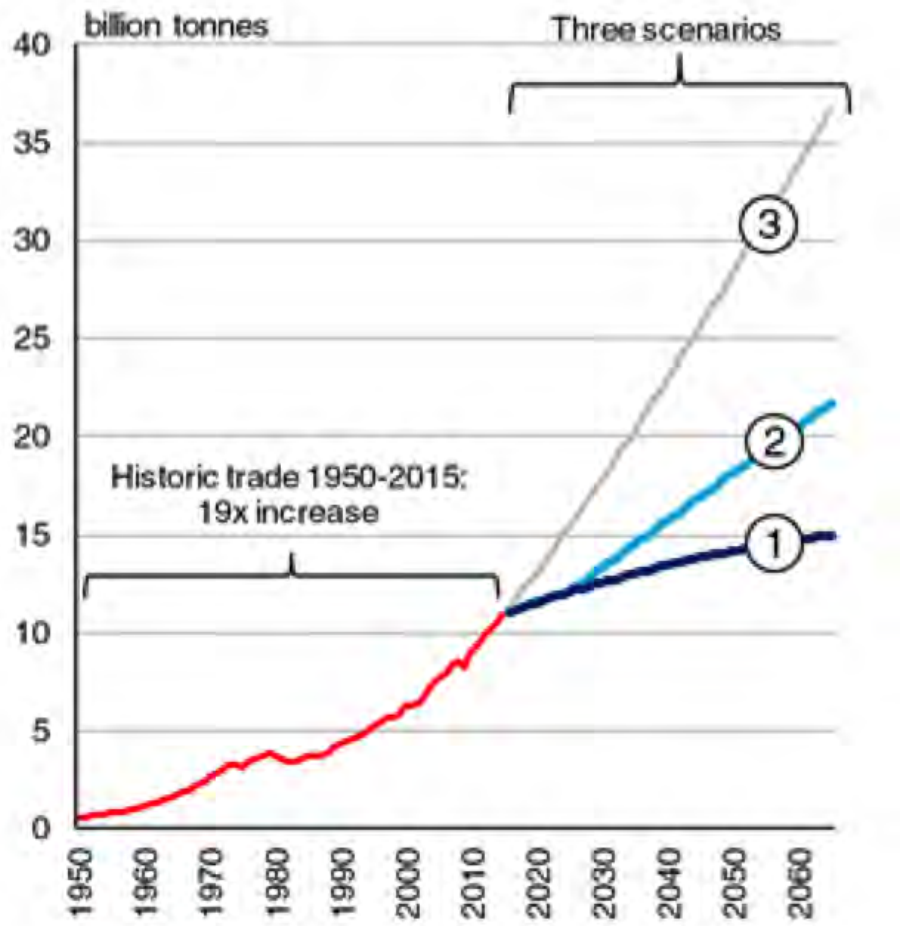


Source: UNCTAD, 2014

Future Seaborne Trade Growth Scenarios

World Seaborne Trade: Three 50 Year Scenarios

The graph shows estimated seaborne trade in billion tonnes in the 1950-2015 period (red line). The three scenarios show potential trends in world seaborne trade for the next 50 year period. The first two scenarios are as described in the text. The third scenario is based on trade per capita into OECD countries remaining steady throughout the period, with trade per capita into non-OECD economies increasing to reach current OECD levels of around 4 tonnes per capita by 2065, as well as expected OECD and non-OECD population growth trends.



Source: Clarkson's, 2015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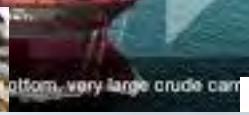
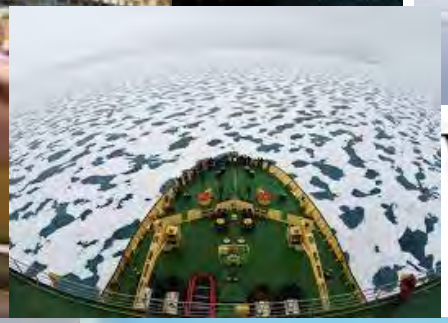
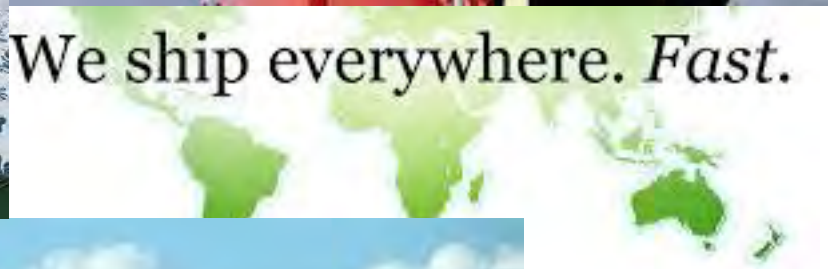
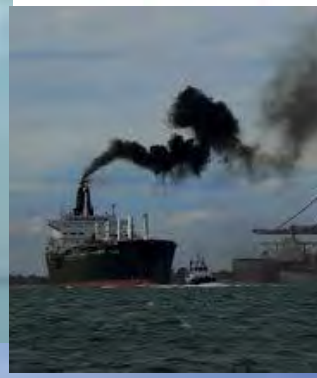





We ship everywhere. *Fast.*

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World Shipping 2012

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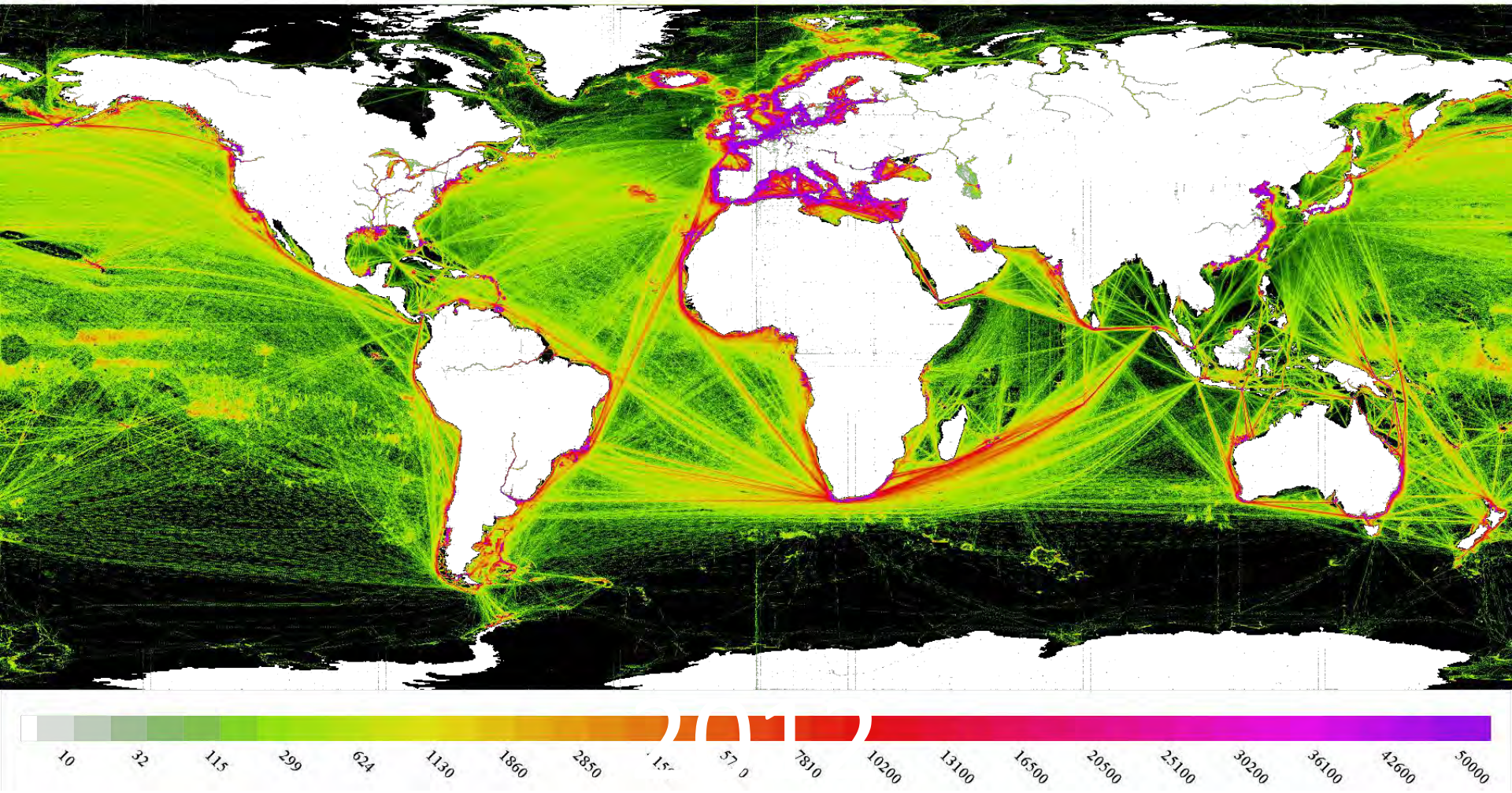
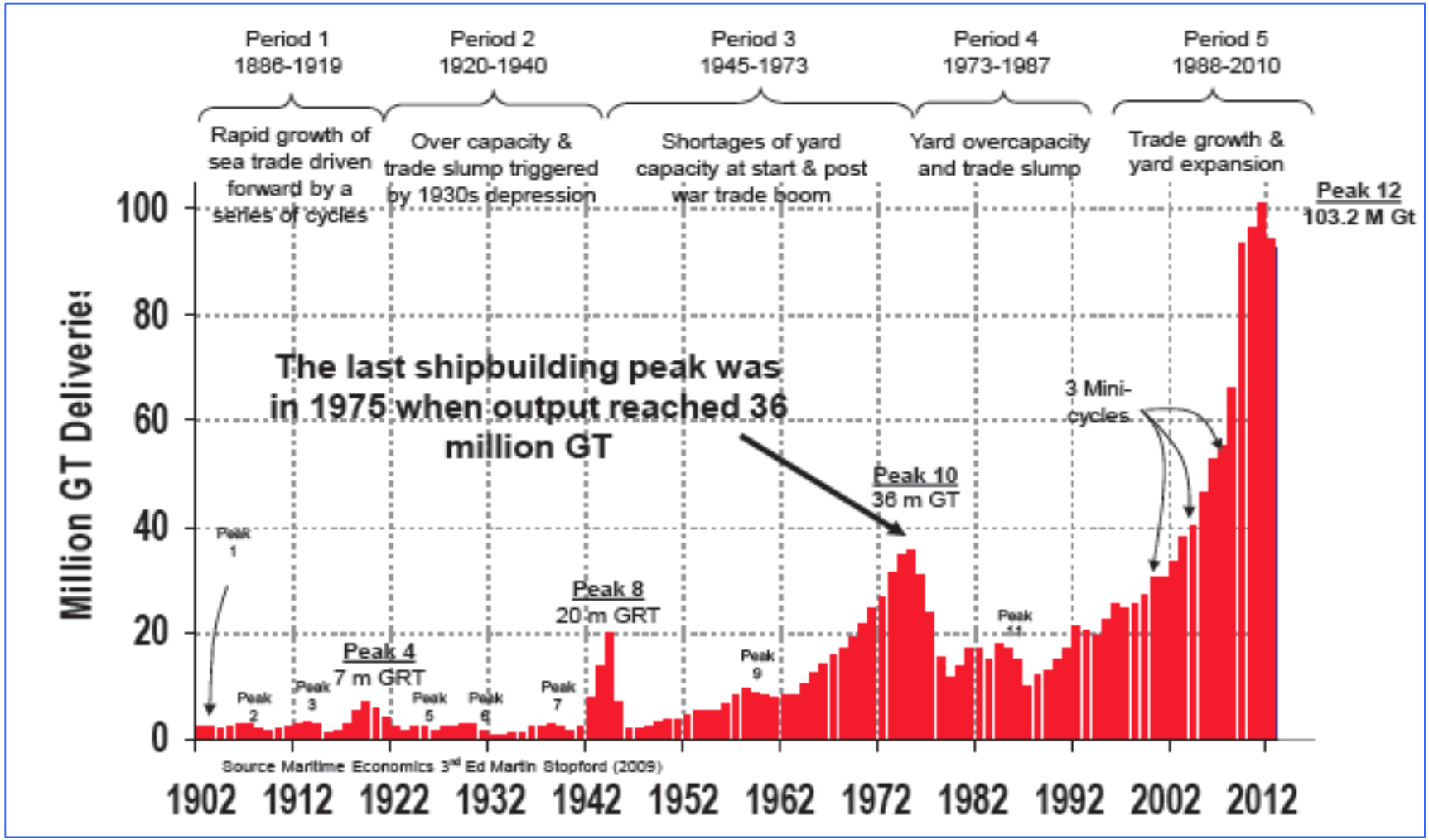


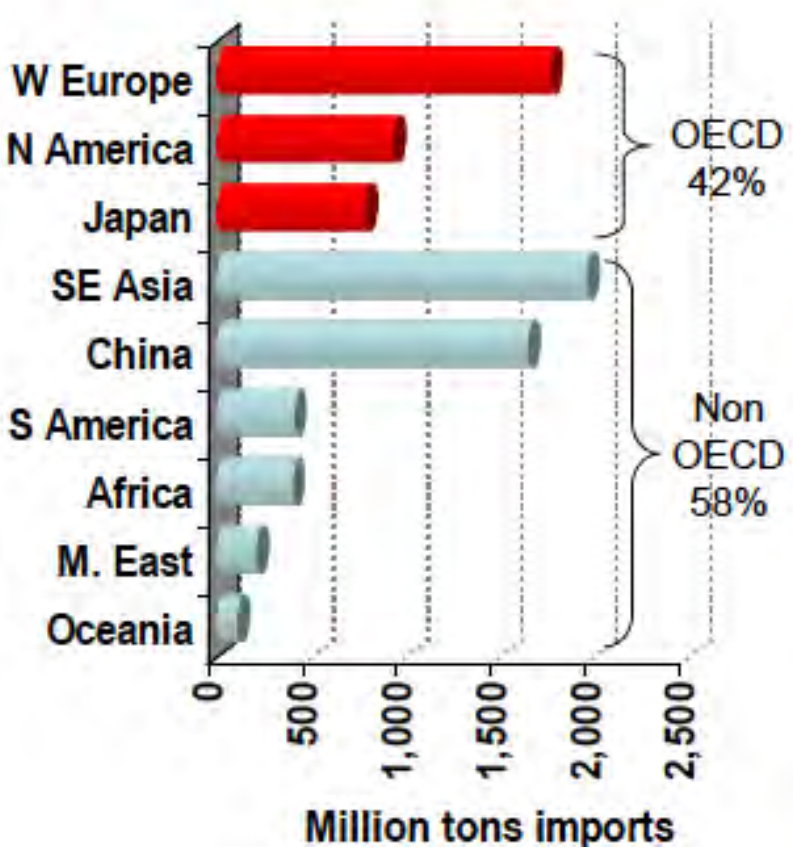
Source: Corbett et al, 2014

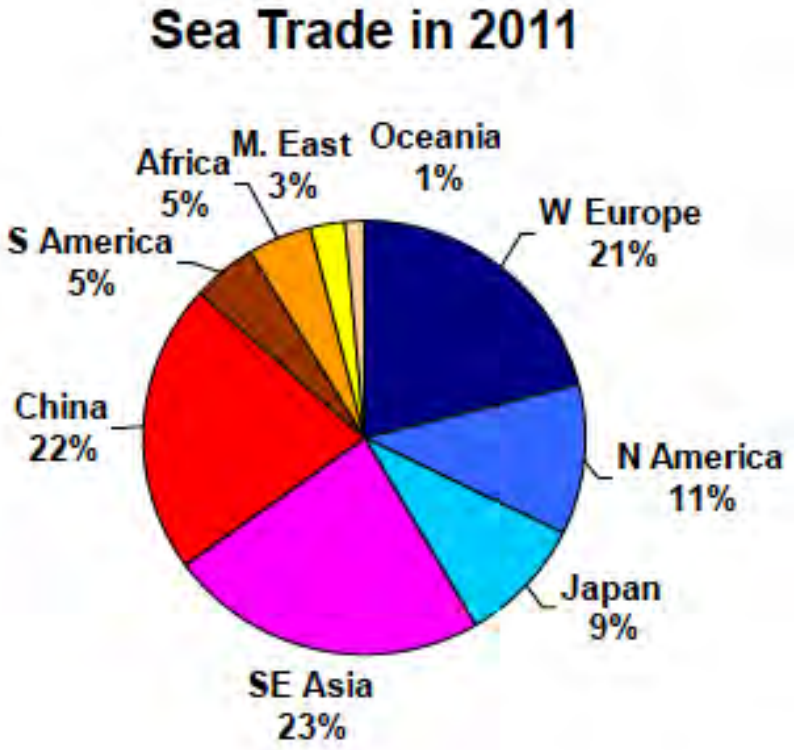
The Greatest Shipping Boom Ever has Just Ended



Source: Martin Stopford, 2013

Global Trade Patterns are Changing and will Continue to Change



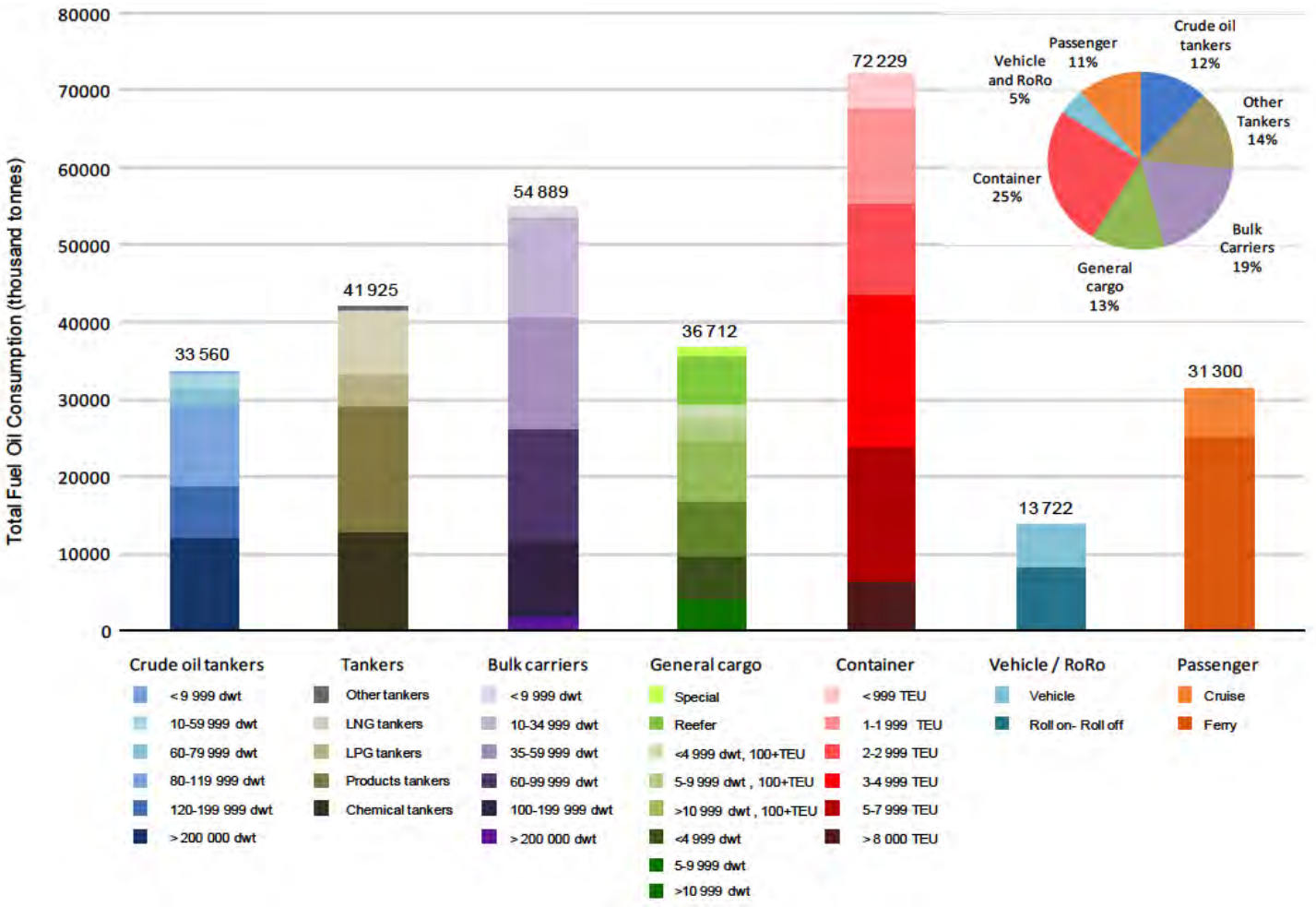


Source: Martin Stopford, 2013

Two specialised UN agencies govern most aspects of shipping regulations: the International Maritime Organisation and the International Labour Organisation.

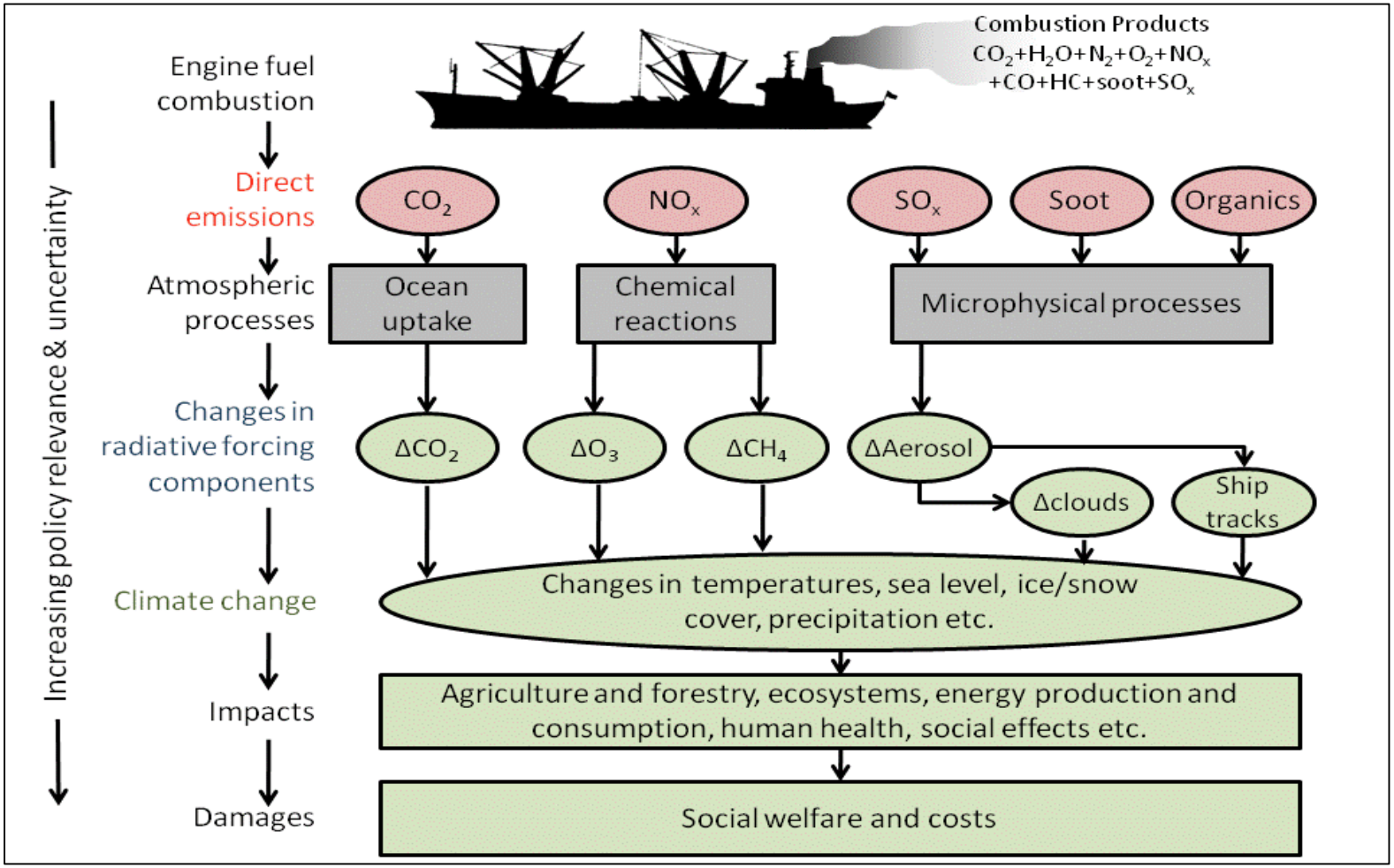
Sources: IMO and ILO

Fuel Use (thousand tonnes) by Vessel Category 2007
(Excluding Fishing, Service and Offshore Supply Vessels)



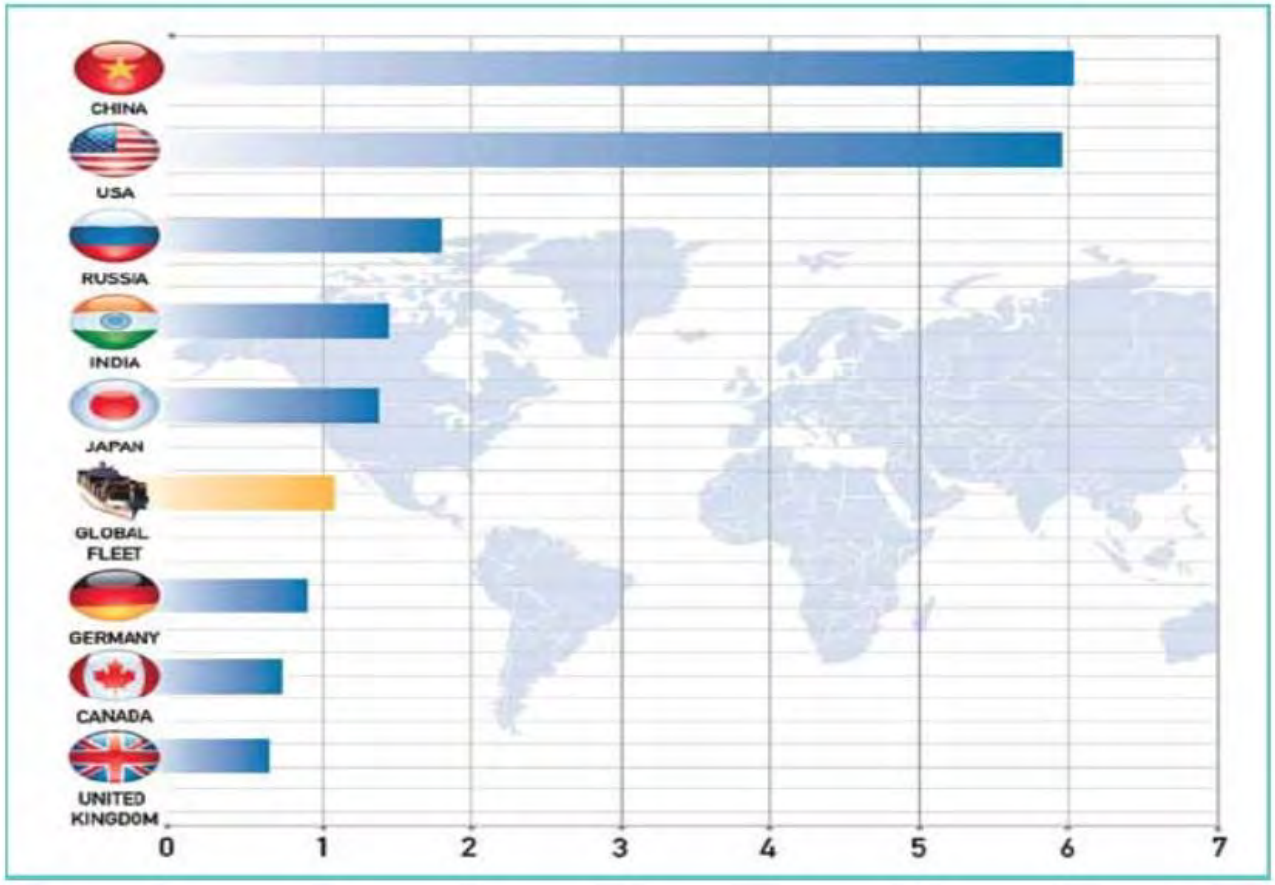
Source: Crisp, 2009

Shipping Emissions Contribution to Climate Change



Source: Faber, 2009

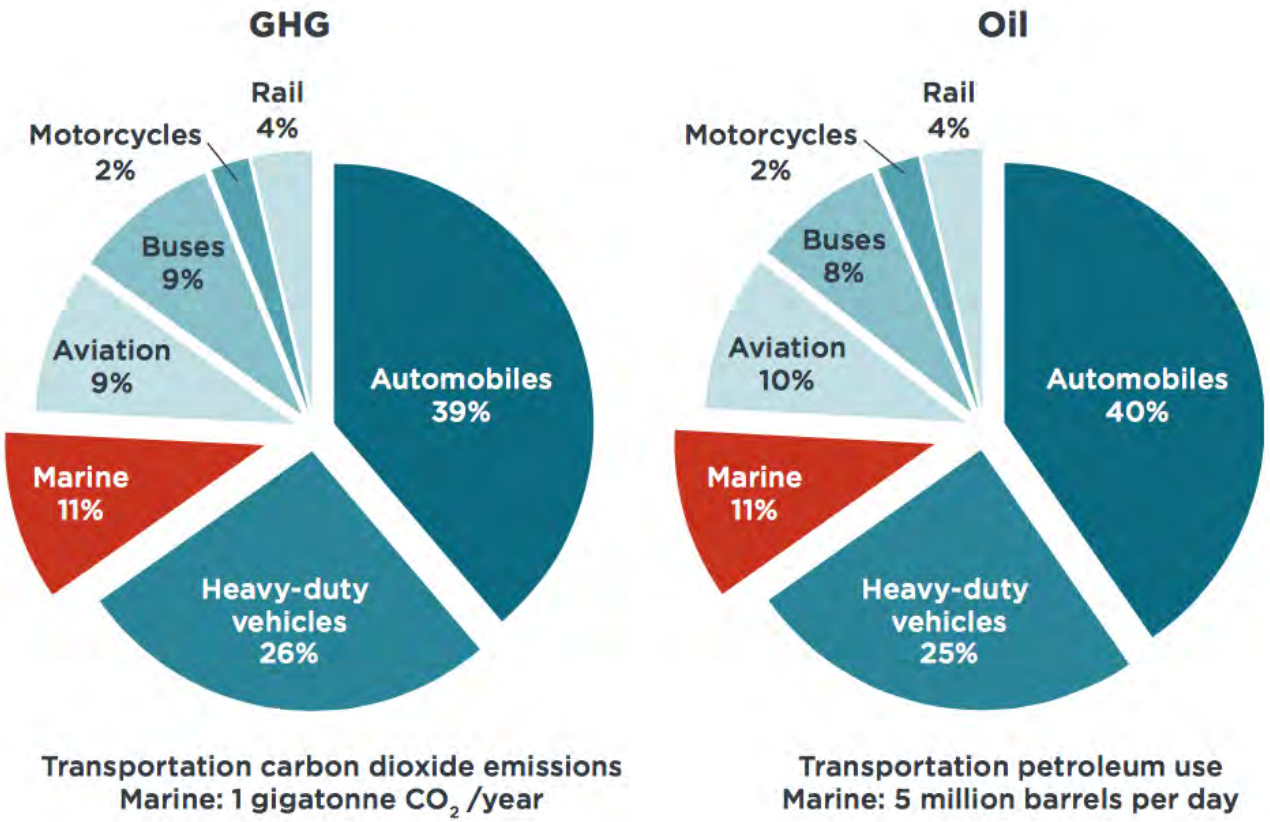
Climate Impact of International Shipping



Shipping emits 1,000 million metric tons of CO_2 per year, around 2-3% of global CO_2 – if it were a country it would be between Japan and Germany.

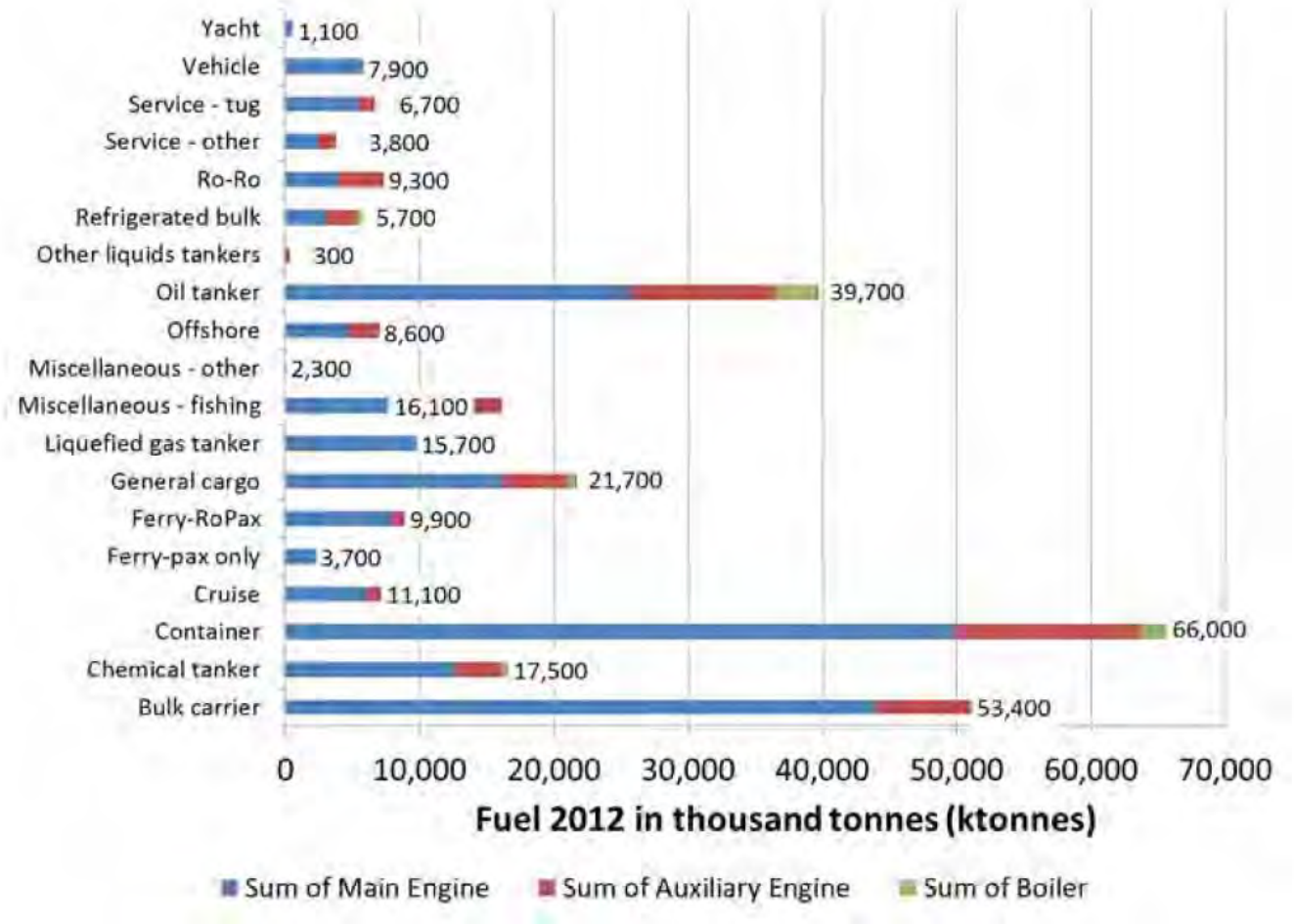
Source: Oceania, 2011

Shipping's Contribution to Global Climate Emissions and Petroleum Consumption, 2010



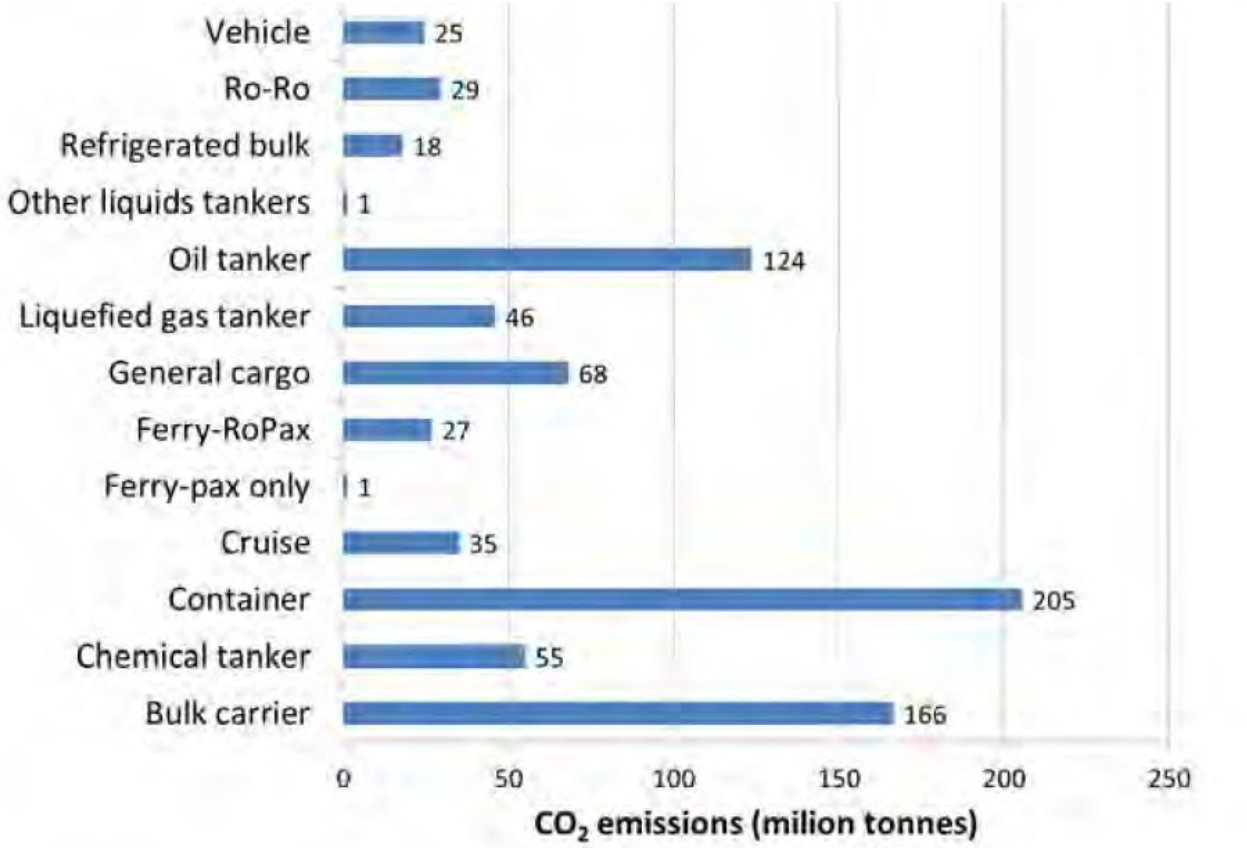
Source: ICCT, 2012

Annual Fuel Consumption by Ship Type and Machinery Component (main, auxiliary and boiler)



Source: Smith et al, 2014

CO_2 Emissions from International Shipping by Ship Type, 2012



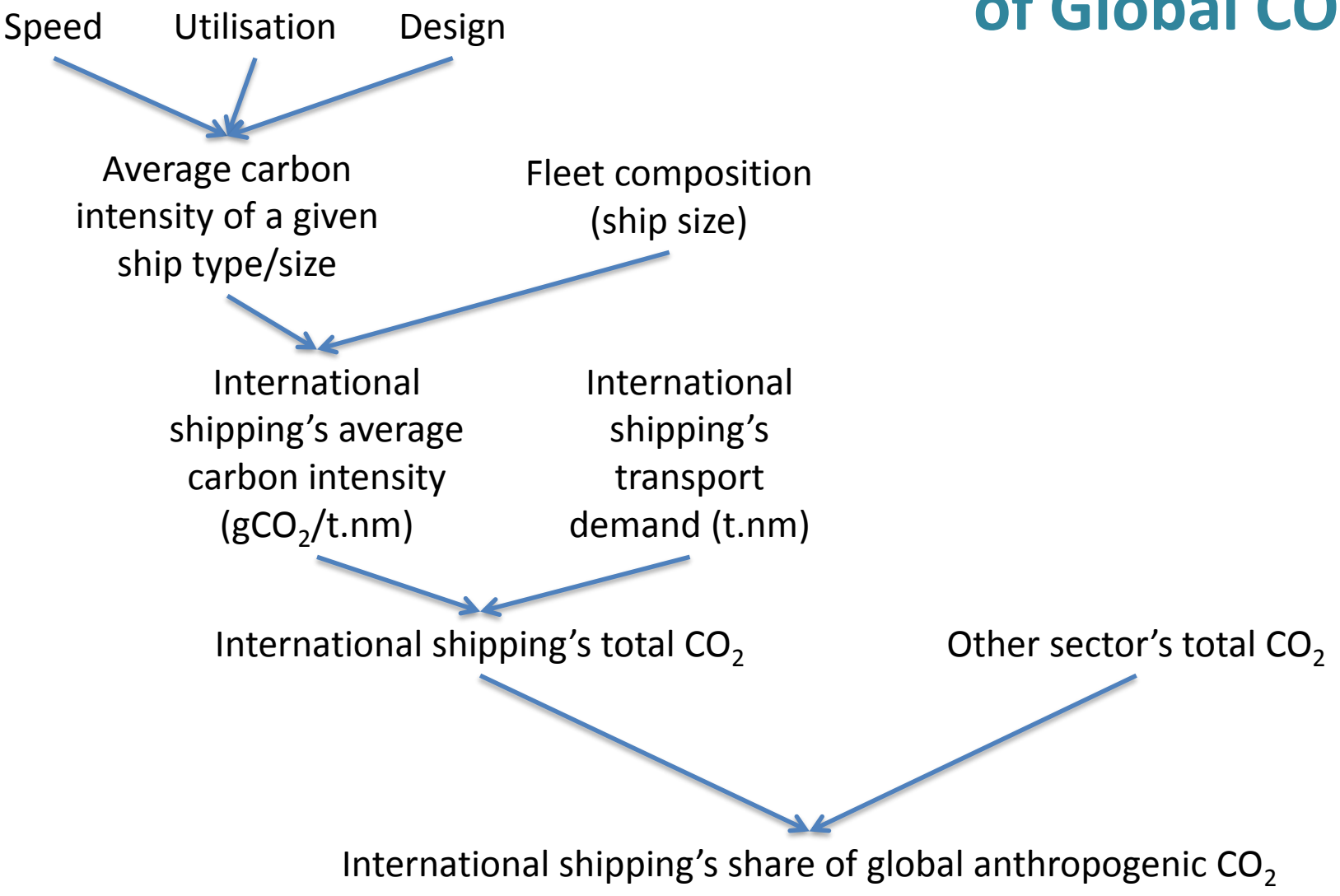
Source: Smith et al, 2014

Over the past 150 years the energy source for world shipping has changed from wind to coal to Diesel and Heavy Fuels Oils.

New energy sources are emerging and could change the face of future shipping.

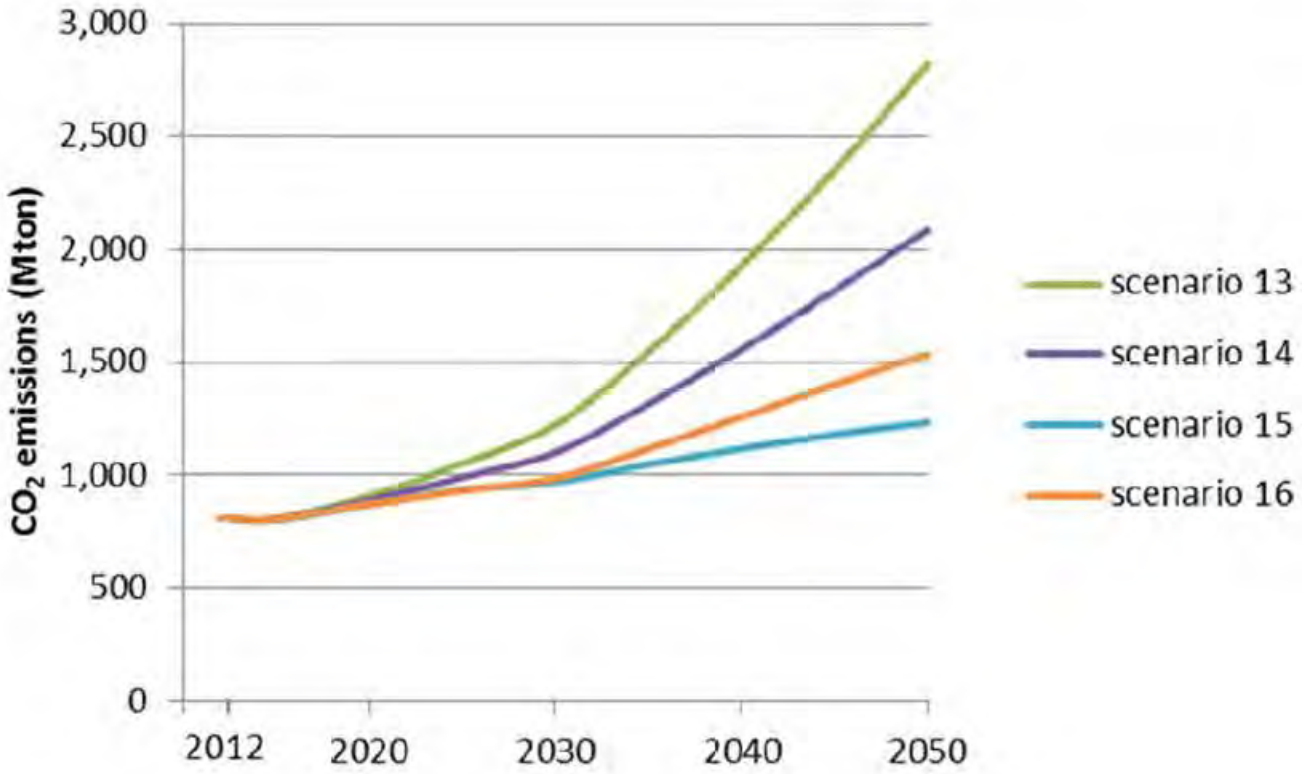
Source: Rolls Royce, 2014

How do we Calculate Shipping's Contribution of Global CO_2?



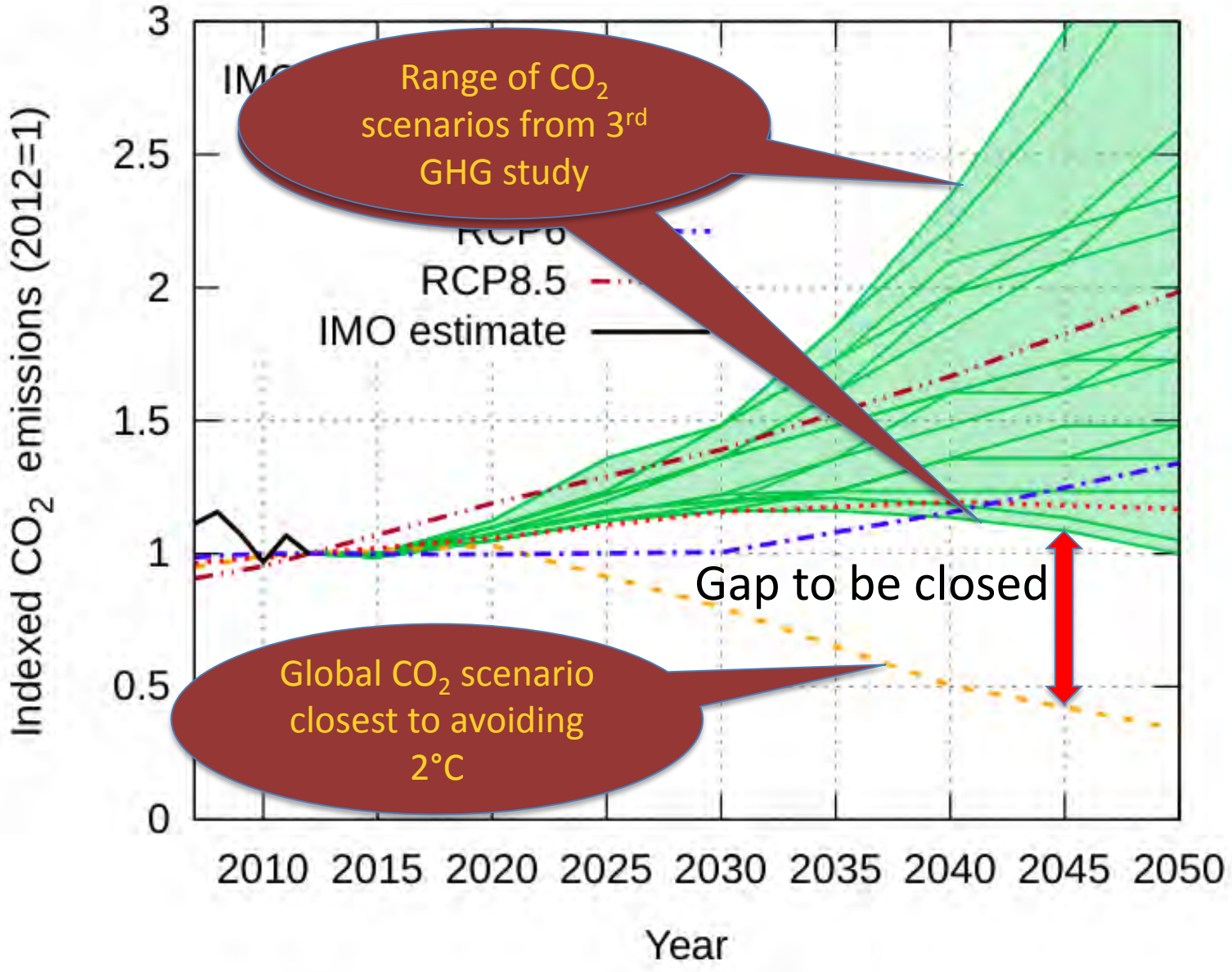
Source: Bows-Larkin, et al (2015) *CO_2 Targets, Trajectories and Trends for International Shipping*

BAU Projections of CO_2 Emissions from International Maritime Transport 2012-2050



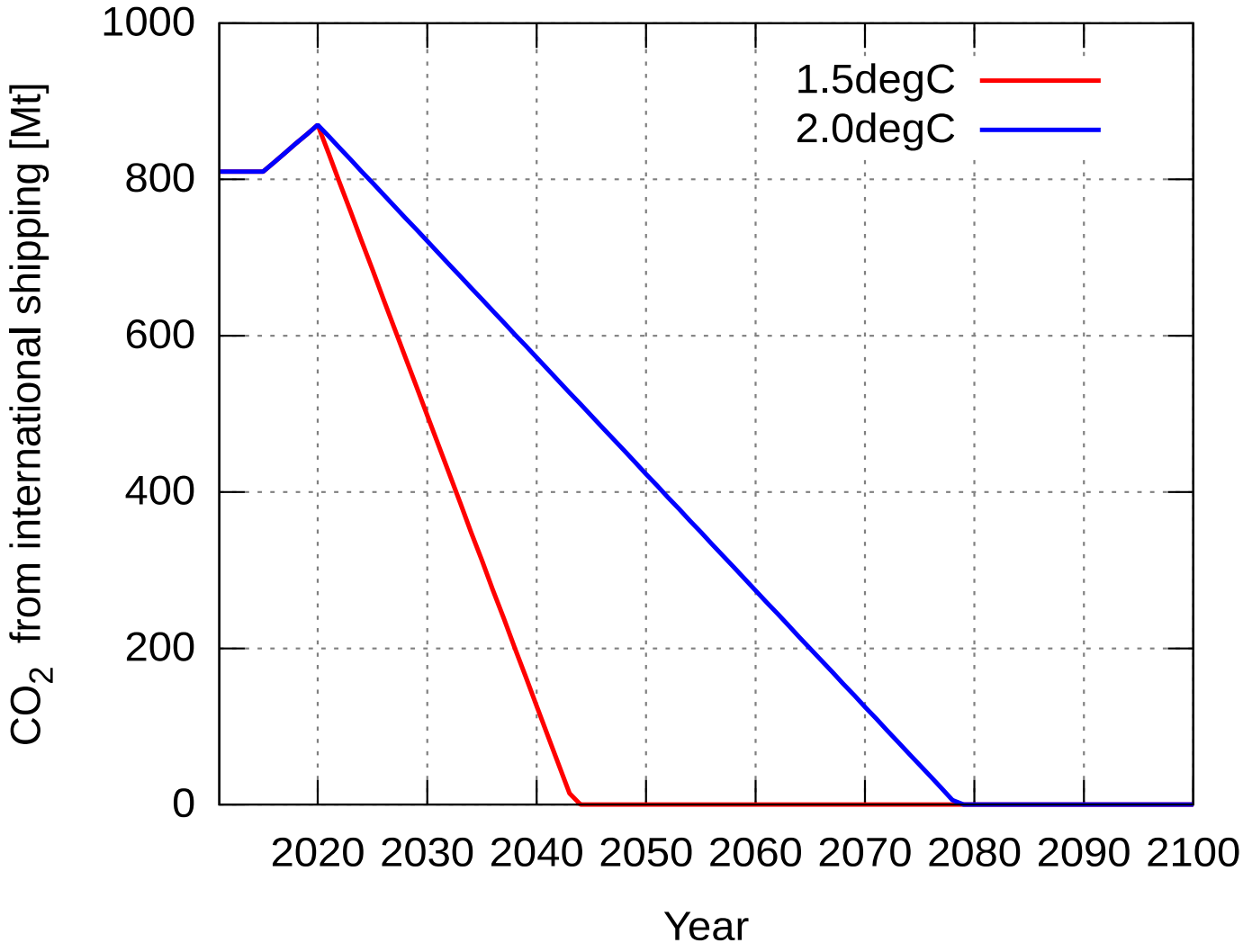
Maritime CO_2 emissions are projected to increase significantly. Depending on future economic and energy developments, these four Business As Usual scenarios project an increase of between 50% and 250% in the period up to 2050.

Source: Smith et al, 2014



Source: Bows-Larkin et al., 2015, Shipping charts a high carbon course, *Nature Climate Change*, 5, 293-295.

CO_2 Budgets and Targets for Shipping



Assumptions:

Uses global CO_2 budgets.

Estimates shipping proportion using 2-3% of global.

Assumes 5 further years of growth.

Highly stylized – if emissions do not reduce this quickly in early years – more will be needed later.

Source: Bows-Larkin, et al (2015) *CO_2 Targets, Trajectories and Trends for International Shipping*

Conclusion

- For shipping to remain at a 2-3% share of global CO_2 totals , emissions will need to peak soon and then rapidly decline.
- Because of expected rising demand, this could mean fleet average EEOI's reducing to 10% of 2012 average by 2050 if global warming is not to exceed 2 degrees.
- 1.5 degrees sets an even more stringent objective and could require a zero carbon shipping industry by 2045.
- Acknowledging recent trends and regulations, and allowing for discussion on what is a 'fair' for shipping, a significant challenge remains for shipping.
- The sooner the planning starts for the inevitable transition, the less rapid the required rate of change.

Disclaimer

This module has been prepared for UNCTAD by Peter Nuttall and Alison Newell of the Pacific Centre for Environment and Sustainable Development, the University of the South Pacific. While every effort is made to ensure the accuracy and completeness of the module, UNCTAD assumes no responsibility for eventual errors or omissions. The content and views expressed are those of the authors and do not purport to represent any organisation.