



Port  change

E-BOOK

JUST IN TIME SAILING

Reduce fuel consumption and CO2 emissions **every port call**

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The Industry's relevance to world trade

The shipping industry being the backbone of world trade is no secret, metaphorically. International shipping carries a whopping 83% of total global traded volume - 11.08 billion tons in 2019 (UNCTAD 2020), attests to the significance of this industry in fueling prosperity across the globe. Businesses and consumers in every corner of the world rely on maritime transport as an essential link of their supply chain needs. World seaborne trade has increased in volume and value steadily over the last many decades. Every small step taken towards improving efficiency in shipping translates to better economics of trade and a more competitive market accessible to the remotest of places in the world.

Collateral Damage – Shipping's carbon footprint

Shipping is, essentially, a mode of transport and to move those enormous loads across the not so forgiving oceans is a herculean task requiring a lot of energy. This energy is derived from, in most cases, fossil fuels, just like the large proportion of the transportation industry. The use of these fossil fuels generates greenhouse gas emissions that contribute to global warming and climate change. This is a negative externality of the shipping industry, which has been of prime concern in recent years that needs to be addressed from multiple fronts.

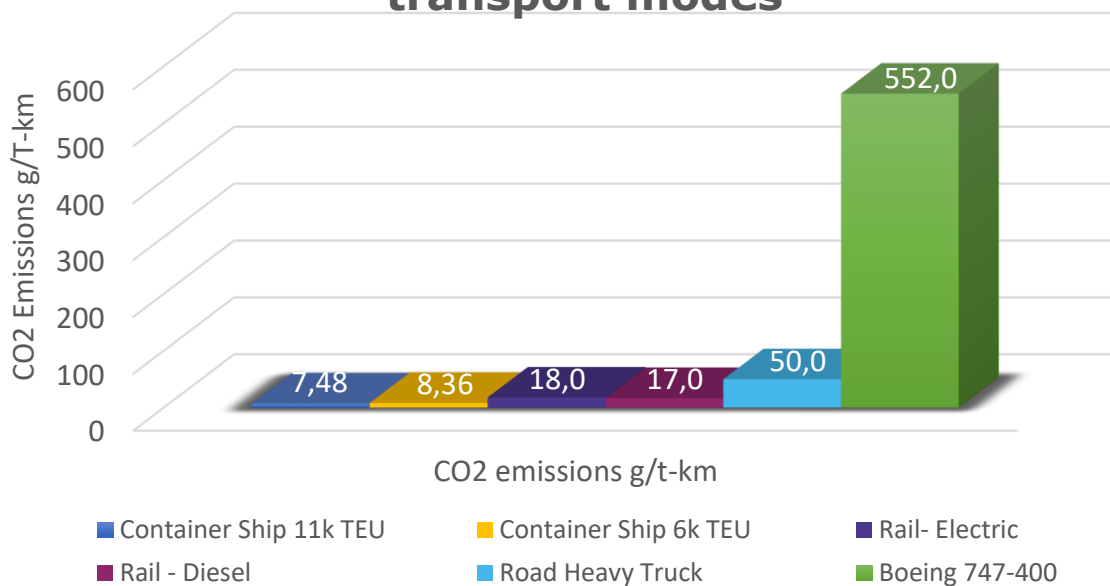
In 2018, GHG emissions from the shipping industry (including carbon dioxide,

methane, and nitrous oxide) were pegged at 1,076 million tonnes (CO₂ equivalent tonnes), which is 2.89% of global emissions. To put that in perspective, if international shipping were a country by itself, it would be the 6th largest emitter of GHG emissions.



It is important to note here that the growth in emissions from shipping was highly correlated to seaborne trade growth until 2008. However, post-2008, there has been a de-coupling of growth in emissions and seaborne trade with emissions growing, nevertheless, but at a much slower pace than the demand for shipping itself. This trend is continuing, and there has been a growing industry-wide discourse on reducing the carbon intensity of shipping. Amongst all the gloom, it is worthwhile to note that shipping has been one of the most efficient modes of transport in terms of fuel efficiency and carbon intensity. This has been established in multiple academic studies, and the figure below captures this quite aptly.

CO2 emissions comparison of freight transport modes



Source: Adapted from Dekker, et al. (2012)

This high level of fuel and emissions efficiency will drive higher proportions of trade volumes to the shipping industry. In absolute terms, that puts a lot of pressure on total emissions from the industry to be continuously on the rise. While emissions from the shipping industry are not subject to limitations and reduction commitments of the UNFCCC and the Kyoto Protocol or other international conventions, the sheer quantum of emissions from the industry calls for much needed attention and concerted efforts.

Drivers of change and the need to change

First and foremost, shipping is a derived demand. An overarching need to continually innovate and make global supply chains efficient drives the need to make shipping and the ship-port interface as optimized as possible. This optimization itself is driven by a number of interwoven factors:

Geo-Politics is a key driver of change and innovation in the shipping industry. Regional stand-offs and most-favored nation (MFN) principles from a policy stand-point severely affect sea-borne trade demand. With these changes (often unprecedented) come long term effects on the logistics chain where variations in asset utilization can hugely impact the bottom line. This creates a demand for new trade lanes and also a reduction of volumes on certain trade lanes. Such measures drastically change the carbon footprint (from transportation) attached to a particular product. A case in point is the recent diplomatic stand-off between Australia and China on the imports of coal. As a result, we have increased shipments of coal on the Indonesia-China trade lane. That translates to at least a 4-day reduction in the voyage and a proportionate ton-mile reduction. To carry the same amount of cargo a typical panama bulk carrier would have burnt around 200 MT less fuel and 620 MT of CO2 emissions less on this shorter voyage.

Economics of transport – While trade pundits might argue that geopolitics is not within the control of the shipping industry per se, the costs and efficiency of transport surely are. The market is extremely competitive and shaving off every cent in costs can have a big effect on any company's bottom line. Newer ships tend to be more fuel-efficient and, as a result, have a smaller carbon footprint than older ships. Economies of scale is an old trick in the book to leverage cost efficiencies. Bigger ships can carry far more cargo than smaller ships do, but do not necessarily need a proportional increase in fuel consumption.

Societal demands – Societies and consumers are becoming increasingly aware of the role of shipping in their lives. How many times have you driven on a highway without spotting a container? More importantly, consumers are keen to know the carbon footprint of the goods they consume. Sustainability goals are high on the agenda of all corporates, and they often use carbon footprint as a key criterion in selecting transport partners.

It is worth noting that with the launching of the Poseidon Principles in 2019 by leading ship financiers, ship financing also has entered the fray of making shipping a sustainable industry. This was followed by the signing of the Sea Cargo Charter in 2020 by leading charterers providing a global framework for aligning chartering activities in shipping with responsible environmental behavior.

Technological developments – It is no longer possible to hide behind the veil of inadequate technology to improve efficiency. The ever-expanding landscape of real-time information sharing, tracking,

and optimization has been used in manufacturing for some time already. Every facet of operations in industries can be monitored and improved by the use of digital technologies. The shipping industry might seem to be laggard in this respect, but its customers are now turning their attention towards digitalizing the sea-leg of their logistics chain.

Environmental needs – This is probably the most important driver for change in the industry and very much defines us at PortXchange. Increasingly, around the globe, governments and societies are recognizing the dangers of global warming and climate change. As mentioned earlier, the shipping industry's carbon footprint is a sizeable one. The fragmented and dispersed nature of players in the industry makes taking concerted action all the more difficult. We, at PortXchange, are up for this challenge and create digital solutions for the industry to achieve your environmental goals and those set by international bodies in this sphere. Most notably, the IMO has stepped up to lay down a GHG reduction strategy for the industry that stipulates a 50% reduction in emissions by 2050 (from 2008 baseline levels). At this point in time, this quantum of reduction will still be congruent with a 2 degree rise in global temperatures.

Do we have a choice to not take action? Most certainly not. In a business as usual (BAU) scenario from 2018 levels (other socio-economic pathways and representative concentration pathways defined by the IPCC), emissions from shipping in 2050 are projected to be 90-130% of 2008 levels. So, we need to take action, and we need to do it together fast!

The options at hand for bringing about the needed change

The options we have as an industry to reduce GHG emissions can be broadly put into 3 buckets – Long-term measures, Medium-term measures, and Short-term measures. Let's discuss in brief some of the most important ones and what these entail:

Long-term measures

Alternative fuels (zero carbon) –

This is the single most effective measure to stem the industry's emissions. A large array of zero-carbon fuels are currently being tested and piloted. These include hydrogen, ammonia, methanol, and biogas. The shift to an alternative fuel is not just a technological and engineering challenge but also one of the political and economic ramifications.

Solar-powered, wind-powered, kites and also battery-powered ships are being tested and developed. At this point in time, the answer as to the sustainable replacement of fuel oil is not yet known. Almost all of these alternative fuels mentioned above are not capable of powering a conventionally sized cargo ship (at the time of writing this article).

Medium-term measures

Alternative fuels (LNG / LPG) -

While these fuels are still fossil fuels, they do offer a significant reduction in emissions (up to 24%) in comparison to the current stock fuel – heavy fuel oil. It should be noted that the capital costs involved in fitting (or retro-fitting) suitable engines can be high. Nevertheless, they

are seen as important transitional fuels before the long-term availability of zero-carbon fuels.

Lightweight construction and changing hull designs –

Most ships are currently built using high tensile steel. This can be replaced with other alternatives such as carbon fiber and aluminum. This will reduce the weight of the ship and thereby reduce energy needed to perform per unit of transport work. Similarly, a lot of research is being carried out in optimizing hull designs that will be even more hydrodynamic and offer lesser resistance to flow.

Hull coating – Another measure is reducing the frictional resistance by enhancing the smoothness of the waterplane area. Coating manufacturers have been trying to perfect this art for a while now, and the benefits of products available in the market keep improving with time. One could typically expect an abatement potential of 5% with a good hull coating.

Economies of scale (in size) –

There has been a steady trend in the increasing size of vessels, especially container ships. Until a few years ago, a 12,000 TEU ship was considered quite large. Those numbers have quickly ballooned to 24,000 TEU ships now. A larger ship consumes lesser fuel per tonne-mile of work done. While the constraints larger ships pose to the ports and terminals remain a matter of concern, this trend of growing sizes is here to stay until the limits of navigational safety are reached. Case in point, with oil tankers, the maximum sustainable size (22.5m draft) was reached in the mid-80's and remained there since, with a few exceptions of course.

Market-based measures – These are probably the most debatable measures of the lot. They can be designed as a simple carbon tax or a more complicated emissions trading scheme. Until now, their efficacy in an internationally operating industry such as shipping is not established. However, taking the view of the environment as a public good, then any negative externality should be compensated by the user (a very simplistic view, no doubt!). The social cost of carbon (SCC) assesses the value of the damage caused to the global economy when a user emits a tonne of CO₂ in the atmosphere. Different bodies peg this value at varying rates from \$36/ton to \$300/ton, and we will not get into the discussion of what is right or wrong. It is important to know that a higher carbon price surely disincentivizes users from emitting GHG emissions more than absolutely needed. The additional carbon cost will drive low-efficiency players out of the market and propel the industry towards finding longer-term solutions for the emissions conundrum.

Short-term measures or Operational measures

Trim optimization and weather routing – Trim optimization involves continually monitoring and shifting small amounts of ballast such that the most optimal trim is maintained at all times. This, in turn, drives an optimized fuel consumption. Weather routing, as the name suggests, is an advisory service that takes into account of the vessel's position, intended route, and the prevailing weather systems. On the basis of the expected weather conditions, the system proposes a route that would entail the least fuel consumption.

Propeller polishing and hull cleaning – These have become almost essential services to vessels and are typically performed every 6-8 months (hull cleaning) and 12 months (propeller cleaning). This cleaning aims to ensure the hull and propeller are smooth with minimum resistance and turbulence. A fouled hull and propeller can easily add 5% to the normal fuel consumption. Hence, this can never be overlooked.

Slow steaming – Slow steaming is the deliberate operation of ships at speeds well below their design speeds. This is a very effective measure to reduce fuel consumption. Also, it has long been used by industry operators as a way to reduce the supply of tonnage in the short term. As a rule of thumb, there is a quadratic relation between speed and fuel consumption. At higher speeds, a 10% reduction in speed could result in a 19% reduction in fuel consumption. It is important to note that the potential to reduce speed is limited to the technical specifications of the engine's operation. Sailing at "low-load" or "off-design" conditions for extended periods can cause engine damage.



A **10% reduction in speed** could result in a **19% reduction in fuel consumption**.

Just in Time (JIT) Arrivals – JIT arrivals is an amalgamation of slow steaming matched to required arrival time at a port/berth such that the vessel need not wait unnecessarily at anchor. A JIT arrival can also be optimized to the least fuel consumption. JIT arrivals is a well-established practice amongst supply chain practitioners and ubiquitous in manufacturing. Real-time operational data sharing is essential for operators to gain the most benefits from JIT. It not only saves money for the ship's operator, it also helps in reducing demurrage costs for terminals, idle time at berth, and helps in maximizing asset (including manpower) utilization at cargo terminals. It improves the overall safety in a port by reducing congestion in the anchorages. In doing all this, it also ensures the GHG emissions are kept to an absolute minimum. We, at PortXchange, want to ensure you get the most out of JIT arrivals and help your company reduce its carbon footprint.

Note: this is not an exhaustive list of measures, but only those that are most discussed currently in the industry.

Key advantages of Just in Time Arrivals

A good thing about Just in Time Arrivals is that all the stakeholders involved in the port call can take advantage of it. Because in the end, we all have a common goal – to improve the processes' efficiency and reduce the carbon footprint. Let's briefly look into the benefits per party:

Benefits for Shipping Lines

Bunker savings

Sailing at the optimal speed instead of hurrying up and waiting at the anchorage results in less fuel consumption. This translates directly to lower operational cost per box for a container shipping line. Ultimately adding to their bottom line.

Lower emissions

Lower bunker consumption directly correlates to emissions: the lower fuel consumption, the lower amount of CO₂ released in the air. With the shipping industry having a significant carbon footprint, the shipping lines are pushed to step up their game to meet the decarbonization targets.

Reduced idle time

A vessel is a cost center when it is idle and not en route transporting cargo. So, the shorter period the vessel is alongside, the more economical beneficial it is. With the JIT concept and all parties aligned on the activities, the overall idle time on both arrival and departure is reduced, resulting in better asset utilization.

Improved schedule reliability(SR)

A reliable schedule is the best way for a shipping line to run an efficient and uninterrupted network. Improved communication on vessel arrival time has a positive cascade effect on the entire port call planning, resulting in a more reliable and predictable overall schedule. A more immense benefit will come from the usage of the JIT concept on the majority of its fleet.

Benefits for Port Authorities

Safety

Reducing congestion in anchorages and in the absence of designated anchorages, reduce congestion in drifting areas. Moving around a huge vessel comes with navigational hazards. A risk of collision in congested areas is always looming. A risk that is quite effectively contained to a large extent (mitigated in some cases) with JIT arrivals.

Environmental impact

With not just shipping lines, however, countries are also looking at reducing the carbon footprint through multiple ways and especially to have more efficient ports. Trade boom can lead to a larger carbon footprint.

Infrastructure and personnel

In the shipping industry, operations personnel often allude to optimized capacity planning, which is precisely what JIT arrivals facilitate. Service levels and operational efficiency of individual tasks at every step of the port call will improve, which drive shorter port turnarounds. And this translates to trade competitiveness, which becomes crucial for businesses in deciding which ports are the more reliable and efficient in servicing their supply chain needs.

Benefits for Terminals

Idle time reduction & improved asset utilization

When all parties are informed and ready to perform their part of the process, idle time can be reduced significantly. For the terminal, this means that it can streamline vessel rotation time and improve its

operational efficiency. In fact, a terminal's adoption of JIT arrivals will help other actors (viz. pilots, tugs, ancillary services to the ship) in the port call process to improve their asset utilization and productivity by reducing the variability in their planning.

Improve competitive position

Terminals need to have a competitive advantage based on location, infrastructure, productivity, amongst other factors. Shipping lines are looking to reduce their emissions and unnecessary bunker consumption. If a terminal they collaborate with can help them achieve this, it is a critical competitive advantage. Not being able to react to the updated terminal planning costs time, money, and unnecessary emissions. With JIT arrivals, the above can be achieved because of the more reliable information on the vessel arrival, reducing unnecessary issues.

Reduce GHG emissions

The expectations from stakeholders across all businesses are slowly shifting from focusing solely on economic targets. Sustainability and emission targets also gain attention. By sharing information and using the same source of truth as all other parties in the port, terminals contribute to reducing CO₂ and NO_x emissions.

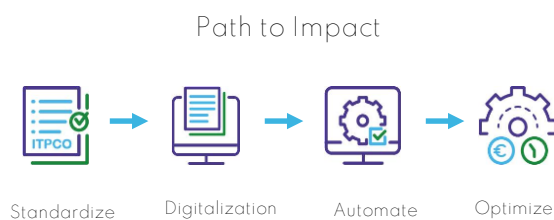
Benefits for other service providers

Efficient Services

Knowing the right time the vessels arrive with JIT, the service providers can ensure that they have the right services, personnel, and equipment available to serve their customers.

Just in Time Sailing: the path to impact

Just in Time sailing is the right thing to do, most people working in the maritime industry agree on that. Why let a ship hurry up and wait at the port? However, it is not happening in at least 50% of the port calls. In order to enable just in time sailing, there are some best practices we can share with you based on the experience we have built up over the past year at PortXchange.



Data standardization

A port call is a joint process in which different organizations are working together. Each of these parties works in their own operational systems, with their own operational procedures and their own definition of the key milestones in the process. How do you communicate to one another if you don't speak the same language? How do you know if a vessel has arrived at the berth, if you don't know whether the person you speak to means that that moment is the first line, all fast, or gangway down? It is very hard and it often results in miscommunication, unnecessary buffers and operational errors. Data standardization is the first step for any improvement project that involves measuring and optimizing processes. Without communication standards for

each milestone in the process, you may think you understand each other, but you are actually speaking different languages.

Fortunately, the maritime industry has done a lot of good work on this over the past years and communication standards for port call management have been developed and acknowledged by the IMO. The PortXchange platform works with these industry standards and helps port communities who want to start with port call optimization to adopt these standards.

Digitalization

Once process milestones are in the same language, we can let systems communicate to each other. Port master data can be combined with layers of planning and actual data from all parties involved in managing vessels going in and out of the port. Digitalization helps create a single point of truth for a port community. Instead of having to call each other, check 10 different websites and send emails back and forth, the status and location of each vessel approaching, in or leaving the port can be easily seen. Digitalization is a very powerful tool for optimization by better decision making based on real time information.

Automation

From the digital platform, things can be taken even a step further. Setting business rules and tolerances as a community, is the perfect basis for a more pro-active way of providing support to the operational staff managing port calls. Imagine if a vessel is planned to be

in the port at 14.00, however the machine learning model spots that she will not make it until 20.00 in the evening. This is very important information for all involved to know as early as possible. Services need to be replanned, the berth can be used for another vessel and there is no need to have pilots and tugs on stand-by.

Optimization

With the right information at hand, real time, 24/7, every professional managing port calls is well informed – and not only that – he/she is looking at the same information as the rest of the port community. This helps to make better decisions, earlier on in the process, with less bilateral communication.

Communication within the port community will always remain key. However, phone calls will be more efficient: rather than figuring out when the vessel is arriving at the port, operational professionals can discuss how to optimize the performance while having all the necessary information at hand and having reviewed different options.

Who should drive Just in Time Arrivals?

Terminals, port authorities, service providers, shipping lines, agents, and everyone involved in the port call need to be part of the process to drive Just in Time Arrival. Any missing link will lead to missing key information, which results in a lower impact. In other words: Just in Time Arrival needs to be driven by the industry.

The problem is, like with anything that has shared responsibility, you run the risk nobody takes ownership.

With PortXchange, we've launched a neutral platform created together with key players from the shipping industry. The platform is available for all ports and all trades, and the implementation is driven by – what we call – a coalition of the willing in every port, consisting of a group of organizations involved in the port call process. Shipping lines like to drive this change, as Just in Time Arrival, in addition to lower emissions, leads to lower bunker consumption and better communication resulting in safer port calls. Also, Port Authorities often take a leading role in this considering this part of their digital infrastructure leading to emission reduction and safer operation. The implementation of a digital platform enabling Just in Time Arrival goes hand in hand with a change in process to make sure the right impact is being made.

If you want to know more about PortXchange, and how we can help you release the benefits of Just in Time arrivals, we encourage you to get in touch with us or book you live interactive demo here: <https://port-xchange.com/live-demo/>

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