

**SCOPE 1 GHG EMISSION DATASET FROM LOGISTIC ACTIVITIES – A
CASE STUDY OF A FINISHED GOODS COMPANY**



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Independent Study Title Scope 1 GHG Emission Dataset from Logistic Activities – A Case Study of a Finished Goods Company

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ABSTRACT

United Nations Framework Convention on Climate Change (UNFCCC) defines the meaning of climate change as “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods”. Accumulation of “greenhouse gases (GHGs)” in the atmosphere causes the increase of global temperatures. GHGs, such as carbon dioxide (CO₂) and methane (CH₄), act as a trap holding heat closer to the Earth and not allowing it to radiate away. Transport sector is a large contributor of GHG emission as a result of fossil fuel-burning. GHG emission has risen to 7.5 billion tones in 2015 which represented 23% of CO₂ emission globally from fuel burning or approximately 18% of all CO₂ emission. An organization has vision of increasing more and more activities of production and sale but desire to maintain the same emission as today. This study focuses on collecting and analyzing data of transportation during import activities of a retail company, which sells sports equipment and goods. Energy-Based approach and Activity-Based approach are used in this study to calculate the amount of CO₂ emission.

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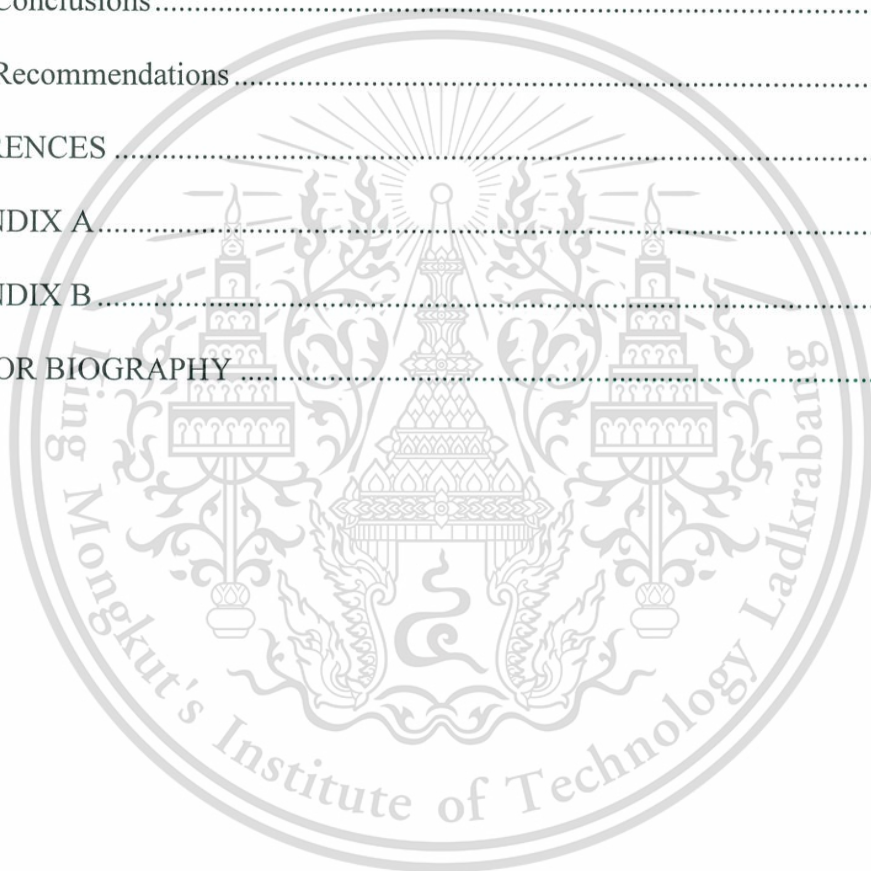
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LIST OF ACRONYMS

CEU	Car-equivalent units
CDP	Carbon Disclosure Project Greenhouse Gases
CO ₂ eq	Carbon dioxide equivalent
DWT	Deadweight
GHGs	Greenhouse gases
OECD	Organization for Economic Co-operation and Development



CHAPTER 1

INTRODUCTION

1.1 Research Background

United Nations Framework Convention on Climate Change states the meaning of climate change as “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods” (UNFCCC, 1992). An accumulation of “greenhouse gases (GHG)” in the atmosphere causes increase in global temperatures. Greenhouse gases, such as carbon dioxide (CO₂) and methane (CH₄), act as a trap holding heat closer to the Earth and not allowing it to radiate away. The average of global temperature has been increasing for the past 150 years (Figure 1.1). After decades of research and hundreds of studies, an overwhelming majority of scientists have come to believe that human activities, especially the burning of fossil fuels such as coal, oil and gas are a major cause of this trend toward higher temperatures (Public Agenda, 2007).

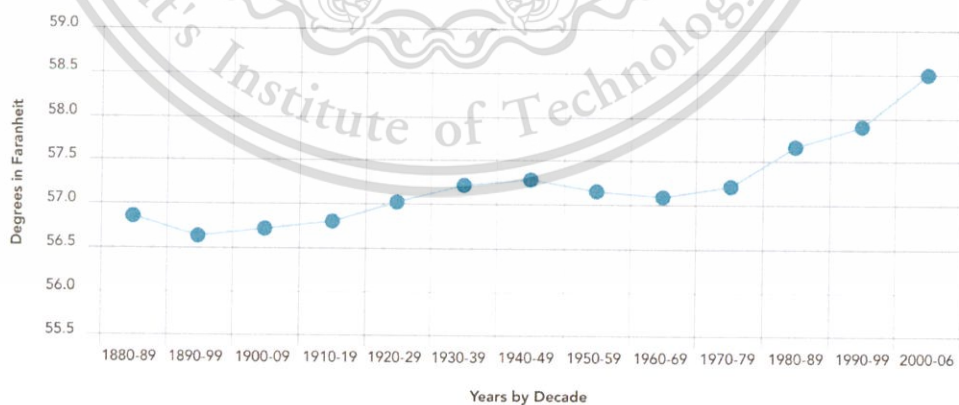


Figure 1.1 Global average temperature

Source: Public Agenda. (2007). Facing the Challenges of Climate Change. Retrieved February 2018, from https://www.publicagenda.org/files/globalwarming_guide.pdf

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Transport sector is a large contributor of GHG emission as a result of fossil fuel-burning. GHG emission has risen to 7.5 billion tones in 2015 which represented 23% of CO₂ emission globally from fuel burning or approximately 18% of all CO₂ emission. Figure 1.2 below shows the emission from transport sector compared to other sectors between Organization for Economic Co-operation and Development (OECD) countries and non-OECD countries (OECD/ITF, 2017)

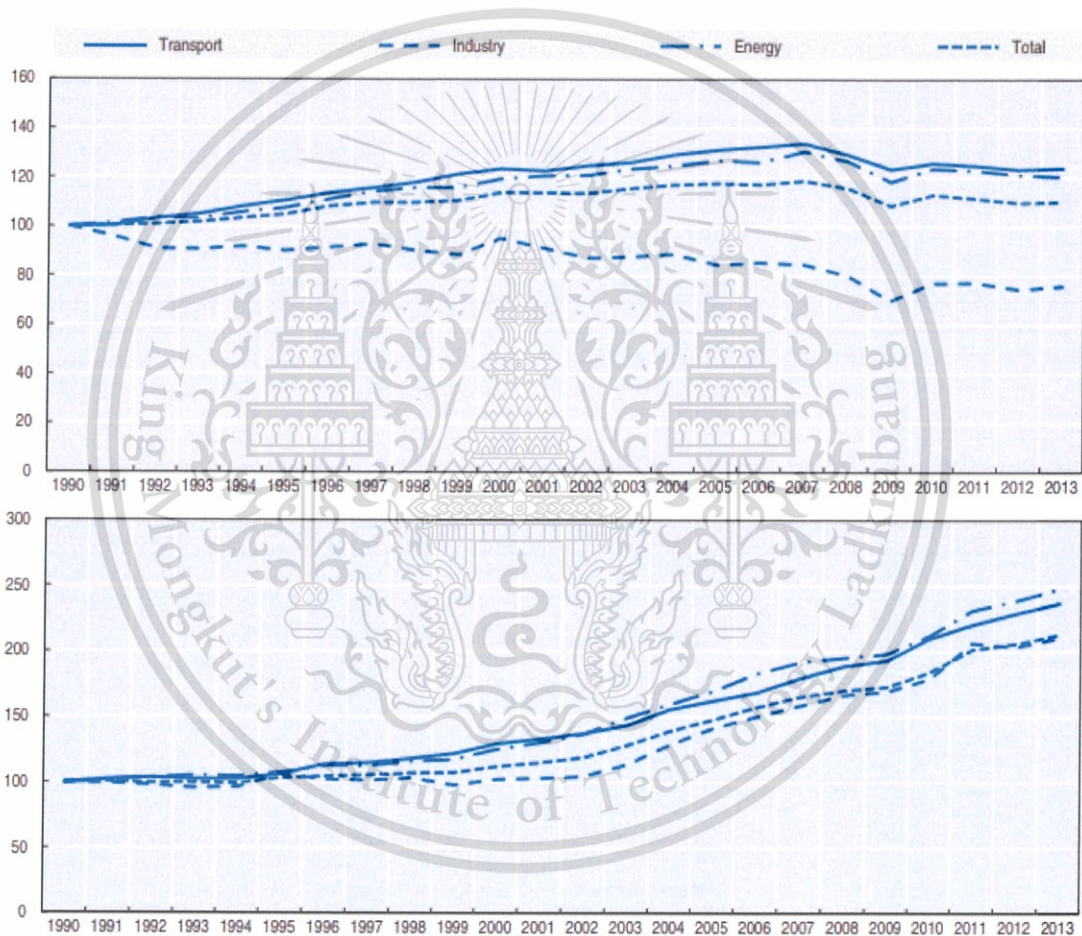


Figure 1.2 CO₂ emission OECD (top) and non-OECD countries (bottom)

Source: IEA (2016), CO₂ Emission from Fuel Combustion Statistics (database), <http://dx.doi.org/10.1787/data-00430-en>

International Transport Forum stated that the volume of emission is 60% higher than it was in 1990, and these emissions are overall growing more quickly than other sectors, especially in OECD countries.

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International Transport Forum mentioned that not only developed economies are facing difficulty in decarbonising their transport sector, but also the projected economic development of some countries. This situation demonstrates the magnitude of the challenge ahead globally. While the Paris Agreement does not refer transport clearly, however the topic of transportation has often been discussed and mentioned by several heads of state at the official and in several events. The necessity of decarbonising transport also appears in the Nationally Determined Contributions (NDCs), which frequently mention transport policies or the role of fuel-efficient technologies and alternative fuels. Some NDCs even mention specific targets for the transport sector. Thus, all countries must combine a wide range of policies including law and regulation, technology research in order to accomplish on climate target (OECD/ITF, 2017).

Generally the reports of carbon targets are often declared publicly for the purpose of Corporate Social Responsibility (CSR) and marketing reasons which are quite the opposite of many other targets that are essentially for internal consumption. In fact, carbon emission targets can be used as a form of 'competitive greenery'. In other words, the companies use their environmental credentials as a differentiator and try to outbid each other in terms of their future environmental performance. DHL, known as Amecan logistics and supply chain company, is one of the companies that use environment policies as part of strategies to compete with its competitors. DHL mostly uses subcontracts of approximately 80% of its transport. The company initially targeted to reduce CO₂ by 10% for its 'own transport' during 2007 to 2012, and by 2020 aims to reduce emission both in-house and contracted operations by 30% (McKinnon & Piecyk, 2014).

It is common for targets to be confined to the freight transport operation. This is understandable as it accounts for approximately 90% of all logistics related emission and government climate change policies tend to treat transport as a separate activity (World Economic Forum, 2009). Setting a target for cutting logistics-related GHG emission is a new experience for most companies. McKinnon & MI Piecyk advised that companies should make an effort to set carbon reduction targets for their logistics operations.

1.2 Problem Statement

An organization has vision of increasing more and more activities of production and sale but desire to maintain the same emission as today. As mentioned earlier that CO₂ emission from transport and logistics industries are large contributors of emission which is approximately 18% of all CO₂ emission and also growing more quickly than other sectors. Currently total CO₂ emission, especially in transportation activities of an organization is not achieving as planned since the more activities, the more emission will be generated. In order to be able to follow up and instruct planning of reduction, the calculation must be performed on regular basis at first place.

1.3 Objectives of the Study

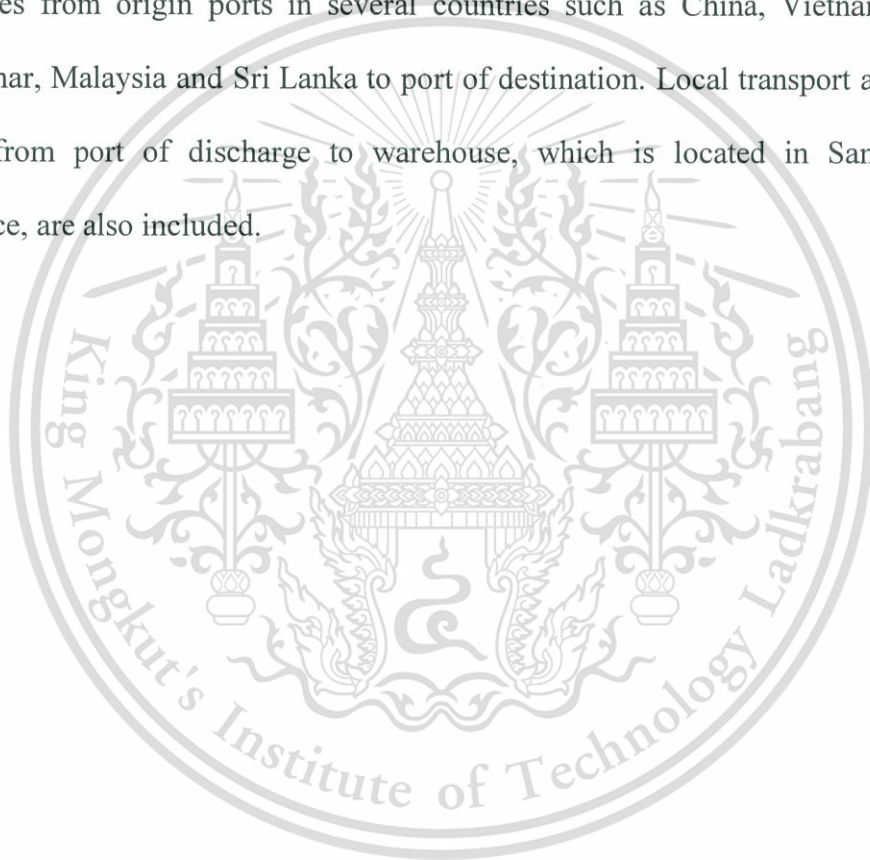
The objective of this research is to have a clear picture of current situation of amount CO₂ emitted from transport activities in one year to be the baseline in order to find solution to reduce emission in the future by:

- Collecting data to measure total CO₂ Emission.

- Identifying major causes of CO₂ Emission and providing advice for reduction.

1.4 Scope of the Study

This study focuses on collecting and analyzing data of transportation during import activities of a retail company, which sells sports equipment and goods. Data were collected from January to December 2018, which include international transport activities from origin ports in several countries such as China, Vietnam, Taiwan, Myanmar, Malaysia and Sri Lanka to port of destination. Local transport activities by truck from port of discharge to warehouse, which is located in Samut Prakan province, are also included.



CHAPTER 2

LITERATURE REVIEW

The theoretical framework of this paper will be provided in this chapter and includes climate change and greenhouse gases. Also, emission from transportation of sea, air, rail and road will be discussed. Furthermore, the focus will be about carbon footprint and tools to calculate emission which is caused by transportation. GHG reduction for transport and logistic industries will be included at the end of this chapter.

2.1 Climate Change and Greenhouse Gases

The average global temperature has been increasing in the past 150 years. Based on researches and studies, it is believed that human activities, especially the burning of fossil fuels are a major cause of this trend towards higher temperatures (Public Agenda, 2007). Henderson and Rebecca M. also claimed in the studies of "Climate Change in 2018: Implications for Business" that world's temperature has been rising since the industrial Revolution (Henderson, 2018).

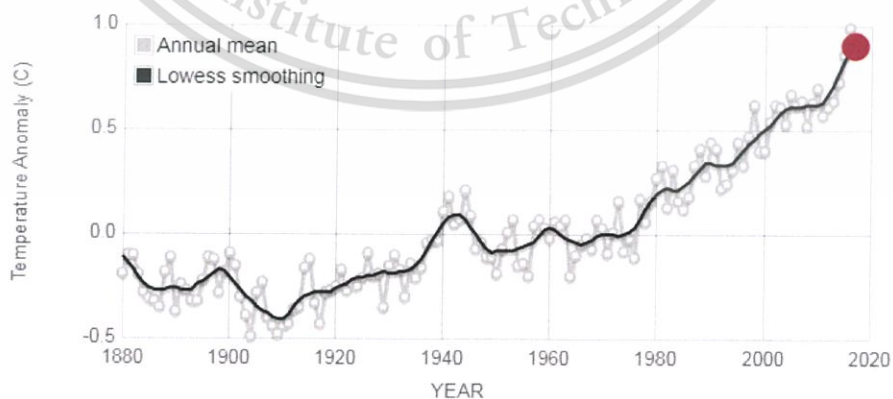


Figure 2.1 Global land-ocean temperature index, 1880-2017

Source: NASA's Goddard Institute for Space Studies (GISS). "Global Temperature", NASA website, <https://climate.nasa.gov/vital-signs/global-temperature/>, accessed July 2018.

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Figure 2.1 shows the risen of global temperature by 0.9 C° from the years between 1880 to 2017. World has reached the warmest year in 2016 since record keeping began. There is broad consensus among scientists community that this warming has been largely driven by increase of GHGs in atmosphere which is particularly caused by carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O). It is common that emission of GHGs are measured in equivalent units of CO₂ emission, or CO₂ eq, by indexing the 100-year global warming potential of each gas to that of CO₂. GHG emission has been growing since the Industrial Revolution, same as the rise in temperature and it was 60% higher in 2010 than it was in 1990 (Figure 2.2). Atmospheric CO₂eq concentration has increased from approximately 290 ppm to 430 ppm since 1990.

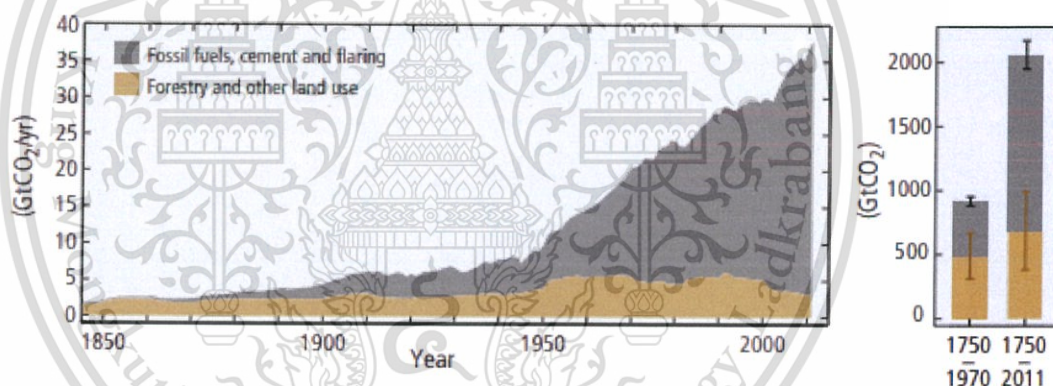


Figure 2.2 Atmospheric CO₂ emission 1850-2010

Source: Climate Change 2014 Synthesis Report Summary for Policymakers

Major sources which cause GHG emission are the activities of fossil fuel burning, especially coal, oil and gas, which are the consequences of clearing forest for agricultural and/ or other purposes. Precisely, consumption of fossil fuel for heat and electricity production generates approximately 25% of total GHG emission while agriculture, forestry, and other land uses (“AFOLU”) cause 24% of total GHG emission (Figure2.3).

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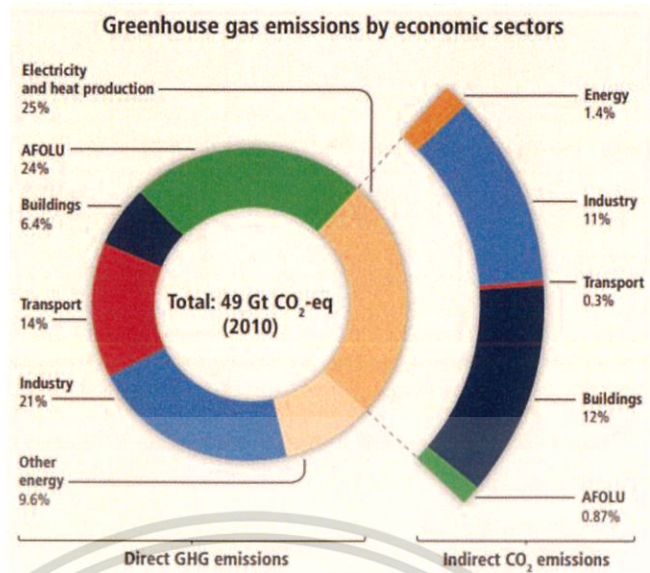


Figure 2.3 Global GHG emission by economic sector, 2010

Source: "Climate Change 2014 Synthesis Report Summary for Policymakers

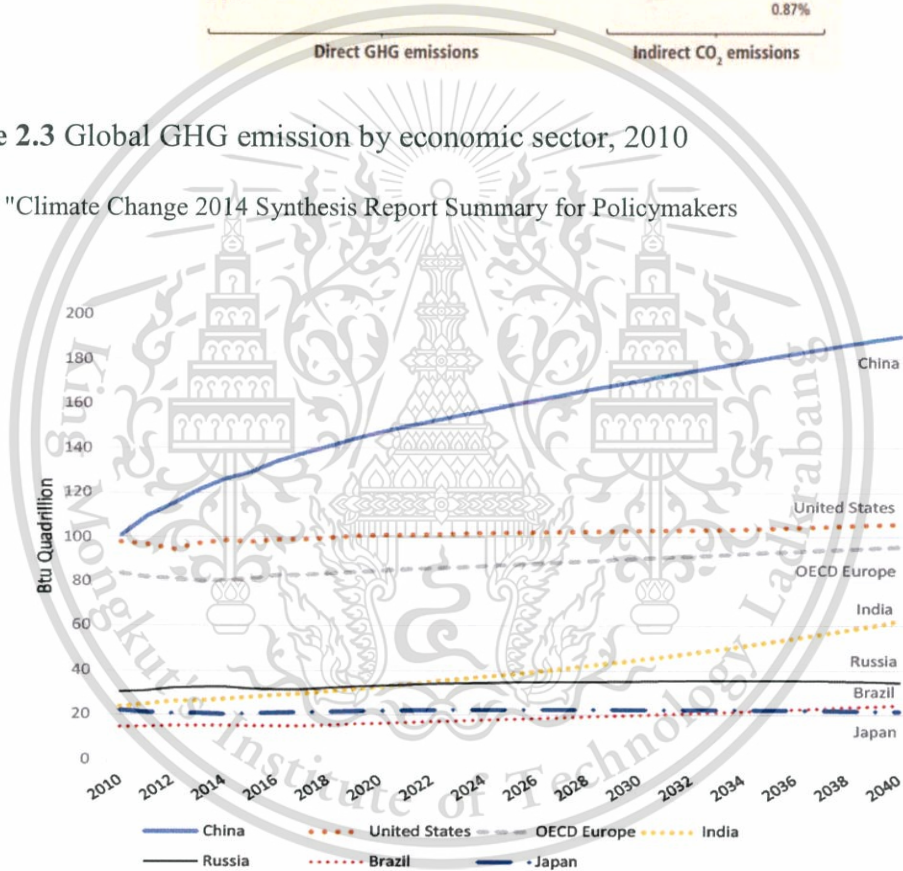


Figure 2.4 World energy consumption by region, 2010-2040

Source: "Climate Change in 2018: Implications for Business." Harvard Business School Background Note 317-032, October 2016. (Revised January 2018)

For other economic sectors such as industry, transport, other energy and building generate 21%,14%, 10% and 6% respectively (Ipcc, 2014). The increase of GHG Emission occurs widely across countries including developed and developing This material is reserved for educational use only, not allowed for commercial use.

countries, and it is predicted to increase continually as referred to in Figure 2.4 that energy consumption is growing from year to year (Henderson, 2018).

In Figure 2.5, Henderson Rebecca explained that “More of atmospheric GHGs will raise up temperature by increasing radiative forcing, or the amount of energy arriving on Earth's surface higher GHG concentrations increase the amount of radiation caught by the atmosphere and redirected back toward the surface. The difference between the rate at which energy arrives on the Earth's surface and the rate at which radiates back is the net heating, with this heat accumulating at and below the surface of Earth's oceans, land, and ice. Currently, the Earth retains approximately 816 terawatts of excess heat per year, or more than 50 times the world's entire energy consumption.” (Henderson, 2018).

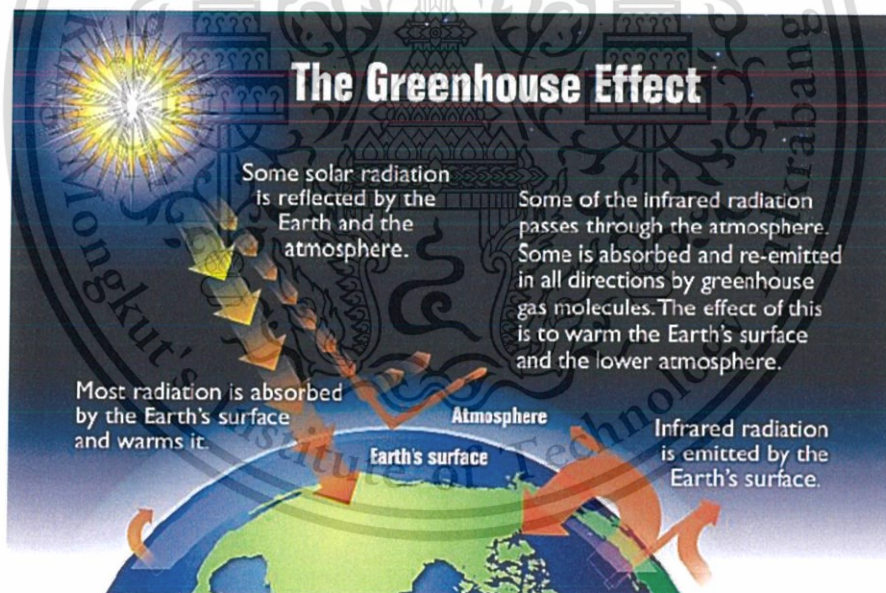


Figure 2.5 Radiative forcing and the greenhouse gas effect

Source: "Climate Change in 2018: Implications for Business." Harvard Business School Background Note 317-032, October 2016. (Revised January 2018)

Evidence of this retained heat leads to global warming and it is clearly visible in observations such as rising surface temperature, warming oceans, and melting ice.

It can also be summarized as:

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A. Global Warming: Rise in temperature induces many other changes such as cloud cover and wind patterns. Some of these changes may also act to enhance the warming in positive feedbacks and at the same time it may counteracts in negative way. In assessment report of "Intergovernmental Panel on Climate Change", by using complex climate models, it is forecasted that temperature will rise by 1.4 c° to 5.8 c° in 2100.

B. Sea Level Rise: Due to two different reasons, firstly, the thermal expansion of seawater and secondly, melting of glaciers and ice sheets of Greenland and Antarctica would also increase the amount of water in the ocean. In 2100, it is expected that the Earth's average sea level will rise from 0.09 to 0.88 meters.

C. Potential Impact on human life:

1) Economic Impact: More than half of human population lives within 100 kilometers of the sea. A rise of sea level will impact on economic from low lying coastal areas and islands, for examples, increasing the beach erosion rates along coastlines, rising sea level displacing fresh groundwater for a substantial distance inland.

2) Agricultural Impact: Research has shown that with higher concentrations of CO₂, plants and forest can grow faster. Though, the effect of global warming may affect the atmospheric general circulation and thus altering the global precipitation pattern as well as changing the soil moisture contents over various continents.

3) Effects on Aquatic systems: Fish population could reduce once loss of coastal wetlands, especially shellfish. Increasing of salinity in estuaries could also reduce the abundance of freshwater species but could increase the presence of marine species. However, the full impact on marine species is still unknown.

4) Effects on Hydrological Cycle: Higher temperatures would probably increase evaporation on earth. These changes would perhaps create new stresses for many water management systems (Ranveer, Latake, & Pawar, 2015).

2.2 Emission Caused by Transportation

According to latest estimation by the International Energy Agency (IEA), transport sector contributed approximately 23% of the total CO₂ emission globally. Direct emission from combustion fuels in transport sector from year 1971 to 2006 represents a rapid growing in share of total global emission (Schipper, 2009).

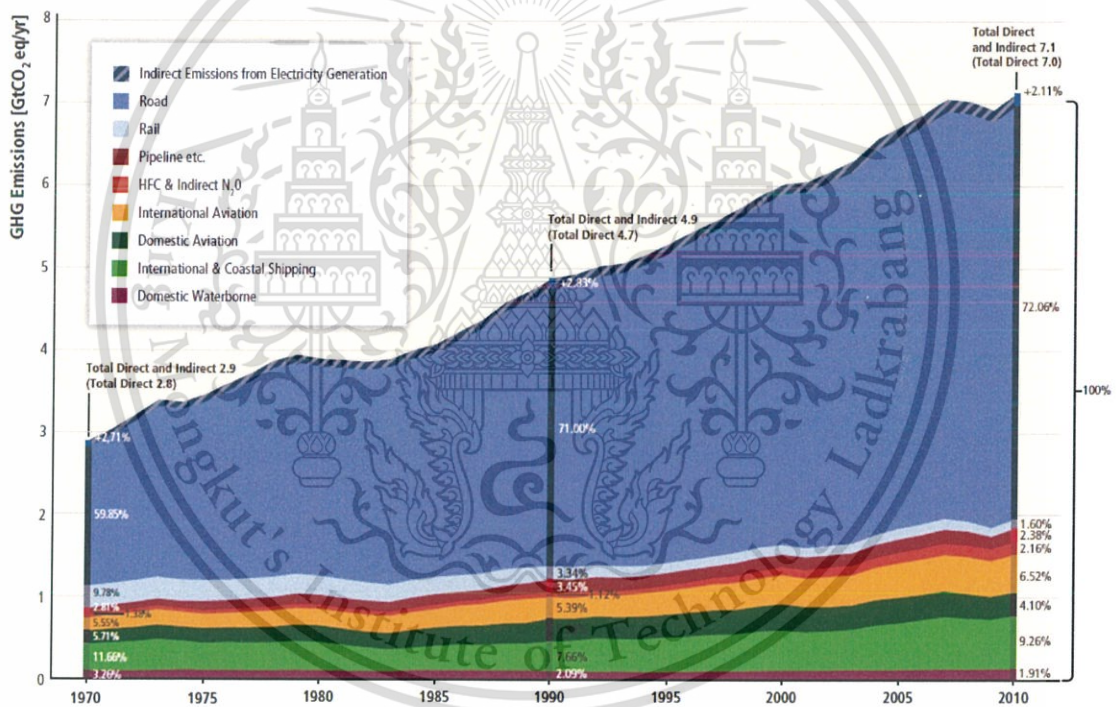


Figure 2.6 Direct GHG emission of the transport sector

Source: Schipper, L (2009). Transport and Carbon Dioxide Emission: Forecasts, Options Analysis, and Evaluation. Retrieved from Asian Development Bank: <http://hdl.handle.net/11540/1402>

Road transport is a major share of emission globally. It increased at a faster rate than any other sectors and have reached 7.0 Gt CO₂eq in 2010 with approximately 80% compared to other sectors (see Figure 2.6) (Sims & Lah, 2014).

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Specifically, road transport is accounted for more than two thirds of the CO₂ emission, while shipping accounts for 14% and aviation 11%. The difference in emission between passenger transport and freight transport is not always taken into account. It can be estimated for road transport by using fleet composition, fuel consumption and carbon intensity data from different countries. Figure 2.7 shows that freight transport accounts for 30%-40% of the road sector emission (Öster, 2011)

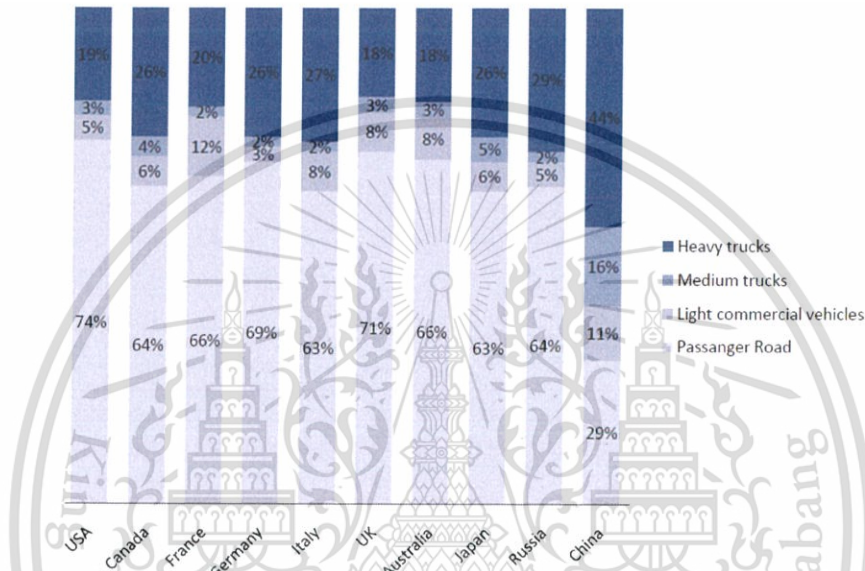


Figure 2.7 Road CO₂ emission freight, non-freight in 2005

Source: International Transport Forum, 2009

A growing transportation activity leads to increasing emission from transport, hence to reach a sustainable future, the increase must slow down and ultimately be reversed (Öster, 2011). Global transport industry, such as manufacturers of vehicles and transport service providers, undertakes research and development activities to become more carbon and energy efficient. In spite of lacking of progress currently, reducing GHG emission could arise from new technologies, policies, and behavioral change. (Sims & Lah, 2014).

2.3 Carbon Footprint

The concept of sustainability has received great interest in recent years and many companies have adopted the term in their vision and core values. Activities such as reducing packaging, using more fuel efficient transportation or requiring suppliers and forwarders to adopt environmental and social programs can at the same time reduce costs, reduce the environmental impact and improve corporate social reputation (Öster, 2011).

Managing the carbon footprint of products within the supply chain is the next step for individual companies to put in the effort in order to reduce carbon emission and mitigate climate change in order to achieve sustainabilities. Since the world has moved to a more carbon-constrained, businesses will have to maintain customers' needs but generate fewer carbon emission. All processes in manufacturing businesses cause emission, both production of goods and services provided to the customer. The complexity of the carbon footprint lay in the different dimensions and factors which influence the carbon footprint of a product, service, and supply chain or in a broader perspective of a nation or even to find a global carbon footprint.

The concept of carbon footprint described by Hertwich and Peters is as follows: "The concept of a carbon footprint captures the interest of businesses, consumers, and policy makers alike. Investors watch the carbon footprint of their portfolios as an indicator of investment risks. Purchasing managers are curious about the carbon footprint of their supply chains, and consumers are increasingly offered carbon-labeled products".

On a business level it is difficult to identify all originators, in a production or supply chain for example: a transportation vehicle needed to be produced, the factory where the vehicle is produced has to be built as well as the machine assembling the

vehicle and the track or the road the vehicle is moving must be constructed and so on. All of these processes are causing CO₂ emission in both direct and indirect way and it has to be considered. Consequently, to find the carbon footprint of a product or service might be more difficult than it seems (Carbon Trust, 2006).

Carbon footprint can be categorised into three main types of GHG scopes, as presented as Figure 2.8:

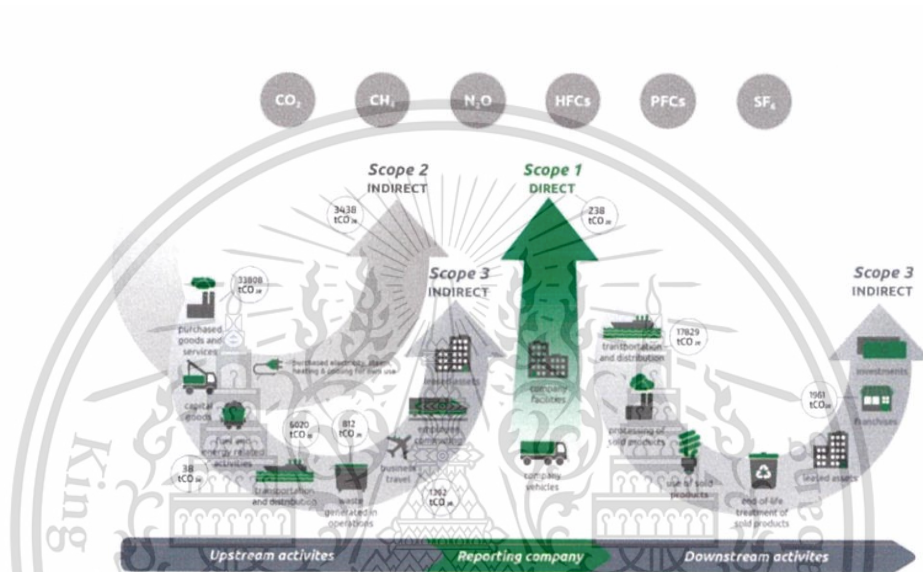


Figure 2.8 Diagram of scope by source

Source: GHG Protocol, 2001

- SCOPE 1- Emission from burning of fossil fuels (for heating, gas boilers for hot water, or fuel for vehicles), including fugitive emission such as refrigerant leakages from air conditioning plant and equipment.
- SCOPE 2- These are the indirect emission (upstream) from importing electricity, heating and lighting systems.
- SCOPE 3- Emission from activities such as waste generation, staff commuting, paper use, accommodation, food, , etc. The boundary of this scope generally only includes what the business can quantify and influence (Favacho, 2016).

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To include environmental aspects into a company's demand forecast and to measure and control the carbon footprint across the supply chain is indeed challenging. To calculate the carbon footprint, mostly a life cycle assessment or an input-output analysis is used. This paper will focus on calculating scope 1 GHG emission caused by transportation of goods, and will be mentioned further in next section.

2.4 Methods of CO₂ Calculation of Emission

The calculation of CO₂ emission can be basically based on several different approaches, but most common for all kind of transport modes are: one based on energy consumption and the other on level of transport activity (McKinnon & Piecyk, 2010). The aim of these two methods is not to calculate the total carbon footprint of freight transport operations but only emission from the fuel which is burned from engine of the transport vehicle itself (DEFRA, 2010).

2.4.1 Energy-Based Approach

The most accurate and simplest way to calculate CO₂, especially for carrier or transport companies, is to record energy (or fuel) use and employ standard emission factors to convert energy (or fuel) values into CO₂ emission. The unit of energy will be litres for road and sea transport, and kilowatt hours for electrified rail and pipeline (McKinnon & Piecyk, 2010).

Since carrier and transport companies are able to access data of fuel consumption, therefore they are more encouraged to collect such data in order to use this approach. Every liter of fuel consumed will result into a certain amount of CO₂ emission with method of activity-based by using the following formula:

$$\text{CO}_2 \text{ emission} = \text{fuel consumption} \times \text{fuel emission conversion factor}$$

$$[\text{Tonnes CO}_2\text{-emission} = \text{liters} \times \text{kg CO}_2 \text{ per liter fuel} / 1,000]$$

It is important for companies to use the accurate emission conversion factor as shown in Table 2.1 below for the different types of energy or fuel being consumed (Cefic-ECTA, 2011).

Table 2.1 Well-to-wheel fuel emission conversion factors

Fuel type	Kg CO ₂ /liter	Kg CO ₂ /kg
Motor Gasoline	2.8	
Diesel Oil	2.9	
Gas Oil	2.9	
Liquefied Petroleum Gas (LPG)	1.9	
Bio gasoline	1.8	
Biodiesel	1.9	
Compressed Natural Gas (LPG)		3.3
Jet Kerosene		3.5
Residual Fuel Oil		3.5

Source: Cefic-ECTA. (2011). Guidelines for measuring and managing CO₂ emission from transport operations. Brussels: Cefic-ECTA.

The Table 2.1 shows that Biofuels have lower emission factors than fossil fuels such as diesel and gas oil by approximately 50%. It is compulsory by Law in some countries, such as Germany, to use a percentage of Biofuels with fossil fuels. So once fuel is a blend of conventional fuel and Biofuels, the value of the conversion factor shall be calculated by share of weighted of each component in the blend.

As most transport operations may use outsourced or subcontracted companies. If access to subcontractor's fuel consumption data is unavailable, therefore a calculation using the activity based approach would be more preferable (Cefic-ECTA, 2011).

2.4.2 Activity-Based Approach

There is a possible way to roughly estimate CO₂ emission for transport operations if energy consumption data is not available and it is by applying an activity-based calculation method with following formula (Cefic-ECTA, 2011):

CO₂ emission = Transport volume by transport mode x average transport distance by transport mode x average CO₂ -emission factor per tonne-km by transport mode

[Tonnes CO₂ emission = tonnes x km x g CO₂ per tonne-km / 1,000,000]

Data of tonnes of transport volumes can be accessible from company's record or EPR systems while software such as MapPoint and Autoroute can provide data estimates of average distance of customer locations for road transport. The same as EcoTransit online which is a tool used to obtain distance data for rail and water transport. In the case of intermodal transport, route and the distance split between different transport modes are unknown, thus carriers are required to provide this information, though the EcoTransit tool provides approximate routing and distance data for intermodal flows specified by the user (McKinnon & Piecyk, 2010).

The choice of CO₂ emission factors for each transport mode is one constraint to resolve in applying the activity-based approach. These are generally expressed as grammes of CO₂ per tonne-km. In 2010, Mckinnon mentioned that "It is necessary to rely, therefore, on the numerous studies that have been undertaken in Europe over the past decade to estimate emission factors for the general movement of freight by different modes". Consequently, it is significant to select the most appropriate emission factor values for each transport mode which will be discussed in following section.

2.4.3 Emission Factors for the Different Transport Modes

Actual transport activities is the starting point of activity-based approach where normally the calculation is based on the set of data such as weight of goods transported, length of haul and transport mode (Öster, 2011). It could be a more accurate approach if include others factors, for example (Cefic-ECTA, 2011):

- The load factor (payload) i.e. the capacity of each transport unit;
- The share of empty space within transport;
- The energy efficiency of the vehicle, train or vessel. This may depends on many others factors such as engine design, characteristics of the vehicle, driving behavior, average speed used, traffic, road infrastructure, etc;

To obtain an accurate estimate of the emission when using an activity based approach, factors such as loading factor and transport routes must be known. The following section identifies the assumptions made by McKinnon in determining the average CO₂-emission factor values for each mode of transport. By identifying the rationale behind these average values, individual companies are recommended to select the most appropriate values for better reflect their individual company situation or company to take into account the reduction effect as a result of specific company measures such as increasing payload, reducing the portion of empty running (Cefic-ECTA, 2011).

A. Road

The average CO₂-emission factor for road transport operations is 62g CO₂/tonne-km which is based on an average load factor of 80% of the maximum vehicle payload and 25% of empty running truck. It is recommended to individual to use emission factors that better reflect the specific characteristics of their supply

chains, products and customer base, by taking into account different payloads and levels of empty running (see Table 2.2 below) (Cefic-ECTA, 2011).

Table 2.2 Carbon emission factors for 40-44 tonne trucks,

load tonnes	% of truck-kms run empty										
	0%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%
10	81.0	84.7	88.8	93.4	98.5	104.4	111.1	118.8	127.8	138.4	151.1
11	74.8	78.2	81.9	86.1	90.8	96.1	102.1	109.1	117.3	127.0	138.6
12	69.7	72.8	76.2	80.0	84.3	89.2	94.7	101.1	108.6	117.5	128.1
13	65.4	68.2	71.4	74.9	78.9	83.4	88.5	94.4	101.3	109.5	119.3
14	61.7	64.4	67.3	70.6	74.2	78.4	83.2	88.7	95.1	102.7	111.8
15	58.6	61.0	63.8	66.8	70.3	74.2	78.6	83.7	89.7	96.8	105.3
16	55.9	58.2	60.7	63.6	66.8	70.5	74.6	79.5	85.1	91.7	99.7
17	53.5	55.7	58.1	60.8	63.8	67.2	71.2	75.7	81.0	87.2	94.7
18	51.4	53.5	55.8	58.3	61.2	64.4	68.1	72.4	77.4	83.3	90.4
19	49.6	51.5	53.7	56.1	58.8	61.9	65.4	69.5	74.2	79.8	86.5
20	48.0	49.8	51.9	54.2	56.8	59.7	63.0	66.9	71.4	76.7	83.0
21	46.6	48.3	50.3	52.5	54.9	57.7	60.9	64.5	68.8	73.9	80.0
22	45.3	47.0	48.8	50.9	53.3	55.9	59.0	62.5	66.5	71.4	77.2
23	44.2	45.8	47.6	49.6	51.8	54.3	57.2	60.6	64.5	69.1	74.7
24	43.2	44.7	46.4	48.3	50.5	52.9	55.7	58.9	62.7	67.1	72.4
25	42.3	43.8	45.4	47.3	49.3	51.7	54.3	57.4	61.0	65.2	70.3
26	41.5	42.9	44.5	46.3	48.3	50.5	53.1	56.0	59.5	63.6	68.5
27	40.8	42.2	43.7	45.4	47.3	49.5	52.0	54.8	58.1	62.1	66.8
28	40.2	41.5	43.0	44.6	46.5	48.6	51.0	53.7	56.9	60.7	65.3
29	39.7	41.0	42.4	44.0	45.7	47.8	50.1	52.7	55.8	59.5	63.9

Source: McKinnon, A.C., Piecyk, M., 2010. Measuring and managing CO₂ emission of European chemical transport. Cefic, Brussels.

B. Rail

Emission factors of railfreight fall into the range between 7.3 to 23 g CO₂ /tonne-km, though most estimates lie within the range 15-23 (Table 2.3). These averages are influenced mainly by four factors (McKinnon & Piecyk , 2010):

- The split between diesel and electric haulag
- The carbon intensity of the electrical power source
- The energy efficiency of the locomotive
- Assumptions about train load factors.

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The emission factors can vary between countries depending on the carbon intensity of their electrical power and the split between electricity and diesel locomotives, making it difficult to establish a representative emission factor for the whole of Europe (Cefic-ECTA, 2011). The average of emission factor for rail freight is 22 g CO₂ / tonne-km.

Table 2.3 Published emission factors for rail freight (g CO₂/ tonne-km)

organisation	all rail freight	diesel-hauled	electric-hauled
ADEME	7.3	55	1.8
NTM	15	21	14
AEA Technology	20		
DEFRA	21		
INFRAS	22.7	38	19
TRENDS	23		
Tremove	26.3		
IFEU		35	18
McKinnon/EWS		18.8	

Source: McKinnon, A.C., Piecyk, M., 2010. Measuring and managing CO₂ emission of European chemical transport. Cefic, Brussels.

C. Maritime

Table 2.4 Published emission factors for maritime transport

	gCO ₂ / tonne-km	Source
Bulk ship		
Small tanker (844 tonnes)	20	DEFRA
Large tanker (18371 tonnes)	5	DEFRA
Small (solid) bulk vessel (1720 tonnes)	11	DEFRA
Large (solid) bulk vessel (14201 tonnes)	7	DEFRA
Container vessels		
Small container vessel (2500 tonnes)	13.5	DEFRA
Larger container vessel (20000 tonnes)	11.5	DEFRA
Average deep-sea container vessel (assuming mean 11 tonne load per TEU)	8.4	BSR/Clean Cargo
Deep-sea tanker (120,000 tonnes)	5	NTM
All Maritime	14	TRENDS

Source: McKinnon, A.C., Piecyk, M., 2010. Measuring and managing CO₂ emission of European chemical transport. Cefic, Brussels.

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Table 2.4 below, compiled by McKinnon, gives an overview of published emission factor values for different types of maritime vessels. For the average of deep-sea shipping is 8.4 g CO₂/tonne-km, for container shipping (based on a study carried out by Clean Cargo / BSR using a sample of nine deep-sea container shipping lines, making no allowance for the repositioning of empty containers) and deep-sea tanker operations is recommended to have an average emission factor of 5 gCO₂ / tonne-km. While for short-sea shipping, it is advised having an average emission factor of 16.0 g CO₂/ tonne-km (Cefic-ECTA, 2011). In addition, more differentiated information in respect of CO₂ emission factors associated with maritime shipping has been identified by IMO which has published emission factors for different categories of ships as shown in Table 2.5 (Cefic-ECTA, 2011).

Table 2.5 Estimates of CO₂ emission factors for cargo ships

Type of ship	Size	Emission factor (gCO ₂ / tonne-km)
Products tanker	60,000 + dwt	5.7
Products tanker	20,000-59,999 dwt	10.3
Products tanker	10,000-19,999 dwt	18.7
Products tanker	5,000-9,999 dwt	29.2
Products tanker	0-4,999 dwt	45.0
Chemical tanker	20,000 + dwt	8.4
Chemical tanker	10,000-19,999 dwt	10.8
Chemical tanker	5,000-9,999 dwt	15.1
Chemical tanker	0-4,999 dwt	22.2
LPG tanker	50,000+m ³	9.0
LPG tanker	0-49,999 m ³	43.5
LNG tanker	200,000+m ³	9.3
LNG tanker	0-199,999 m ³	14.5
General cargo	10,000+dwt	11.9
General cargo	5,000-9,999 dwt	15.8
General cargo	0-4,999 dwt	13.9
General cargo	10,000 + dwt, 100 + TEU	11.0
General cargo	5,000-9,999 dwt, 100 + TEU	17.5
General cargo	0-4,999 dwt, 100 + TEU	19.8
Refrigerated cargo	All	12.9
Container	8,000 + TEU	12.5
Container	5,000-7,999 TEU	16.6
Container	3,000-4,999 TEU	16.6
Container	2,000-2,999 TEU	20.0
Container	1,000-1,999 TEU	32.1
Container	0-999 TEU	36.3
Vehicle	4,000 + ceu	32.0
Vehicle	0-3,999 ceu	57.6
Ro-Ro	2,000 + lm	49.5
Ro-Ro	0-1,999 lm	60.3

Source: Second IMO GHG Study 2009

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D. Intermodal

Once a set of emission factors has been determined for individual transport modes, these values can be used to derive composite emission factors for intermodal operations. These composite values need to be weighted by the relative distances travelled for each of the modes in the course of the intermodal journey. Table 2.6 below shows a range of emission factors for different types of intermodal service with the road share of the total distance travelled in a range of 5% to 20%. Until more data is provided by intermodal operators, an average 10% of road feeder distance can be assumed (Cefic-ECTA, 2011).

Table 2.6 Composite emission factors for intermodal combinations

Intermodal combination	Road distance as % of total				
	5%	10%	15%	20%	
road-rail	average railfreight	24.0	26.0	28.0	30.0
	electrified rail (EU average)	21.2	23.3	25.5	27.6
	electrified rail (France)	10.0	12.8	15.5	18.2
	diesel rail	25.9	27.8	29.7	31.6
road-inland waterway	32.6	34.1	35.7	37.2	
road short-sea	ro-ro ferry - truck	49.7	50.3	51.0	51.6
	ro-ro ferry - rail	38.3	39.5	40.8	42.0
	small tanker (844 tonnes)	22.1	24.2	26.3	28.4
	large tanker (18371 tonnes)	7.9	10.7	13.6	16.4
	small bulk vessel (1720 tonnes)	13.6	16.1	18.7	21.2
	large bulk vessel (14201 tonnes)	9.8	12.5	15.3	18.0
	small container vessel (2500 tonnes)	15.9	18.4	20.8	23.2
	larger container vessel (20000 tonnes)	14.0	16.6	19.1	21.6
	all short sea	18.3	20.6	22.9	25.2

Source: McKinnon, A.C., Piecyk, M., 2010. Measuring and managing CO₂ emission of European chemical transport. Cefic, Brussels.

E. Airfreight

Emission factors for airfreight vary widely, reflecting differences in the length of haul and nature of the operation (Table 2.7). Two sources, WRI / World Business Council for Sustainable Distribution and NTM, have provided different emission

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factors for each distance range. As the mean length of haul for airfreight movements of 7000 kms, an average of the two long haul emission factors is 602 g CO₂ / tonne-km. (McKinnon & Piecyk , 2010)

Table 2.7 Emission factors for air freight transport

short haul	medium haul	long haul	source
1580	800	570	WRI/WBCSD (2003)
1925	867	633	NTM (2005)
	673		INFRAS/TRENDS (2004)

Source: McKinnon, A.C., Piecyk, M., 2010. Measuring and managing CO₂ emission of European chemical transport. Cefic, Brussels.

Table 2.8 Recommended average emission factors

Transport mode	gCO ₂ / tonne-km
Road transport	62
Rail transport	22
Barge transport	31
Short sea	16
Intermodal road/rail	26
Intermodal road/barge	34
Intermodal road/short sea	21
Pipelines	5
Deep-sea container	8
Deep-sea tanker	5
Airfreight	602

Source: McKinnon, A.C., Piecyk, M., 2010. Measuring and managing CO₂ emission of European chemical transport. Cefic, Brussels.

McKinnon also proposed set of carbon emission factors which is summarized in Table 2.8. These recommended emission factors are average values for the wide range of transport activities. It can be used to estimate the total carbon footprint of individual companies as default values. It could be preferable if companies are able to derive emission factors for their specific transport operations, reflecting the characteristics of their supply chains, products and customer base.

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International Maritime Organization has published and compared CO₂ emission of ships, which have efficiency loaded, with other modes of transport in Figure 2.9. This figure illustrates that gain in CO₂ efficiency can be achieved by increasing multimodal transport. When considering figures of this kind, the effect of cargo type should be considered. Heavy (bulk) cargos such as steel, coal, and oil can be more efficiently transported than lighter cargos (e.g., manufactured goods) on board ships, rail, or road; hence the potential for energy-efficient transport depends on the type of goods being transported. Figure 2.10 shows the same comparison but also includes air freight.

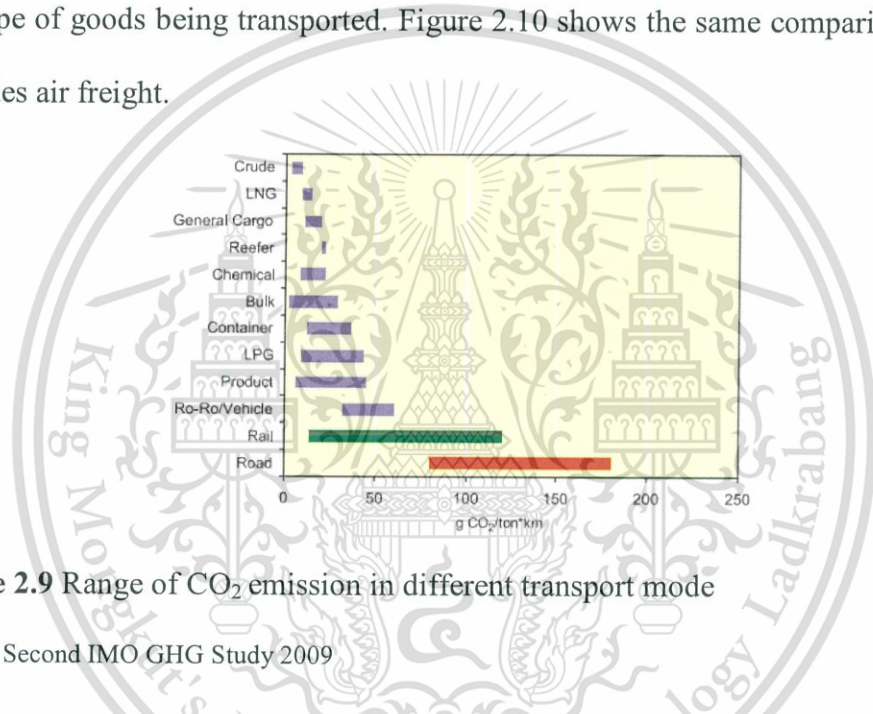


Figure 2.9 Range of CO₂ emission in different transport mode

Source: Second IMO GHG Study 2009

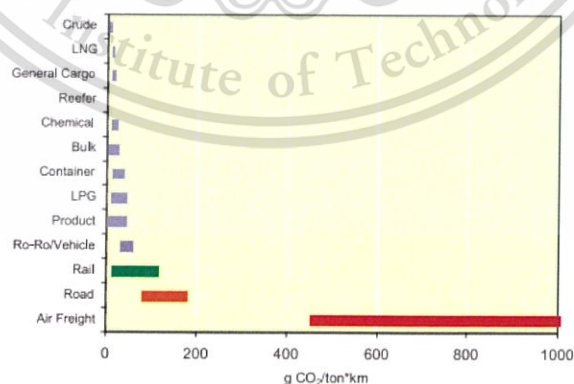


Figure 2.10 Range of CO₂ emission included air freight

Source: Second IMO GHG Study 2009

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2.5 GHG Reduction for Transport and Logistics Industry

The topics of environmental and awareness of carbon-related have increased in society for the past two decades. Logistics industry, as a fossil fuel-related sector, knew that it was a threat to existing business models which generated significant impacts on markets, costs, and also led to institutional pressures through regulatory policies. Consequently, logistics companies were voluntarily generating inventory curtail and trade carbon emission. Furthermore, managers in these companies interacted with each other within associations, conferences and climate negotiations, leading to some convergence in their perceptions of climate-change issues and of their interests. Apparently, these global industries have become more important institutional influences on corporate strategy than the home country environment (Herold & Lee, 2017). As a result, logistic companies have taken action such as setting target of carbon reduction. From Table 2.9, examples of carbon reduction targets for logistical activities are shown. Some companies obviously define the intensity metric in their company literature while some others companies have given a range. Those that do employ a range of different metrics make it difficult to compare the targets on a consistent basis (McKinnon & Piecyk, 2012)

Table 2.9 Examples of carbon reduction targets for logistical activities

Company	Normalizer	Time period	Carbon reduction target (%)
Deutsche Post/DHL	Every letter and parcel delivered, every tonne of cargo transported and every square meter of warehouse space	2007–2020	30
DB Schenker	Tonne-km	2006–2020	≥20
UPS	UPS Transportation Index	2010–2017	5
UPS Airlines – global	Pounds of CO ₂ emitted for every ton of capacity transported on nautical mile	2005–2020	20
Fedex® (aircraft)	Available ton-mile	2005–2020	20
TNT (mail and express)	Not specified: only refers to CO ₂ efficiency	2007–2020	45
Maersk Line	Not specified: only refers to CO ₂ intensity	2007–2020	25
NYK Line	Unit of transportation from vessels	2006–2013	10

Source: McKinnon, Piecyk (2012). Setting targets for reducing carbon emission from logistics: current practice and guiding principles.

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As seen that Deutsche Post or DHL have targeted to reduce 30% by 2020. Precisely, DHL is one of the largest international logistic company which is active worldwide. DHL is encompassed with three different divisions: express, global forwarding and Freight, as well as supply chain service. DHL has focused on CSR and sustainability for the past decade and believes that sustainable and environmental-friendly services will be able to contribute to long-term competitiveness improvement and also to have a positive influence on new customers. Optimizing transport route, using alternative drive system and energy-efficient warehouse are the most important actions. Green products and services oriented to CO₂, and GHG emission reduction, according to a general logic of green optimization are also offered by DHL, such as:

- Promoting awareness campaign dedicated to the reduction of its fleet fuel consumption, which is estimated to be more than one million liters a month;
- Testing a highly environmental-friendly trial vehicle, in partnership with Renault Trucks and Grand Lyon, within FIDEUS (Freight Intelligent Delivery of Goods in European Urban Spaces) European Research Program.

In logistics industry, green product and process innovations are even more important because they contribute to give a good response to stakeholders' environmental pressures. On the other hand, green managerial innovation may not seem directly linked to environmental performance improvement, because the integration of a sustainable approach into current business strategies is not so common (Silvia , 2014).

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Company Background

This case study is about a French retail company which sells sports equipment and goods. The first branch in Thailand was opened during the late 2015, but nowadays there are ten stores. Seven stores are located within Bangkok area, one in Pattaya, one in Chiang Mai and the newest one is in Phuket. The objective of this company is to make sport accessible to as many people as possible, thus targeting middle class market as the products offered are at competitive prices as compared to other sport equipment companies. It offers sports equipment and clothing for more than 50 different types of sport and has approximately 5000 exclusive products. In 2018, 6.1 million pieces were imported, which made up of approximately 95% of total quantities purchased (from 7 different countries), valued at 630 millions Thai baht. Whereas 5% of quantity purchased were from local suppliers (located in Thailand). The company aims to increase quantity to purchase by up to 30% each year and expects to reach 1.5 billions Thai baht in turnover by the end of 2019.

3.2 Data Collection

This research follows a five steps procedure for the measurement and reporting of carbon emission which is recommended by the UK Carbon Trust as shown in Figure 3.1 below. Since the objectives of the study have been mentioned already in chapter one, other steps of the study, such as selection of calculation method, data collection of choice of emission factors and calculations are all

presented in this chapter. Finally the analysis, result and reporting will be discussed in the next chapter.

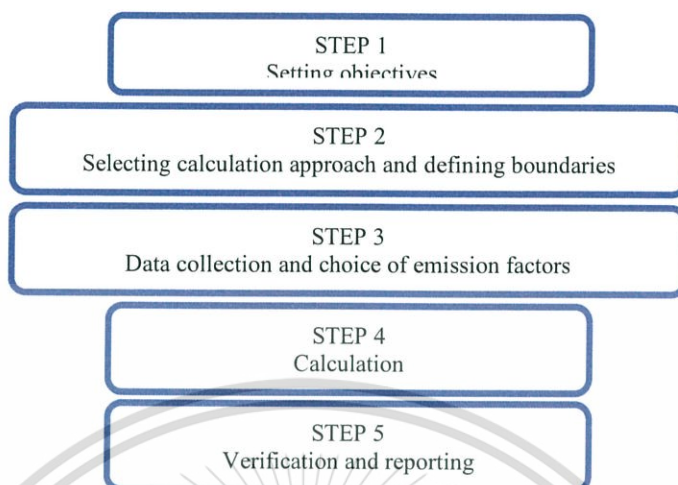


Figure 3.1 Five steps procedure to measure and report carbon emission

3.3 Selecting Methods of Calculation

Calculation methods of CO₂ emission which were suggested by Alan McKinnon in both Sections 2.4.1 and 2.4.2 are applied to this research in order to calculate emission from fuel which are burned from the engine of transport vehicle for all import activities within the scope of this study as shown in Figures 3.2 below.

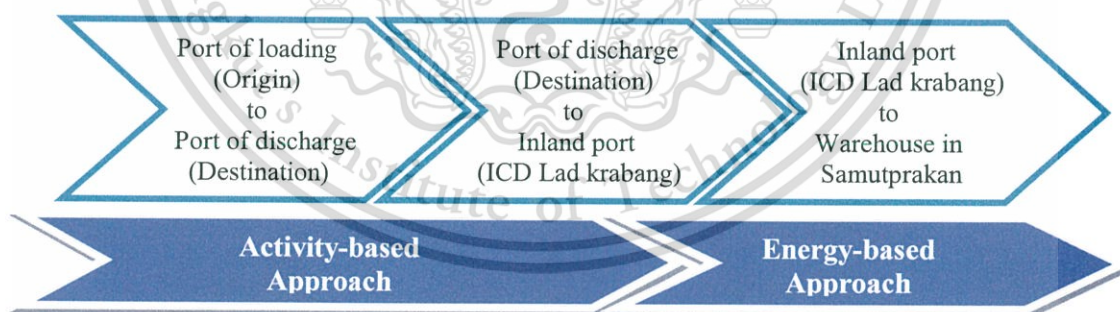


Figure 3.2 Calculation methods for all import activities

Activity-based approach: a rough estimate of the carbon footprint of a transport operation by applying a simple formula:

$$\text{CO}_2 \text{ emission} = \text{Transport volume by transport mode} \times \text{average transport distance by transport mode} \times \text{average CO}_2 \text{-emission factor per tonne-km by transport mode}$$

$$[\text{Tonnes CO}_2 \text{ emission} = \text{tonnes} \times \text{km} \times \text{g CO}_2 \text{ per tonne-km} / 1,000,000]$$

This method will be applied to 2 different parts of import activities, firstly, international transport from port of loading at origin to port of discharge at destination or Laem Chabang port (“LCB”) which mainly uses sea freights (container vessels), and another activity is the rail transportation of containers from port of discharge to inland port which is located in Lad Krabang (“ICD LKB”).

Energy-based approach: Since this is a more accurate way to calculate of CO₂ emission and the company also has the ability to access data of fuel consumption from outsourced service provider, this method is applied to activity of transport from ICD Lad Krabang to final destination or warehouse by using the following formula:

$$\text{CO}_2 \text{ emission} = \text{Fuel consumption} \times \text{fuel emission conversion factor}$$

$$[\text{Tonnes CO}_2\text{-emission} = \text{liters per km} \times \text{km} \times \text{kg CO}_2 \text{ per liter fuel} / 1,000]$$

3.3.1 Choices of Emission Factors

In the process of establishing calculation, not only more additional differentiated information in respect of CO₂ emission factors for each transport mode is needed to be identified, but also other data such as distance, type of vessel etc must be presented before calculation.

A. International Transport

International Maritime Organization has published emission factors for various type of vessel (see Table 3.1). And referring to section 2.4.3, average CO₂ emission for air freight is approximately 600g CO₂/tonne-km. This allows us to apply in part of international transportation from port to port for both mode of sea and air freight.

Since only vessel name is available from company data, but not the capacity of its vessel, such data will be collected from website Vessletracking.net and it can be summarized by all vessel name and capacity which the company uses in order to

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transport goods from port of origin to port of destination as shown in Table 3.2. While average distance from port to port which is collected from website sea-distances.org is summarized in Table 3.3.

Table 3.1 Estimate of CO₂ emission factors for cargo ships

Type	Size	Emission Factor (g of CO ₂ /tonne-km)
Products tanker	60,000+ dwt	5.7
Products tanker	20,000 - 59,999 dwt	10.3
Products tanker	10,000 - 19,999 dwt	18.7
Products tanker	5,000 - 9,999 dwt	29.2
Products tanker	0 - 4,999 dwt	45
Bulk carrier	200,000+ dwt	2.5
Bulk carrier	100,000 - 199,999 dwt	3
Bulk carrier	60,000 - 99,999 dwt	4.1
Bulk carrier	35,000 - 59,999 dwt	5.7
Bulk carrier	10,000 - 34,999 dwt	7.9
Bulk carrier	0 - 9,999 dwt	29.2
General cargo	10,000+ dwt	11.9
General cargo	5,000 - 9,999 dwt	15.8
General cargo	0 - 4,999 dwt	13.9
General cargo	10,000+ dwt, 100+TEU	11
General cargo	5,000 - 9,999 dwt, 100+TEU	17.5
General cargo	0 - 4,999 dwt, 100+TEU	19.8
Refrigerated cargo	All	12.9
Container	8,000+ TEU	12.5
Container	5,000 - 7,999 TEU	16.6
Container	3,000 - 4,999 TEU	16.6
Container	2,000 - 2,999 TEU	20
Container	1,000 - 1,999 TEU	32.1
Container	0 - 999 TEU	36.3
Vehicle	4,000+ ceu	32
Vehicle	0 - 3,999 ceu	57.6

Source: Second IMO GHG Study 2009

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Table 3.2 Data collection of vessel used by company

Vessel	Capacity (TEU)	g CO ₂ per tonne-km
ACRUX N	1740	32.1
ANAN BHUM	1018	32.1
AS MORGANA	4255	16.6
BOX EXPRESS	1708	32.1
CAPE QUEST	2190	20
DONGJIN VOYAGER	1800	32.1
EXPRESS BLACK SEA / 030E	3398	16.6
GENOVA / 035E	2000	20
HANSA FALKENBURG	1740	32.1
HYUNDAI BANGKOK	6408	16.6
ITAL MELODIA	4363	16.6
ITHA BHUM	1498	32.1
KAMA BHUM	1498	32.1
KATRIN-S	2546	20
KUO LIN	1756	32.1
LADY OF LUCK	2205	20
LEDA TRADER	2452	20
MAENAM 1	908	36.3
MARIVIA	2078	20
MCC KYOTO	1713	32.1
MOL EMINENCE	5087	16.6
MOL SUCCESS / 1065E	2553	20
NEWARK / 022E	3398	16.6
NORDTIGER	1756	32.1
NYK PAULA / 166E	2778	20
OSAKA EXPRESS	8749	12.5
RACHA BHUM / 093E	2732	20
SFL AVON	1740	32.1
SINAR BALI	1064	32.1
SINAR SUBANG	1708	32.1
STAR RIVER / 0020N	2732	20
STARSHIP TAURUS	14354	12.5
TSINGTAO EXPRESS	8749	12.5
UNI-ANGEL	1164	32.1
UNI-PROBITY	1618	32.1
WANA BHUM / 024N	2378	20
X-PRESS KAILASH / 175E	2741	20
YM INTERACTION	1799	32.1
YM UNISON	8208	12.5

Source: <http://www.vesseltracking.net/ship/jitra-bhum-9133329>, 5th April 2018

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Table 3.3 Estimated distances from POL to POD

Mode	Country	POL	POD	Distance (km)
SEA	China	Qingdao Pt, CN	LCB	4592.96
SEA	China	Sanshan, CN	LCB	4081.808
SEA	China	Shanghai Pt, CN	LCB	4081.808
SEA	China	Shanghai, CN	LCB	4081.808
SEA	China	Shekou, CN	LCB	3479.908
SEA	China	Xiamen Pt, CN	LCB	3087.284
SEA	China	Xiamen, CN	LCB	3087.284
SEA	China	Xingang (Tianjin), CN	LCB	5143.004
SEA	China	Xingang, CN	LCB	5143.004
SEA	Malaysia	Penang (Georgetown), MY	LCB	2148.32
SEA	Malaysia	Penang (Georgetown), MY	BKK	2235.364
SEA	Myanmar	Yangon, MM	LCB	3520.652
SEA	Singapore	Singapore, SG	LCB	1451.968
SEA	Sri Lanka	Colombo, LK	LCB	4354.052
SEA	Taiwan	Taichung, TW	LCB	3033.576
SEA	Vietnam	Haiphong, VN	LCB	2457.604
SEA	Vietnam	Ho Chi Minh City, VN	LCB	1174.168
AIR	China	Shenzhen, CN	BKK	3479.908

Source: <https://sea-distances.org>, 5th April 2018

B. Inland Transport

Activity-based approach is continuously used in this part, and inland transport in this paper is referring to activity of transporting containers from port of discharge which is located in Laem Chabang, Rayong to inland port Lad Krabang, Bangkok with average distance of 118 kms (Charoensawad, 2006), which mainly uses rail transport. Thus the average of CO₂ emission factor of rail transport of 22 gCO₂/tonne-km which is recommended by McKinnon in the previous chapter will be applied.

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Table 3.4 Recommended average emission factors for road and rail transport

Transport Mode	gCO₂ /tonne-km
Road transport	62
Rail transport	22

Source: McKinnon, A.C., Piecyk, M., 2010. Measuring and managing CO₂ emission of European chemical transport. Cefic, Brussels.

C. Transportation to final destination

Fuel consumption and type of fuel used in transporting containers from ICD Lad Krabang to final destination, which is approximately 27 kilometers, are required in order to be applied in energy-based approach. Survey form as per Appendix A below were sent to service providers. Data and CO₂ emission factors are summarized as shown in Table 3.5

Table 3.5 Average emission factors for transport to final destination

Survey	Average fuel consumption/ round from LKB to final destination (Liters)	Fuel type	kg CO₂ per liter fuel
Company A	9.64	Diesel oil	2.9
Company B	10.8	Diesel oil	2.9

CHAPTER 4

RESULTS AND DISCUSSION

After collecting data for 12 months from January to December 2018, data were calculated as follows:

A. International Transport

As mentioned in previous chapter, this part was calculated by multiplying data collection of weight (tonne), distance(km), and gCO₂ per tonne-km for each container with format as shown in Figure 4.1.

International freight transport activities (Sea-Air from POL to POD) = tonnes x km x g CO ₂ per tonne-km / 1,000,000								
Month	Container	Vessel	POL	POD	Weight (tonne)	Distance (km)	g CO ₂ per tonne-km	Tonnes CO ₂ emissions

Figure 4.1 Calculation format for international transport

Tonnes of CO₂ emission per each container as shown in Table 4.1 (more details in Appendix B) shipped during each month were calculated based on data collection of total weight of each container multiply by average distance from port of origin to port of destination, multiply by gCO₂ per tonnes-km based on type and size of vessel and then divided by 1,000,000.

Table 4.1 Calculation of CO₂ emission of international transport (per container)

Month	Container	Vessel	POL	POD*	Weight (tonne)	Distance (km)	g CO ₂ / tonne-km	Tonnes CO ₂
Jan	MRKU0359376	ACRUX N	Qingdao Pt, CN	Lad Krabang, TH	5.691	4592.96	32.1	0.84
Jan	PONU7596535	ACRUX N	Qingdao Pt, CN	Lad Krabang, TH	10.930	4592.96	32.1	1.61
Jan	TTNU1120544	ACRUX N	Qingdao Pt, CN	Lad Krabang, TH	6.190	4592.96	32.1	0.91
Jan	TCLU4587810	RACHA BHUM / 093E	Singapore, SG	Lad Krabang, TH	4.125	1451.96	20	0.12

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Table 4.2 CO₂ emission of international transport per origin

Origin	Total containers	Total tonne CO ₂ Emission (Internation freight transport)
Shanghai Pt, CN	106	110.41
Shekou, CN	45	28.09
Qingdao Pt, CN	22	23.05
Singapore, SG	88	7.54
Haiphong, VN	22	5.10
Ho Chi Minh City, VN	31	4.38
Xingang (Tianjin), CN	12	4.32
Xiamen, CN	8	3.27
Taichung, TW	7	1.49
Yangon, MM	8	1.39
Colombo, LK	4	0.31
Penang (Georgetown), MY	3	0.14

From this part of activity, a summary of total emission per port of origin as shown in Table 4.2 can be drawn. The highest value of total tonnes was emitted by shipments from Shanghai (China), and is equal to 110.4 tonnes, while the lowest was from Penang (Malaysia) shipments with only 0.14 tonnes of CO₂ emitted for the whole year.

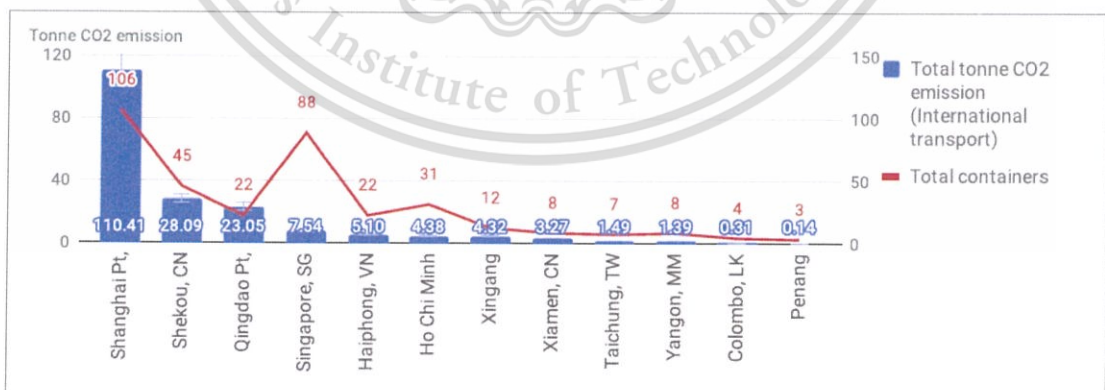


Figure 4.2 Relationship of CO₂ emission & container (international transport)

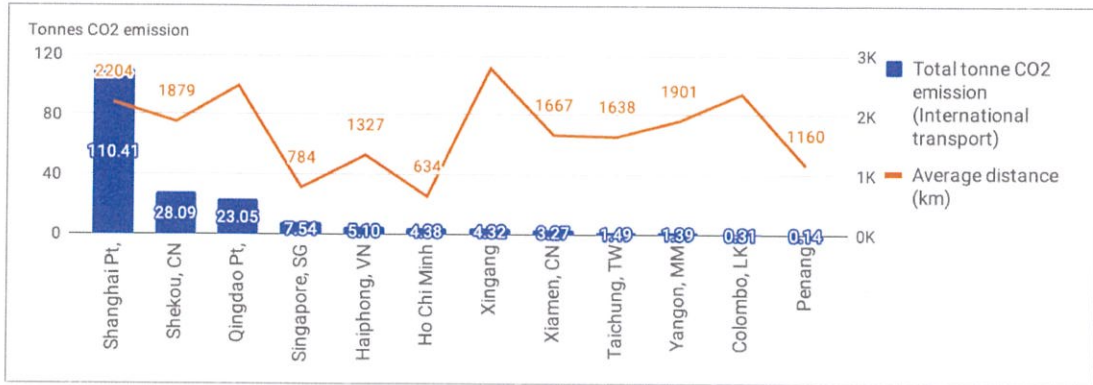


Figure 4.3 Relationship of CO₂ emission & distance (international transport)

Figures 4.2 and 4.3 show the relationship between total CO₂ emission and total number of containers, also distance from port to port since these two factors are direct variables. As a result, number of containers tend to have more impact on the emission since the higher number of containers, the more weight to be multiplied. Except from shipments coming from Singapore, the 2nd origin with highest number of containers, this seems like number of containers is not the variable which impact the most to emission. Other variables, such as distance and weight of shipment, may have more impact on total emission.

B. Inland transport (from port of discharge to inland port)

To estimate CO₂ emission for inland transport, the average of CO₂ emission factor of rail transport at 22 gCO₂/tonne-km which is recommended by McKinnon, were applied in this part of activity.

					Inland Transport (Rail from LCB-LKB) = tonnes x km x g CO ₂ per tonne-km / 1.000.000			
Month	Container	Vessel	POL	POD	Weight (tonne)	Distance (km)	g CO ₂ per tonne-km	Tonnes CO ₂ emissions

Figure 4.4 Calculation format for inland transport

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Data collection and calculation were filled in format as shown in Figure 4.4. Tonnes CO₂ emission per each containers shipped from Laem Chabang port to Lad Krabang in each month were calculated based on data collection:

- 1) Total weight of each container
- 2) Average distance Leam Chabang port to Lad Krabang = 110 kilometers,
- 3) gCO₂ per tonnes-km for rail transport = 22 gCO₂/tonne-km

then all factos were multiplied and divided by 1,000,000. The result is shown in Table 4.3 (more details in Appendix B).

Table 4.3 Calculation of CO₂ emission of inland transport, rail (per container)

Month	Container	Vessel	POL	POD*	Weight (tonne)	Distance (km)	g CO ₂ /tonne-km	Tonnes CO ₂ emission
Jan	MRKU0359376	ACRUX N	Qingdao Pt, CN	Lad Krabang, TH	5.691	110	22	0.014
Jan	PONU7596535	ACRUX N	Qingdao Pt, CN	Lad Krabang, TH	10.930	110	22	0.026
Jan	TTNU1120544	ACRUX N	Qingdao Pt, CN	Lad Krabang, TH	6.190	110	22	0.014
Jan	TCLU4587810	RACHA BHUM / 093E	Singapore, SG	Lad Krabang, TH	4.125	110	22	0.009

Table 4.4 CO₂ emission of inland transport (rail) per origin

Origin	Total containers	Inland Transport (Rail) Total tonne CO ₂ Emission
Shanghai Pt, CN	106	2.4
Shekou, CN	45	0.71
Singapore, SG	88	0.67
Ho Chi Minh City, VN	31	0.43
Qingdao Pt, CN	22	0.39
Haiphong, VN	22	0.17
Xiamen, CN	8	0.13
Xingang (Tianjin), CN	12	0.07
Taichung, TW	7	0.05
Yangon, MM	8	0.03
Colombo, LK	4	0.01
Penang (Georgetown), MY	3	0.01

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From Table 4.4, it can be seen that most of shipments produced CO₂ less than a tonne per year per origin, except from Shanghai origin which has the most number of containers per year. In this part, distance and gCO₂ per tonne-km are fixed numbers since all shipments are discharged and brought to same port with same mode of transport, so the variable which has most impact to emission would be total weight of goods.

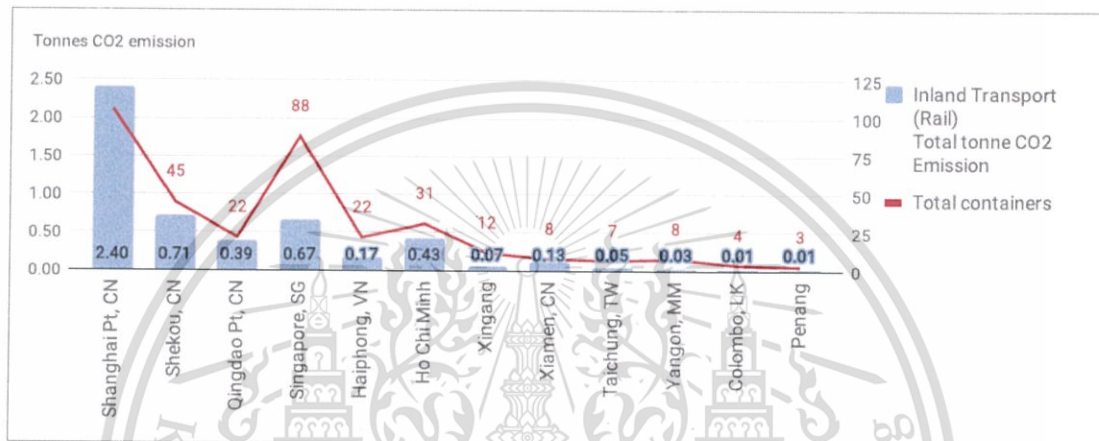


Figure 4.5 Relationship of CO₂ emission & container (inland transport)

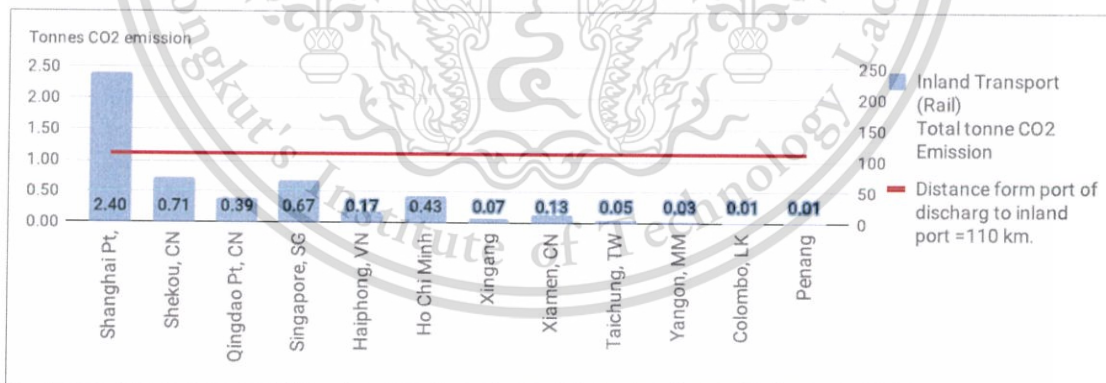


Figure 4.6 Relationship of CO₂ emission & distance (inland transport)

Figure of relationship between total CO₂ emission & number of containers above (Figure 4.5) shows that the more containers, the more emission will be produced. It is expected that shipment from Shanghai origin will produce the most because of the number of containers shipped. On the contrary with Singapore origin, This material is reserved for educational use only, not allowed for commercial use.

a huge number of containers were shipped while total emission was only 0.39 tonnes. It can be assumed that it is because weight of goods per container of shipment from Singapore is less than other origins. For this part of activity, distance is not playing main factor to impact emission as it shown in linear line in Figure 4.6 relationship of CO₂ emission and distance.

C. Inland transport to final destination (Road transport)

Another inland transport, by road, to final destination by container trucking was calculated with a different method. Energy-based approach was used instead of activity-based approach by taking fuel consumption per trip, given by transport company, multiply with kg CO₂ per liter fuel (base on type of fuel) and data was filled in the format as shown in Figure 4.7.

					Inland Transport (Truck from LKB-Warehouse) = liters x kg CO ₂ per liter fuel / 1,000		
Month	Container	Vessel	POL	POD*	Fuel consumption (Liter)	kg CO ₂ per liter fuel	Tonnes CO ₂ emissions

Figure 4.7 Calculation format of inland transport (road to final destination)

The result of calculation was filled in the mentioned format for all containers which were transported from Lad Krabang port to final destination during each month. It was calculated based on data collection of:

- 1) Fuel consumption taken from suvery and use the highest number at 10.8 lite
- 2) gCO₂ per tonnes-km for road transport (Diesel oil) = 2.9 gCO₂/tonne-km can be find in Table 4.5 (more details in Appendix B).

Table 4.5 Calculation of CO₂ emission of inland transport, road (per container)

Month	Container	Vessel	POL	POD*	Fuel consumption (Liter)	kg CO ₂ per liter fuel	Tonnes CO ₂ emission
Jan	MRKU03 59376	ACRUX N	Qingdao Pt, CN	Lad Krabang, TH	10.8	2.9	0.03132
Jan	PONU759 6535	ACRUX N	Qingdao Pt, CN	Lad Krabang, TH	10.8	2.9	0.03132
Jan	TTNU112 0544	ACRUX N	Qingdao Pt, CN	Lad Krabang, TH	10.8	2.9	0.03132
Jan	TCLU458 7810	RACHA BHUM / 093E	Singapore, SG	Lad Krabang, TH	10.8	2.9	0.03132

Table 4.6 CO₂ emission of inland transport (road to final destination)

Origin	Total containers	Inland Transport (Truck) Total tonne CO ₂ Emission
Shanghai Pt, CN	106	3.32
Shekou, CN	45	1.41
Singapore, SG	88	0.69
Ho Chi Minh City, VN	31	2.76
Qingdao Pt, CN	22	0.69
Haiphong, VN	22	0.97
Xiamen, CN	8	0.38
Xingang (Tianjin), CN	12	0.25
Taichung, TW	7	0.22
Yangon, MM	8	0.25
Colombo, LK	4	0.13
Penang (Georgetown), MY	3	0.09

From calculation Table Figure 4.5, it can be seen that number of emission is same for all containers because fuel consumption and gCO₂ per tones-km are fixed number. Total emission of road transport per each container can also be calculated by 0.031 multiply by total number of containers, and the result are shown in Table 4.6. The relationship between total number of containers and total CO₂ emission is shown in Figure 4.8. CO₂ produced varied based on number of containers, and it is observed that the more containers transported, the more emission of CO₂ for this activity.

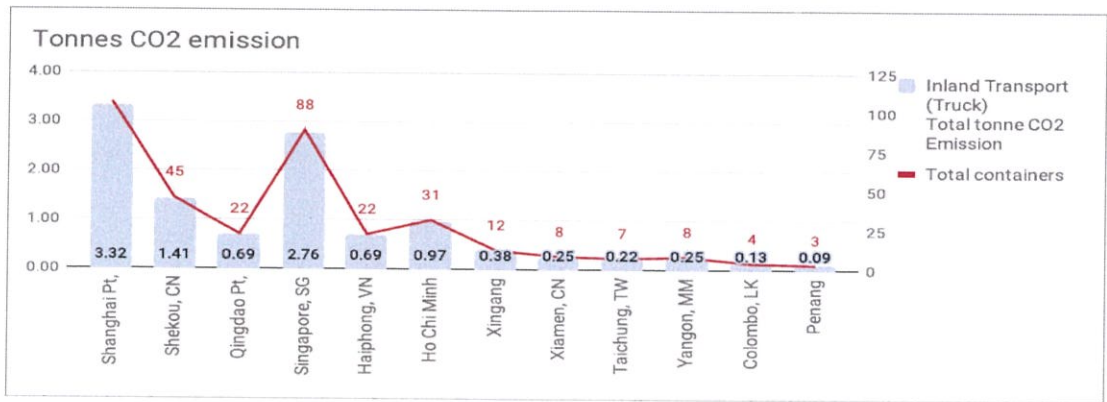


Figure 4.8 Relationship of CO₂ emission & container (road to final destination)

In total, 205.70 tonnes of CO₂ were emitted by this company in 2018, or in average 17.1 tonnes of CO₂ emission per month. Figure 4.9 shows the amount breakdown of CO₂ emission together with total volume (cbm.) for each month. Furthermore, average CO₂ emission per TEU per origins is also shown in Figure 4.10, whereby shipments coming from Qingdao, Shanghai and Yangon are the top 3 origins with most emission per TEU.

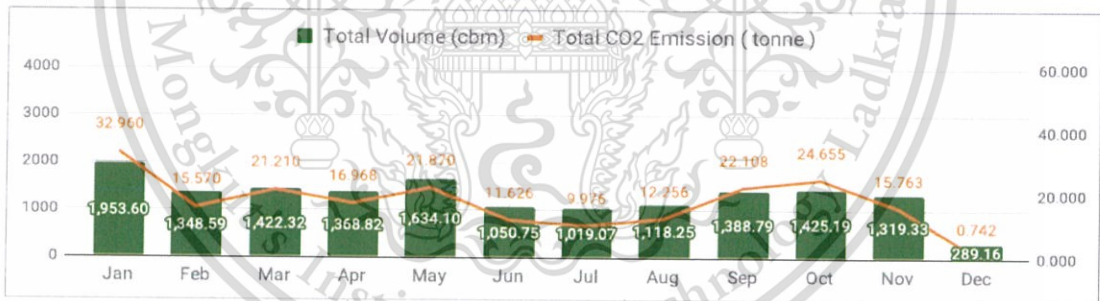


Figure 4.9 Total tonne CO₂ emission & total volume

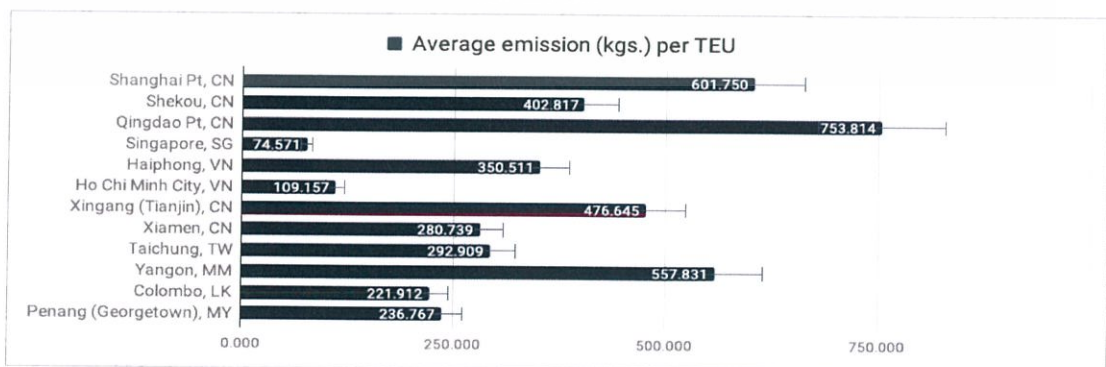


Figure 4.10 Average CO₂ emission per TEU per origin

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CHAPTER 5

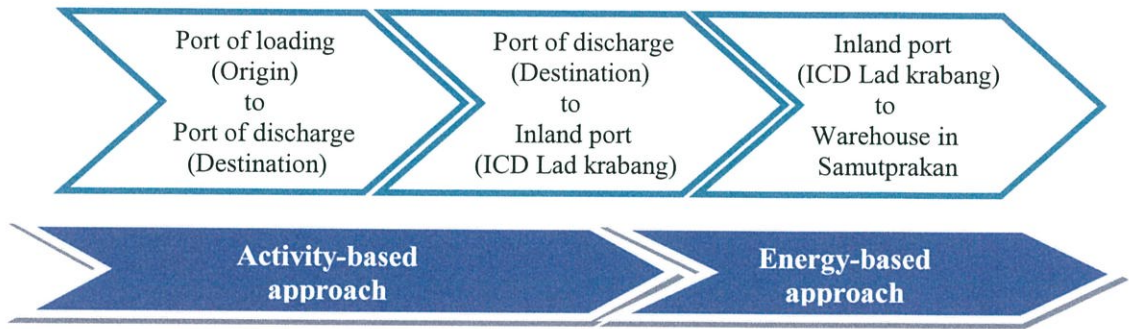
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

An accumulation of “greenhouse gases (GHG)” in the atmosphere causes an increase in global temperatures. Greenhouse gases, such as carbon dioxide (CO₂) and methane (CH₄), act as a trap, holding heat closer to the Earth and not allowing it to radiate away. The average of global temperature has been increasing for the past 150 years. Transport sector is one of the main contributors to an increase in GHG level worldwide. As more and more development occurs in the world, the use of transportation is relatively increasing and many companies are increasing their activities by also trying to keep the same level of CO₂ emitted or better, decreasing the emission level.

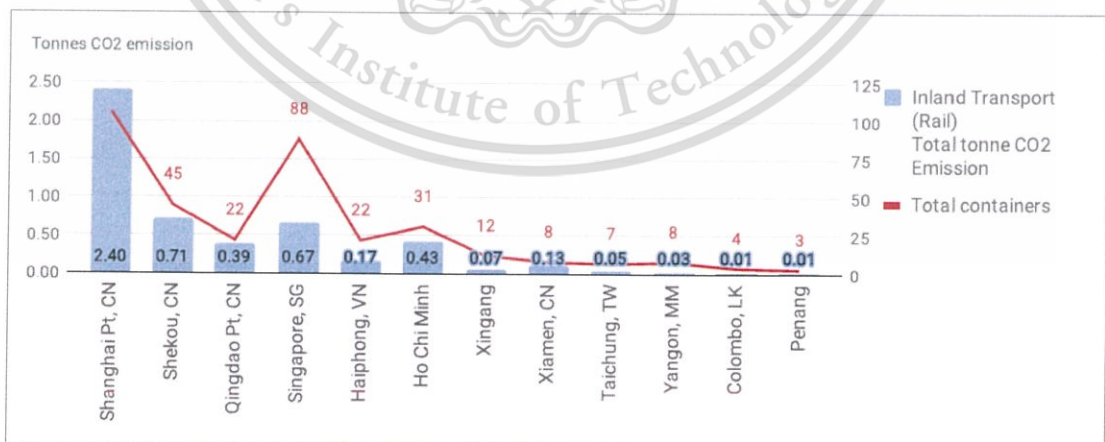
Therefore, this study was aimed in analyzing the current transportation situation in a specific company in order to assess the level of CO₂ emitted as well as finding out the causes of these emission. The series of data have been collected for over a period of 12 months in order to get a better estimation of the current situation based on yearly activities of this company.

Activity-based approach and Energy-based approach have been applied to this research in order to calculate emission from fuel which are burned from the engine of transport vehicle for all import activities within the scope of this study as shown in the figure below.

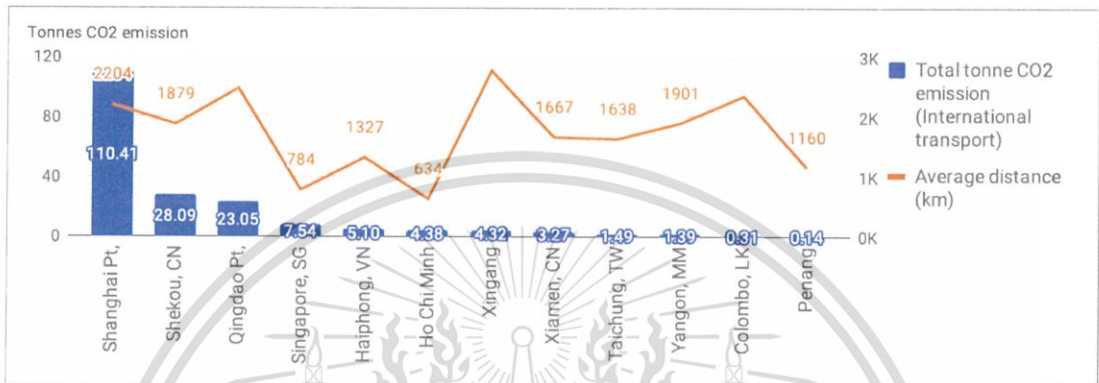


In the process of establishing calculation, not only more additional differentiated information in respect of CO₂ emission factors for each transport mode is needed to be identified, but also other data such as distance, type of vessel, and others must be presented before calculation. Since only vessel name is available from company data, but not the capacity of its vessel, such data will be collect from website Vessletracking.net and it can be summarized by all vessel name and capacity which the company uses in order to transport goods from port of origin to port of destination.

After data related to vessels have been found, the next step was to collect data regarding inland transportation such as trains and trucks from the port of discharge Laem Chabang to ICD Lad Krabang then to final destination at Samut Prakarn.



The graph above is the comparison between number of containers from each port compared to the amount of CO₂ emission. It can be observed that most containers were shipped from Shanghai port and that the level of CO₂ emission is also the highest. It should also be noted that the number of containers shipped from Singapore is also very high but with much less CO₂ emission compared to Shanghai.



The figure above is the comparison between CO₂ emission versus average distance between ports of origin to destination. It can be concluded that the lesser the distance is, the lower the CO₂ emission would be. Inland transportation has been studied but since there is only 1 transport mode between port of discharge Laem Chabang and ICD Lad Krabang and to final destination Samut Prakarn, it cannot be compared.

Finally, the total amount of CO₂ emission in 2018 was 205.70 tonnes or in average 17.1 tonnes of CO₂ emission per month. These values could be used as the baseline to monitor for future activities in 2019 and onwards. Since this company is planning to increase its activity, it is an undeniable fact that CO₂ emission might increase as there would be more shipment frequency or volume increased. Therefore, after this study has been completed, there are a few recommendations that could be considered for future use in the next section of this paper.

5.2 Recommendations

After the study has been completed, the sum up of total emission in 2018 can be used as a report to share among organizations for current situation of import activities in Thailand to compare with existing report in other countries. The result of average emission per origin per TEU can also be used to calculate total emission in the future by multiplying the average emission value with number of TEUs imported. In this way, it will help to reduce the time and steps of data collection.

It is seen that many factors in the transport sector leads to a high emission of CO₂. In order to get a better picture, especially for inland transportation, it would be recommended to study alternative ways of transportation between port of discharge Laem Chabang and ICD Lad Krabang. Since the study of alternative transport mode has not been made, it is not possible to give a conclusion on whether the best option of transportation has been found or not.

It could be useful to use other methods of calculation in order to compare results to see which will be the best series of analysis as this study has been based on the most common calculation and formula used nowadays.

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Fuel Consumption Survey

As part of the research thesis, this survey is conducted to investigate and collect data of fuel type and consumption used to transport containers from ICD Lat krabang to final destination (WHA warehouse, Bangna trad Km.18) in order to report GHG from import transport activities. Appreciate your fulfillment of this survey. Any information obtained in connection with this study that can be identified with you will remain confidential.

* Required

Average fuel consumption (Liters) *

Your answer

Fuel type *

- Diesel Oil
- Gas Oil
- Liquefied Petroleum Gas (LPG)
- Compressed Natural Gas (CNG)
- Bio gasoline
- Bio diesel

SUBMIT

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APPENDIX B

Month	Container	Vessel	POL	POD*	International freight transport activities (Sea-Air from POL to POD)				Inland Transport (Rail from LCB-LKB)				Inland Transport (Truck from LKB-Warehouse)			
					Weight (tonne)	Distance (km)	g CO2 per tonne-km	Tonnes CO2 emissions	Distance (km)	g CO2 per tonne-km	Tonnes CO2 emissions	fuel consumption (Liter)	kg CO2 per liter fuel	Tonnes CO2 emissions	fuel consumption (Liter)	kg CO2 per liter fuel
Jan	MRKU0359376	ACRUX N	Qingdao Pt, CN	Lat Krabang, TH	5.691	4592.96	32.1	0.84	110	22	0.014	10.8	2.9	0.03132		
Jan	PONU7596535	ACRUX N	Qingdao Pt, CN	Lat Krabang, TH	10.930	4592.96	32.1	1.61	110	22	0.026	10.8	2.9	0.03132		
Jan	TTNU1120544	ACRUX N	Qingdao Pt, CN	Lat Krabang, TH	6.190	4592.96	32.1	0.91	110	22	0.015	10.8	2.9	0.03132		
Jan	TCLU4587810	RACHA BHUM / 09: Singapore, SG	Singapore, SG	Lat Krabang, TH	4.125	1451.968	20.0	0.12	110	22	0.010	10.8	2.9	0.03132		
Jan	GLDU9410136	YM UNISON	Xiamen, CN	Lat Krabang, TH	2.520	3087.284	12.5	0.10	110	22	0.006	10.8	2.9	0.03132		
Jan	MDFU6822904	YM UNISON	Xiamen, CN	Lat Krabang, TH	6.083	3087.284	12.5	0.23	110	22	0.015	10.8	2.9	0.03132		
Jan	TGHU6579303	YM UNISON	Xiamen, CN	Lat Krabang, TH	8.836	3087.284	12.5	0.34	110	22	0.021	10.8	2.9	0.03132		
Jan	ETTU0247268	UNI-PROMOTE	Xingang (Tianjin), CN	Lat Krabang, TH	2.277	5143.004	32.1	0.38	110	22	0.006	10.8	2.9	0.03132		
Jan	TCLU8304306	EXPRESS BLACK SE	Singapore, SG	Lat Krabang, TH	5.125	1451.968	16.6	0.12	110	22	0.006	10.8	2.9	0.03132		
Jan	TEMU8918410	UNI-PROMOTE	Xingang (Tianjin), CN	Lat Krabang, TH	2.416	5143.004	32.1	0.40	110	22	0.006	10.8	2.9	0.03132		
Jan	EISU2161278	ITAL MELODIA	Taichung, TW	Lat Krabang, TH	3.328	3083.576	16.6	0.17	110	22	0.008	10.8	2.9	0.03132		
Jan	BMOU5218928	STARSHIP TAURUS	Ho Chi Minh City, VN	Lat Krabang, TH	3.877	1174.188	12.5	0.06	110	22	0.009	10.8	2.9	0.03132		
Jan	BMOU5649083	KAMA BHUM	Shanghai Pt, CN	Lat Krabang, TH	13.911	4081.808	32.1	1.82	110	22	0.034	10.8	2.9	0.03132		
Jan	CLHU4748008	KAMA BHUM	Shanghai Pt, CN	Lat Krabang, TH	21.756	4081.808	32.1	2.85	110	22	0.053	10.8	2.9	0.03132		
Jan	CMAU4156700	KAMA BHUM	Shanghai Pt, CN	Lat Krabang, TH	15.881	4081.808	32.1	2.08	110	22	0.038	10.8	2.9	0.03132		
Jan	HMCU1050325	UNI-ANGEL	Shekou, CN	Lat Krabang, TH	5.985	3479.908	32.1	0.67	110	22	0.014	10.8	2.9	0.03132		
Jan	TCLU4317352	UNI-ANGEL	Shekou, CN	Lat Krabang, TH	9.547	3479.908	32.1	1.07	110	22	0.023	10.8	2.9	0.03132		
Jan	TGHU4849082	KAMA BHUM	Shanghai Pt, CN	Lat Krabang, TH	22.056	4081.808	32.1	2.89	110	22	0.053	10.8	2.9	0.03132		
Jan	UESU2347487	KAMA BHUM	Shanghai Pt, CN	Lat Krabang, TH	12.680	4081.808	32.1	1.66	110	22	0.031	10.8	2.9	0.03132		
Jan	TCKU4360433	STAR RIVER / 0020: Singapore, SG	Singapore, SG	Lat Krabang, TH	4.115	1451.968	20.0	0.12	110	22	0.010	10.8	2.9	0.03132		
Jan	BMOU2319581	HYUNDAI HONGKO	Haiphong, VN	Lat Krabang, TH	2.784	2457.604	16.6	0.11	110	22	0.007	10.8	2.9	0.03132		
Jan	TCLU4229483	NYK PAULA / 1666	Singapore, SG	Lat Krabang, TH	2.998	1451.968	20.0	0.09	110	22	0.007	10.8	2.9	0.03132		
Jan	NYKU3391607	MAENAM1	Yangon, MM	Lat Krabang, TH	1.096	3520.652	36.3	0.14	110	22	0.003	10.8	2.9	0.03132		
Jan	TCNU6251924	NEWARK / 022E	Singapore, SG	Lat Krabang, TH	5.562	1451.968	16.6	0.13	110	22	0.013	10.8	2.9	0.03132		
Jan	TRHU2533029	WANA BHUM / 026	Singapore, SG	Lat Krabang, TH	2.922	1451.968	20.0	0.08	110	22	0.007	10.8	2.9	0.03132		
Jan	NYKU4786094	MOL SUCCESS / 106	Singapore, SG	Lat Krabang, TH	5.002	1451.968	20.0	0.15	110	22	0.012	10.8	2.9	0.03132		
Jan	EITU0478035	NORDTIGER	Ho Chi Minh City, VN	Lat Krabang, TH	2.161	1174.168	32.1	0.08	110	22	0.005	10.8	2.9	0.03132		
Jan	HMCU1072936	NORDTIGER	Ho Chi Minh City, VN	Lat Krabang, TH	6.991	1174.168	32.1	0.26	110	22	0.017	10.8	2.9	0.03132		
Jan	APZU4659628	KUO LIN	Shanghai Pt, CN	Lat Krabang, TH	5.187	4081.808	32.1	0.68	110	22	0.013	10.8	2.9	0.03132		
Jan	CMAU1255612	KUO LIN	Shanghai Pt, CN	Lat Krabang, TH	3.646	4081.808	32.1	0.48	110	22	0.009	10.8	2.9	0.03132		
Jan	CMAU9024353	KUO LIN	Shanghai Pt, CN	Lat Krabang, TH	16.578	4081.808	32.1	2.17	110	22	0.040	10.8	2.9	0.03132		
Jan	PONU0840573	LADY OF LUCK	Penang (Georgetown), MY	Lat Krabang, TH	1.889	2148.32	20.0	0.08	110	22	0.005	10.8	2.9	0.03132		
Jan	BSIU2431128	HYUNDAI SINGAPC	Haiphong, VN	Lat Krabang, TH	1.770	2457.604	16.6	0.07	110	22	0.004	10.8	2.9	0.03132		
Jan	APHU6719554	JITRA BHUM	Shanghai Pt, CN	Lat Krabang, TH	20.628	4081.808	32.1	2.70	110	22	0.050	10.8	2.9	0.03132		
Jan	BMOU6451493	JITRA BHUM	Shanghai Pt, CN	Lat Krabang, TH	11.701	4081.808	32.1	1.53	110	22	0.028	10.8	2.9	0.03132		
Jan	CMAU5798881	JITRA BHUM	Shanghai Pt, CN	Lat Krabang, TH	5.876	4081.808	32.1	0.77	110	22	0.014	10.8	2.9	0.03132		

Month	Container	Vessel	POL	POD*	Weight (tonne)	Distance (km)	g CO2 per tonne-km	Tomnes CO2 emissions	Distance (km)	g CO2 per tonne-km	Tomnes CO2 emissions	fuel consumption (Liter)	kg CO2 per liter fuel	Tomnes CO2 emissions	Tomnes CO2 emissions
Jan	MRKU6350381	MCC KYOTO	Qingdao Pt, CN	Lat Krabang, TH	13,483	4592.96	32.1	1.99	110	22	0.033	10.8	2.9	0.03132	2.052
Jan	TCLU6261756	STAR RIVER / 00211	Singapore, SG	Lat Krabang, TH	4,462	1451.968	20.0	0.13	110	22	0.011	10.8	2.9	0.03132	0.171
Jan	EMCU6013419	UNI-ANGEL	Shekou, CN	Lat Krabang, TH	2,404	3479.908	32.1	0.27	110	22	0.006	10.8	2.9	0.03132	0.306
Jan	TCLU424272	RACHA BHUM / 09	Singapore, SG	Lat Krabang, TH	4,229	1451.968	20.0	0.12	110	22	0.010	10.8	2.9	0.03132	0.164
Jan	DRYU4123747	X-PRESS KAILASH / Singapore, SG	Lat Krabang, TH	Lat Krabang, TH	2,815	1451.968	20.0	0.08	110	22	0.007	10.8	2.9	0.03132	0.120
Jan	MOFU5866683	WANA BHUM / 027	Singapore, SG	Lat Krabang, TH	3,278	1451.968	20.0	0.10	110	22	0.008	10.8	2.9	0.03132	0.134
Jan	NYKU08391913	NYK PAULIA 167E	Singapore, SG	Lat Krabang, TH	3,022	1174.168	20.0	0.09	110	22	0.007	10.8	2.9	0.03132	0.126
Jan	MAGU5283910	STARSHIP TAURUS	Ho Chi Minh City, VN	Lat Krabang, TH	6,808	1451.968	12.5	0.10	110	22	0.016	10.8	2.9	0.03132	0.148
Feb	BSIU2084461	KAMA BHUM	Shanghai Pt, CN	Lat Krabang, TH	3,863	4081.808	32.1	0.51	110	22	0.009	10.8	2.9	0.03132	0.547
Feb	GMU05848278	KAMA BHUM	Shanghai Pt, CN	Lat Krabang, TH	16,552	4081.808	32.1	2.17	110	22	0.040	10.8	2.9	0.03132	2.240
Feb	GESU1372049	OSAKA EXPRESS	Shekou, CN	Lat Krabang, TH	2,520	3479.908	12.5	0.11	110	22	0.006	10.8	2.9	0.03132	0.147
Feb	GESU5904010	OSAKA EXPRESS	Shekou, CN	Lat Krabang, TH	5,452	3479.908	12.5	0.24	110	22	0.013	10.8	2.9	0.03132	0.282
Feb	TRLU459488	EXPRESS BLACK SE / Singapore, SG	Lat Krabang, TH	Lat Krabang, TH	0,354	1451.968	16.6	0.01	110	22	0.001	10.8	2.9	0.03132	0.041
Feb	CAXU6380853	HYUNDAI BANGKO	Haiphong, VN	Lat Krabang, TH	1,751	1451.968	16.6	0.04	110	22	0.004	10.8	2.9	0.03132	0.078
Feb	MRKU0103255	HANSA FALKENBUJ	Qingdao Pt, CN	Lat Krabang, TH	3,184	2457.604	16.6	0.13	110	22	0.008	10.8	2.9	0.03132	0.169
Feb	NYKU4153162	MOLSUCCESS / 10K	Singapore, SG	Lat Krabang, TH	8,701	4592.96	32.1	1.28	110	22	0.021	10.8	2.9	0.03132	1.335
Feb	TRHU1921077	STAR RIVER / 023E	Singapore, SG	Lat Krabang, TH	4,717	1451.968	20.0	0.14	110	22	0.011	10.8	2.9	0.03132	0.180
Feb	NYKU5112110	NEWARK / 023E	Singapore, SG	Lat Krabang, TH	1,151	1451.968	20.0	0.03	110	22	0.003	10.8	2.9	0.03132	0.068
Feb	BEAU4454713	UNI-ANGEL	Shekou, CN	Lat Krabang, TH	3,598	1451.968	16.6	0.09	110	22	0.009	10.8	2.9	0.03132	0.127
Feb	EISU9202770	UNI-ANGEL	Shekou, CN	Lat Krabang, TH	10,645	3479.908	32.1	1.19	110	22	0.026	10.8	2.9	0.03132	1.246
Feb	EMCU09454716	UNI-ANGEL	Shekou, CN	Lat Krabang, TH	8,961	3479.908	32.1	1.00	110	22	0.022	10.8	2.9	0.03132	1.054
Feb	TCNU2291195	UNI-ANGEL	Shekou, CN	Lat Krabang, TH	7,664	3479.908	32.1	0.86	110	22	0.019	10.8	2.9	0.03132	0.906
Feb	MOAU6764874	WANA BHUM / 028	Singapore, SG	Lat Krabang, TH	9,686	3479.908	32.1	1.08	110	22	0.023	10.8	2.9	0.03132	1.137
Feb	BMOU2371445	HYUNDAI JAKARTA	Haiphong, VN	Lat Krabang, TH	1,735	1451.968	20.0	0.05	110	22	0.004	10.8	2.9	0.03132	0.086
Feb	CMAU7087250	KUO LIN	Shanghai Pt, CN	Lat Krabang, TH	3,224	2457.604	16.6	0.13	110	22	0.008	10.8	2.9	0.03132	0.171
Feb	TCKU2129092	RACHA BHUM / 09F	Singapore, SG	Lat Krabang, TH	10,821	4081.808	32.1	1.42	110	22	0.026	10.8	2.9	0.03132	1.475
Feb	APZU4482872	JITRA BHUM	Shanghai Pt, CN	Lat Krabang, TH	2,146	1451.968	20.0	0.06	110	22	0.005	10.8	2.9	0.03132	0.099
Feb	TGHU5044760	JITRA BHUM	Shanghai Pt, CN	Lat Krabang, TH	7,125	4081.808	32.1	0.93	110	22	0.017	10.8	2.9	0.03132	0.982
Feb	TRHU1815814	JITRA BHUM	Shanghai Pt, CN	Lat Krabang, TH	7,234	4081.808	32.1	0.95	110	22	0.018	10.8	2.9	0.03132	0.997
Feb	DFSU2803896	UNI-PROMOTE	Xingang (Tianjin), CN	Lat Krabang, TH	2,705	4081.808	32.1	0.35	110	22	0.007	10.8	2.9	0.03132	0.392
Feb	EISU1788052	KATRIN-S	Ho Chi Minh City, VN	Lat Krabang, TH	0,787	5143.004	32.1	0.13	110	22	0.002	10.8	2.9	0.03132	0.163
Feb	EISU1834203	KATRIN-S	Ho Chi Minh City, VN	Lat Krabang, TH	5,201	1174.168	20.0	0.12	110	22	0.013	10.8	2.9	0.03132	0.166
Feb	NYKU4391068	X-PRESS MAKALU / Singapore, SG	Lat Krabang, TH	Lat Krabang, TH	6,002	1174.168	20.0	0.14	110	22	0.015	10.8	2.9	0.03132	0.187
Feb	YMMU1155513	YM INTERACTION	Taichung, TW	Lat Krabang, TH	4,557	1451.968	20.0	0.13	110	22	0.011	10.8	2.9	0.03132	0.175
Feb	NYKU3381698	X-PRESS KAILASH / Singapore, SG	Lat Krabang, TH	Lat Krabang, TH	2,479	3033.576	32.1	0.24	110	22	0.006	10.8	2.9	0.03132	0.279
Feb	NYKU4765656	X-PRESS KAILASH / Singapore, SG	Lat Krabang, TH	Lat Krabang, TH	2,079	1451.968	20.0	0.06	110	22	0.005	10.8	2.9	0.03132	0.097
Feb	BRTU2001807	ANAN BHUM	Yangon, MM	Lat Krabang, TH	4,704	1451.968	20.0	0.14	110	22	0.011	10.8	2.9	0.03132	0.179
Feb	TRHU1918242	WANA BHUM / 029	Singapore, SG	Lat Krabang, TH	1,062	3520.652	32.1	0.12	110	22	0.003	10.8	2.9	0.03132	0.154
Feb	TCLU9572176	EXPRESS BLACK SE / Singapore, SG	Lat Krabang, TH	Lat Krabang, TH	1,939	1451.968	20.0	0.06	110	22	0.005	10.8	2.9	0.03132	0.092
Feb	TEMU2515783	MOLEMINENCE	Colombo, LK	Lat Krabang, TH	4,439	1451.968	16.6	0.11	110	22	0.011	10.8	2.9	0.03132	0.149
Feb				Lat Krabang, TH	1,901	4354.052	16.6	0.14	110	22	0.005	10.8	2.9	0.03132	0.173

Month	Container	Vessel	POL	POD*	Weight (tonne)	Distance (km)	g CO2 per tonne-km	Tonnes CO2 emissions	Distance (km)	g CO2 per tonne-km	Tonnes CO2 emissions	fuel consumption (Liter)	Kg CO2 per liter fuel	Tonnes CO2 emissions	Tonnes CO2 emissions
Mar	NYKU3129665	MOL SUCCESS / 10K Singapore, SG		Lat Krabang, TH	2,038	1451,968	20.0	0.06	110	110	0.005	10.8	2.9	0.03132	0.095
Mar	MAGU217854	SINAR SUBANG	Shekou, CN	Lat Krabang, TH	4,365	3479,908	32.1	0.49	110	110	0.011	10.8	2.9	0.03132	0.529
Mar	APZU4907998	ITHA BHUM	Shanghai Pt, CN	Lat Krabang, TH	3,041	4081,808	32.1	0.40	110	110	0.007	10.8	2.9	0.03132	0.437
Mar	MOFU0629631	YM ULTIMATE	Shekou, CN	Lat Krabang, TH	6,220	3479,908	12.5	0.27	110	110	0.015	10.8	2.9	0.03132	0.317
Mar	CMAU7611177	ITHA BHUM	Shanghai Pt, CN	Lat Krabang, TH	10,978	4081,808	32.1	1.44	110	110	0.027	10.8	2.9	0.03132	1.496
Mar	MSKU6405974	SFL AVON	Qingdao Pt, CN	Lat Krabang, TH	10,864	4592,96	32.1	1.57	110	110	0.026	10.8	2.9	0.03132	1.629
Mar	TCNU9607135	STAR RIVER / 0024H Singapore, SG		Lat Krabang, TH	13,843	4592,96	32.1	2.04	110	110	0.034	10.8	2.9	0.03132	2.106
Mar	TRHU2638312	STAR RIVER / 0024H Singapore, SG		Lat Krabang, TH	1,603	1451,968	20.0	0.05	110	110	0.004	10.8	2.9	0.03132	0.082
Mar	BMOU4887092	BOX EXPRESS	Shekou, CN	Lat Krabang, TH	8,039	3479,908	32.1	0.90	110	110	0.019	10.8	2.9	0.03132	0.949
Mar	BEAU2067320	HYUNDAI SINGAPORE HAIPHONG, VN		Lat Krabang, TH	2,142	2457,604	16.6	0.09	110	110	0.005	10.8	2.9	0.03132	0.124
Mar	HIMCU3005114	BOX EXPRESS	Shekou, CN	Lat Krabang, TH	3,210	3479,908	32.1	0.36	110	110	0.008	10.8	2.9	0.03132	0.398
Mar	NYKU3637877	RACHA BHUM / 09K Singapore, SG		Lat Krabang, TH	1,925	1451,968	20.0	0.06	110	110	0.005	10.8	2.9	0.03132	0.092
Mar	NYKU2990350	NEWARK 024E	Singapore, SG	Lat Krabang, TH	2,046	1451,968	16.6	0.05	110	110	0.005	10.8	2.9	0.03132	0.086
Mar	MRKU6661070	CAPE QUEST	Penang (Georgetown), Lat Krabang, TH	0,983	2148,32	20.0	0.04	110	110	110	0.002	10.8	2.9	0.03132	0.076
Mar	APZU4602664	JITRA BHUM	Shanghai Pt, CN	Lat Krabang, TH	14,837	4081,808	32.1	1.94	110	110	0.036	10.8	2.9	0.03132	2.011
Mar	TRLU4822780	JITRA BHUM	Shanghai Pt, CN	Lat Krabang, TH	19,957	4081,808	32.1	2.61	110	110	0.048	10.8	2.9	0.03132	2.695
Mar	EISU9426002	STARSHIP TAURUS	Ho Chi Minh City, Lat Krabang, TH	7,562	1174,168	110	12.5	0.11	110	110	0.018	10.8	2.9	0.03132	0.161
Mar	NYKU8482783	NYK PAULA / 169E Singapore, SG		Lat Krabang, TH	2,753	1451,968	20.0	0.08	110	110	0.007	10.8	2.9	0.03132	0.118
Mar	NYKU8066385	GENOVA / 035E Singapore, SG		Lat Krabang, TH	3,194	1451,968	20.0	0.09	110	110	0.008	10.8	2.9	0.03132	0.132
Mar	CMAU8098285	KAMA BHUM	Shanghai Pt, CN	Lat Krabang, TH	9,398	4081,808	32.1	1.23	110	110	0.023	10.8	2.9	0.03132	1.285
Mar	BRDU9000063	SINAR BALI	Yangon, MM	Lat Krabang, TH	0,957	3520,652	32.1	0.11	110	110	0.002	10.8	2.9	0.03132	0.149
Mar	TGHU0288419	AS MORGANA	Shekou, CN	Lat Krabang, TH	1,961	3479,908	16.6	0.11	110	110	0.005	10.8	2.9	0.03132	0.149
Mar	TCLU2559146	HYUNDAI BANGKO HAIPHONG, VN		Lat Krabang, TH	1,431	2457,604	16.6	0.06	110	110	0.003	10.8	2.9	0.03132	0.093
Mar	TCLU4242860	MOL SUCCESS / 10K Singapore, SG		Lat Krabang, TH	2,989	1451,968	20.0	0.09	110	110	0.007	10.8	2.9	0.03132	0.125
Mar	MOFU0727880	TSINGTAO EXPRESS	Shekou, CN	Lat Krabang, TH	5,167	3479,908	12.5	0.22	110	110	0.013	10.8	2.9	0.03132	0.269
Mar	APZU3915160	ITHA BHUM	Shanghai Pt, CN	Lat Krabang, TH	2,035	4081,808	32.1	0.27	110	110	0.005	10.8	2.9	0.03132	0.303
Mar	CXDU1663713	WANNA BHUM / 031 Singapore, SG		Lat Krabang, TH	5,063	1451,968	20.0	0.15	110	110	0.012	10.8	2.9	0.03132	0.191
Mar	TNUA4575059	ITHA BHUM	Shanghai Pt, CN	Lat Krabang, TH	15,710	4081,808	32.1	2.06	110	110	0.038	10.8	2.9	0.03132	2.128
Mar	MRKU0502208	MARIVIA	Qingdao Pt, CN	Lat Krabang, TH	8,777	4592,96	20.0	0.81	110	110	0.021	10.8	2.9	0.03132	0.859
Mar	NYKU8066240	RACHA BHUM / 09K Singapore, SG		Lat Krabang, TH	2,450	1451,968	20.0	0.07	110	110	0.006	10.8	2.9	0.03132	0.108
Mar	EMCU9812912	UNI-PROBITY	Xingang (Tianjin), Lat Krabang, TH	2,769	5143,004	32.1	0.46	110	110	0.007	10.8	2.9	0.03132	0.495	
Mar	HMCUJ035486	DONGJIN VOYAGE	Ho Chi Minh City, Lat Krabang, TH	3,444	1174,168	110	32.1	0.13	110	110	0.008	10.8	2.9	0.03132	0.169
Mar	MOFU0639080	STAR RIVER / 0026K Singapore, SG		Lat Krabang, TH	3,582	1451,968	20.0	0.10	110	110	0.009	10.8	2.9	0.03132	0.144
Mar	TEMU627790	SINAR SUBANG	Shekou, CN	Lat Krabang, TH	6,910	3479,908	32.1	0.77	110	110	0.017	10.8	2.9	0.03132	0.820
Mar	BEAU2155631	BOX EXPRESS	Haiphong, VN	Lat Krabang, TH	4,501	2457,604	32.1	0.36	110	110	0.011	10.8	2.9	0.03132	0.397

Month	Container	Vessel	POL	POD*	Weight (tonne)	Distance (km)	g CO2 per tonne-km	Tonnes CO2 emissions	Distance (km)	g CO2 per tonne-km	Tonnes CO2 emissions	fuel consumption (Liter)	Kg CO2 per liter fuel	Tonnes CO2 emissions	Tonnes CO2 emissions
Apr	TCLU1781799	MOL CHARISMA	Shekou, CN	Lat Krabang, TH	3,568	3479,908	12.5	0.16	110	22	0.009	10.8	2.9	0.03132	0.195
Apr	SEGU4992747	NEWARK / 025E	Singapore, SG	Lat Krabang, TH	4,885	1451,968	16.6	0.12	110	22	0.012	10.8	2.9	0.03132	0.161
Apr	HMCU1088676	BOX EXPRESS	Taichung, TW	Lat Krabang, TH	4,189	3033,576	32.1	0.41	110	22	0.010	10.8	2.9	0.03132	0.449
Apr	INKU6646350	GSL AFRICA	Shanghai Pt, CN	Lat Krabang, TH	11,383	4081,808	20.0	0.93	110	22	0.028	10.8	2.9	0.03132	0.988
Apr	UESU5261221	GSL AFRICA	Shanghai Pt, CN	Lat Krabang, TH	7,923	4081,808	20.0	0.65	110	22	0.019	10.8	2.9	0.03132	0.697
Apr	EISU1827729	NORDTIGER	Ho Chi Minh City, V	Lat Krabang, TH	4,866	1174,168	32.1	0.18	110	22	0.012	10.8	2.9	0.03132	0.226
Apr	APZU4655345	KAMA BHUM	Shanghai Pt, CN	Lat Krabang, TH	2,637	4081,808	32.1	0.33	110	22	0.006	10.8	2.9	0.03132	0.370
Apr	CAXU8066530	KAMA BHUM	Shanghai Pt, CN	Lat Krabang, TH	8,816	4081,808	32.1	1.16	110	22	0.021	10.8	2.9	0.03132	1.208
Apr	TRLU6741707	KAMA BHUM	Shanghai Pt, CN	Lat Krabang, TH	11,717	4081,808	32.1	1.54	110	22	0.028	10.8	2.9	0.03132	1.595
Apr	XINU4023330	KAMA BHUM	Shanghai Pt, CN	Lat Krabang, TH	1,206	4081,808	32.1	0.16	110	22	0.003	10.8	2.9	0.03132	0.192
Apr	XINU4023330	KAMA BHUM	Shanghai Pt, CN	Lat Krabang, TH	3,591	4081,808	32.1	0.47	110	22	0.009	10.8	2.9	0.03132	0.511
Apr	TGHU5278389	MOL SUCCESS / 1	Singapore, SG	Lat Krabang, TH	3,120	1451,968	20.0	0.09	110	22	0.008	10.8	2.9	0.03132	0.129
Apr	EGSU3121487	BOX EXPRESS	Haiphong, VN	Lat Krabang, TH	2,151	2457,604	32.1	0.17	110	22	0.005	10.8	2.9	0.03132	0.206
Apr	TCLU4599657	STAR RIVER / 028	Singapore, SG	Lat Krabang, TH	4,318	1451,968	20.0	0.13	110	22	0.010	10.8	2.9	0.03132	0.167
Apr	BRTU2000138	SINAR BALI	Yangon, MM	Lat Krabang, TH	0,776	3520,652	32.1	0.09	110	22	0.002	10.8	2.9	0.03132	0.121
Apr	MRKU0056580	HANSA BREITENB	Qingdao Pt, CN	Lat Krabang, TH	6,831	4592,96	32.1	1.01	110	22	0.017	10.8	2.9	0.03132	1.055
Apr	TCNU8935572	BUXHARMONY	Shanghai Pt, CN	Lat Krabang, TH	13,442	4081,808	20.0	1.10	110	22	0.033	10.8	2.9	0.03132	1.161
Apr	TRHU0612708	BUXHARMONY	Shanghai Pt, CN	Lat Krabang, TH	8,231	4081,808	20.0	0.67	110	22	0.020	10.8	2.9	0.03132	0.723
Apr	OCGU8086635	BOX EXPRESS	Shekou, CN	Lat Krabang, TH	8,567	3479,908	32.1	0.96	110	22	0.021	10.8	2.9	0.03132	1.009
Apr	KKFU1850157	NYK FURANO / 04	Singapore, SG	Lat Krabang, TH	3,406	1451,968	16.6	0.08	110	22	0.008	10.8	2.9	0.03132	0.122
Apr	SIKU3012840	EXPRESS BLACK	Colombo, LK	Lat Krabang, TH	1,449	4354,052	16.6	0.10	110	22	0.004	10.8	2.9	0.03132	0.140
Apr	TCLU4322390	STARSHIP TAURUS	Ho Chi Minh City, V	Lat Krabang, TH	5,030	1174,168	12.5	0.07	110	22	0.012	10.8	2.9	0.03132	0.117
Apr	TKCU4209279	NYK PAULA / 171E	Singapore, SG	Lat Krabang, TH	2,101	1451,968	20.0	0.06	110	22	0.005	10.8	2.9	0.03132	0.097
Apr	KKFU1811166	AMBASSADOR BR	Shekou, CN	Lat Krabang, TH	6,289	3479,908	16.6	0.36	110	22	0.015	10.8	2.9	0.03132	0.410
Apr	ETIU0077182	UNI-AHEAD	Haiphong, VN	Lat Krabang, TH	7,124	3479,908	16.6	0.41	110	22	0.017	10.8	2.9	0.03132	0.460
Apr	CAIU9405630	JITRA BHUM	Shanghai Pt, CN	Lat Krabang, TH	1,638	2457,604	32.1	0.13	110	22	0.004	10.8	2.9	0.03132	0.164
Apr	CMAU8297683	JITRA BHUM	Shanghai Pt, CN	Lat Krabang, TH	14,593	4081,808	32.1	1.91	110	22	0.035	10.8	2.9	0.03132	1.979
Apr	CMAU9127346	JITRA BHUM	Shanghai Pt, CN	Lat Krabang, TH	4,438	4081,808	32.1	0.58	110	22	0.011	10.8	2.9	0.03132	0.623
Apr	DFSU2056854	JITRA BHUM	Shanghai Pt, CN	Lat Krabang, TH	2,569	4081,808	32.1	0.34	110	22	0.006	10.8	2.9	0.03132	0.374
Apr	TCLU7293418	STAR RIVER / 027	Singapore, SG	Lat Krabang, TH	7,990	4081,808	32.1	1.05	110	22	0.019	10.8	2.9	0.03132	1.098
Apr	BRTU2000380	TONTO JAYA	Yangon, MM	Lat Krabang, TH	1,778	1451,968	20.0	0.05	110	22	0.004	10.8	2.9	0.03132	0.087
Apr				Lat Krabang, TH	0,875	3520,652	32.1	0.10	110	22	0.002	10.8	2.9	0.03132	0.132

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Month	Container	Vessel	POL	POD*	Weight (tonne)	Distance (km)	g CO2 per tonne-km	Tonnes CO2 emissions	Distance (km)	g CO2 per tonne-km	Tonnes CO2 emissions	fuel consumption (Liter)	kg CO2 per liter fuel	Tonnes CO2 emissions	Tonnes CO2 emissions
Jun	EISU9337501	STARSHIP TAURUS	Ho Chi Minh City, V	Lat Krabang, TH	7.378	1174,168	12.5	0.11	110	22	0.018	10.8	2.9	0.03132	0.157
Jun	IMTU1012846	CSCL LIMA	Shekou, CN	Lat Krabang, TH	7.344	3479,908	20.0	0.51	110	22	0.018	10.8	2.9	0.03132	0.560
Jun	EGSU030152689	UNI-PERFECT	Haiphong, VN	Lat Krabang, TH	3.699	2457,604	32.1	0.29	110	22	0.009	10.8	2.9	0.03132	0.332
Jun	TCLU4291900	DONGJIN VOYAGE	Ho Chi Minh City, V	Lat Krabang, TH	6.224	1174,168	32.1	0.23	110	22	0.015	10.8	2.9	0.03132	0.281
Jun	APZU4631451	COSCO HOUSTON	Shanghai Pt, CN	Lat Krabang, TH	10.428	4081,808	16.6	0.71	110	22	0.025	10.8	2.9	0.03132	0.763
Jun	CMAU4125870	COSCO HOUSTON	Shanghai Pt, CN	Lat Krabang, TH	5.888	4081,808	16.6	0.40	110	22	0.014	10.8	2.9	0.03132	0.445
Jun	ECMU4447648	SEASPAN SANTO	Shanghai Pt, CN	Lat Krabang, TH	5.571	4081,808	16.6	0.38	110	22	0.013	10.8	2.9	0.03132	0.422
Jun	TRHU3665122	MARIBOR	Shanghai Pt, CN	Lat Krabang, TH	8.002	4081,808	16.6	0.05	110	22	0.002	10.8	2.9	0.03132	0.088
Jun	TRLU9298300	COSCO HOUSTON	Shanghai Pt, CN	Lat Krabang, TH	7.668	4081,808	16.6	0.52	110	22	0.019	10.8	2.9	0.03132	0.569
Jun	FSCU4683563	MARIBOR	Shanghai Pt, CN	Lat Krabang, TH	8.675	4081,808	16.6	0.59	110	22	0.021	10.8	2.9	0.03132	0.640
Jun	SEGU4175813	MARIBOR	Shanghai Pt, CN	Lat Krabang, TH	4.199	4081,808	16.6	0.28	110	22	0.010	10.8	2.9	0.03132	0.326
Jun	TCNU1771498	MARIBOR	Shanghai Pt, CN	Lat Krabang, TH	10.864	4081,808	16.6	0.74	110	22	0.026	10.8	2.9	0.03132	0.794
Jun	TCLU4397213	UNI-PERFECT	Shekou, CN	Lat Krabang, TH	5.860	3479,908	32.1	0.65	110	22	0.014	10.8	2.9	0.03132	0.700
Jun	MRKU0169191	HANSA FALKENBL	Qingdao Pt, CN	Lat Krabang, TH	6.088	4592,86	32.1	0.90	110	22	0.015	10.8	2.9	0.03132	0.944
Jun	EITU0048590	UNI-AHEAD	Haiphong, VN	Lat Krabang, TH	2.049	2457,604	32.1	0.16	110	22	0.005	10.8	2.9	0.03132	0.198
Jun	CMAU31222840	SEASPAN SANTO	Shanghai Pt, CN	Lat Krabang, TH	3.394	4081,808	16.6	0.23	110	22	0.008	10.8	2.9	0.03132	0.270
Jun	FBLU0071440	EVER UTILE	Xingang (Tianjin), CN	Lat Krabang, TH	1.507	5143,004	16.6	0.13	110	22	0.004	10.8	2.9	0.03132	0.164
Jun	TEMU7505134	AMBASSADOR BR	Xiamen, CN	Lat Krabang, TH	9.028	3087,284	16.6	0.46	110	22	0.022	10.8	2.9	0.03132	0.516
Jun	TGHU9157261	AMBASSADOR BR	Xiamen, CN	Lat Krabang, TH	8.879	3087,284	16.6	0.46	110	22	0.021	10.8	2.9	0.03132	0.508
Jun	EISU1840253	UNI-PERFECT	Ho Chi Minh City, V	Lat Krabang, TH	5.128	1174,168	32.1	0.19	110	22	0.012	10.8	2.9	0.03132	0.237
Jun	DFSU1011019	UNI-AHEAD	Taichung, TW	Lat Krabang, TH	1.428	3033,576	32.1	0.14	110	22	0.003	10.8	2.9	0.03132	0.174
Jun	TCLU9431985	MARIBOR	Shanghai Pt, CN	Lat Krabang, TH	15.149	4081,808	16.6	1.03	110	22	0.037	10.8	2.9	0.03132	1.094
Jun	APZU3765564	MARIBOR	Shanghai Pt, CN	Lat Krabang, TH	4.948	4081,808	16.6	0.34	110	22	0.012	10.8	2.9	0.03132	0.379
Jun	TCLU6468825	UNI-PERFECT	Shekou, CN	Lat Krabang, TH	8.714	3479,908	32.1	0.97	110	22	0.021	10.8	2.9	0.03132	1.026
Jun	BMOU3103196	NYK ISABEL 704N	Singapore, SG	Lat Krabang, TH	0.264	1451,968	20.0	0.01	110	22	0.001	10.8	2.9	0.03132	0.041

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Month	Container	Vessel	POL	POD*	Weight (tonne)	Distance (km)	g CO2 per tonne-km	Tonnes CO2 emissions	Distance (km)	g CO2 per tonne-km	Tonnes CO2 emissions	fuel consumption (Liter)	kg CO2 per liter fuel	Tonnes CO2 emissions	Tonnes CO2 emissions
Jul	CMAU8365699	SEASPAN SANTOX	Shanghai Pt, CN	Lat Krabang, TH	4,403	4081,808	16.6	0.30	110	0.011	22	10.8	2.9	0.03132	0.340
Jul	ECMU4570122	SEASPAN SANTOX	Shanghai Pt, CN	Lat Krabang, TH	10,001	4081,808	16.6	0.68	110	0.024	22	10.8	2.9	0.03132	0.733
Jul	DRYU2678577	UNI-AHEAD	Hai Phong, VN	Lat Krabang, TH	3,401	2457,604	32.1	0.27	110	0.008	22	10.8	2.9	0.03132	0.308
Jul	SMCU1049346	NYK APOLLO	Colombo, LK	Lat Krabang, TH	4,433	4354,052	16.6	0.03	110	0.001	22	10.8	2.9	0.03132	0.064
Jul	TCLU8739414	STAR RIVER 032W	Singapore, SG	Lat Krabang, TH	1,431	1451,968	20.0	0.04	110	0.003	22	10.8	2.9	0.03132	0.076
Jul	TCLU2954937	STAR RIVER 032N	Singapore, SG	Lat Krabang, TH	2,281	1451,968	20.0	0.07	110	0.006	22	10.8	2.9	0.03132	0.103
Jul	CXDU1374270	STAR RIVER 032N	Singapore, SG	Lat Krabang, TH	4,692	1451,968	20.0	0.14	110	0.011	22	10.8	2.9	0.03132	0.179
Jul	TINU4545666	HANSA SIEGBURG	Qingdao Pt, CN	Lat Krabang, TH	5,673	4592,96	32.1	0.84	110	0.014	22	10.8	2.9	0.03132	0.881
Jul	EMCU1345107	UNI-PERFECT	Shekou, CN	Lat Krabang, TH	5,957	3479,908	32.1	0.67	110	0.014	22	10.8	2.9	0.03132	0.711
Jul	FCU3128295	COSCO HOUSTON	Shanghai Pt, CN	Lat Krabang, TH	1,700	4081,808	16.6	0.12	110	0.004	22	10.8	2.9	0.03132	0.151
Jul	APZU4587488	COSCO HOUSTON	Shanghai Pt, CN	Lat Krabang, TH	14,713	4081,808	16.6	1.00	110	0.036	22	10.8	2.9	0.03132	1.064
Jul	TCNU3890997	NYK ISABEL	706N Singapore, SG	Lat Krabang, TH	4,679	1451,968	20.0	0.14	110	0.011	22	10.8	2.9	0.03132	0.179
Jul	TCLU1688513	RACHA BHUM	102N Singapore, SG	Lat Krabang, TH	4,314	1451,968	20.0	0.13	110	0.010	22	10.8	2.9	0.03132	0.167
Jul	TCLU4410830	STAR RIVER /033N	Singapore, SG	Lat Krabang, TH	2,640	1451,968	20.0	0.08	110	0.006	22	10.8	2.9	0.03132	0.114
Jul	TRHU3708820	UNI-AHEAD	Hai Phong, VN	Lat Krabang, TH	2,457	2457,604	32.1	0.19	110	0.006	22	10.8	2.9	0.03132	0.231
Jul	TCLU8353199	UNI-ARDENT	Xiamen, CN	Lat Krabang, TH	5,386	3087,284	32.1	0.53	110	0.013	22	10.8	2.9	0.03132	0.576
Jul	GATU4460019	STARSHIP TAURUS	Ho Chi Minh City, V	Lat Krabang, TH	4,973	1174,168	12.5	0.07	110	0.012	22	10.8	2.9	0.03132	0.116
Jul	TGHU9030997	UNI-PERFECT	Shekou, CN	Lat Krabang, TH	7,987	3479,908	32.1	0.89	110	0.019	22	10.8	2.9	0.03132	0.943
Jul	APZU3590640	SEASPAN SANTOX	Shanghai Pt, CN	Lat Krabang, TH	3,804	4081,808	16.6	0.26	110	0.009	22	10.8	2.9	0.03132	0.298
Jul	CMAU9025180	SEASPAN SANTOX	Shanghai Pt, CN	Lat Krabang, TH	15,733	4081,808	16.6	1.07	110	0.038	22	10.8	2.9	0.03132	1.195
Jul	TCLU4011315	NYK PAULA	18101N Singapore, SG	Lat Krabang, TH	2,640	1451,968	20.0	0.08	110	0.006	22	10.8	2.9	0.03132	0.114
Jul	ECMU9848670	MARIBOR	Shanghai Pt, CN	Lat Krabang, TH	8,579	4081,808	16.6	0.58	110	0.021	22	10.8	2.9	0.03132	0.633
Jul	MSKU4447820	EM HYDRA	Qingdao Pt, CN	Lat Krabang, TH	3,036	4592,96	32.1	0.45	110	0.007	22	10.8	2.9	0.03132	0.486
Jul	EITU1101494	DONGJIN VOYAGE	Ho Chi Minh City, V	Lat Krabang, TH	4,494	1174,168	32.1	0.17	110	0.011	22	10.8	2.9	0.03132	0.212
Jul	EGHU3250942	DONGJIN VOYAGE	Ho Chi Minh City, V	Lat Krabang, TH	3,192	1174,168	32.1	0.12	110	0.008	22	10.8	2.9	0.03132	0.159

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Month	Container	Vessel	POL	POD*	Weight (tonne)	Distance (km)	g CO2 per tonne-km	Tomnes CO2 emissions	Distance (km)	g CO2 per tonne-km	Tomnes CO2 emissions	fuel consumption (Liter)	kg CO2 per liter fuel	Tomnes CO2 emissions	Tomnes CO2 emissions
Aug	TCLU9039597	UNI-AHEAD	Haiphong, VN	Lat Krabang, TH	2,122	2457,604	32.1	0.17	110	22	0.005	10.8	2.9	0.09132	0.204
Aug	TCLU6361550	UNI-PROMOTE	Xingang (Tianjin), (Lat Krabang, TH	Lat Krabang, TH	2,225	5143,004	32.1	0.37	110	22	0.005	10.8	2.9	0.09132	0.404
Aug	EMCU3295957	UNI-PROMOTE	Xingang (Tianjin), (Lat Krabang, TH	Lat Krabang, TH	1,403	5143,004	32.1	0.23	110	22	0.003	10.8	2.9	0.09132	0.266
Aug	EMCU1335916	UNI-PERFECT	Shekou, CN	Lat Krabang, TH	7,861	3479,908	32.1	0.88	110	22	0.019	10.8	2.9	0.09132	0.928
Aug	SEGU2872085	UNI-PERFECT	Shekou, CN	Lat Krabang, TH	3,674	3479,908	32.1	0.41	110	22	0.011	10.8	2.9	0.09132	0.451
Aug	CMAU0286455	KOTA LATIF	Shanghai Pt, CN	Lat Krabang, TH	4,359	4081,808	16.6	0.30	110	22	0.010	10.8	2.9	0.09132	0.337
Aug	TRHU3221067	AS CLEMENTINA	Shanghai Pt, CN	Lat Krabang, TH	8,005	4081,808	20.0	0.34	110	22	0.010	10.8	2.9	0.09132	0.385
Aug	APHU6379623	KOTA LATIF	Shanghai Pt, CN	Lat Krabang, TH	1,970	1451,968	16.6	0.54	110	22	0.019	10.8	2.9	0.09132	0.593
Aug	NYKU4841967	VIRA BHUM 094E	Singapore, SG	Lat Krabang, TH	7,938	4081,808	20.0	0.06	110	22	0.005	10.8	2.9	0.09132	0.093
Aug	ZCSU6505643	AS CLEMENTINA	Shanghai Pt, CN	Lat Krabang, TH	2,574	3038,576	20.0	0.65	110	22	0.019	10.8	2.9	0.09132	0.699
Aug	EITU0526323	ITAL MELODIA	Taichung, TW	Lat Krabang, TH	7,490	4081,808	20.0	0.13	110	22	0.006	10.8	2.9	0.09132	0.167
Aug	ZCSU2559180	GSL AFRICA	Shanghai Pt, CN	Lat Krabang, TH	7,009	4081,808	20.0	0.61	110	22	0.018	10.8	2.9	0.09132	0.661
Aug	ZCSU2605000	GSL AFRICA	Shanghai Pt, CN	Lat Krabang, TH	0,605	1451,968	20.0	0.02	110	22	0.017	10.8	2.9	0.09132	0.620
Aug	TRLU9725530	NYK PAULA/18102	Singapore, SG	Lat Krabang, TH	4,357	1451,968	20.0	0.13	110	22	0.011	10.8	2.9	0.09132	0.157
Aug	DRYU9508295	NYK ISABEL/708N	Singapore, SG	Lat Krabang, TH	3,981	1451,968	20.0	0.12	110	22	0.010	10.8	2.9	0.09132	0.168
Aug	KKFU7555190	NYK PAULA/18102	Singapore, SG	Lat Krabang, TH	3,149	3520,652	36.3	0.40	110	22	0.008	10.8	2.9	0.09132	0.157
Aug	CCLU3696954	NINOS	Yangon, MM	Lat Krabang, TH	1,403	1451,968	20.0	0.04	110	22	0.003	10.8	2.9	0.09132	0.441
Aug	MOAU6724444	ACX PEARL 141N	Singapore, SG	Lat Krabang, TH	3,714	1451,968	20.0	0.11	110	22	0.009	10.8	2.9	0.09132	0.075
Aug	NYKU8308220	RACHA BHUM 104I	Singapore, SG	Lat Krabang, TH	2,246	3087,284	32.1	0.22	110	22	0.005	10.8	2.9	0.09132	0.148
Aug	IMTU3034675	UNI-ARDENT	Xiamen, CN	Lat Krabang, TH	9,355	3087,284	32.1	0.93	110	22	0.023	10.8	2.9	0.09132	0.259
Aug	BEAU4467840	UNI-ARDENT	Xiamen, CN	Lat Krabang, TH	3,057	1174,168	32.1	0.12	110	22	0.007	10.8	2.9	0.09132	0.981
Aug	EITU0450552	NORDTIGER	Ho Chi Minh City, V	Lat Krabang, TH	4,836	1174,168	32.1	0.18	110	22	0.012	10.8	2.9	0.09132	0.154
Aug	IMTU1093597	NORDTIGER	Ho Chi Minh City, V	Lat Krabang, TH	5,001	2457,604	32.1	0.39	110	22	0.012	10.8	2.9	0.09132	0.225
Aug	EISU1727648	UNI-PERFECT	Haiphong, VN	Lat Krabang, TH	4,687	3479,908	32.1	0.52	110	22	0.011	10.8	2.9	0.09132	0.438
Aug	IMTU1022084	UNI-PERFECT	Shekou, CN	Lat Krabang, TH	12,349	4081,808	16.6	0.84	110	22	0.030	10.8	2.9	0.09132	0.566
Aug	TCNU9729350	MARIBOR	Shanghai Pt, CN	Lat Krabang, TH	1,498	1451,968	20.0	0.04	110	22	0.004	10.8	2.9	0.09132	0.898
Aug	MOAU0551315	MOL SUCCES/075I	Singapore, SG	Lat Krabang, TH	3,768	4592,96	32.1	0.55	110	22	0.009	10.8	2.9	0.09132	0.078
Aug	LLTU2073004	RHL AURORA	Qingdao Pt, CN	Lat Krabang, TH	5,534	4081,808	16.6	0.37	110	22	0.013	10.8	2.9	0.09132	0.595
Aug	CMAU8383277	COSCO WELLINGT	Shanghai Pt, CN	Lat Krabang, TH	10,834	4081,808	16.6	0.73	110	22	0.026	10.8	2.9	0.09132	0.420
Aug	FSCU4629198	COSCO WELLINGT	Shanghai Pt, CN	Lat Krabang, TH											0.792

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Month	Container	Vessel	POL	POD*	Weight (tonne)	Distance (km)	g CO2 per tonne-km	Tonnes CO2 emissions	Distance (km)	g CO2 per tonne-km	Tonnes CO2 emissions	Fuel consumption (Liter)	kg CO2 per liter fuel	Tonnes CO2 emissions	Tonnes CO2 emissions
Sep	HMCU1023994	STARSHIP TAURUS	Ho Chi Minh City, Vietnam	Lat Krabang, TH	22,773	1174,168	12.5	0.33	110	0.055	22	10.8	2.9	0.03132	0.421
Sep	CMAU7887761	CONTSHIP WIN	Shekou, CN	Lat Krabang, TH	7,110	3479,908	32.1	0.79	110	0.017	22	10.8	2.9	0.03132	0.843
Sep	CEMU4553948	SEASPAN SANTOS	Shanghai Pt, CN	Lat Krabang, TH	11,802	4081,808	16.6	0.80	110	0.029	22	10.8	2.9	0.03132	0.860
Sep	UETU5445578	KMTC TIANJIN	Shanghai Pt, CN	Lat Krabang, TH	1,173	4081,808	20.0	0.10	110	0.003	22	10.8	2.9	0.03132	0.130
Sep	FCIU7122150	SM HOCHIMINH	Qingdao Pt, CN	Lat Krabang, TH	5,711	4592,96	32.1	0.84	110	0.014	22	10.8	2.9	0.03132	0.887
Sep	CBHU8606444	NYK FURANO/050E	Singapore, SG	Lat Krabang, TH	3,367	1451,968	16.6	0.08	110	0.008	22	10.8	2.9	0.03132	0.121
Sep	DFSU617267	NYK FURANO/050E	Singapore, SG	Lat Krabang, TH	2,600	1451,968	16.6	0.06	110	0.006	22	10.8	2.9	0.03132	0.100
Sep	DFSU6178267	NYK FURANO/050E	Singapore, SG	Lat Krabang, TH	3,237	1451,968	16.6	0.08	110	0.008	22	10.8	2.9	0.03132	0.117
Sep	DFSUA290133	LEDA TRADER	Ho Chi Minh City, Vietnam	Lat Krabang, TH	5,230	1174,168	20.0	0.12	110	0.013	22	10.8	2.9	0.03132	0.167
Sep	DRYU9756096	LEDA TRADER	Ho Chi Minh City, Vietnam	Lat Krabang, TH	6,047	1174,168	20.0	0.14	110	0.015	22	10.8	2.9	0.03132	0.188
Sep	BEAU2857659	SITC KANTO	Shanghai Pt, CN	Lat Krabang, TH	3,705	4081,808	32.1	0.49	110	0.009	22	10.8	2.9	0.03132	0.526
Sep	KMTU8218960	SITC KANTO	Shanghai Pt, CN	Lat Krabang, TH	12,465	4081,808	32.1	1.63	110	0.030	22	10.8	2.9	0.03132	1.695
Sep	EGHU1020489	UNI-ARDENT	Shekou, CN	Lat Krabang, TH	7,499	3479,908	32.1	0.84	110	0.018	22	10.8	2.9	0.03132	0.887
Sep	GESU6595615	UNI-PERFECT	Haiphong, VN	Lat Krabang, TH	6,290	2457,604	32.1	0.50	110	0.015	22	10.8	2.9	0.03132	0.543
Sep	CAIU6125476	CONTSHIP WIN	Shekou, CN	Lat Krabang, TH	2,438	3479,908	32.1	0.27	110	0.006	22	10.8	2.9	0.03132	0.310
Sep	SEGU6212731	CONTSHIP WIN	Shekou, CN	Lat Krabang, TH	9,600	3479,908	32.1	1.07	110	0.023	22	10.8	2.9	0.03132	1.127
Sep	CCLU7165149	GENOVA/18104E	Singapore, SG	Lat Krabang, TH	4,031	1451,968	20.0	0.12	110	0.010	22	10.8	2.9	0.03132	0.158
Sep	TRHU2559384	MRKU0831712	HANSA BREITENBU	Xingang (Tianjin), China	2,093	1451,968	20.0	0.06	110	0.005	22	10.8	2.9	0.03132	0.097
Sep	MSKU8979307	HANSA BREITENBU	Xingang (Tianjin), China	Lat Krabang, TH	5,075	5143,004	32.1	0.84	110	0.012	22	10.8	2.9	0.03132	0.881
Sep	BMOU5785747	MOUNT NICHOLSO	Shanghai Pt, CN	Lat Krabang, TH	2,479	5143,004	32.1	0.41	110	0.006	22	10.8	2.9	0.03132	0.447
Sep	BMOU6036701	MOUNT NICHOLSO	Shanghai Pt, CN	Lat Krabang, TH	19,261	4081,808	32.1	2.52	110	0.047	22	10.8	2.9	0.03132	2.602
Sep	BMOU6366220	MOUNT NICHOLSO	Shanghai Pt, CN	Lat Krabang, TH	11,417	4081,808	32.1	1.50	110	0.028	22	10.8	2.9	0.03132	1.555
Sep	TGHU5149674	MOUNT NICHOLSO	Shanghai Pt, CN	Lat Krabang, TH	6,289	4081,808	32.1	0.82	110	0.015	22	10.8	2.9	0.03132	0.871
Sep	TGHU5152831	MOUNT NICHOLSO	Shanghai Pt, CN	Lat Krabang, TH	20,371	4081,808	32.1	2.67	110	0.049	22	10.8	2.9	0.03132	2.178
Sep	SAJU2031172	KOTA LAYAR	Colombo, LK	Lat Krabang, TH	16,084	4081,808	32.1	2.11	110	0.039	22	10.8	2.9	0.03132	2.750
Sep	DFSUA299188	KMTC SURABAYA	Ho Chi Minh City, Vietnam	Lat Krabang, TH	0,482	4354,052	16.6	0.03	110	0.001	22	10.8	2.9	0.03132	0.067
Sep	TSTU0235019	KMTC SURABAYA	Ho Chi Minh City, Vietnam	Lat Krabang, TH	5,971	1174,168	20.0	0.14	110	0.014	22	10.8	2.9	0.03132	0.186
Sep	SEGU1978010	SAWASDEE BANGK	Qingdao Pt, CN	Lat Krabang, TH	3,020	1174,168	20.0	0.07	110	0.007	22	10.8	2.9	0.03132	0.110
Sep	SEQUA792250	SAWASDEE BANGK	Qingdao Pt, CN	Lat Krabang, TH	2,787	4592,96	32.1	0.41	110	0.007	22	10.8	2.9	0.03132	0.449
Sep	CBHU8161087	BALTHASAR SCHUL	Singapore, SG	Lat Krabang, TH	4,503	4592,96	32.1	0.66	110	0.011	22	10.8	2.9	0.03132	0.706
Sep				Lat Krabang, TH	3,827	1451,968	16.6	0.09	110	0.009	22	10.8	2.9	0.03132	0.133

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Month	Container	Vessel	POL	POD*	Weight (tonne)	Distance (km)	g CO2 per tonne-km	Tonnes CO2 emissions	Distance (km)	g CO2 per tonne-km	Tonnes CO2 emissions	fuel consumption (Liter)	Kg CO2 per liter fuel	Tonnes CO2 emissions	Tonnes CO2 emissions
Oct	EISU9964166	UNI-PERFECT	Haiphong, VN	Lat Krabang, TH	2,755	2457,604	32.1	0.22	110	22	0.007	10.8	2.9	0.03132	0.255
Oct	CBHU8953014	GENOVA/1810SE	Singapore, SG	Lat Krabang, TH	4,387	1451,968	20.0	0.13	110	22	0.011	10.8	2.9	0.03132	0.169
Oct	CBHU8979408	NYK FURANO/051E	Singapore, SG	Lat Krabang, TH	4,124	1451,968	16.6	0.10	110	22	0.010	10.8	2.9	0.03132	0.141
Oct	TCUJ1521529	NYK FURANO/051E	Singapore, SG	Lat Krabang, TH	2,053	1451,968	16.6	0.05	110	22	0.005	10.8	2.9	0.03132	0.086
Oct	CCLU3793764	GENOVA/1810SE	Singapore, SG	Lat Krabang, TH	1,673	1451,968	20.0	0.05	110	22	0.004	10.8	2.9	0.03132	0.084
Oct	EISU1670590	UNI-POPULAR	Haiphong, VN	Lat Krabang, TH	5,848	2457,604	32.1	0.46	110	22	0.014	10.8	2.9	0.03132	0.507
Oct	FSCU8925095	LEDA TRADER	Ho Chi Minh City, VN	Lat Krabang, TH	6,769	1174,168	20.0	0.16	110	22	0.016	10.8	2.9	0.03132	0.207
Oct	FCIU9733288	SEASPAN FRASER/Singapore, SG	Singapore, SG	Lat Krabang, TH	3,118	1451,968	16.6	0.08	110	22	0.008	10.8	2.9	0.03132	0.114
Oct	SUDU7309243	MCC HA LONG	Yangon, MM	Lat Krabang, TH	3,741	3520,652	32.1	0.42	110	22	0.008	10.8	2.9	0.03132	0.114
Oct	ECMU4421134	APL CAIRO	Shekou, CN	Lat Krabang, TH	5,006	3479,908	20.0	0.35	110	22	0.012	10.8	2.9	0.03132	0.463
Oct	TGHU5086093	APL CAIRO	Shekou, CN	Lat Krabang, TH	6,538	3479,908	20.0	0.46	110	22	0.016	10.8	2.9	0.03132	0.392
Oct	FCIU7450355	NORDPANTHER	Shanghai Pt, CN	Lat Krabang, TH	15,371	4081,808	32.1	2.01	110	22	0.037	10.8	2.9	0.03132	0.502
Oct	FCIU7450397	NORDPANTHER	Shanghai Pt, CN	Lat Krabang, TH	19,724	4081,808	32.1	2.58	110	22	0.048	10.8	2.9	0.03132	2.083
Oct	FCIU7459711	NORDPANTHER	Shanghai Pt, CN	Lat Krabang, TH	20,134	4081,808	32.1	2.64	110	22	0.049	10.8	2.9	0.03132	2.663
Oct	KMTU9275218	NORDPANTHER	Shanghai Pt, CN	Lat Krabang, TH	8,727	4081,808	32.1	1.14	110	22	0.021	10.8	2.9	0.03132	2.718
Oct	SEGU5552681	NORDPANTHER	Shanghai Pt, CN	Lat Krabang, TH	8,406	4081,808	32.1	1.10	110	22	0.020	10.8	2.9	0.03132	1.196
Oct	TCLU8717589	UNI-ARDENT	Shekou, CN	Lat Krabang, TH	8,915	3479,908	32.1	1.00	110	22	0.022	10.8	2.9	0.03132	1.153
Oct	TEMU0694231	UNI-ARDENT	Shekou, CN	Lat Krabang, TH	2,908	3479,908	32.1	0.32	110	22	0.007	10.8	2.9	0.03132	0.363
Oct	HMCU9005913	AREOPOLIS	Xingang (Tianjin), CN	Lat Krabang, TH	2,436	5143,004	20.0	0.25	110	22	0.006	10.8	2.9	0.03132	0.288
Oct	DFSU4299850	KMTC SURABAYA	Ho Chi Minh City, VN	Lat Krabang, TH	7,363	1174,168	20.0	0.17	110	22	0.018	10.8	2.9	0.03132	0.222
Oct	MAGU5601159	KMTC SURABAYA	Ho Chi Minh City, VN	Lat Krabang, TH	5,422	1174,168	20.0	0.13	110	22	0.013	10.8	2.9	0.03132	0.172
Oct	CAIU4393464	TOKYO TOWER	Shanghai Pt, CN	Lat Krabang, TH	14,018	4081,808	32.1	1.84	110	22	0.034	10.8	2.9	0.03132	1.902
Oct	SEGU5580733	TOKYO TOWER	Shanghai Pt, CN	Lat Krabang, TH	13,396	4081,808	32.1	1.76	110	22	0.032	10.8	2.9	0.03132	1.819
Oct	CBHU5660082	NYK FURANO/052E	Singapore, SG	Lat Krabang, TH	1,270	1451,968	16.6	0.03	110	22	0.003	10.8	2.9	0.03132	0.065
Oct	GLDU9361978	NYK FURANO/052E	Singapore, SG	Lat Krabang, TH	4,702	1451,968	16.6	0.11	110	22	0.011	10.8	2.9	0.03132	0.156
Oct	FCIU7130330	KMTC HAIPHONG	Qingdao Pt, CN	Lat Krabang, TH	11,433	4592,96	32.1	1.69	110	22	0.028	10.8	2.9	0.03132	1.745
Oct	TCNU8414002	KMTC HAIPHONG	Qingdao Pt, CN	Lat Krabang, TH	8,695	4592,96	32.1	1.28	110	22	0.021	10.8	2.9	0.03132	1.334
Oct	MSKU5088160	TS KAOSHUNG	Taichung, TW	Lat Krabang, TH	2,654	3033,576	32.1	0.26	110	22	0.006	10.8	2.9	0.03132	0.296
Oct	FCIU6496048	MOUNT NICHOLSO	Shanghai Pt, CN	Lat Krabang, TH	0,877	4081,808	32.1	0.11	110	22	0.002	10.8	2.9	0.03132	0.148
Oct	FCIU7233750	MOUNT NICHOLSO	Shanghai Pt, CN	Lat Krabang, TH	8,240	4081,808	32.1	1.08	110	22	0.020	10.8	2.9	0.03132	1.131
Oct	SEGU4799722	MOUNT NICHOLSO	Shanghai Pt, CN	Lat Krabang, TH	8,966	4081,808	32.1	1.18	110	22	0.022	10.8	2.9	0.03132	1.232

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Month*	Container	Vessel	POL	POD*	Weight (tonne)	Distance (km)	g CO2 per tonne-km	Tonnes CO2 emissions	Distance (km)	g CO2 per tonne-km	Tonnes CO2 emissions	fuel consumption (Liter)	kg CO2 per liter fuel	Tonnes CO2 emissions	Tonnes CO2 emissions
Nov	FSCU4964365	EVER PEACE	Haiphong, VN	Lat Krabang, TH	6.455	2457.604	32.1	0.51	110	22	0.016	10.8	2.9	0.03132	0.556
Nov	TCNUJ3311700	APL JEDDAH	Shekou, CN	Lat Krabang, TH	8.463	3479.908	20.0	0.59	110	22	0.020	10.8	2.9	0.03132	0.641
Nov	CBHU6015632	GENOVA/18106E	Singapore, SG	Lat Krabang, TH	3.711	1451.968	20.0	0.11	110	22	0.009	10.8	2.9	0.03132	0.148
Nov	TCNUJ5201929	KMTC TIANNJIN	Shanghai Pt, CN	Lat Krabang, TH	0.513	4081.808	20.0	0.04	110	22	0.001	10.8	2.9	0.03132	0.074
Nov	BMOU6685461	NORDPUMA	Shanghai Pt, CN	Lat Krabang, TH	14.008	4081.808	32.1	1.84	110	22	0.034	10.8	2.9	0.03132	1.901
Nov	BMOU6934439	NORDPUMA	Shanghai Pt, CN	Lat Krabang, TH	9.751	4081.808	32.1	1.28	110	22	0.024	10.8	2.9	0.03132	1.333
Nov	FCIU7147333	NORDPUMA	Shanghai Pt, CN	Lat Krabang, TH	14.775	4081.808	32.1	1.94	110	22	0.036	10.8	2.9	0.03132	2.003
Nov	KMTU9295472	NORDPUMA	Shanghai Pt, CN	Lat Krabang, TH	14.502	4081.808	32.1	1.90	110	22	0.035	10.8	2.9	0.03132	1.967
Nov	TEMU6566650	NORDPUMA	Shanghai Pt, CN	Lat Krabang, TH	4.266	4081.808	32.1	0.56	110	22	0.010	10.8	2.9	0.03132	0.601
Nov	CMAU1642735	ELLA	Shekou, CN	Lat Krabang, TH	1.856	3479.908	16.6	0.11	110	22	0.004	10.8	2.9	0.03132	0.143
Nov	FCIU8179248	ELLA	Shekou, CN	Lat Krabang, TH	5.922	3479.908	16.6	0.40	110	22	0.017	10.8	2.9	0.03132	0.448
Nov	EGHU9312620	STARSHIP TAURUS	Ho Chi Minh City, VN	Lat Krabang, TH	6.691	1174.168	12.5	0.10	110	22	0.016	10.8	2.9	0.03132	0.146
Nov	BMOU6034988	SITC KANTO	Shanghai Pt, CN	Lat Krabang, TH	5.509	4081.808	32.1	0.70	110	22	0.013	10.8	2.9	0.03132	0.740
Nov	KMTU9302859	SITC KANTO	Shanghai Pt, CN	Lat Krabang, TH	10.060	4081.808	32.1	1.32	110	22	0.024	10.8	2.9	0.03132	1.374
Nov	DRYU4050487	PONTRESINA	Ho Chi Minh City, VN	Lat Krabang, TH	4.425	1174.168	20.0	0.11	110	22	0.011	10.8	2.9	0.03132	0.146
Nov	GVCU4063030	SEASPANFRASER/C	Singapore, SG	Lat Krabang, TH	5.612	1451.968	16.6	0.14	110	22	0.014	10.8	2.9	0.03132	0.180
Nov	CCLU4631731	SEASPAN FRASER/I	Singapore, SG	Lat Krabang, TH	3.031	1451.968	16.6	0.07	110	22	0.007	10.8	2.9	0.03132	0.112
Nov	TCLU8747686	UNI-ARDENT	Shekou, CN	Lat Krabang, TH	2.444	1451.968	16.6	0.06	110	22	0.006	10.8	2.9	0.03132	0.096
Nov	TRLU6986361	UNI-ARDENT	Shekou, CN	Lat Krabang, TH	11.389	3479.908	32.1	1.27	110	22	0.028	10.8	2.9	0.03132	1.331
Nov	FSCU8820387	SEASPAN DUBAI/O	Singapore, SG	Lat Krabang, TH	8.073	3479.908	32.1	0.90	110	22	0.020	10.8	2.9	0.03132	0.953
Nov	GLDU9753243	EVER PEACE	Haiphong, VN	Lat Krabang, TH	5.902	1451.968	16.6	0.14	110	22	0.014	10.8	2.9	0.03132	0.188
Nov	BSIU3084105	KMTC SURABAYA	Ho Chi Minh City, VN	Lat Krabang, TH	2.897	2457.604	32.1	0.23	110	22	0.007	10.8	2.9	0.03132	0.267
Nov	CAIU2951490	GENOVA/18107E	Singapore, SG	Lat Krabang, TH	3.663	1174.168	20.0	0.09	110	22	0.009	10.8	2.9	0.03132	0.126
Nov	UETU5188654	GENOVA/1810E	Singapore, SG	Lat Krabang, TH	2.463	1451.968	20.0	0.07	110	22	0.006	10.8	2.9	0.03132	0.109
Nov	CBHU5841199	SEASPAN FRASER /	Singapore, SG	Lat Krabang, TH	4.612	1451.968	20.0	0.14	110	22	0.012	10.8	2.9	0.03132	0.183
Dec	GESU6907478	SEASPAN FRASER /	Singapore, SG	Lat Krabang, TH	3.010	1451.968	16.6	0.07	110	22	0.007	10.8	2.9	0.03132	0.111
Dec	TRHU2795374	SEASPAN DUBAI /	Singapore, SG	Lat Krabang, TH	4.697	1451.968	16.6	0.11	110	22	0.011	10.8	2.9	0.03132	0.156
Dec	UETU5297001	SEASPAN DUBAI /	Singapore, SG	Lat Krabang, TH	0.990	1451.968	16.6	0.02	110	22	0.002	10.8	2.9	0.03132	0.058
Dec	CBHU9167480	GENOVA/18108 E	Singapore, SG	Lat Krabang, TH	4.389	1451.968	16.6	0.11	110	22	0.011	10.8	2.9	0.03132	0.148
Dec	MAGU2423109	GENOVA/18108 E	Singapore, SG	Lat Krabang, TH	4.834	1451.968	20.0	0.14	110	22	0.012	10.8	2.9	0.03132	0.183
Dec					1.759	1451.968	20.0	0.05	110	22	0.004	10.8	2.9	0.03132	0.087

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