CARBON FOOTPRINT OF HUMANITARIAN LOGISTICS

Case: The Finnish Red Cross

Virva Anttila

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Tampereen ammattikorkeakoulu
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TAMPEREEN AMMATTIKORKEAKOULU
Tampere University of Applied Sciences

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Author: Virva Anttila

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ABSTRACT

This thesis was written on the basis that despite all studies and analyses companies, governments and industries have about pollution and carbon footprint voluntary organizations have very little information about that. This will serve as background information for the Finnish Red Cross for the procurement operations. Although many relief item deliveries to areas suffered from natural disasters are very urgent, certain factors allow planners to take environmental impact and carbon emissions into account.

The Finnish Red Cross has its logistics centre in Tampere, from where all logistics operations are organized. Majority of the products never come to Finland as they are procured internationally from where they are directly transported to the destination. This thesis proves that relief items purchased as close to the destination and are transported by truck or train produce significantly less emissions than items purchased from distant countries and are transported by plane. This decision can significantly reduce carbon emissions and the products should be procured locally and transported by train or ship when and wherever possible.

Key words: Pollution, carbon dioxide, the Red Cross, humanitarian logistics, green logistics, carbon footprint

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1. Introduction

1.2. Background

Nowadays, carbon emissions have become a widely known issue among people. According to a survey carried out by Deutsche Post DHL in 2009, the greenhouse effect was considered one of the major issues in the world, among such threats as terrorism and economic insecurity. The fact if the global warming is actually caused by people or is it just an inevitable phenomenon remains under controversy, at least to some extent. For instance in the United States some representatives of the new Republican branch, the Tea Party, deny the existence of global warming (The Guardian, 2011). However, many countries, industries and private citizens share their concern and try to reduce their "carbon footprint" in order to secure this world as we know it also for future generations.

According to the International Panel on Climate Change (2007), the logistics industry is a major source of CO_2 emissions. According to the same source, the industry accounts for approximately 13% of global greenhouse gases. However, this figure includes the passenger transportation in which this thesis will not focus on.

Many transportation and logistics companies such as TNT, DHL, and Finnair already have a wide range of different research papers and reports on their carbon footprint and they all share a concern regarding the emissions from their operations. They are spending time and effort to do research on how they can operate in a more sustainable manner. This does not only include the environmental aspect but they also talk about social responsibility and the well being of their staff. Companies call this "corporate responsibility". For example, as Mr. Vesa-Matti Jussila from TNT Finland states (2011), TNT has calculated and gathered information concerning carbon emissions. 50 % of their emissions are derived from truck transport, 40% from airplanes and 10% of buildings. As TNT has 30 000 trucks and 50 airplanes, it is evident that a proportional amount of emissions of airplanes is significantly higher. As an example, an average TNT airplane consumes 8000 kilograms kerosene per hour thus creating 3 kilograms carbon emission under the same time period.

In order to reduce the emissions, TNT has gathered and applied different strategies. For instance, they have a target of having more and more electric trucks to transport road freight and they try to optimize flight routes so that the routes are as short as possible and that the waiting time before landing is minimized. Also refilling the tank of an aircraft will occur more often. As the tank is not full at all times, it will reduce the total weight of the aircraft thus reducing emissions.

According to various websites and reports of different humanitarian organizations, their reports and publications about their supply chain models or logistics operations do not include any big emission reduction projects. Mainly organizations in the field of humanitarian logistics focus on the respond times to emergencies and how efficiently they can run their operations. Since their operations are mostly reactive and respond to emergencies and other disasters in order to save human lives, respond times are the most critical factor when planning the operational functions. However, not all the situations are the same. Different humanitarian organizations take part into development projects, such as long-term disaster reduction, livelihood and health related programmes.

In addition, not all emergency situations require the same respond times. For example, there are slow onset disaster types such as draught and rapid onset disaster types such as earthquakes. This is why there are five different case studies in this thesis. They represent different urgency levels and so they all have different opportunities to plan more environmentally friendly logistics operations to destinations. It is obvious, that a sudden disaster, such as the earthquake in Haiti, needs faster reactions than long-term development projects. However, there are a few aspects that define the urgency level for the operation more accurately: the nature of the disaster, the number of people in need of disaster relief and, in case of the International Federation of Red Cross and Red Crescent Societies, the capacity of the local National Red Cross or Red Crescent Society. In addition, the coordination by the Finnish Red Cross of the deliveries also plays an important role so that the correct amount of goods is delivered, and the staff working on the project has sufficient skills and expertise. Also one factor that affects the carbon footprint is the fact if the supplies are available locally or if they need to be transported from different countries.

1.2. Objectives

The objective is to gather and provide information to the Finnish Red Cross about the carbon dioxide emissions of different types of transport modes and also to demonstrate how different types of procurement processes cause different amount of CO_2 emissions. For example, when the relief items are purchased locally, internationally or if they are transported from the warehouse of the Finnish Red Cross have different procurement processes and environmental impact

The calculations only take into consideration the transport of the finished products from the point of purchase to the point of consumption.

1.3. Research methods

The case studies included in this thesis are the following:

Monsoon floods in Pakistan in 2010
Earthquake in Haiti in 2010
Floods in Kenya in 2010
Food security project between the Finnish Red Cross and Zimbabwe Red Cross National Society
Long term project including 2nd hand clothing deliveries from the Finnish Red Cross to Tajikistan Red Crescent Society

Each case study consists of the following elements: Logistics capacity assessment presents the country focusing on the infrastructure, transportation network and geographical facts. The emergency or disaster background information is derived from actual emergency appeal that is the project plan published by International Federation of the Red Cross and according to it the Red Cross National Societies are contributing and supporting the operation by cash, material assistance or staffing. Tables present the amount of goods, routes and the modes of transport of the deliveries of each operation with the support of the Finnish Red Cross.

As a research method for emission calculations, I used the emission calculator called EcoTransIT. EcoTransIT, or Ecological Transport Information Tool Worldwide, describes itself as “an easy to handle web based software tool for assessing the environmental impact of transporting freight by various transport modes worldwide” (Ecotransit, 2010). It is free and available to everyone. Partners who established and maintain this tool are, among others, Trenitalia S.p.A., Renfe, GreenCargo AB and DB Schencker Rail GmbH.

According to Ecotransit.org, there are various impacts on environment the traffic can cause, such as consumption of resources, land use, greenhouse effect, depletion of the ozone layer, acidification toxic effects on ecosystems and on human beings, summer smog and noise. The EcoTransIT calculator takes the air quality issues into consideration and compares the energy consumption and emissions of all freight transported by rail, road, aircraft and ship. Primary energy consumption takes into account the direct energy consumption by the vehicle and the processes involved in generating and distributing of the final product. The calculator also takes into account the distance and the comparison between routes. The calculator considers the route change and calculates the emissions also according to the correct distance. I calculated the emissions for each delivery transported to the destination.

1.5. Limitations of the research

The Finnish Red Cross has only limited information available about the exact types of the vehicles used for transport. The locations and routes for deliveries do not include the information about the exact address of the storages and warehouses as the goods are procured up to the destination and the supplier is responsible to arrange the transportation to the final point of consumption.

As a consequence, the calculations are approximate and only provide a rough picture of the consumption and pollution levels the different modes cause. EcoTransIT gives the opportunity for an accurate emission calculation by defining the load factor, empty trip factor, the vehicle type and the emission standard. However, these facts are not available for the cases presented in this thesis. As a rule of thumb, the container type used for

most transports organized by the Finnish Red Cross is the 40 ft container. Those containers are used both for multi-modal transports and many times for intercontinental transports for example in Kenya and Pakistan from warehouse to warehouse, but not to the final point of consumption.

As the purpose if this study is not to calculate the accurate emissions caused by previous operations, the accurate calculations are not necessary to achieve this target. The target is to provide background information about emission levels of different types of transport modes and also to compare the emission levels of different types of operations. The types of operations I refer to are the procurement processes; whether the supplies are shipped from the warehouse of the Finnish Red Cross, if they are shipped from local supplier or other countries.

We can still take a better look at some of the factors that affect the total emissions and energy consumption caused by transport. First of all, geography has a significant impact on the total energy consumption of a vehicle (Ecotransit, 2011). It goes without saying that the steeper the uphill is on the way, the more the vehicle will consume energy. When it comes to rail transport, the method to produce electricity is a very significant factor. For example, in Sweden GreenCargo's source of energy is hydropower (Ecotransit, 2010). The transportation network also has restrictions, as the road network is often denser than the rail. As such, the route by rail might be longer than by truck and thus increasing the comparative emission level from trains.

Other factors are the vehicle type, the age, the type of tires used and the loading capacity. If the maximum level of capacity is reached in the vehicle, the load factor is 100% thus taking the full advantage of the vehicle. Vehicle type indicates to the size, model and even to the emission standard that are all essential facts when calculating accurate emission level of a particular transport mode.

Since conflicts and war situations require strict objectivity and neutrality from humanitarian organizations, and these operations are planned in a different manner, they are excluded from this thesis. In addition, the emissions calculations only include the transportation of the finished goods, not the emissions occurred during the production or manufacturing of the goods, nor the waste management in the destination.

2. The Red Cross

2.1. The Red Cross and Red Crescent movement

The Red Cross is one of the best-known humanitarian organizations in the world (The Red Cross, 2010). The origin goes back to Northern Italy in 1859, where a Swiss man, Henry Dunant organized volunteers to help the victims of the battle of Solferino. In 1862, the International Committee of Red Cross (ICRC) was established in Geneva where it still has its headquarters. From there operate the essential branches for the international aid (The Red Cross, 2010).

The Red Cross and the Red Crescent movement operate globally and consists of independent bodies that all share the common mission and principles. The movement consists of the International Committee of the Red Cross (ICRC), the International Federation of Red Cross and Red Crescent Societies (IFRC), and 186 Red Cross and Red Crescent Societies worldwide. ICRC is an independent organization working in war and conflict zones. IFRC directs and coordinates international assistance for victims of natural disasters. The National Societies act as auxiliaries to the public authorities of their own countries in the humanitarian field and provide a range of services including disaster relief, health and social programmes. All parties of the movement have their own individual status and mandate, and exercise no authority over the other.

2.2. The International Federation of Red Cross and Red Crescent Societies

2.2.1. History

The International Federation of Red Cross and Red Crescent Societies were founded in 1919 in Paris after the First World War (IFRC, 2010). After the war, there was a need for the Red Cross Societies to work together. Henry Davidson, who was the president of American Red Cross War Committee, suggested about establishing a federation of all Red Cross Societies. The first objective of the IFRC was to improve the health of people in countries that had suffered the most during the years of war. The founding countries were Britain, France, Italy, Japan and the United States. Nowadays there are 186 recog-

nized Red Cross and Red Crescent National Societies in the world and the IFRC is the biggest humanitarian organization in the world.

2.1.2. Vision and mission

IFRC provides assistance without discrimination towards nationality, religion, race, class or political opinion (IFRC, 2010). The symbol of a red crescent is used in place of the red cross of many Islamic countries. IFRC focuses on four areas in its work: promotion of humanitarian values, disaster response, preparedness and community care.

Strategy 2020 is guiding the actions of the IFRC from the beginning of the year 2011 throughout the end of 2020. It defines the aims and actions for the IFRC and the member National Societies in order to achieve the common vision: “To inspire, encourage, facilitate and promote at all times all forms of humanitarian activities by National Societies, with a view to preventing and alleviating human suffering, and thereby contributing to the maintenance and promotion of human dignity and peace in the world” (IFRC, 2011).

The strategic aims are to save lives, protect livelihoods, strengthen recovery from disasters and crises, enable healthy and safe living and promote social inclusion and a culture of non-violence and peace (IFRC, 2011).

The enabling actions to achieve the strategic goals are to build strong National Societies, pursue humanitarian diplomacy to prevent and reduce vulnerability in a globalized world and to function effectively as an International Federation (IFRC, 2011).

2.1.3. Organization

As any big organization, IFRC also has many departments and administrative levels. IFRC consists of all the Red Cross and Red Crescent National Societies and the secretariat. The secretariat, which is located in Geneva, is responsible for the daily operations of the IFRC. It has been decentralized to the regions and there are seven zones globally to support the work of the National Societies. All decisions and policies are made by the governing bodies, from which the highest sector is the General Assembly (IFRC, 2010).

2.1.4. Logistics in IFRC

The IFRC has three logistics centers located in Panama, Dubai and Kuala Lumpur (IFRC, 2010). The logistics centers are mandated to cover three different areas. The base located in Panama covers the American continent and the one in Dubai covers Europe, Africa and Central Asia. The one in Kuala Lumpur is for the Far East Asia, Australia and Oceania. The objective for these centers is to deliver assistance and relief to certain number of people in a certain amount of time. They are prepared to support 5000 families in 48 hours and 15 000 families in two weeks with such items as tents or shelter tool kits, water canisters, blankets and kitchen utilities. It also provides stocking and procurement and training services for National Societies (IFRC, 2010).

Picture 1: Location of the headquarters and three logistics centers of the IFRC.
Source: IFRC, 2011

2.2. The Finnish Red Cross

2.2.1. General information

The Finnish Red Cross was established in 1877 and is now one of the biggest humanitarian organizations in Finland (Finnish Red Cross, 2010). It operates both domestically and internationally. Domestic projects and activities include first aid education, blood donation service, and HIV and AIDS Support. Internationally the Finnish Red Cross provides help and assistance in dozens of countries in cooperation with IFRC in natural disaster situations and with ICRC in conflict areas. Finnish Red Cross also has several bilateral long-term projects with other Red Cross and Red Crescent National Societies worldwide. The actions on the Finnish Red Cross are based on the seven Fundamental

Principles of the International Red Cross and Red Crescent movement. They are humanity, impartiality, neutrality, independence, voluntary service, unity and universality. In addition, the Finnish Red Cross also has three main goals in its own recommendations and guidelines for the years 2011-2014 (The Finnish Red Cross, 2011). According to those guidelines The Finnish Red Cross provides relief assistance in disasters and emergencies, reinforces health and secure life, and supports humanity.

2.2.2. Logistics operations

The Finnish Red Cross provides international aid in three forms: goods, delegates and money. The aid is delivered internationally and is focused on disaster relief as well as on development programmes. The logistics center of the Finnish Red Cross is located in Kalkku, Tampere and it is responsible of the procurement, warehousing, transport of relief supplies, packing of the 2nd hand clothing, as well as developing and producing Emergency Response Units (Finnish Red Cross, 2010). Area of the warehouse is 4000 m^2 and there are always certain items to be deployed:

Two field hospitals
Four health clinics
Water and sanitation equipment
IT/Telecom Emergency Response Unit
Two Logistics Emergency Response Units
Two relief Emergency Response Units

The Finnish Red Cross is stocking also relief items to support 10 000 people, or approximately 2000 families. Therefore there are also blankets, clothes, medicine, mosquito nets, tents, tarpaulins or other necessary products available for shipping. The Finnish Red Cross always works through the network of Red Cross movement in order to guarantee the most efficient operation. Monetary transfers and consumption of goods are in control of the Red Cross and usage in destination is supervised. The logistics center employs currently approximately ten permanent workers and the personnel reserve includes approximately 500 trained delegates with expertise on different fields.

The rules of procurement guarantee that all material is purchased effectively and the process is transparent. The Finnish Red Cross is constantly developing and improving its procurement functions in order to ensure effective and efficient procurement but still flexible enough to be able to respond to urgent situations. Price of the product is not the only criteria, but also quality and the fact that it is suitable for local circumstances. For example, agricultural products and foodstuff is always purchased as close to the final destination as possible and 90% of all procured items never come to Finland, as the origin is overseas. Usually the offers and procurements are made during a longer time period, but sudden emergencies, such as earthquakes, require faster processes. For those the Red Cross is using its emergency stock from Finland. The Red Cross has defined standards for the most common products in order to guarantee the good quality and the typical characteristic is to purchase goods in big quantities and few basic relief commodities for rapid onset operations.

Picture 2: Stock of Emergency Respond Units
Source: The Finnish Red Cross (2010)

The logistics center also stocks supplies for the National Emergency Supply Agency. The Finnish Red Cross takes care of the procurement of those items so they are purchased according to the standards of the Red Cross and can be used as international re-

lief items. In that case, The Finnish Red Cross asks for permit to use those items and the procures replacement to be stocked.

Picture 3: Warehouse stock
Source: The Finnish Red Cross (2010)

3. Logistics

3.1. Logistics and supply chain management

Logistics itself is a very limited expression, as it is only one part of a bigger picture called the supply chain management, or SCM (Hugos, 2003). As logistics mainly indicates to transport of an item from one point to another, supply chain includes all aspects related to logistics, such as inbound and outbound transportation management, fleet management, warehousing, materials handling, order fulfillment, logistics network design, inventory management, supply and demand planning, management of third party logistics service providers (CSCMP, 2011) quality, manufacturing, procurement, distribution and sales. The Council of Supply Chain Management Professionals (2011) define logistics management as a "part of supply chain that plans, implements, and controls the efficient, effective forwards and reverses flow and storage of goods, services and related information between the point of origin and the point of consumption in order to meet customer's requirements".

Other branches involved in today's supply chain can include such functions as engineering, R&D, marketing, advertising, and sales representation, customer service, procurement, packaging and assembly, production planning and scheduling. Logistics management is involved in all levels of planning and execution, and it is an integrating function, which coordinates and optimizes all logistics activities, as well as integrates with other functions in the whole supply chain (CSCMP, 2011). All kinds of logistics operations require an accurate and efficient coordination of all these functions. Basically, the concept of supply chain management means the whole chain of the product from the acquisition of the raw materials to the completed service or product delivered to the final consumer.

According to Michael Hugos (2003) a concept of "JIT", or just-in-time production is nowadays closely linked with supply chain management. Manufacturers, vendors and retailers all work towards the same goal; to meet their customer's demands and to do that in the minimum amount of time eliminating all wasteful efforts on the way.

One essential way how the concept of SCM has changed in recent years is the involvement of what some people call the "information society" (Hugos, 2003). The Internet and thus the constant connection between locations make on time data available to all parties involved in the supply chain. This helps to plan and maintain efficient and customer oriented operations and customer service. On-going reporting and effortless information flow are crucial for any kind of operations or enterprise in order to keep up the competitive advantage. Despite the assistance and support the information technology brings to the markets, the companies face some unprecedented challenges in the markets (Haapanen & Vepsäläinen, 1999). The competition is harder and harder and many enterprises need to be able to offer something value added to their customers.

3.2. Humanitarian logistics

3.2.1. Continuous aid work and disaster relief

Humanitarian logistics can be distinguished into these main categories; continuous aid work and disaster relief (Kovacs & Spens, 2007). Usually, the term disaster relief covers natural disasters and some man-made disasters such as terrorist attacks or nuclear at-

tacks. Generally, disaster relief includes three distinguished phases, which are the preparation phase, the immediate response phase and the reconstruction phase (Kovacs & Spens, 2007). The first phase includes preparing to the possible disaster, such as having an evacuation plan for possible volcano eruption in Iceland. As stated in the report written by Kovacs and Spens (2007), most material about humanitarian logistics concentrate on the first phase of preparedness often assuming particular scenarios and the fact that there is only demand for particular goods. Reconstruction phase includes the rebuilding and long-term recovery of the disaster.

3.2.2. Humanitarian logistics versus business logistics

There are a few key characteristics that are distinctive to humanitarian logistics as opposed to commercial operations (Tomasini & Wassenhove, 2009):

Non-profit operations
Equality and neutrality
Impartiality
Limited resources
Limited amount of skilled staff
Bias or restrictions
Donors
Unstable and unpredictable supply chain

First of all, and this of course goes without saying, humanitarian operations are non-profit. The word “humanitarian” relates to the word “humanity” (Tomasini & Wassenhove, 2009), which implies to the idea that all humans are equal and anyone suffering should always be helped. Equality is guaranteed by neutrality of the organizations, which means that the help should be offered without any bias towards the people in need. For example, in conflict zones the relief items or food commodities distributed by the Red Cross do not have any markings implicating to donors or organizations. Impartiality means that help should be offered first to the people most in need without any discrimination. These operations also very often include cooperation of the local government or military (Oloruntoba & Gray, 2006). Sometimes governments can even hin-

der or prevent the aid deliveries. For example, the Russian customs has imposed restrictions to the development aid (Yle, 2011).

Humanitarian logistics projects also face very distinctive problems versus business logistics. Very often the resources are more limited with humanitarian projects. With human resources the challenge is to have sufficient personnel available with enough skills and expertise (Tomasini & Wassenhove, 2009). Other problem is money as funds are not always available when needed. Richard Oloruntoba (2006) states that according to a survey many humanitarian organizations had people working in the field of logistics but only few had actual specialization on that area. In addition, many people, organizations and donors have different levels of commitment and there is a different amount of resources to meet different amount of demand every time, which also creates uncertainty (Tomasini and Wassehove, 2009).

One distinctive difference is the fact that one actor in a humanitarian logistics is the donor. As the demand for the disaster relief is not man-created and the customer or the final consumer is not the buyer, humanitarian logistics need to get their funding and supplies from somewhere else. Although non-governmental organizations usually are the main actors in humanitarian operations, in recent years private donors and private sector have become a major source of funding and supplies (Kovacs and Spens, 2007). Many humanitarian organizations also compete with each other for donors, as donors are more prone to offer their money for sudden disasters rather than long-term development (Oloruntoba, 2006). Some donors might offer unwanted help, for instance medicine with passed expiry dates or unsuitable clothes for certain climatic circumstances. Donors also often want to see their aid to be delivered directly to the destination (Oloruntoba & Gray, 2006), although all actors in the whole supply chain are dependent on the finance and donations. For instance, sometimes it would do greater good to donate forklift parts in order to secure the ability to transport and deliver certain products to the destination.

Another resource problem is directly related to transport. In many cases, infrastructure can be seriously damaged in disaster areas (Kovacs & Spens, 2007). In addition, in many cases disasters are more prone to less developed regions and in that kind of places the infrastructure is inadequate already before any destruction. In addition, short-term

disaster aid is often more luring rather than long-term development aid. Often regions need long-term funding for long-term recovery after the disaster and immediate aid.

The model of the whole supply chain in humanitarian operations is often more complex than in business logistics (Oloruntoba & Gray, 2006). International humanitarian supply chains are clearly unstable and unpredictable due to constant change of circumstances, donors and funding. In that way, the operations require accurate and efficient planning and the project can fail after a lot of effort due to insufficient organization (Kovacs & Spens, 2007). For example, the abundance of aid providers can lead to duplicate efforts in operations and material. After the tsunami to Eastern Asia in 2006, several small organizations collected money for the victims of the tsunami but they did not have means to transport the goods to the destination. In that case they allocated their funds to bigger operators who took care of the actual delivery of disaster relief.

Whereas businesses often have rather stable situation with suppliers and buyers, disasters do not warn about themselves and they are very difficult to predict. To be able to respond quickly to situations also means that sufficient inventory and supplies should be stored in warehouses at all times.

In short, the key performance indicators, or KPI, for the humanitarian logistics are generally stated to be good pre-planning, correct organization and allocation of the goods and staff and the readiness to react to the changing situations. This is why we will take a deeper look in the matter of pollution in this thesis. And the need for humanitarian logistics is not reducing, but the contrary: in the future, as the man-made and natural disasters are predicted to increase, there will be a growing “market” for humanitarian logistics (Kovacs & Spens, 2007).

3.3. Pollution and the carbon footprint

One of the big challenges of the logistics companies is to respond to the environmental requirements and the reduction of emissions (Springer, 2002). As already mentioned before, the transportation companies are one of major sources of greenhouse gas emissions. One very positive aspect is that often planning and carrying out more environ-

mental friendly and sustainable operations bring long-term savings to companies and organizations.

First of all, what are global warming and greenhouse gases? When people talk about global warming, they mean the increase of the average temperature on the Earth. This can be an evolutionary fact as the Earth has gone through different phases, such as the ice age over ten thousand years ago. Greenhouse gases are on the other hand atmospheric gases that trap sun's heat inside the Earth's atmosphere thus causing warming of the average temperature (The World Watch Institute, 2009). One of the most common greenhouse gases is the carbon dioxide, but there are also others such as methane, nitrous oxide, ozone and water vapor (The World Watch Institute, 2009).

The global warming is mostly considered a threat for the nature and ecosystems and most people recognize this problem as caused by human beings. According to the World Watch Institute, a safe level of warming would be at maximum two Celsius degrees. Unfortunately the predicted warmth level will reach the two degrees thus creating a serious threat to the ecosystems and human beings as well (Greenpeace, 2010).

What individuals and organizations can do in order to alleviate the climate change? They can reduce the consumption of the fossil fuels and the overall energy consumption. Small steps such as taking the bus instead of a car combined to the master operational changes towards more environmentally friendly method can make a big difference. All it takes is some effort from all of us.

3.4. Green logistics

As already mentioned before, many commercial logistics companied have plans to reduce their carbon footprint and means to achieve this goal. However, according to Rodrigue, Slack and Comtois (2001) green logistics is a paradox as an idea. Logistics refers to transportation, and transportation creates different kind of emissions. Logistics inherently causes pollution and thus the combination "green logistics" may sound contradictive. However, maybe the term "greener logistics" would be more meaningful. As logistics itself cannot be green, one can always bee "greener" than the other, in other words minimize the pollution level. For example, TNT plans to have level zero emissions in

the future (Jussila, 2011). This can be achieved, for example, by balancing the pollution by planting trees whose ability to absorb carbon dioxide equal the level the vehicles and planes operated by TNT cause in a certain period of time.

4. Logistics capacity assessments

4.1. Kenya

Picture 4: Map of Kenya
Source: CIA, 2011

General information: The total area of Kenya is 580 367 km^2 and it has borders with Somalia in the east, Tanzania in the south, Uganda in the west, short borderline with Sudan in the northwest, Ethiopia in the north and long coastline to the Indian Ocean in the southeast.

Road network: Kenya has a comprehensive road network. However, as only 1800 kilometers or 20% of the roads are paved, rain seasons and natural phenomena have an effect on the roads thus making some routes inaccessible.

Rail network: The rail network is obsolete, as it has very limited capacity in tonnage volume and very limited delivery speed. In 2006, Rift Valley Railways (RVR) won the right to run Kenya's railways for the next 25 years.

Inland waterways: Although country has numerous rivers, waterways due to their shallowness are not particularly used for transport.

Airports: Jomo Kenyatta International Airport (NBO) is the biggest airport facility in Kenya. Accurate location is Embakasi, a suburb 15 kilometers of the center of Nairobi. There are thirteen other airports in Kenya, located in different areas.

Harbors: Port of Mombasa is the biggest seaport in Kenya. In addition, it also serves Uganda, Rwanda, Burundi, DRC, Southern Sudan, Ethiopia, Somalia and Northern Tanzania.

4.2. Tajikistan

Picture 5: Map of Tajikistan
Source: CIA, 2011

General info: Tajikistan has borders with Uzbekistan in the west, China in the east, Kyrgyzstan in the north and Afghanistan in the south and its area is 143 100 km^2.

Road network: Country has a fairly good road network and it connects all regions of the country by paved roads. However, snow and harsh winters, rock falls or landslides can cause delays and blockages on the roads. If some ways are disconnected, secondary roads are generally passable.

Rail network: Rail enters Tajikistan in Aivaj in the south, Dushanbe in the middle of the country and in Khujad in the north. The rail network was well established during Soviet times and connected all Soviet Republics. Tajikistan was a part of this system and is able to move and receive any cargo to any of these countries relatively easily.

Airports: Cargo transport is concentrated in Dushanbe airport. In total, there are seventeen airports with paved runways and nine with unpaved runways (CIA, 2011).

4.3. Pakistan

Picture 6: Map of Pakistan
Source: CIA, 2011

General information: Pakistan is bordered by India in the east, China in the north, and Afghanistan and Iran in the west. It has a 1046-kilometer-long coastline in the south and total area of the country is 803 940 km^2.

Road and rail network: Roads are the main way of transporting goods in Pakistan. Right now it covers over 90% of the passenger and freight movement in the country. In total the road network covers 259 197 kilometers. Until the 70s, the railroad was actually the main mean of transport in Pakistan. However, when the road network expanded, the share of inland transport of the rail network lowered significantly. In the last seven years it has shown growth but still remaining the secondary mode of transport.

Harbors: The first built port is located in Karachi and is called Port of Muhammed bin Qasim. The Gwardar port was built in 2007. The district of Balochistan has 600 kilometers of coastline where this newer port is located. The flow of cargo arriving to the ports has grown strongly lately due to country's economic growth. Now the problem is that the ports do not have sufficient capacity to handle all the cargo. For that reason, various projects have been implemented to improve the operations at the port.

4.4. Zimbabwe

Picture 7: Map of Zimbabwe
Source: CIA ,2011

General information: Zimbabwe is bordered by four countries; Mozambique in the east, South Africa in the south, Botswana in the southwest and Zambia in the northwest. One distinctive feature on Zimbabwe's geography is the high plateau that goes all the way from southwest to northeast across the whole country. It is 650 kilometers long, 80 kilometers wide and its altitude is mostly between 1200 and 1500 meters above sea level. The total area is 390 580 km^2.

Road network: The road network consists of total over 18 000 kilometers of road, of which 8600 kilometers are paved. The primary roads are in good condition and mostly free from obstructions. A loaded truck can maintain an average speed of 50 km/h. The

real challenge is the rural areas, as the road network is in a bad condition. For example, road from Nyamapanda (the entry point on the Mozambique border) is 238 kilometers long and takes about three or four hours to drive. One problem on the way would be the lack of petrol stations, as there are only three of them.

Rail network: The rail network is maintained and run by the National Railways of Zimbabwe (NRZ). It has about 3000 kilometers of rail and 1,067-meter gauge. The NRZ has an important transit function concerning the whole Southern Africa. In the north it is liked to the Zambia Railways and to the Beira Railroad Corporation in Mozambique. In the west, it links to the Botswana Railways and that way to South Africa as well.

Airports: There is one international airport in Zimbabwe's capital, Harare. There is also another airport for light aircrafts called Charles Prince Airport near Harare and six others around the country.

Harbours and inland waterways: As Zimbabwe does not have a port on its own the main ports for transporting are Durban in South Africa and Beira in Mozambique. There are seven main entry points to Zimbabwe: two on the Mozambique border, three on the Zambia border and one in South Africa and Botswana borders.

Inland waterways: Zimbabwe has three major rivers; the Zambezi, the Save and the Limpopo. They have very little significance when it comes to transport.

4.5. Haiti

Picture 8: Map of Haiti
Source: CIA, 2011

General information: Haiti is situated in the Caribbean sharing an island with Dominican Republic. The total area of the country is 27 750 km^2.

Road and rail network: For inland transportation, road is the primary route to move people and goods. There is no reliable information about the road network available and the conditions vary significantly across the country. Only a small part of the roads are paved and there might be problem crossing rivers as the secondary roads not always have bridges connecting the roads on each side of the waterway. As far as rail network goes, it is not currently functioning in Haiti.

Airports: The main international airport is called Toussaint Louverture International Airport, abbreviation of which is PAP

Harbours: There are two main ports that are open for international trade. They are the Port of Port-au Prince and Cap Haïtien. There are also other eight ports that receive international trade.

5. Case studies

5.1. Emergency background

5.1.1. Kenya

In 2010, exceptionally heavy rainfall was recorded in Kenya and it resulted in floods and destruction of infrastructure and property in northwestern districts, western and central highlands and in a few areas in the southeast. Approximately 40 people lost their lives and 8270 households suffered either partial or total loss of their property. In addition, 50 000 people were affected by the floods and needed humanitarian assistance. By the end of the project, Kenya Red Cross Society (KRCS) was able to rescue and relocate 92 people, distribute 13,330 non-food items to affected people, and distribute 322 200 aqua tabs and 66 700 PUR sachets.

As the Finnish Red Cross has good connections and good cooperation with the local National Society and its supply chain team and they have several Kenyan suppliers on their database and have experience on their services and products, the goods for this operation were acquired and transported from local suppliers in Kenya and manufacturers. This was done in order to support the local economy and reduce the delivery time and minimize the transit distance.

5.1.2. Tajikistan

The 2nd hand clothing deliveries are part of the other projects run with partner National Societies. In Tajikistan the Finnish Red Cross has been active already almost for two decades. Climaticwise and also culturally the 2nd hand clothing from Finland is very suitable for those countries and there is a high need for them.

5.1.3. Pakistan

In July 2010 the worst flood hit Pakistan since 1929. According to the estimation, over 20 million people of Pakistan’s 170 million were affected by the flood. It also caused severe damage to farmland, infrastructure and to multiple essential buildings such as hospitals and health clinics. The majority of the country was seriously affected, except

the northernmost parts. The need of aid was predicted to last until the year of 2011, as the sowing season would be missed in most areas.

5.1.4. Zimbabwe

This case concerns a continuous seed distribution project between The Finnish Red Cross and the local National Society in Zimbabwe. The need for this derives from 2008 of increasing food insecurity. The problem originates from worsening economic environment, which set challenges to people already having problems with food insecurity. In addition, HIV and AIDS epidemic made the situation even worse weakening all the positive gains in human development. In total, the situation was severe and there were an estimated 5,1 million people suffering from lack of nutrition.

As in the case of Kenya, the Zimbabwe National Red Cross Society took the main responsibility of the coordination of the humanitarian aid with support of the IFRC. Also the World Food Program, Food and Agriculture Organizations and the government of Zimbabwe worked closely with ZNRCS in this project.

The origin for the seeds is Zimbabwe and the manure is from South Africa. The Finnish Red Cross assisted with the purchase of the fertilizer but no seeds or other products in this project originated from Finland. The whole distribution was carried out by a collective distribution from the capital.

5.1.5. Haiti

In January 12th 2010, an earthquake of a magnitude of 7 Mw, hit the Haitian coast. After the incident, it was impossible to estimate the accurate number of deaths and injuries. Considering the condition of infrastructure, the residents and slum housing the damages were massive around the country. The most important target of the Red Cross was to prevent any more loss of life and to provide support and relief for the survivors. The living conditions in Haiti are very poor as over 76% of the population living with less than 2 USD per day. That made international support crucial for the victims suffering from the damages caused by the earthquake.

Picture 9: Loading of a plane to Haiti

Source: The Red Cross (2010)

6.1. Transported items and emissions

6.1.1. Kenya

Material	Pieces	Weight (kg)	Volume (m^3)	Origin	Route	CO_2 emissions (tons)
Blankets	19 875	35 775	224	Kenya	Thika-Nairobi:truck	0,14
Cooking supplies Mosquito nets Tarpaulins	53587	150 600	583,2		50 kilometers within Nairobi: truck	0,38
					Total CO_2 emissions	0,52

Table 1: Transported items in Kenya

6.1.2. Tajikistan

Destination	Material	Weight (kg)	Volume (m3)	Origin	Route	CO_2 emissions (tons)
Tajikistan	2nd hand clothing	37166	190	The Finnish Red Cross Logistics center	Tampere-Kouvola: truck Kouvola-Dushanbee: train	0,79 4,61
					Total CO_2 emissions	5,40

Table 2: Transported items in Tajikistan

6.1.3. Pakistan

Material	Pieces	Weight (kg)	Volume (m^3)	Origin	Route	CO_2 emissions
Blankets	40 000	60 000	428	Pakistan	Karachi-Multan: truck	0,045
Blankets	28 000	42 000	242	India	Jaipur-Mumbai; truck, Mumbai -Karachi; ship; Karachi-Multan; truck	3,37 0,37 0,031
Medical supplies	635	20 983	99,50	Holland	Amsterdam-Islamabad: flight	86
Mosquito nets	14 600	6 640	13,32	Thailand	Bangkok - Islamabad: flight Islamabad - Mardan: truck	36 0,18
Tarpaulins	4 500	20 250	45	Pakistan	Lahore - Mardan: truck	0,68
					Total CO_2 emissions	126,68

Table 3: Transported items in Pakistan.

6.1.4. Zimbabwe

Material	Number of bags	Weight (kg)	Volume (m3)	Origin	Route	CO_2 emissions
Maize seeds, 10 kg/bag	16 605	166 050	266	South-Africa	Pietersburg - Harare: truck	9,28
Durra seeds, 10 kg/bag Sugar beans, 5 kg/bag Fertilizer, 50 kg/bag	15 838	489 990	724,45	Zimbabwe	50 kilometers within Harare: truck	1,49
					Total CO_2 emissions	10,77

Table 4: Transported items in Zimbabwe.

6.1.5. Haiti

Material	Weight (kg)	Volume (m3)	Origin	Routing	CO2 emissions (tons)
Autoclaves Tarpaulins Family tents Buckets	23 169	85	The Finnish Red Cross logistics center	Tampere-Berlin: truck Berlin-Santo Domingo: flight Santo Domingo-Port-au-Prince: truck	3,79 132,90 0,015
Family tents Medical items Vehicles	 125 000	613		Tampere - Helsinki: truck Helsinki-Port-au-Prince: flight	1,54 751,36
Medical supplies Office Supplies Spare parts	239	3		Tampere - Helsinki: truck Helsinki - Santo Domingo: flight Santo Domingo - Port-au-Prince: truck	0,0025 1,21 0,00013
Health clinic	14 423	1 260		Tampere - Port-au-Prince: flight	83,79
Field hospital Relief emergency unit Family tents	21 062	94		Tampere - Helsinki: truck Helsinki - Berlin: flight Berlin-Port-au-Prince: flight (with 10 tons more freight)	0,26 34 177,54
				Total CO_2 emissions	1186,41

Table 5: Transported items in Haiti.

7. Analysis

7.2. Conclusions

By far the most polluting transport process was the goods to Haiti from the Red Cross, Tampere warehouse, whose total carbon dioxide emissions were over 1000 tons. In order to guarantee fast response to rapid onset disasters, there is always a certain amount of stock ready to be shipped abroad. In these cases, the material has to be available immediately and there is no time to start procurement processes with local suppliers especially if there is no guarantee about the quality and reliability of the products and suppliers. Especially in case of Haiti, the best option to transport the items to destination was by flight as the products were stocked in Finland and had to be transported as fast as possible to meet the urgent demand.

Although rapid onset disasters require fast and thus more polluting modes of transport, emissions can be minimized by different coordination of the routes. For example, 23 tons of relief items were transported from Tampere to Berlin by truck thus creating less than four tons of emissions. Direct flight from Tampere to Port-au-Prince would have created almost 139 tons of emissions whereas the flight from Berlin to Haiti created them 133 tons. Given the fact the calculations are approximate, the fact of part of the trip was taken by truck did not create significant difference, only 2 tons. Also when taking into consideration the unloading and reloading, the most direct route would be more useful if the plane is full and thus avoiding the empty trip factor. In this case, the emergency response units and health clinics items were transported to the destination in a charter flight from Tampere via Berlin in order to guarantee the fastest delivery. More people and goods from other western Red Cross National Societies were loaded there in order to have a full aircraft arriving to Haiti.

Other emergency situation that required rather fast reaction was the flood in Pakistan. Many items for this were purchased form Pakistan and thus long transportation distances could be avoided. Over 80 tons of items were supplied locally, whose transport caused approximately 0,7 tons of carbon dioxide. 21 tons of items were transported from Amsterdam, Netherlands and that alone created 86 tons of carbon dioxide emissions. Had the route been Amsterdam-Karachi by ship and then from Karachi to Islamabad by truck, the emissions would have been significantly lower, 1,22 tons from sea transport and 2 tons of truck transport. So the difference would have been over 80 tons. 42 tons of items that were purchased from India were transported partly by truck and ship, caused 3,7 tons of carbon emissions.

It was proven in many tables that trains are the least consumptive method for inland transport. Considering the distance from Tampere to Dushanbe, the emissions for 2nd hand clothing deliveries were only 5,40 tons thus making this the least consumptive operations with a long distance. Transport from Finland to Central Asia is ideal with non-stop route almost to the destination and due to the functioning railway. However, it is not as simple in all locations. Rails do not lead directly to the warehouse or the point of consumption, but the goods have to be loaded, unloaded and reloaded in different points. It creates additional risks about damage and even theft.

In cases of Kenya and Zimbabwe, the majority of goods were transported within the capital because of the fact that the products were purchased from local suppliers. As the delivery routes were short, a few dozen of kilometers, it makes these operations the least consumptive. Operations in Kenya only caused approximately 0,52 tons of carbon dioxide emissions. Operation in Zimbabwe caused as much as approximately 10,77 tons, but the difference is caused by the fact that part of the seeds were transported from South Africa. This transport caused over 9 tons of CO_2 emissions.

Different factors create challenges when deciding between different transportation methods in order to send goods to crisis areas. The lack of proper infrastructure, the location of the country, and the fact that many natural disasters have destroyed the existing network and environment make the transport as quickly as possible very difficult to the destination and the lack or non existence of possible local suppliers. The fact that central Asian countries are in the middle of the continent prevents the usage of ferries. The location of Haiti makes rail transport impossible.

It is also very important thing to take into consideration, that greenhouse gases are not the only way in what way the different transport vehicles pollute the environment. With boats and ferries, they create noise that distracts underwater animals. Mammals such as dolphins and whales speak with such voices and signals with frequency that can be disturbed by the noise of the ferries. In addition, they also pollute water with the fuel. However, it is difficult to acquire information about local vessels and the fuel they use and influence the quality of those in one-time operations.

7.3. Recommendations

Taking the different cases into consideration, the recommendations for the Finnish Red Cross are the following. In urgent cases, such as Haiti, the rapid response is the most important thing. The most direct route to the destination is the most environmentally friendly way to transport goods as fast as possible or in cases where flight is the only option to transfer the goods to the destination in a minimum amount of time. There might also be a change to take different supplies in different routes, especially when the volumes are high and the empty load factor would be minimized. For example, the

medical supplies to Haiti should be taken to the destination as fast as possible whereas other items might not have the equal urgency.

For on-going deliveries, such as clothing to Central Asia, the best way to transport the goods is by train, depending on the location of the country. Of course, the availability of the functioning rail network has to be taken into consideration. If the goods are transported to other continents, the best way to deliver these is by ship.

In cases, such as Pakistan, where the urgency level is high, but the situation evolves gradually, part of things can be transported in a more environmental friendly way, such as rail or ship. It depends on the initial incident, but if the flood evolves slowly and the affected areas can be predicted, the first freight can be transported directly with the fastest way. Then, more goods can be shipped at the same time but with slower and more environmentally friendly transport modes. For example, if less urgent items could be purchased from Europe and the most urgent items could be procured locally. This way the items that are purchased from further could be transported by ship or train to the final destination.

In cases, such as Kenya, where the local country can provide needed supplies, the situation is ideal. In these cases the transportation distances and thus the delivery times can be minimized. In every case, local procurement is the best option when it comes to environment and pollution. Compared to the case of Haiti, the carbon emissions were over 99% higher than in the one of Kenya.

One of the problems with this thesis was the fact that the Finnish Red Cross has insufficient information about the transportation details. It would be recommended to have the suppliers to make delivery reports including the local warehouse locations and the exact delivery route, and the type of the transport vehicle. However, this is a challenge for the Red Cross as this information is not always possible to gather. Having good relations with the local National Society and doing research of the possible suppliers would be helpful with this matter.

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9. Appendices

9. 1. Tables acquired from Kirsi Pohjola, the Finnish Red Cross

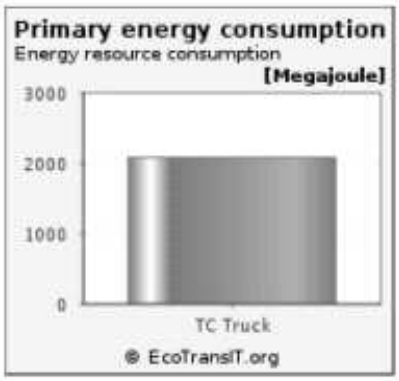
KOHDE	MATERIAALI	kpl/ pakkaus/ hoitoyksikkö	kg	m³	Tavaran toimittaja	alkuperä/ lähetys-maa	Reititys
HAITI 2	Autoklaaveja	2	18,509.50	75.50	SPR Logistiikkakeskus	Suomi	Tre-Berliini auto, Berliini-Santo Domingo lento, Santo Domingo-Port au Prince auto..
HAITI 2	Pressuja 4x6m	900			SPR Logistiikkakeskus	Suomi	Tre-Berliini auto, Berliini-Santo Domingo lento, Santo Domingo-Port au Prince auto..
HAITI 2	Ämpäreitä, 10 ltr	4,000			SPR Logistiikkakeskus	Suomi	Tre-Berliini auto, Berliini-Santo Domingo lento, Santo Domingo-Port au Prince auto..
HAITI 2	Perhetelttoja	340	4,660.00	10.00	SPR Logistiikkakeskus	Suomi	Tre-Berliini auto, Berliini-Santo Domingo lento, Santo Domingo-Port au Prince auto..
HAITI 3	Liikkuvan ERU-klinikan lisälaitteet ja tarvikkeet	4,142	95,300.00	510.00	SPR Logistiikkakeskus	Suomi	Tre-Hki auto, HKI- Port au Prince (PAP) lento.
HAITI 3	ERU majoitusleiri tarvikkeita (Base Camp)	1			SPR Logistiikkakeskus	Suomi	Tre-Hki auto, HKI- Port au Prince (PAP) lento.
HAITI 3	Hätämajoitus-yksikkö (Shelter)	1			SPR Logistiikkakeskus	Suomi	Tre-Hki auto, HKI- Port au Prince (PAP) lento.
HAITI 3	Nissan Pickup	3			SPR Logistiikkakeskus	Suomi	Tre-Hki auto, HKI- Port au Prince (PAP) lento.
HAITI 3	Peräkärryjä	2			SPR Logistiikkakeskus	Suomi	Tre-Hki auto, HKI- Port au Prince (PAP) lento.
HAITI 3	Perhetelttoja	500	29,000.00	100.00	SPR Logistiikkakeskus	Suomi	Tre-Hki auto, HKI- Port au Prince (PAP) lento.
HAITI 3	Suihkuteltat	2	744.00	3.30	Eurovinil S.p.A	Italia	Milano-Santo Domingo lento, Santo Domingo-Port au Prince auto
HAITI 4	Lääkinnällisiä tuotteita ERU-klinikalle ja sairaalaan	4	126.80	0.44	SPR Logistiikkakeskus	Suomi	Tre-Hki auto, HEL-Santo Domingo lento, Santo Domingo- Port au Prince auto.
HAITI 4	Toimistotarvikkeita	26	50.00	1.50	SPR Logistiikkakeskus	Suomi	Tre-Hki auto, HEL-Santo Domingo lento, Santo Domingo- Port au Prince auto.
HAITI 4	Ilma-,polttoaine- ja öljyn-suodattimia	173	63.00	1.13	SPR Logistiikkakeskus	Suomi	Tre-Hki auto, HEL-Santo Domingo lento, Santo Domingo- Port au Prince auto.
KENIA	Huopia, 50% villa	19,875	35,775.00	224.00	Spinners & Spinners Ltd	Kenia	Thika-NBO (n.60km) auto
KENIA	Keitto- ja ruokailuvälineitä 5 henk.perheelle	17,762	88,810.00	432.00	Kaluworks Limited	Kenia	NBO-NBO auto,
KENIA	Moskiittoverkkoja, 190x180x150cm	32,440	16,220.00	62.00	Spartan Relief Supplies Ltd	Kenia	NBO-NBO auto,
KENIA	Pressuja 4x6m	3,385	45,570.00	89.20	Reltex Tarpaulins (Africa) EPZ Ltd	Kenia	NBO-NBO auto,
KENIA	Saippuaa, yleiskäyttö, 800g	15,000	12,000.00	22.00	Spartan Relief Supplies Ltd	Kenia	NBO-NBO auto,
KENIA	Vesikanistereita, 20L	33,120	10,500.00	119.00	Spartan Relief Supplies Ltd	Kenia	Taiwan-Mombasa laiva, Mombasa-NBO auto
PAKISTAN	Huopia, synteettinen (akryyli/polyesteri), 150 x 200 cm	68,000	90,800.00	688.00	Alpinter Ltd	Pakistan	Karachi-Multan auto
PAKISTAN	Lääkinnällisiä tarvikkeita 10 000 hengelle	635	20,983.00	99.50	IDA	Hollanti	Amsterdam-Islamabad lento
PAKISTAN	Moskiittoverkkoja, 160x180x150cm	14,400	3,960.00	13.32	Netto Group Co. Ltd	Pakistan	Bangkok-Islamabad lento, Islamabad-Mardan auto
PAKISTAN	Moskiittoverk-koja,190x180x150cm	200	2,680.00	6.32	AIPACS OACG	Pakistan	Karachi-Mardan auto.
PAKISTAN	Pressuja, 4x6m	4,500	20,250.00	45.00	Baldev Woollen International	Intia	Bunjab-Mumbai auto, Mumbai-Karachi laiva, Karachi-Mardan auto
ZIMBABWE	Maissin siemeniä, 10 kg pussi	16,605	166,050.00	266.00	V & M Grains C.C	Etelä-Afrikka	Pietersburg- Harare- ks.liite
ZIMBABWE	Durran siemeniä, 10 kg/pussi	1,340	13,400.00	20.10	V & M Grains C.C	Zimbabwe	Harare- ks.liite
ZIMBABWE	Sokeripavun siemeniä, 5 kg/pussi	5,518	27,590.00	30.35	V & M Grains C.C	Zimbabwe	Harare- ks.liite
ZIMBABWE	Pintalannoite, 50 kg/säkki	8,980	449,000.00	674.00	V & M Grains C.C	Zimbabwe	Harare- ks.liite
	Materiaalitoimitukset yhteensä	**287,798**	**2,290,717**	**5,365**			

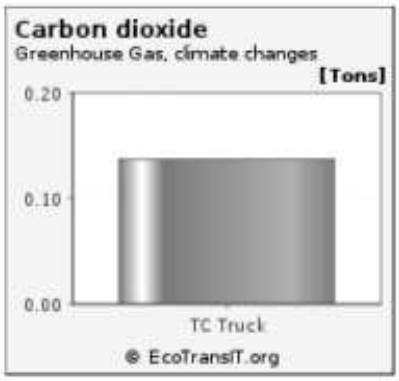
HAITI 1	Liikkuva ERU-klinikka	1	14,423.00	1,260.00	ERU	Suomi	TMP-PAP lento
HAITI 2	Kirurginen ERU-sairaala	1	18,568.00	80.30	ERU	Suomi	TRE-HKI auto, HEL-PAP lento
HAITI 2	ERU avunjakelu-yksikkö (Relief)	1	2,500.00	13.50	ERU	Suomi	TRE-HKI auto, HEL-PAP lento
PAKISTAN	ERU Logistiikka-yksikkö, airops ja ilmakaariteltta	5	617.00	2.98	ERU	Suomi	TRE-HKI auto, HEL-Kööpenhamina-Lontoo-Islamabad lento
	ERUT yhteensä	**8**	**36,108**	**1,357**			

		paalit	kg	m³		
Sierra Leone	Käytettyjä vaatteita	414	14,255.00	62.00	SPR Logistiikkakeskus	Suomi
Djibouti	Käytettyjä vaatteita, neuleita ja ÄT-peittoja	430	14,353.00	64.50	SPR Logistiikkakeskus	Suomi
Mongolia	Käytettyjä vaatteita, kenkiä, neuleita ja ÄT-peittoja	558	19,542.00	120.00	SPR Logistiikkakeskus	Suomi
Liberia	Käytettyjä vaatteita, apupupuja, neuleita ja ÄT-peittoja	401	13,570.00	60.00	SPR Logistiikkakeskus	Suomi
Chad	Käytettyjä vaatteita ja neuleita	407	12,749.00	61.00	SPR Logistiikkakeskus	Suomi
Tadjikistan	Käytettyjä vaatteita ja neuleita	641	19,705.00	96.20	SPR Logistiikkakeskus	Suomi
Tadjikistan	Käytettyjä vaatteita ja ÄT-peittoja	625	17,461.00	93.70	SPR Logistiikkakeskus	Suomi
	Vaatteet ym yhteensä	**3,476**	**111,635.00**	**557.40**		

9.2. Emission calculation tables

37 tons of blankets from Thika to Nairobi by truck





Primary energy consumption
Energy resource consumption

	[Megajoule] TC Truck
Truck	2.082
Sum:	2.082

© EcoTransIT.org

Carbon dioxide
Greenhouse Gas, climate changes

	[Tonnes] TC Truck
Truck	0,14
Sum:	0,14

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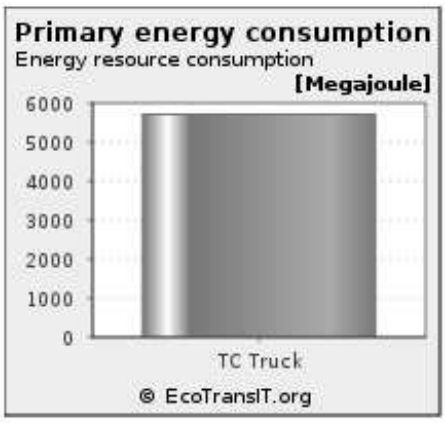
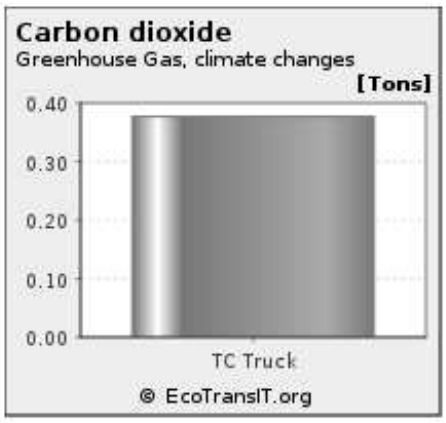
Source: EcotransIT, 2011

150 tons of relief items 50 kilometers within Nairobi by truck





Primary energy consumption
Energy resource consumption

	[Megajoule] TC Truck
Truck	5.711
Sum:	5.711

© EcoTransIT.org

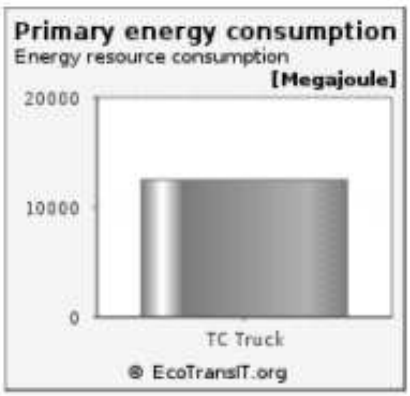
Carbon dioxide
Greenhouse Gas, climate changes

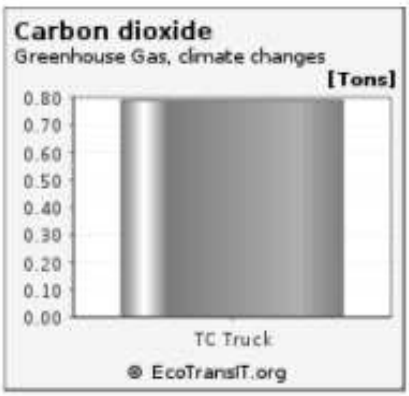
	[Tonnes] TC Truck
Truck	0,38
Sum:	0,38

© EcoTransIT.org

Source: EcotransIT, 2011

2nd hand clothing from Tampere-Kouvola by truck



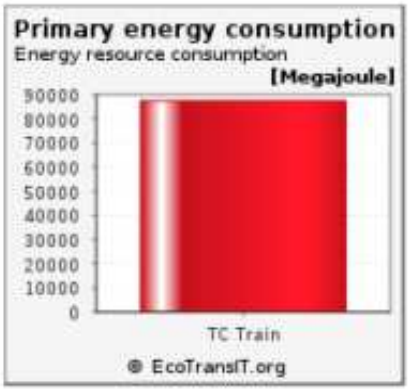


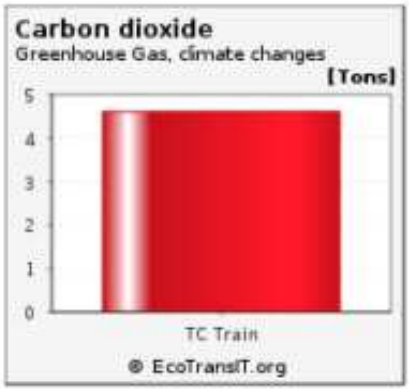
Primary energy consumption Energy resource consumption	[Megajoule]
	TC Truck
Truck	12.493
Sum:	12.493
© EcoTransIT.org	

Carbon dioxide Greenhouse Gas, climate changes	[Tonnes]
	TC Truck
Truck	0,79
Sum:	0,79
© EcoTransIT.org	

Source: EcotransIT, 2011

2nd hand clothing from Kouvola to Dushanbee by train



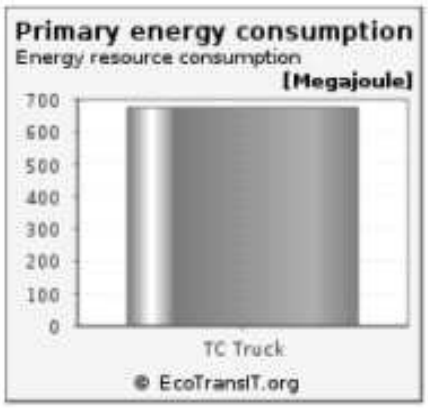


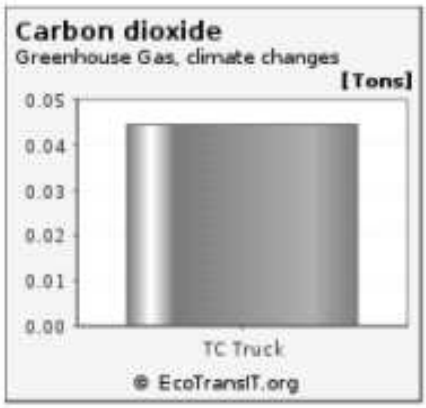
Primary energy consumption Energy resource consumption	[Megajoule]
	TC Train
Train	87.557
Sum:	87.557
© EcoTransIT.org	

Carbon dioxide Greenhouse Gas, climate changes	[Tonnes]
	TC Train
Train	4,61
Sum:	4,61
© EcoTransIT.org	

Source: EcotransIT, 2011

60 tons of blankets from Karachi to Multan by truck





Primary energy consumption
Energy resource consumption
[Megajoule]

	TC Truck
Truck	675
Sum:	675

© EcoTransIT.org

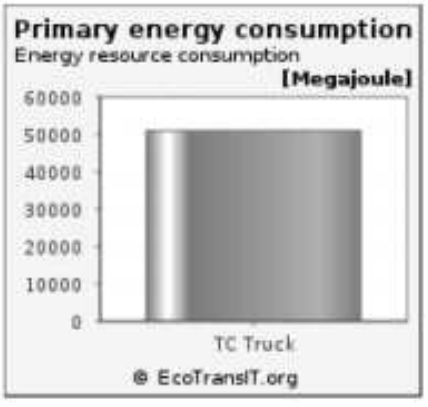
Carbon dioxide
Greenhouse Gas, climate changes
[Tonnes]

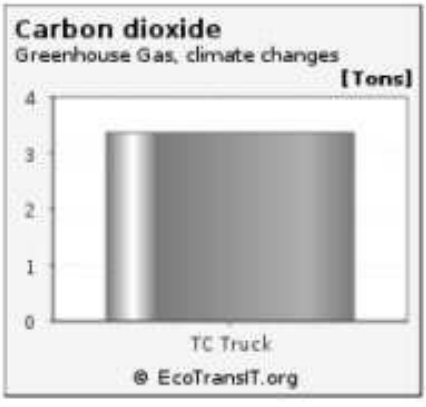
	TC Truck
Truck	0,045
Sum:	0,045

© EcoTransIT.org

Source: EcotransIT, 2011

42 tons of blankets from Jaipur to Mumbai by truck





Primary energy consumption
Energy resource consumption
[Megajoule]

	TC Truck
Truck	51.083
Sum:	51.083

© EcoTransIT.org

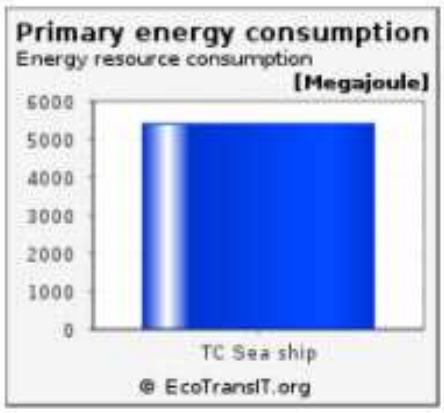
Carbon dioxide
Greenhouse Gas, climate changes
[Tonnes]

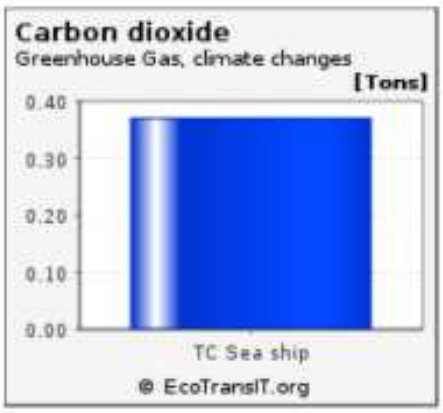
	TC Truck
Truck	3,37
Sum:	3,37

© EcoTransIT.org

Source: EcotransIT, 2011

42 tons of blankets from Mumbai to Karachi by ship





Primary energy consumption Energy resource consumption	[Megajoule]
	TC Sea ship
Sea ship	5.410
Sum:	**5.410**

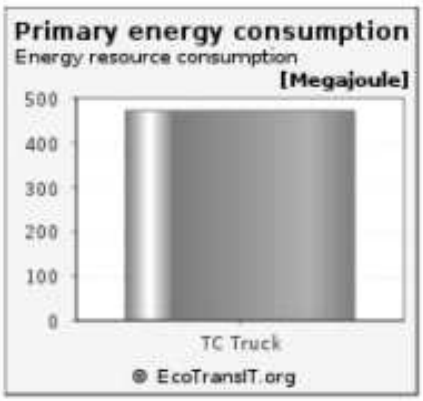
© EcoTransIT.org

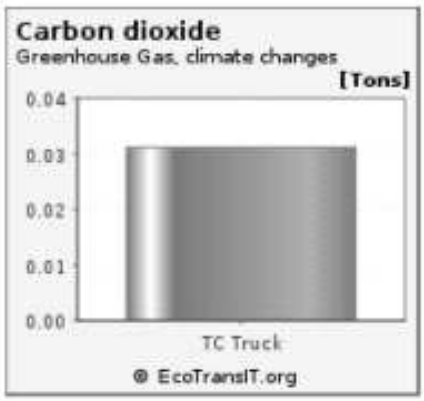
Carbon dioxide Greenhouse Gas, climate changes	[Tonnes]
	TC Sea ship
Sea ship	0,37
Sum:	**0,37**

© EcoTransIT.org

Source: EcotransIT, 2011

42 tons of blankets from Karachi to Multan by truck





Primary energy consumption Energy resource consumption	[Megajoule]
	TC Truck
Truck	473
Sum:	**473**

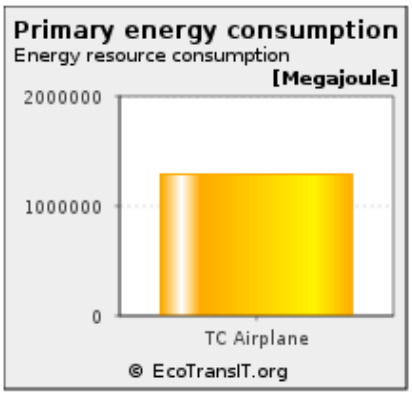
© EcoTransIT.org

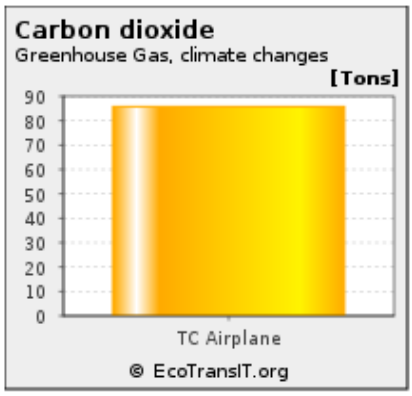
Carbon dioxide Greenhouse Gas, climate changes	[Tonnes]
	TC Truck
Truck	0,031
Sum:	**0,031**

© EcoTransIT.org

Source: EcotransIT, 2011

21 tons of medical supplies from Amsterdam to Islamabad by flight





Primary energy consumption
Energy resource consumption
[Megajoule]

	TC Airplane
Airplane	1.290.238
Sum:	1.290.238

© EcoTransIT.org

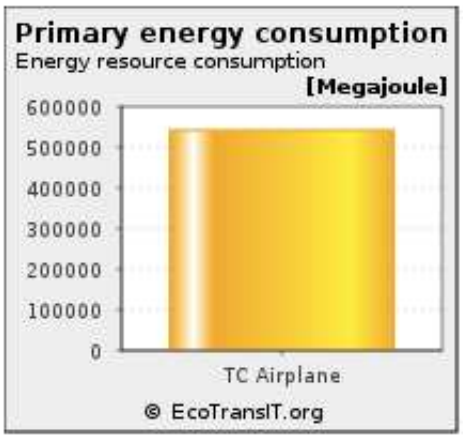
Carbon dioxide
Greenhouse Gas, climate changes
[Tonnes]

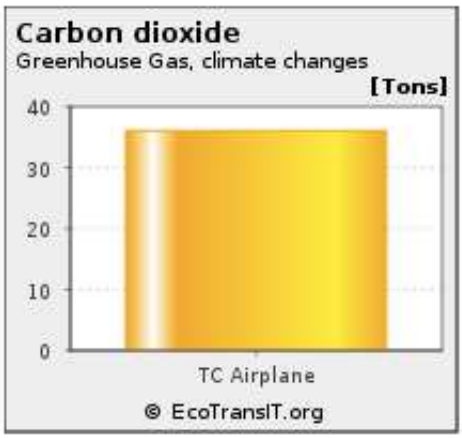
	TC Airplane
Airplane	86
Sum:	86

© EcoTransIT.org

Source: EcotransIT, 2011

14 tons of mosquito nets from Bangkok to Islamabad by flight





Primary energy consumption
Energy resource consumption
[Megajoule]

	TC Airplane
Airplane	542.050
Sum:	542.050

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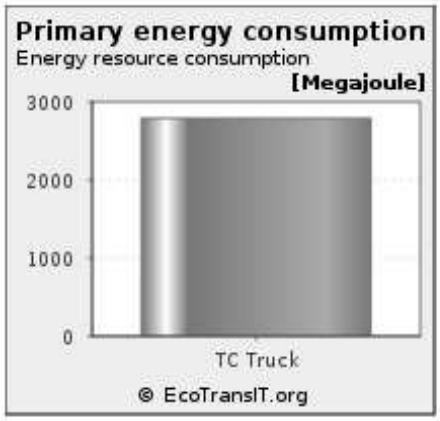
Carbon dioxide
Greenhouse Gas, climate changes
[Tonnes]

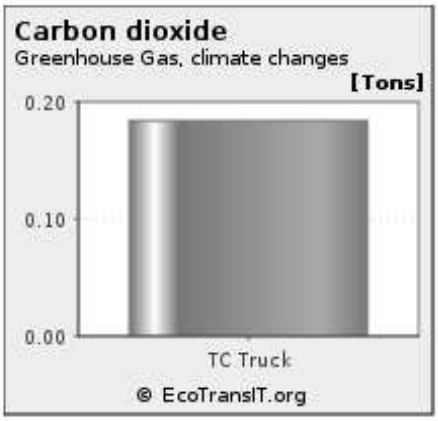
	TC Airplane
Airplane	36
Sum:	36

© EcoTransIT.org

Source: EcotransIT, 2011

14 tons of mosquito nets from Islamabad to Mardan by truck





Primary energy consumption
Energy resource consumption
[Megajoule]

	TC Truck
Truck	2.789
Sum:	**2.789**

© EcoTransIT.org

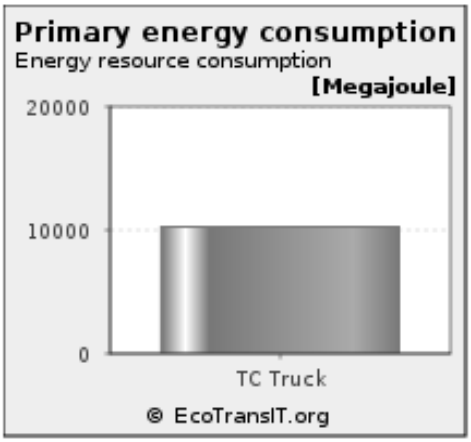
Carbon dioxide
Greenhouse Gas, climate changes
[Tonnes]

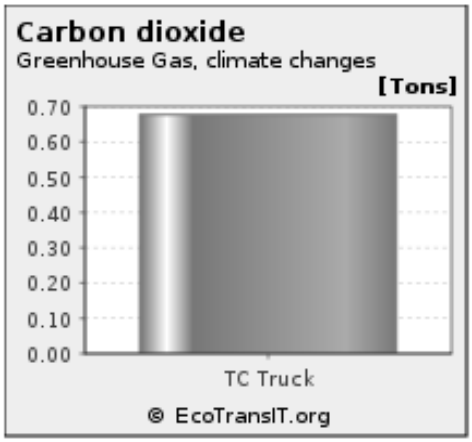
	TC Truck
Truck	0,18
Sum:	**0,18**

© EcoTransIT.org

Source: EcotransIT, 2011

20 tons of tarpaulins from Lahore to Mardan by truck





Primary energy consumption
Energy resource consumption
[Megajoule]

	TC Truck
Truck	10.269
Sum:	10.269

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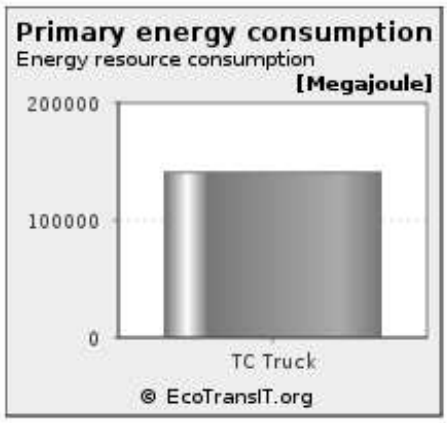
Carbon dioxide
Greenhouse Gas, climate changes
[Tonnes]

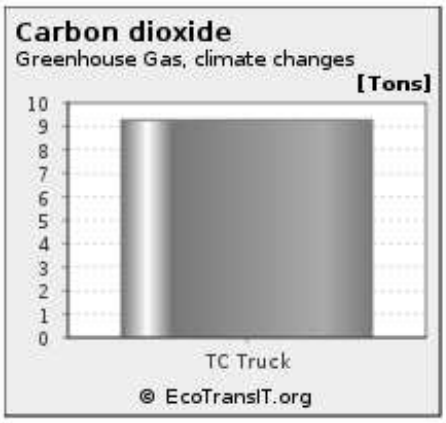
	TC Truck
Truck	0,68
Sum:	0,68

© EcoTransIT.org

Source: EcotransIT, 2011

166 tons of seeds from Pietersburg to Harare by truck





Primary energy consumption
Energy resource consumption
[Megajoule]

	TC Truck
Truck	140.693
Sum:	**140.693**

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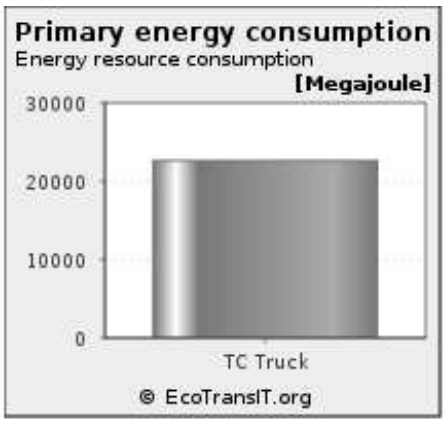
Carbon dioxide
Greenhouse Gas, climate changes
[Tonnes]

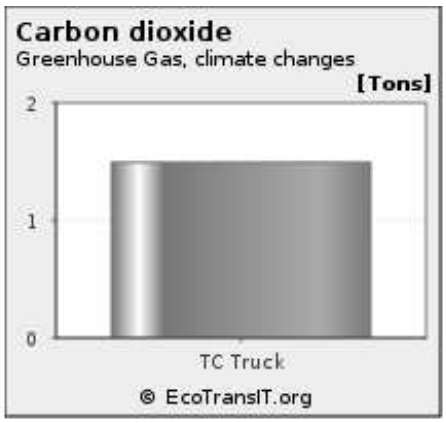
	TC Truck
Truck	9,28
Sum:	**9,28**

© EcoTransIT.org

Source: EcotransIT, 2011

499 tons of seeds 50 km within Harare by truck





Primary energy consumption
Energy resource consumption
[Megajoule]

	TC Truck
Truck	22.643
Sum:	**22.643**

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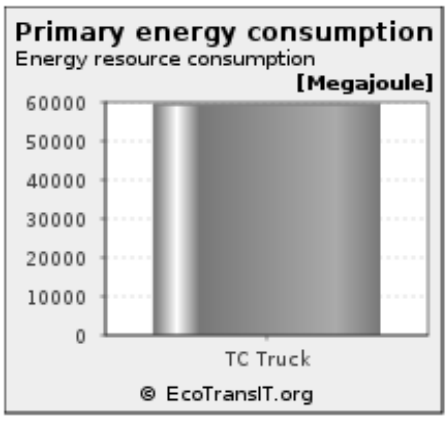
Carbon dioxide
Greenhouse Gas, climate changes
[Tonnes]

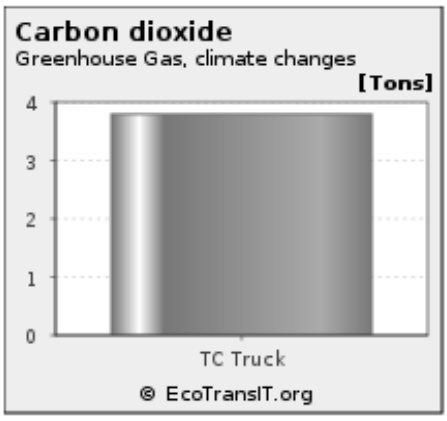
	TC Truck
Truck	1,49
Sum:	**1,49**

© EcoTransIT.org

Source: EcotransIT, 2011

23 tons of items from Tampere to Berlin by truck





Primary energy consumption Energy resource consumption	[Megajoule]
	TC Truck
Truck	59.381
Sum:	59.381

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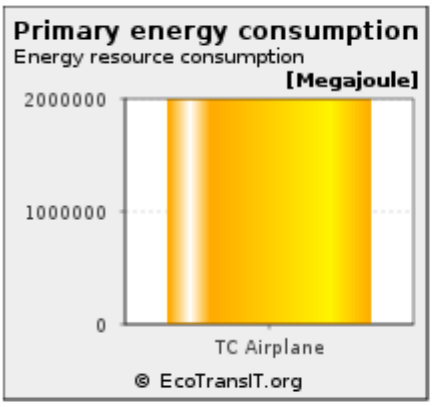
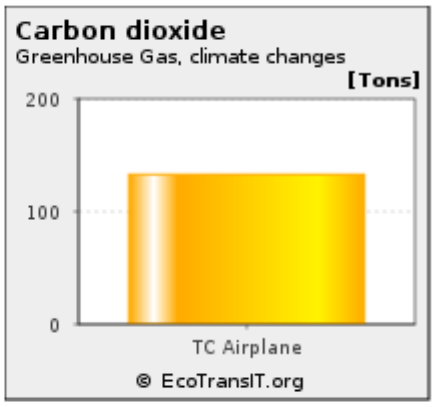
Carbon dioxide Greenhouse Gas, climate changes	[Tonnes]
	TC Truck
Truck	3,79
Sum:	3,79

© EcoTransIT.org

Source: EcotransIT, 2011

23 tons from Berlin to Santo Domingo





Primary energy consumption Energy resource consumption	[Megajoule]
	TC Airplane
Truck	4.280
Airplane	1.994.411
Sum:	1.998.691

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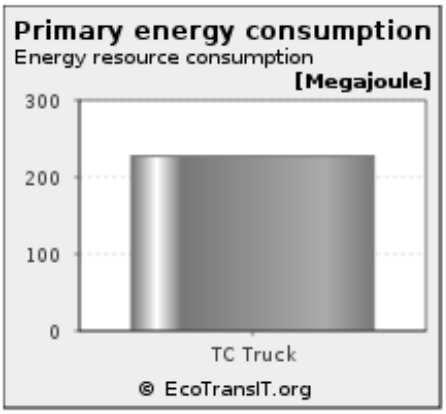
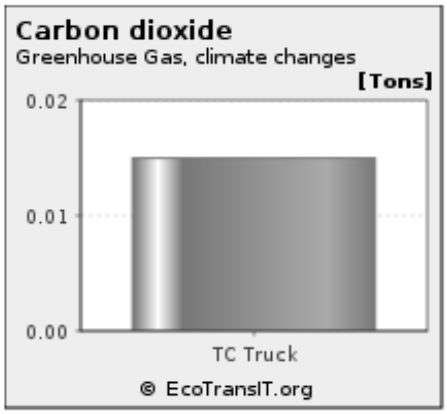
Carbon dioxide Greenhouse Gas, climate changes	[Tonnes]
	TC Airplane
Truck	0,27
Airplane	132,63
Sum:	132,90

© EcoTransIT.org

Source: EcotransIT, 2011

23 tons from Santo Domingo to Port-au-Prince by truck





Primary energy consumption Energy resource consumption	[Megajoule]
	TC Truck
Truck	227
Sum:	227

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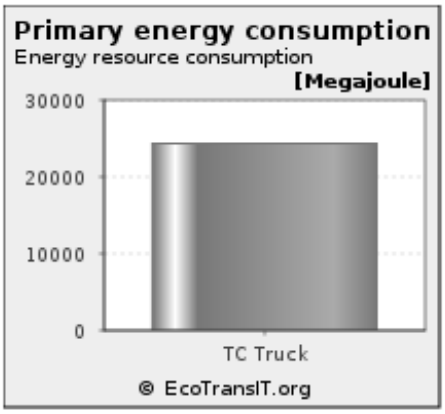
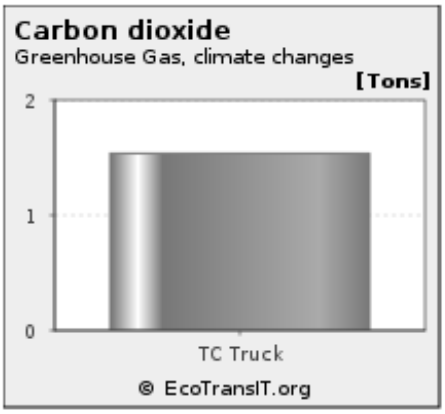
Carbon dioxide Greenhouse Gas, climate changes	[Tonnes]
	TC Truck
Truck	0,015
Sum:	0,015

© EcoTransIT.org

Source: EcotransIT, 2011

125 tons from Tampere to Helsinki by truck





Primary energy consumption Energy resource consumption	[Megajoule]
	TC Truck
Truck	24.332
Sum:	24.332

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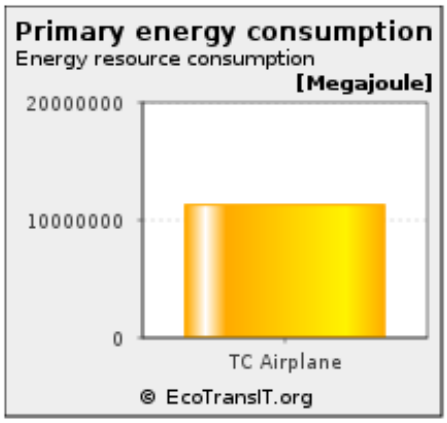
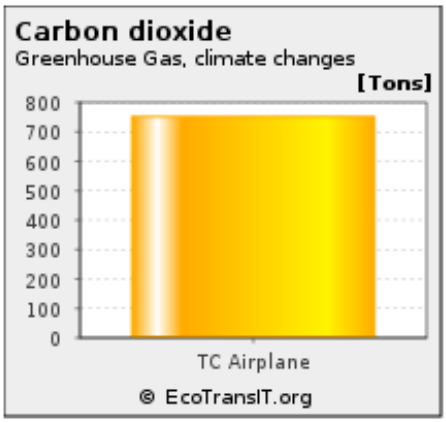
Carbon dioxide Greenhouse Gas, climate changes	[Tonnes]
	TC Truck
Truck	1,54
Sum:	1,54

© EcoTransIT.org

Source: EcotransIT, 2011

125 tons from Helinki to Port-au-Prince by flight





Primary energy consumption Energy resource consumption	[Megajoule]
	TC Airplane
Truck	49.112
Airplane	11.249.456
Sum:	11.298.568

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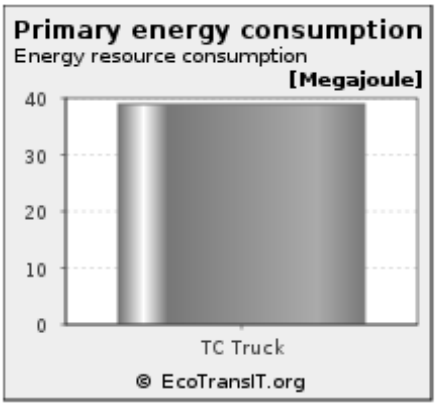
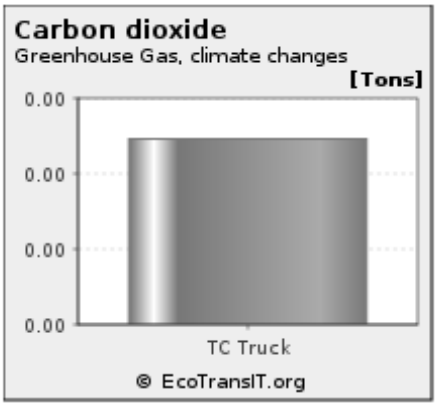
Carbon dioxide Greenhouse Gas, climate changes	[Tonnes]
	TC Airplane
Truck	3,24
Airplane	748,12
Sum:	751,36

© EcoTransIT.org

Source: EcotransIT, 2011

0,2 tons from Tampere to Helsinki by truck





Primary energy consumption Energy resource consumption	[Megajoule]
	TC Truck
Truck	39
Sum:	39

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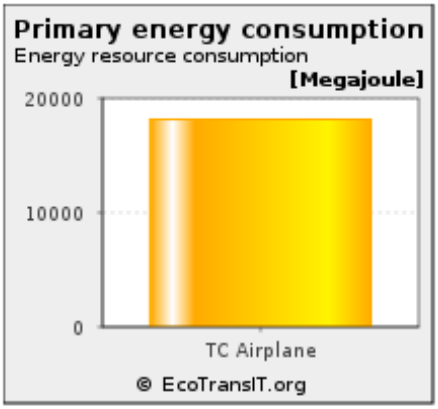
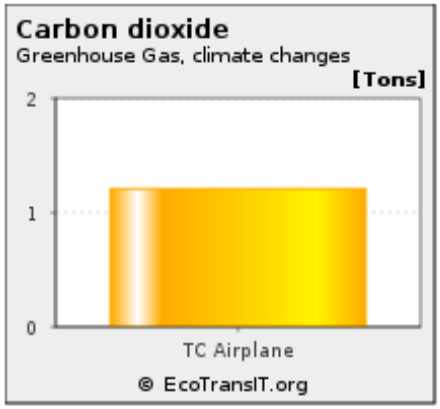
Carbon dioxide Greenhouse Gas, climate changes	[Tonnes]
	TC Truck
Truck	0,0025
Sum:	0,0025

© EcoTransIT.org

Source: EcotransIT, 2011

0,2 tons from Helsinki to Santo Domingo by flight





Primary energy consumption
Energy resource consumption
[Megajoule]

	TC Airplane
Truck	11
Airplane	18.156
Sum:	**18.166**

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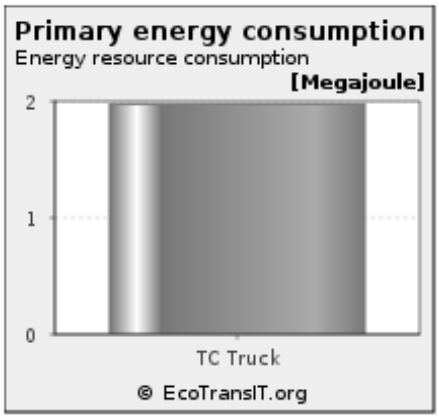
Carbon dioxide
Greenhouse Gas, climate changes
[Tonnes]

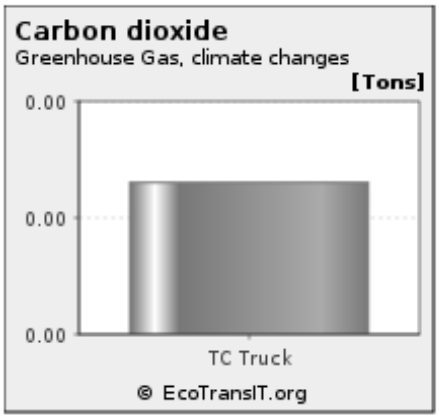
	TC Airplane
Truck	0,00070
Airplane	1,20741
Sum:	**1,20811**

© EcoTransIT.org

Source: EcotransIT, 2011

0,2 tons from Santo Domingo to Port-au-Prince by truck





Primary energy consumption
Energy resource consumption
[Megajoule]

	TC Truck
Truck	1,98
Sum:	**1,98**

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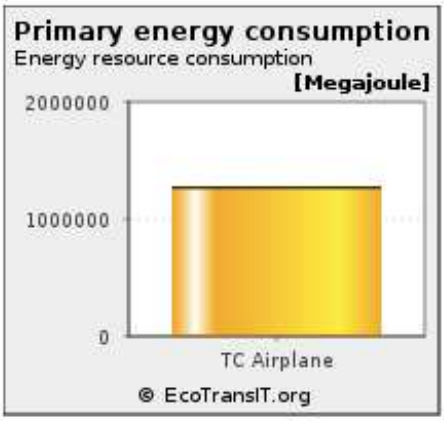
Carbon dioxide
Greenhouse Gas, climate changes
[Tonnes]

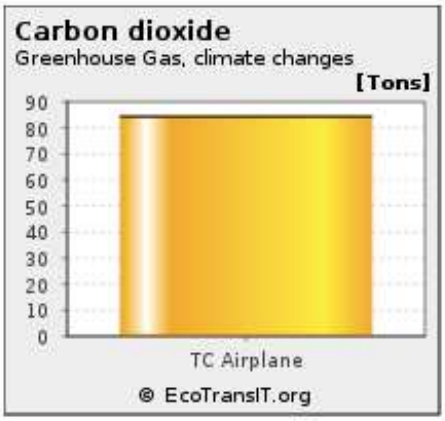
	TC Truck
Truck	0,00013
Sum:	**0,00013**

© EcoTransIT.org

Source: EcotransIT, 2011

14 tons of health clinic from Tampere to Port-au-Prince by flight





Primary energy consumption
Energy resource consumption
[Megajoule]

	TC Airplane
Truck	8.342
Airplane	1.259.939
Intermodal transfer	51
Sum:	**1.268.332**

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Carbon dioxide
Greenhouse Gas, climate changes
[Tonnes]

	TC Airplane
Truck	0,5423
Airplane	83,7892
Intermodal transfer	0,0022
Sum:	**84,3338**

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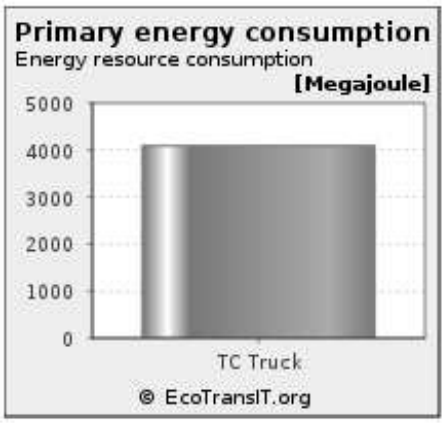
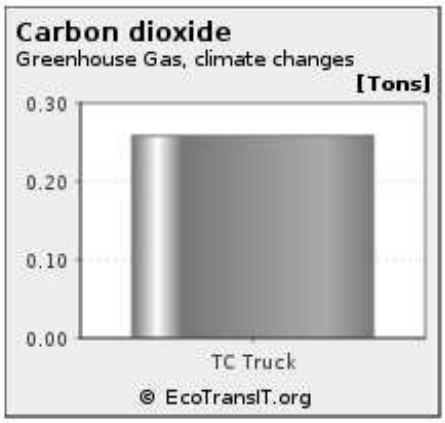
Source: EcotransIT, 2011

21 tons emergency response unit from Tampere to Helsinki by truck





Primary energy consumption
Energy resource consumption
[Megajoule]

	TC Truck
Truck	4.088
Sum:	**4.088**

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Carbon dioxide
Greenhouse Gas, climate changes
[Tonnes]

	TC Truck
Truck	0,26
Sum:	**0,26**

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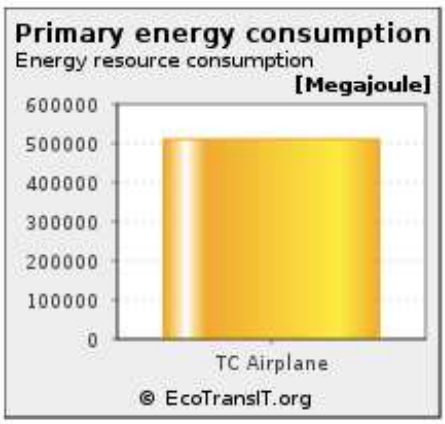
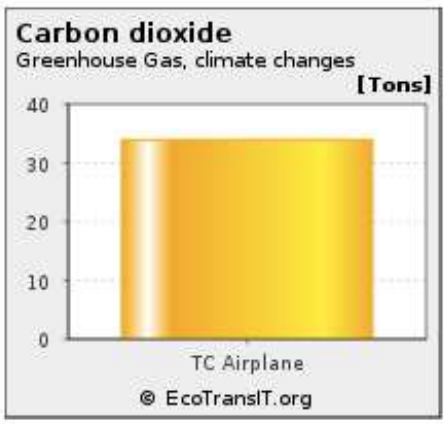
Source: EcotransIT, 2011

21 tons emergency response unit from Helsinki to Berlin by flight





Primary energy consumption
Energy resource consumption
[Megajoule]

	TC Airplane
Airplane	510.318
Sum:	**510.318**

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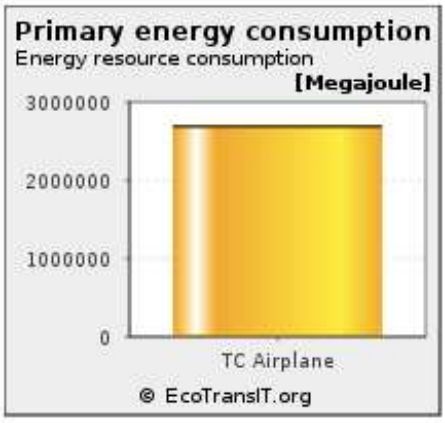
Carbon dioxide
Greenhouse Gas, climate changes
[Tonnes]

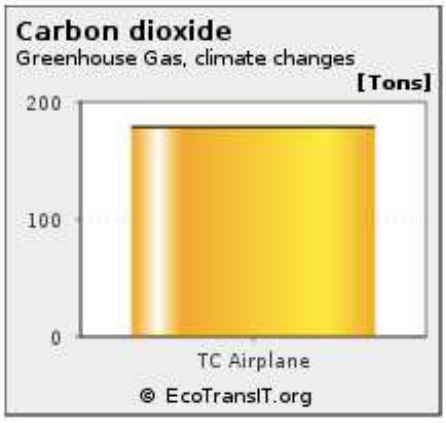
	TC Airplane
Airplane	34
Sum:	**34**

© EcoTransIT.org

Source: EcotransIT, 2011

31 tons of relief items from Berlin to Port-au-Prince by flight





Primary energy consumption
Energy resource consumption
[Megajoule]

	TC Airplane
Truck	17.948
Airplane	2.669.696
Intermodal transfer	122
Sum:	**2.687.766**

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Carbon dioxide
Greenhouse Gas, climate changes
[Tonnes]

	TC Airplane
Truck	1,1678
Airplane	177,5417
Intermodal transfer	0,0058
Sum:	**178,7153**

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Source: EcotransIT, 2011

9.3. Comments from Kirsi Pohjola, the Finnish Red Cross

Kuljetusten päästöt on aiheena hyvin ajankohtainen. Paljon kuljetuksia käyttävät organisaatiot pohtivat miten laskea ja raportoida ympäristövaikutukset, joista kuljetus on vain yksi tekijä . Asia on tärkeä myös puhtaasti hankinnan näkökulmasta. Useammissa organisaatioissa ympäristötekijät tulisi huomioida kriteerinä hankintapäätöstä tehdessä, mutta yksinkertaisia ja luotettavia työkaluja tasapuoliseen kuljetusten ympäristövaikutusten analysointiin ei yleisessä käytössä löydy.

Tässä työssä tuli esiin eri kuljetusmuotojen ympäristövaikutukset hiilidioksidimäärinä sekä paikallisesti tai alueellisesti hankittujen tuotteiden ympäristövaikutukset vs. kaukaa kuljetettaviin. Työn tulokset mahdollisti vertailun karkealla tasolla, mikä oli työn tavoitteena. Työlle annetut tavoitteet täyttyivät.

Teoriapohjana oli humanitaarinen logistiikka ja green logistics. Jos näistä teorioista tai esim. ympäristötieteen puolelta olisi löytynyt selvä malli olisi loppupäätelmiä voinut tehdä mallinnuksen mukaan ja näin helpottanut ja syventänyt loppupäätelmiä. Tai työelämää enemmän palvelevana tarkistellut käytännön ongelmaa perehtymällä muiden organisaatioiden ympäristövaikutusten laskemisen toimintamalleihin ja miten ne toimivat humanitaarisessa logistiikassa.

Raportoinnissa olisi voinut muotoilla taulukoita enemmän lukijaystävälliseksi eli tässä tarkoitan lukijoita, joille operaatiot eivät ole tuttuja. Lhyt ja selkeä maakohtainen logistiikkaosio teki työstä selkeän, koska se loi operaatiokuvausten lisäksi raamit logistiikka toiminnoille. Loppupäätelmiin enemmän konkretiaa esim. suhteutuksia painoihin ja kuutioihin, joita kuljetettu. Kuitenkaan tämä ei ole iso asia, sillä tiedot ovat työssä ja sieltä saatavissa.

Kokonaisvaltaisesti työ oli hyvä ja SPR:n määrittelemät tavoitteet täyttyivät. Työssä näkyi, että organisaation toimintaan oli perehdytty ja ulkopuolisena se vaati paljon työtä ja aikaa.