LOW CARBON LOGISTIC

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Reduction Of Fossil Co2 Emissions and Other Types of Pollutants From The Transport Sector In The Baltic Sea Region – Theory And Practical Possibilities

GOOD PRACTICE BOOK

LOW CARBON LOGISTICS

Interreg South Baltic

EUROPEAN UNION

European Regional Development Fund

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1 INTRODUCTION

The Baltic Sea region is distinguished for its unique biodiversity and landscape. The Curonian Spit (northern part of the peninsula belongs to Lithuania), has been included in the UNESCO World Natural and Cultural Heritage List. However, one must acknowledge that this region is mostly affected by high levels of pollution. The pollution of the Baltic Sea can be determined by several factors that are divided into two groups – internal and external. Internal factors encompass such concepts as the depth of the sea – the Baltic Sea is relatively shallow, diverse information sources indicate an average depth ranging between 50 and 100 metres. Moreover, there is a poor water mass exchange with the ocean; rivers draining into the Baltic Sea and shipping have a great impact on the pollution levels. Even though that shipping is monitored in the Baltic Sea, however, certain accidents, such as unauthorized ballast water and oil discharge into the sea, cannot be avoided. Another group – external factors, which are directly linked with human economic activities. Paradoxically, these activities may be conducted far away from the sea. The Baltic Sea region is directly influenced by global pollution, which is the fundamental cause of the greenhouse effect. One of the major factors of this pollution is the extent of CO2 emissions.

In some sense, an indicator of the CO2 is a derivative value that shows both – direct emissions of carbon dioxide and other accompanying emissions. The concept of CO2 footprint will be explored in a greater detail in other chapters of this publication.

The environmental challenges of the Baltic region have raised concerns in the European Union. In 2015 as the Action Plan – Working document accompanying the communication concerning the European Union strategy for the Baltic Sea region explores essential pollution problems and its guidelines[1].

The aforementioned information shows that environmental problems of the Baltic region remain a relevant question on the agenda. Additionally, action plans and other documents of the European Union highlight both – the importance of environmental problems in the Baltic Sea region and causes which usually occur in the coastal regions and have a direct impact on the environmental situation in the Baltic Sea region.

Actions have to both minimise the adverse effects of human activities that cause pollution and work towards preventing damage, by for example establishing an ecologically coherent network of well-managed marine protected areas as one tool within a wider integrated sea use management (ISUM) approach to maritime spatial planning and integrated coastal zone management (ICZM). In addition to the threats, other upcoming trends and uncertainties that have been identified[2] as potentially damaging to Baltic Sea wildlife and biodiversity now or in the near future include increased infrastructure development (such as ports, pipelines, power cables etc.) and increased coastal zone activities (including cities, tourism facilities, coastal defence structures, energy supply systems, fish farms).[3]

The activities of transport and logistics are the major sources of pollution affecting the entire environmental situation in the region and globally. Not surprisingly, one of the sections of the research and innovation program Horizon 2020 is designed for transport that is Smart, Green and Integrated. It is very likely that by 2020 there will be new scientific research and projects carried-out in the contexts of Green Logistics and Transportation Impact Analysis.

The project **"Low Carbon Logistics"** is of no exception and is aimed at starting the establishment of low carbon logistic structures in 5 locations within the SB-region (4 project partners and 1 associated partner), giving them best practice status towards widest possible adaptation, the project will start with:

1. Analysis of preconditions (flows, type of goods, stakeholders, guidelines etc.).
2. Joint development of a low carbon logistics concept for towns and rural areas in the SB region, which will be done jointly by the pilot regions and an international consortium of transport and mobility experts.
3. The joint concept will serve as the basis for local/regional working plans + long-term strategies, developed as local adaptations in close cooperation with relevant players.
4. In its last stage, the project will start the active implementation of the determined measures and solutions, one pilot measure per region included. The whole process is designed to be continued after the project towards a holistic low carbon logistic area in accordance with the international concept. To achieve this, this work will

1 Commission staff working document. European Union Strategy for the Baltic Sea Region. ACTION PLAN {COM(2009) 248} Brussels, 10.9.2015. SWD(2015) 177 final.

2 WWF (2012). Counter Currents: Scenarios for the Baltic Sea 2030.

3 Commission staff working document. European Union Strategy for the Baltic Sea Region. ACTION PLAN {COM(2009) 248} Brussels, 10.9.2015. SWD(2015) 177 final.

be accompanied by extensive public acceptance measures from the very beginning, which includes campaign work, but also the development and recommendation of business models pertaining to low carbon logistics, the creation of an international label for low carbon logistics institutions and learning from best practices by different means.

A third field of project activities aims to merge the national expertise of the involved expert partners for optimum international use and to ensure that this expertise plus the additional knowhow gained via the project work will remain available for active use during and after the project: For this, an international consultancy structure will be established and lastingly operated towards supporting specific regions with the green logistics attempts, guidance on green policy instruments relevant for this work included.

This publication provides theoretical aspects of the environmental sensitive activities. Green Logistics – what does it mean? Descriptions of the main impacts forces to the environment – different types of the emissions, untypical pollution (light, noise), fatalities at the traffics accident. CO2 emissions and CO2 footprints. Baltic Sea Region – overview of the problematical zones and challenges, historical aspects in Neringa, Rietavas, Olofström, Bad Doberan, Stargard. The examples of best practices are presented, described and named as possible solutions for the green logistics in the different regions of the BSR (Neringa, Rietavas, Olofström, Bad Doberan, and Stargard).

As the author of this publication, I would like to express my gratitude to the following researchers/institutions who provided information and examples of the best practices from different regions of the Baltic Sea:
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Diverse information sources were used in compilation of this publication, including scientific-methodical literature, educational literature, project reports, research materials, information reports and web sources. Generally, literature sources are cited in footnotes, however, full list of sources is provided at the end of publication, in references list.

2 THEORETICAL ASPECTS OF ENVIRONMENTALLY-SENSITIVE ACTIVITIES

The overview of theoretical aspects on Green logistics, CO2 emissions and environmental impacts is based on Mckinnon, A.; Cullinane, Sh.; Browne, M.; Whiteing, A. Green Logistics. Improving the Environmental Sustainability of Logistics (Kogan Page 2010, p. 372, ISBN 978-0-7494-5678-8) book and other authors indicated in the references list. The author's, of this publication, pedagogical-scientific experience in conducting the course of Green logistics was applied in the assessment of theoretical aspects also.

There is a considerable number of pollutants and forces acting upon the environment, however, project's analytics is concerned with pollution sources generated from Transport and Logistics System. However, apart from CO2, transport releases a number of hazardous substances into the environment (see fig. 1). Additionally, the levels of motorization are rising providing prerequisites to increase numbers of the vehicle. Diesel engines are popular across many countries and in most cases commercial vehicle fleet is made up from diesel-powered engines. As we will explain later on, the extent of CO2 generated from diesel engines is one of the highest.

Paradoxically, modern and contemporary logistics solutions can be damaging to the environment. The precise interpretation and applications of LEAN theories in practice may result in serious environmental challenges, where the supply of the stock and component parts for the production is organized in small batches to be delivered in frequent intervals. The modern business approach is focused on meeting personalized customer's needs where door-to-door delivery is highly exercised resulting in the increase of the congestion and thus emissions of harmful substances.

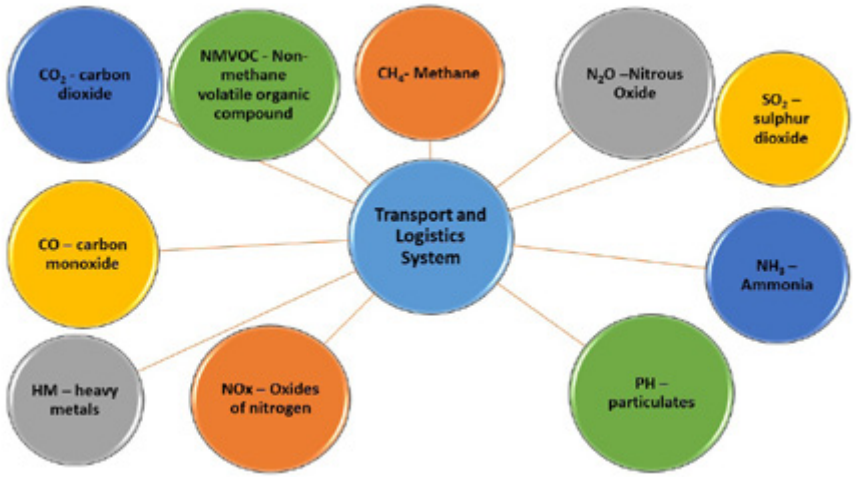

Fig. 1. Substances causing negative effect on the environment that are generated from Transport and Logistics System

The analysis on the environmental impacts of transportation involves three levels of impacts: **global, regional and local.** It is worth noting that local impact may turn into regional in an event of the substances spillage or release in a larger territory.

GLOBAL POLLUTION substances are directly or indirectly linked with the greenhouse effect and climate change. The following substances are classified as causing indirect impact on the climate change: NOx, NMVOC, CO, CH4. The group of substances having direct impact are as follows: CH4, CO2, N2O. Substances of the global impact quickly spread in the environment and under the influence of atmospheric processes cover large territories. Most importantly, these substances create conditions in which solar radiation reaches the earth's surface, resulting in high temperature, but thermal convection processes are terminated and excess heat is not eradiated back to the space. As a result, atmosphere temperatures are rising, causing negative impact on the climate – droughts, extreme cold and heat waves, decline in water resources, melting glaciers, sea level rise, etc. Most importantly, biodiversity and human natural environment are directly influenced under these processes. Moreover, conventional plant and animal species are under immediate threat of extinction, conditions for invasive biological species to thrive are created, which in turn destroys existing biological balance. To make things even worse, climate change is influencing human habitat – extreme temperatures, water scarcity, soil becomes unsuitable for growing food. The theory of "climate refugees" or "climate migrants" is being discussed for some time now. The term itself refers to the subset of environmental migrants forced to move due to sudden or gradual alterations in the natural environment related to at least one of three impacts of climate change. This process may lead to new migration flows into territories that are more suitable for living. However, this may result in further ethnic, religious and military conflicts.

REGIONAL POLLUTION. Its impact is localized in the context of corresponding regions and covers less global territories. Regional pollution can be characterised in terms of acidification and photochemical effect. The impact of acidification effect – acid rains, since this effect is heavily influenced by the following substances: NH3, SO2, NOx. Upon the release into the atmosphere, these substances react with water and the result is multifarious acids, of which the best known is the sulphuric acid H2SO4. Unfortunately, the impact of these acids on the environment can be negative – biodiversity change is induced, plant species become extinct, fauna is under negative influence, pH of the soil is altered, as well as growing conditions for food crops. Acid rain is very hazardous to the marine and aquatic animals. The mollusc shell is typically a calcareous exoskeleton comprised of lime compounds that directly react with acids. Recently, there has been increased debate over the changes of the pH in the human body and negative effects of the acidity. Photochemical effect has more complex mechanism – NOx, NMVOC, CO substances exposed to sunlight produce dangerous compounds which negatively affect human respiratory system – respiratory tract, bronchus, lungs, and induce cardio – vascular diseases. The skin can also be irritated – dermatitis, allergic reactions, other skin diseases may develop under the influence of photochemical effect. The term photochemical smog refers to air pollution containing ozone, nitrogen oxides and carbohydrates. Some of the substances under photochemical influence are classified as carcinogens.

Local pollution is especially perceptible by people living, working and being in corresponding territories as they encounter with direct and strong impact. Local pollution substances generated from Transport and Logistics system are as follows: Nitrogen oxides (NOx), Hydrocarbons (HCs), Ozone (O3), Particulates (PH), Carbon monoxide (CO), Sulphur dioxide (SO2).

NOISE POLLUTION. There are so-called untypical forms of environmental impacts, such as noise pollution, deaths, injuries and light pollution. Light pollution is concerned with excessive and inappropriate artificial light on the streets, buildings, billboards, etc. As a major side-effect of urbanization, it generates artificial light sources that can negatively impact humans and animals. Primarily, light pollution can influence bird migration, as well as wild animals. Light pollution may have adverse effects on human health as it triggers insomnia and disrupts rest regimen. Recently, there has been increased debate over the influence of the blue colour on human health. There are certain theories claiming that blue lights inhibit the production of melanin in the body, which in turn prevent proper rest and induce stressful conditions. Additionally, there are theories, stating that a blue light, widely used in billboards and mobile devices, negatively impacts human retina. Light pollution is not so relevant in analysing activities of the Logistics systems, however, noise pollution and its impact on the environment during accidents is very significant. Therefore, it is necessary to bear in mind certain aspects while analysing noise and its impact. Noise can be emanated from vehicles, motor operations and dynamic loads. Noise can also be produced from moving parts, fans and loading equipment.

According to Alan McKinnon (McKinnon et al. 2010), the immediate adverse effects of noise disturbance include annoyance, communication difficulties, loss of sleep and impaired cognitive functioning resulting in loss of work productivity; longer-term, physiological and psychological health issues may also arise (den Boer and Schroten, 2007). Currently, around 30 per cent of the European Union's population is exposed to road traffic noise and 10 per cent to rail noise levels above 55 dB(A). Data on aircraft noise exposure is less reliable, though it is thought that around 10 per cent of the EU population may be highly disturbed by air transport noise (EEA, 2003).

Trucks generate road noise from three sources:

- **propulsion noise (power train/engine sources), which dominates at low speeds (less than 50 km/h);**
- **tyre/road-contact noise, which is the main cause of noise at speeds above 50 km/h;**
- **aerodynamic noise, which increases as the vehicle accelerates.**

European vehicle noise standards for individual vehicles were introduced in the early 1970s (Directive 70/157/EEC), when the permitted noise emissions for trucks were set at 80 dB(A). Noise standards have been tightened several times since then (Affenzeller and Rust, 2005). Significant reductions in noise levels have been achieved by technical advances in engine design, tyres and the aerodynamic profiling of vehicles. Nevertheless, overall noise levels have not improved, as the growth and spread of traffic in space and time has largely offset both technological improvements and other abatement measures (INFRAS, 2004)[4].

ROAD TRAFFIC ACCIDENTS, INJURIES AND FATALITIES. Human being is a part of the living nature and can be directly influenced by transportation system – he may get injured or fatally injured. Therefore, Green logistics consider this aspect. Unfortunately, there is no exact data, but following the lines of historical tendencies, it is possible to claim that the number of fatalities in the Baltic Sea Region is gradually declining (see fig. 2). However, the number of injuries is steady or even increasing.

Despite of the strict regulations on traffic safety, it is possible to make an assumption that the tendencies and problems remain. The latest research on the advancements obtained by separate BSR countries is necessary. However, one must acknowledge that this area of Green logistics is an object of separate interests, where the questions of traffic safety reassurance are covered. This is a broad and separate area of activity, thus, it will not be elaborated, but it will be considered in answering the following questions:

1. Transport infrastructure is in conformity with the laws of ergonomics and traffic safety;
2. Employee labour conditions, the role of human factor;
3. Traffic intensity, assessment on traffic accident probability.

4 Mckinnon, A.; Cullinane, Sh.; Browne, M.; Whiteing, A. Green Logistics. Improving the Environmental Sustainability of Logistics. Kogan Page 2010, p. 372, ISBN 978-0-7494-5678-8.

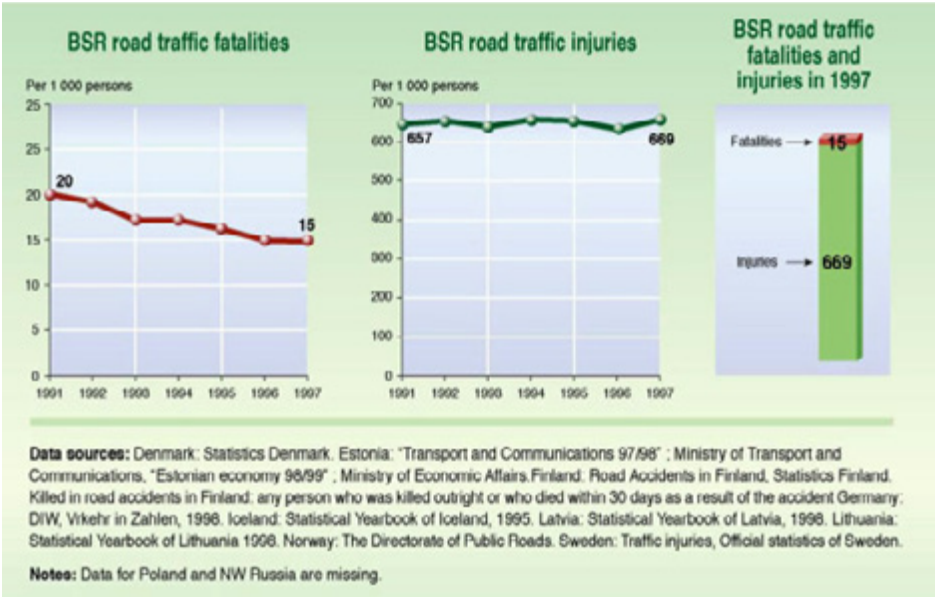

Fig. 2. Road Traffic Injuries and Fatalities in the Baltic Sea Region. Graphics from the year 2000 Baltic 21 biannual indicator-based status report on sustainable development in the Baltic Sea Region (Baltic 21 Series No 1/2000). The graphic shows road traffic injuries and fatalities in the Black Sea Region from 1991 to 1997. Author: Philippe Rekacewicz, UNEP/GRID-Arendal. Sources: www.grida.no

LEGAL REGULATION can be divided into two groups of impact - repressive and motivational. Unfortunately, institutions select repressive method of legal regulation as the most effective and tangible. Under this method, generally accepted legislation prohibits logistics activities causing negative impact on the environment by implementing certain policies, such as limited traffic, entrance fees, prohibited parking or parking restricted by high tariffs. Motivational measures – are generally favourable conditions created through tax incentives to develop measures of green logistics. The best example, applicable in Vilnius city municipality, are the so-called "A lanes" or priority lanes. Priority lanes or "A lanes" are specifically designed traffic lanes on roadways for public transport and electric cars. Another good example of motivational measures are free of charge electric charging stations. Regulations on heavy-duty vehicle emissions were first introduced in the European Union in 1992. Currently, EURO6 standard which was adopted in 2013, is valid, moreover, there is an ongoing debate in regards to the implementation of EURO7 standard. These standards control the emissions of hazardous substances in diesel truck engines.

One of the most interesting examples of the best practices in legal regulation is a legal framework applicable in the United States of America. As it is well-known, that one of the most effective mechanism for process regulation is the tax policy and investment

support. **Fixing America's Surface Transportation Act or "FAST Act"** includes several provisions to improve the condition and performance of the national freight network and to support investment in freight-related surface transportation projects. The FAST Act establishes a national policy of maintaining and improving the condition and performance of the National Multimodal Freight Network ("the Network"), described below, to ensure that the Network provides a foundation for the U.S. to compete in the global economy. **The FAST Act** specifies goals associated with this national policy related to the condition, safety, security, efficiency, productivity, resiliency, and reliability of the Network, and also **to reduce the adverse environmental impacts of freight movement on the Network**. These goals are to be pursued in a manner that is not burdensome to State and local governments. [49 U.S.C. 70101]

National Freight Strategic Plan – within 2 years of enactment, the FAST Act requires DOT to establish (and publish on its website) a national freight strategic plan. DOT will develop (and update) the plan in consultation with State DOTs, MPOs, and other appropriate public and private transportation stakeholders. [49 U.S.C. 70102][5] [6]

A brief overview of **scientific research.** One of the most interesting research was carried-out by scientists Jianhua Yang, Jidong Guo, Shugang Ma from Dongling School of Economics and Management, University of Science and Technology Beijing, publication entitled „Low-carbon city logistics distribution network design with resource deployment". To summarize the article, the Authors claim, that The Chinese government has now published its emission reduction goal of carbon dioxide by 2020 and any industrial player is obliged to take effective initiatives to decrease its carbon footprint. For the city logistics distribution system, as a significant energy-consuming and pollutant-emitting sector, energy saving and emission reduction are very meaningful especially for megacities like Beijing. With rational hypotheses and parameter design, meanwhile considering the deployment of low-carbon resources, a novel carbon tax-constrained city logistics distribution network planning model is proposed. The model is a bilinear non-convex mixed integer programming and is reduced to a pure linear mixed integer programming through proper linearization. To verify the effectiveness of the model, an empirical study is conducted on a city logistics operator in Beijing and the popular commercial optimization suite IBM ILOG CPLEX is adopted for optimization purpose. Through analysis of the optimization results and comparison with traditional optimization models, it is found that the proposed model can help the city logistics distribution operator save up to 9.2% of operational cost during a full service cycle, and meanwhile cut down its carbon dioxide discharge by around 54.5% or 2135 metric tons at most.[7]

5 Source: https://www.fhwa.dot.gov/fastact/factsheets/fpppfs.cfm

6 Additional detail regarding transport and logistics legislation in the USA: https://www.gpo.gov/fdsys/pkg/BILLS-114hr22enr/html/BILLS-114hr22enr.htm

7 Jianhua Yang, Jidong Guo, Shugang Ma. Low-carbon city logistics distribution network design with resource deployment. Journal of Cleaner Production 119 (2016) 223e228. Journal homepage: www.elsevier.com/ locate/ jclepro

3 GREEN LOGISTICS AND THE ROLE OF CO2 EMISSIONS

Having completed the analysis on theoretical aspects of environmental impact and possible sources of pollution that is generated from Transport and Logistics operations, it is possible to conclude, that it is obligatory to organize logistics activities in a way that would help to avoid, minimize or optimize negative emissions and environmental impacts. Following this argumentation, it is possible to formulate a general definition of Green logistics – organization of regular logistics activities by minimising environmental impact in the process. **Green logistics covers the following problem areas:**

- Minimization of CO2 emissions;
- Minimization of other emissions causing damaging impact;
- Minimization of noise pollution;
- Increase of traffic safety, elimination of road traffic fatalities;
- Urban logistics – selection of optimal routes in densely populated areas considering other traffic participants in order to avoid traffic congestion, economize fuel consumption and optimize cargo delivery time. Frequently, these problem areas are referred to as the last mile problem.

In order to solve these problems, there is a constant search for possible project, organizational, technical and technological solutions related to the following aspects:

- Proper vehicle load – optimized cargo volumes with computed CO2 emissions per one cargo unit;

- Organisational solutions that enable to consolidate cargo and minimize the route and duration;
- Legal regulation of logistics processes with properly adapted environmental considerations;
- Use of alternative fuels – biodiesel, gas, ethanol;
- Applications of the latest EURO standards in operating characteristics of truck motors;
- Use of renewable energy sources in supplying logistics infrastructure – electricity generated from solar and wind energy for warehouses, logistics centres, vehicle battery charging;
- Applications of electric and hybrid powered engines in passenger and cargo transportation;
- Driving style and culture – avoidance of sudden acceleration and braking, uneven speed, and unsafe entrance into turning curves;
- Infrastructure solutions enabling to form a "green wave" – an objective to establish and implement infrastructure and management solutions that would enable the vehicle to move in a steady speed without a necessity to stop.

The number of diverse emissions and environmental impacts is substantially high and it is thus difficult to control. Therefore, CO2 emission is widely analysed in scientific, especially methodical literature. One can even come across the term Carbon footprint. Why? Firstly, CO2 emissions operate in conjunction with other hazardous substances – NOx, NMVOC, CO, CH4 meaning that CO2 emissions is treated like a general pollution indicator in order to facilitate environmental impact assessment. Secondly, CO2 are the gases that have contributed the most to climate change processes and the greenhouse effect. Thirdly, on the basis of the amounts of CO2 emissions, it is possible to determine the quantities of fossil fuels as these processes share direct dependency. Therefore, this publication and further project activities will draw attention on CO2 emissions assessing other possible types of pollutants.

In order to answer the question – how to estimate CO2 emissions, it is possible to follow two methodologies. The first methodology is designed to estimate the overall amounts of CO2 released to the environment in accordance with the type of fuel combusted and corresponding convergence coefficients. Should this be the case, the overall amount of the combusted fuel from transport over the selected period of time is taken into account.

In order to determine the actual extent of damage and "efficiency of the emissions", the second methodology is to be used, where overall amounts of CO2, vehicle load, distance travelled and other factors are taken into account. In most cases, CO2 levels are distributed per cargo unit or passenger. Thus, environmental efficiency of activity organization can be determined by observing emissions dynamics. This means, that transportation of 1 box involves 100 kg of CO2 emissions per unit, however, if 10 boxes are transported, the amount of emissions per one cargo unit will be equal to 10 kg. However, it is thus more advantageous to use the first CO2 emission estimation methodology

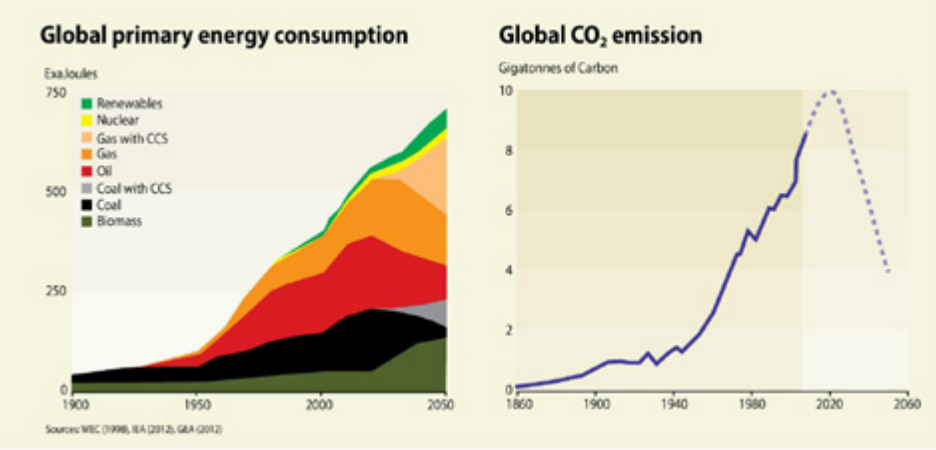

Fig. 3. The figure on the left shows historical consumption from 1900 to 2009 and the GEA scenario's projections for the period 2010 to 2050. The figure on the right shows global carbon dioxide emissions, both historical since 1860 and projected. The projections are based on one of three illustrative GEA pathways that were interpreted by two different modelling frameworks: IMAGE and MESSAGE. This figure shows IMAGE modelling results (IMAGE – GEA_med_450). Author: GRID-Arendal. Sources: www.grida.no

as it quite accurately determines actual quantities, extent of the Carbon Footprint and is not interpreted in any other way.

The term **"Carbon footprint"** is frequently used in diverse sources. The term refers to overall amount of carbon dioxide released into the atmosphere, but it is estimated by considering all forms of energy consumption – fuel used in vehicles, thermal insulation and refrigeration equipment, etc. As it was mentioned, the analysis of carbon footprint, other emissions are taken into account as well, since carbon footprint can be defined as the total amount of carbon dioxide and other gases causing greenhouse effect (expressed in CO2 equivalents) emitted directly and indirectly from an entity (Carbon Trust, 2007).[8]

8 Source and more information on:
https://www.carbontrust.com/resources/guides/carbon-footprinting-and-reporting/carbon-footprinting/

4 BALTIC SEA REGION – A BRIEF DESCRIPTION OF THE CHALLENGES IN NERINGA, RIETAVAS, OLOFSTRÖM, BAD DOBERAN, STARGARD

The following cities and regions participate in the project:

- **Bad Doberan, Germany (Associated partner),**
- **Neringa, Lithuania (Project partner),**
- **Olofström, Sweden (Project partner),**
- **Rietavas, Lithuania (Project partner),**
- **Stargard, Poland (Associated partner).**

See fig. 4.

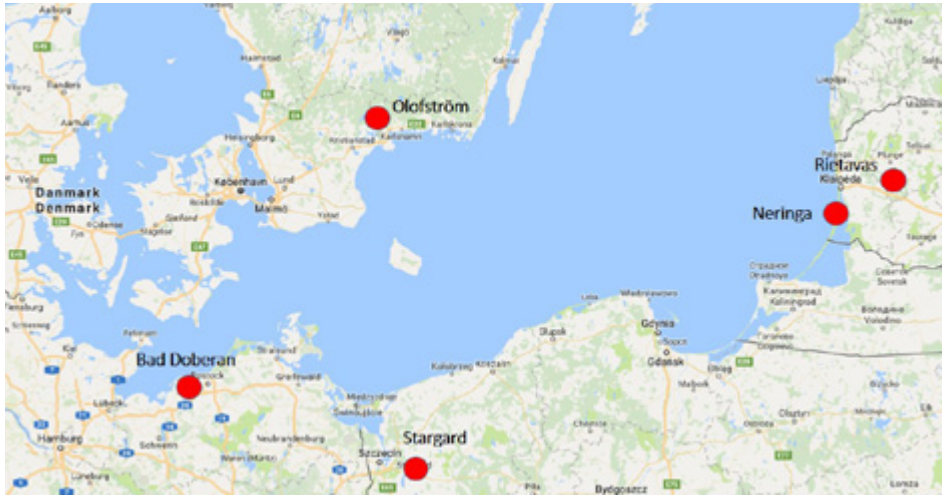

Fig. 4. Project partner regions in the Baltic Sea Region
Maps data © Google 2016

All of the project's regions encounter the pollution and negative emissions in one way or another. As it was mentioned, the pollution of the Baltic Sea has a great impact on certain types of activities: tourism, economics and organization of logistics. Additionally, cities and regions do contribute to higher levels of pollution while performing certain economic activities. Therefore, an overview and analysis on regional problems is focused on environmental aspects of freight transport efficiency.

BAD DOBERAN

Because of the importance of tourism, the inner city of Bad Doberan has developed into a compact city centre with many shops, whose supply with goods by trucks and transporters causes air pollution, noise and congestion. Moreover, delivering in Bad Doberan faces several obstacles due to a pedestrian area with time restrictions, narrow streets and few loading zones.

While analysing the most important challenges in the city, the problems of environmental impact and the need to optimize transport efficiency were indicated. Without resolving these problems, the issues of air pollution and noise level remain actual. It is very important to solve these problems as the city has the status of resort.

NERINGA MUNICIPALITY

Neringa municipality is a city located in the Curonian Spit, comprising several settlements. Virtually, the entire territory of Neringa municipality has the status of nature-reserve Park. Transport connection from Neringa to the continental part of Lithuania is carried out only by ferry. The number of passengers transposed by ferry decreased while the number of transport displacement via ferry – grew in 2011.

All the settlements of Neringa are linked with each other and also linked with city of Klaipėda by the regional road Smiltynė–Nida (the road has continuation of ferry connection). Alternative communication capability (except in winter) is by water transport in the Curonian Lagoon and Nemunas, the river.

Especially in the summer Neringa is crowded by tourists. 230 000 cars have entered the territory of the small municipality of Neringa since the beginning of 2015 till September, which leads to considerable air pollution and noise. In 2011 there were 682 individual cars for 1000 residents registered in municipality of Neringa, when the national average was 492 cars, and the regional average – 489 cars. From 2006 to 2011 the num-

ber of cars increased by 32.7% in Neringa municipality, while only 4% had increased in the whole Klaipėda region. Trucks that are passing checkpoints of Neringa are divided into two categories: cargo transport up to 5.5 tonnes and over 5.5 tonnes. According to the date from checkpoints in 2015 the most of cargo transport that flows in Neringa do so from May until the end of August

The motorization level in the municipality is the highest in whole region of Klaipėda. The warm season intensifies recreation and traffic flows are increasing in Neringa, leading to increase of air pollution and nitrogen oxides NOx, sulfur dioxide SO2, carbon monoxide CO, hydrocarbons CnHm, lead Pb and others. [9]

OLOFSTRÖM MUNICIPALITY

Olofströms Näringsliv (the business development department) is the implementing partner in this project and their solution will be beneficial to Olofström municipality as geographical area. Olofström municipality is a relatively small municipality with 13 000 inhabitants, despite that there are a lot of large industries in the area, e.g. Volvo Cars. As a consequence of the business structure in the municipality there are a lot of heavy fright transportation in the municipality and its surroundings, both train and trucks. ONAB has identified the large companies' transports as one reason to the flow of goods in the municipality and their role in this project is to coordinate the companies in the municipality to create opportunities for collaboration in the area of local/regional freight transportation (last-mile or short-distance transports).The large industries in the municipality will soon face an increase in production volumes and ONAB wants to address the importance of collaboration regarding transports to avoid sub optimizations (leading to unnecessary transports) within the geographical boarders of Olofström. The goal will be to find positive effects from collaboration using solutions that will reduce CO2 emissions and other negative environmental and social impacts in the municipality and enhance the competitiveness among regional companies.

The most important challenges in Olofström are linked with environmental impact, safety and security, as these problems cause air pollution and noise level.

9 Information by Sonata Dirsytė „Žaliosios politikos institutas“

RIETAVAS MUNICIPALITY

Rietavas is situated on the junction of two main national roads – 164 Mažeikiai – Plungė-Tauragė and 197 Kryžkalnis – Rietavas – Vėžaičiai. These roads cross the town and trucks/heavy vehicles carrying goods pass the town causing traffic, noise and pollution which reduce quality of life in Rietavas. Logistics of goods that are brought to different entities should be studied/analysed in order to optimize the delivery firstly to public entities. The most important challenges in Rietavas are linked with safety and security and need of transport effectiveness (transport optimization). Air pollution and noise level are the most actual environmental problems in the Rietavas at this moment. Transit flow that crosses city territory is an essential problem that creates conditions to form a number of issues to be solved by the measures of Green logistics. Firstly, it is a problem of general pollution – the great amounts of hazardous emissions, particulates and noise. As it is presented in Table 1, in the summary of this chapter, residents experience the effects of pollution to the full extent. However, transit traffic flow directly pertains to the accident rate or direct impact on humans, i.e. accidents where people may be injured or killed. Knowing that heavy-weight transport is dominant in transit traffic flow, thus the consequences of these fatal accidents are very painful.

Solution methods to this problem can be radical – building of the bypasses, establishment of isolated transport infrastructure, etc. The so-called "soft" measures - traffic control, speed restrictions, authorization/prohibition of traffic depending on time of the day, day of the week or season. Engineering solutions – sound walls to eliminate noise pollution. Additionally, the establishment of centralized systems of goods and inventory distribution or City Logistics systems. At least every institution operating under municipalities' order (kindergartens, schools, hospitals, etc.) may organize goods' delivery in cooperation with other institutions. Additionally, development of environmentally-friendly transport fleet.

STARGARD

Stargard city is included in "Programme of air protection for West Pomerania Voivodeship" due to large dust concentration from particulates and benzopyrene. Therefore Stargard Municipality developed "Plan for low carbon economy for city of Stargard" which describes planned system activities aimed at reducing energy consumption, reducing carbon emissions and increasing the production of renewable energy sources. As it was proven that huge amount of pollution in Poland comes from fuels in road transport, there is a strong need to implement low carbon transport solutions within the city and region.

The most important challenges in Stargard are linked with environmental impact and the need to improve road infrastructure, as these problems result in air pollution.

SUMMARY

To summarize the provided information of the regions, it is possible to claim that the essential problem in the project's regions lies in the need to optimize transportation to reduce emissions, noise, transport systems and infrastructure. The majority of logistical problems are linked to increased levels of noise and air pollution, as the initial research conducted in municipalities suggest. As it was mentioned in the theory overview, air pollution is ascribed to local pollution group and has a direct impact on human health. Therefore, the aim is to reduce air pollution and improve quality of life in regions has a complex impact, i.e. removed or minimized local pollution substances result in improved quality of life, protected human health, decreased incidents of chronic diseases; real estate value is growing under qualitative environment conditions. Table 1 presents types of negative effects induced by local pollution substances.

Substances causing negative effect	Description and impact objects
Nitrogen oxides (NOx)	Nitric oxide result from combustion at high temperatures where nitrogen and oxygen combine. Short-term effects are rarely noticed but long-term exposure to fairly low levels can affect the functioning of the lungs. At higher levels, emphysema may occur (EPA, 2008).
Hydrocarbons (HCs)	Hydrocarbons result from the incomplete combustion of organic materials. Included within this category are volatile organic compounds (VOCs). Many hydrocarbons, such as benzene, are known to be carcinogenic, though the actual levels likely to cause damage are not known precisely (US Dept of Health and Human Services, 1999).
Ozone (O_3)	Ozone is formed when nitrogen oxides and VOCs react with sunlight. Exposure to high levels of ground level ozone can lead to respiratory problems and nausea. Children, asthmatics and the elderly may be more susceptible or vulnerable to the effects (Royal Society, 2008).
Particulates (PH)	Particulates come in various sizes and from a variety of sources. In the case of vehicles, the majority take the form of soot emitted by diesel engines, particularly those that are badly tuned. There are concerns over the likely carcinogenic effects, particularly of the smaller PM10 particles (EPA, 2009). These particles are also linked to respiratory and cardiovascular problems and to asthma (Rogers, 2007).
Carbon monoxide (CO)	Carbon monoxide results from the incomplete combustion of carbon-based fuels. It binds well with haemoglobin, which carries oxygen around the body. It binds 200 times more easily than oxygen and so reduces the circulation of oxygen. At low levels of exposure, perception and thought are impaired but at high levels it can cause death (HPA, 2009).
Sulphur dioxide (SO2)	Fossil fuels, particularly diesel, contain sulphur. When they are burned in the engine, the remaining sulphur is converted into sulphur dioxide, an acidic gas which is then emitted through the exhaust pipe. Normally, it causes irritation to the eyes, nose and throat of those exposed to it. At low levels it may also temporarily make breathing difficult for people with predisposed respiratory illness, such as asthma (HPA, 2008).

Table 1. Local pollution substances and its negative impact on human health. According Alan McKinnon (McKinnon at al 2010).[10]

10 Mckinnon, A.; Cullinane, Sh.; Browne, M.; Whiteing, A. Green Logistics. Improving the Environmental Sustainability of Logistics. Kogan Page 2010, p. 372, ISBN 978-0-7494-5678-8.

5 GOOD PRACTICES FOR THE SOUTH BALTIC REGION

As the initial review on the project's regions has shown, essential problems are linked to air pollution, noise, and the need to optimize the activities of transport systems. This wish is understandable and natural since all the regions under analysis are resorts and the problem of air quality and noise levels is of great importance. Considering expectations, expressed by regions on the initial interview, the following tendencies and possible changes have been noticed:

- Logistical (for example: better transport method – joint delivery and intermodal transport, etc.);
- Route and load optimization.
- Co-operative (for example: public-private cooperation, urban consolidation centres);
- Optimizing physical logistics processes by providing a sophisticated IT support;
- Technical (for example: innovative technologies of ICT and ITS);
- Electric cargo;
- Smaller, fully loaded cargo;
- Cargo bikes/e-bikes;
- Shift to eco-friendly transport carrier;

All the expectations are associated with three essential solutions and best practices in the following areas:

1. Logistics solutions, on the basis of which the movement of transport flows are optimized in the city territory (Urban Logistics or Last Mile Problem) – one of the possible solutions to establish optimized cargo distribution system. This system would enable to connect all the applied systems into one unified "city cargo distribution" system;
2. Applications of IT and ITC in order to obtain efficient management of logistics system by establishing optimized links between distribution network and the supply chain operating under minimal emissions: "order – production/supply from inventory – transportation – distribution – consumer's feedback";
3. Applications of new technical-technological solutions, considering electric – freight cars or low-load vehicles.

Applications of these measures are linked with natural changes in regions and cities. It is expected that motorised delivery traffic will be reduced in the city centre, which will lead to a reduction in emissions and an increase in the attractiveness of the shopping miles.

5.1 LOGISTICS

Let us familiarize with ongoing projects and current possibilities. Mainly in the 90s many concepts were initiated under the term city logistics. The approaches ranged from goods consolidation in depots to competitive advantages through special permits for deliveries. Only eight of these projects are still now active. Most were discontinued due to lack of profitability or internal cooperation problems of the companies involved.

5.1.1 LAMILO

With the ambitious EU plans to keep inner cities free of exhaust emissions, the subject is once again assumed highly. So the EU has encouraged the research project LaMiLo, which has dealt with new approaches to the last mile in the transport chain. In London deliveries of goods were bundled for 300 Council building in a central hub and then brought to the target by a small carrier. Officials in Brussels focused on wholesale and tried their delivery from City Depot. Other pilot cities concentrated on bundling of consignment and extradition with freight-bicycles.[11]

5.1.2 ENCLOSE

That city logistics projects can not only be useful for large cities shows the ENCLOSE project, which was aimed at small and medium-sized historic towns in Europe. The main focus of the project was to increase awareness of energy-efficient and sustain-

11 Source:
http://www.lamiloproject.eu/
http://knowledgehub.lamiloproject.eu/

able urban logistics. Using so-called Sustainable Urban Logistics Plans (SULPs) in nine city project solutions should be developed sustainable urban logistic solutions. Among the identified solutions in particular stand out Urban Consolidation Centres, Low Emission Zones and the use of electric vehicles and IT systems.[12]

5.1.3 SPEDITHUN, THUN, SWITZERLAND

SpediThun is a city logistics scheme operating an urban distribution centre. The project that emerged from the public private partnership "Stadtmobilität Thun" is also organised in a public private partnership itself.

The aim of this urban logistics concept is to reduce the heavy traffic from the city centre of Thun. Deliveries are bundled in a City Hub and transported with environmentally friendly vehicles.

SpediThun is a city logistics scheme operating an urban distribution centre. The project that emerged from the public private partnership "Stadtmobilität Thun" is also organised in a PPP itself. The informal PPP is composed of five essential partners which are building a sort of steering committee for this launched project. In collaboration with two local transport operators a terminal was realised in the outskirts of Thun. At the terminal the goods are reconsolidated and then delivered twice a day to the retailers in the inner city using appropriate vehicles adapted to the network of narrow streets downtown. The project aims at delivering at least 200 consignments per week, reducing the number of trucks with trailer downtown to zero and reducing the number of trucks downtown up to 20 %. The project was started with an intensive marketing campaign including over 300 transport operators as well as local businesses.>In average, around 50 tons are delivered into the city per month by the SpediThun vans.

A part from the location of the terminal its opening hours are estimated to be crucial for the success of the project. Another key factors is seen to be the fact that the whole project is embedded in the framework project "urban mobility" which takes a governing and co-ordinating part bringing together the various actors and their differing demands and supplies while knowing about the specific details and complexity of the transport business. Furthermore the involved transport operators are known to be highly innovative, have good local contacts and have a close relation to the project.

The projects is economically independent and apparently attractive for the two transport operators involved. The transport operator covered their entire costs due to terminal investments, etc. The municipality covered the cost for public relations and marketing. All other members of the working group covered their own expenses.

At the beginning personal contacts were crucial but finally the partnership worked out well. Nevertheless, the steering group broke up after the launch of the project and a first evaluation meeting. A success factor for the partnership and the project respectively was the broad composition of the steering group. An innovative actor is needed for initiating the project, but broad partnership is necessary in order to reduce the implementation risk. Although the partnership was attached to a project, thus temporary, it was broken up too quickly. The partnership should have continued in order to elaborate further measures supportive to the project.[13] [14]

12 Source: http://www.enclose.eu/

5.1.4 UPS MICRO-DEPOTS, HAMBURG – LAST MILE SOLUTION

Early in the morning, containers are packed at the UPS headquarter in Hamburg's east side with pre-sorted packages for the inner city. These containers are then transported to selected central locations in the city centre, where they are placed as intermediate storage facilities. From the intermediate storage, the supplier delivers the packages to the UPS customers within a radius of two or two and a half kilometre around the containers on foot or by bicycle. Heavy consignments are transported with the sackcloth. In the evening, when the traffic drops, the empty containers are returned to the UPS headquarters.

UPS will soon launch this concept in Paris.

13 Armin Schmauss, http://www.eltis.org/discover/case-studies/spedithun-urban-distribution-centre-operated-city-logistics-scheme-switzerland

14 Source: http://www.eltis.org/discover/case-studies/spedithun-urban-distribution-centre-operated-city-logistics-scheme-switzerland
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Fig. 5. Example of the cargo-bike technology practical implementation. Source: http://cargobike.jetzt/wp-content/uploads/2015/11/IMG_1958.jpg

5.1.5 AUTONOMOUS ROBOTS FOR DELIVERING PACKAGES, HAMBURG – LAST MILE SOLUTION

Three Starship robots are delivering packages from Hermes parcel receiving offices to select customers at home. Customers no longer have to pick up their packages in a Hermes shop. Now, select test customers can order a delivery per smart phone and can decide on the time as well. Test project started in October 2016. Companies: Hermes (parcel service), Starship Technologies (robot); municipality: Ottensen, Hamburg [15]

5.1.6 URBAN RETAIL LOGISTICS, DORTMUND

The main goal of the project Urban Retail Logistics (URL) was the development of alternative concepts for the distribution in urban areas. In an Urban Hub the flow of goods is cross-border bundled. The focus in this project was on the retail. Several trading companies joined forces to bundle their goods in the Urban Hub and then deliver the goods to the city center in Dortmund in a variety of scenarios with a neutral freight forwarder. Project's results – 22% driven kilometers and – 18% CO2e. Companies: Metro, Lekkerland, REWE, DOEGO, Landgard, Capgemini, GS1, Fraunhofer IML[16] [17].

15 Source: http://www.hamburg-news.hamburg/en/cluster/media-it/starship-robot-delivers-hermes-packages-hamburg/

16 Source: http://www.urbanretaillogistics.de/index.php?screen=startseite

17 Information by Clemens Weiss, Research GmbH Wismar, Competence Centre for Rural Area Mobility.

5.1.7 CODISTRIBUTION/COPACKING KRONOBERG

Municipalities purchase a lot of goods that are transported from different suppliers to many different municipal buildings. The distribution vehicles contribute to for example air pollution, traffic and CO2-emissions and it should be in the interest of the municipality that such transport is as efficient and environmentally friendly as possible. By taking control of parts of the transport flow the municipalities have a great opportunity to reduce the number of kilometres driven and thereby CO2-emissions.

At the county level (Kronoberg County) the saving potential was estimated to 20–29% of CO2 emissions and number of kilometres in the study. The study included all municipalities in Kronoberg county (Växjö already had an implemented system). The concept is now implemented in six of eight municipalities in the county. A lot of heavy vehicles outside public buildings; emissions, noise and vibration from vehicles, the working environment for those receiving the goods. The concept decreased CO2 emission with more than 50%. Other positive effects were that the number of deliveries decreased with around 70% and the number of driven kilometres with more than 25%. In addition, a coordinated distribution leads to decreased traffic, increased competitiveness among local suppliers and improved working environment.

5.1.8 CODISTRIBUTION/COPACKING YSTADKLUSTRET

Simrishamn, Tomelilla and Ystad municipalities took in September 2011 the decision to jointly introduce coordinated distribution of goods to all three municipalities. An external project manager was hired and the coordinated goods distribution expected to be operational sometime in 2013.

The consolidation terminal was to handle (initially) food (including chilled and frozen) and consumables and durables was to be included gradually. This was expected to result in 70 percent fewer shipments.

What is special in this case is that the municipalities took care of the route optimization themselves and thus the planning of the transports. The goal of the work in this project was promoting local producers and creating a better environment. Location and companies, municipality implemented are Ystad, Tomelilla, Simrishamn. What problems were solved by this solution? The municipality wanted to increase the amount of locally produced food. Break-even: Distribution costs are equal to the savings due to lower product prices.

5.1.9 CO-DISTRIBUTION INNER CITY IN GOTHENBURG

City centers are very sensitive to traffic. Besides the space is limited and congestion easily occurs, the safety and well-being are also key factors as pedestrians and cyclists must share space with cars and trucks on the streets.

Photograph: Jenny Christenson/City of Gothenburg

Stakeholders from government agencies, retailers, transportation companies, property owners and interest groups are working together to find solutions that create a pleasant, safe, and attractive city centre. The new regulations have unauthorized traffic declined by 90 percent in recent years, such as length limitation, the accessibility and traffic safety has improved significantly. A key question, however, is to minimize traffic congestion in the area during the times that most visitors are on the streets.

Problems were solved by this solution – Purposes. Receive smaller parcels for businesses in the city centre, loading these, and deliver the goods via uniform distribution routes. Reduce the environmental impact and create a safer a traffic environment by utilizing small, electrically powered, and practical distribution vehicles. Unauthorized traffic reduction by 90% of the CO2 emission.[18]

5.1.10 INDUSTRY COLLABORATION INSJÖN, LEKSAND, SWEDEN

Three companies of different character have initiated a transport collaboration. One company imports a lot of goods from Asia and two companies export to Asia. There are large flows between this terminal in Leksand and the port of Gothenburg. The terminal company had insights in all three companies and knew their transport route and challenges invited them all to a meeting. The initiative has resulted in a both way flow and a reduction of empty containers. Problems were solved by this solution are related with containers running empty between Sweden and Asia. Reduction of costs, unnecessary transport and emissions.

Information regarding CO2 emission decreasing is not available. Assumingly the emissions in the country (Sweden) was not that much affected since the transport is performed by train. Though a positive effect is that the load on the rail tracks probably decreased and opened up possibilities for other actors to use the often overloaded transport mode. Decreased container transport by sea could in this case have a more positive effect on the environment. To make the collaboration work efficiently the three companies has adapted the size of the containers to fit their product.[19] [20]

18 Source: http://www.innerstadengbg.se/innerstaden-goteborg/projekt/stadsleveransen/

5.1.11 POLAND – PROJECTS' EXPERIENCE

While analysing practices, results of the carried-out research and implemented projects, it is possible to claim that the conducted analysis showed that 30 Polish cities have implemented solutions that enable development of sustainable urban freight transport. Most of the cities have populations exceeding 100,000 inhabitants. Summing up, it must be admitted that over the recent years the interest in the problems of urban freight transport has increased, and Polish cities began to show more initiative regarding implementation of solutions that enable sustainable development of that transport sector. Undoubtedly, this is an effect of the growing awareness in that regard, and also of international initiatives taken in the form of partner projects focused on emphasizing such issues. However, it must be noted that the implemented solutions show considerable similarity and most often they are limited to soft measures of a restrictive nature. More often than not the implementations consisted in designating restricted traffic zones for delivery vehicles or even in total banning them from entering the city centre. Several cities have also implemented regulations regarding delivery time windows.

It must be emphasized that there are few initiatives focused directly on promoting energy-saving transport and implementing solutions based on using alternative forms of distribution such as freight bicycles or electric vehicles. The only solution which has been developing particularly dynamically in Poland is implemented by the In Post company, a manufacturer and operator of pack stations. An example of effective cooperation in determining appropriate locations for the pack stations was shown in Szczecin under the C-LIEGE project. This seems to be the right direction. Although this solution is of a commercial nature, it is important that cities facilitate its development and get involved in improving effectiveness of this form of distribution, by e.g. making good locations available at a reasonable cost[21].

More useful information on the ongoing and implemented projects can be obtained from **ELTIS website – ELTIS – The urban mobility observatory.** Eltis facilitates the exchange of information, knowledge and experiences in the field of sustainable urban mobility in Europe. It is aimed at individuals working in transport as well as in related disciplines, including urban and regional development, health, energy and environmental sciences. Created more than 10 years ago, Eltis is now Europe's main observatory on urban mobility. It is financed by the European Commission's Directorate General for Mobility and Transport. Under three key themes – DISCOVER, RESOURCES, PARTICI-

19 Source: http://trafikverket.ineko.se/Files/sv-SE/11827/RelatedFiles/100810_godset_nr2_ 2016.pdf

20 Information by Anna Månsson, Energikontor Sydost AB, Energy Agency for Southeast Sweden.

21 Information Source: Kijewska K., Johansen B. G., Iwan S., The Results of work, GRASS Project Deliverable 1.2.1, 2014

PATE – Eltis provides the information, good practices, tools and communication channels needed to help you turn your cities into models of sustainable urban mobility.

The dedicated MOBILITY PLANS section offers a hub of information on how to develop and implement Sustainable Urban Mobility Plans (SUMPs) as the need for more sustainable and integrated planning processes in Europe grows. For more information about this section, visit the About the Platform page.[22]

5.2 ELECTRIC CARS

Electric cars are widely applied in modern logistics. The initial application examples are associated with light vehicles designed for individual use or provision of taxi services. Under modern conditions, electric cars are more frequently used in freight transportation. As an example, let us analyse the Smith Electric Vehicles company. Smith Electric Vehicles manufactures and markets zero-emission commercial electric vehicles that are designed to be a superior-performing alternative to traditional diesel trucks due to higher efficiency and lower total cost of ownership. Vehicle designs leverage more than 80 years of experience in selling and servicing electric vehicles in the United Kingdom. They are partner with global leaders across multiple industries: food & beverage, utility, telecommunications, retail, grocery, parcel and postal delivery, school transportation, military and government. They customers include many of the world's largest fleet operators, including PepsiCola's Frito-Lay division, Staples, TNT, Sainsburys, Openreach, Coca-Cola, DHL, FedEx and the U.S. Military. Smith currently designs, produces and sells two vehicle platforms, the Smith Newton and the Smith Edison, both of which can be configured for multiple applications. We are headquartered in Kansas City, Missouri and have manufacturing facilities in Kansas City, Missouri, and The Future Technology Centre, Sunderland, U.K.[23]

Some stories from electric vehicles users.

22 Source and more information on: http://www.eltis.org/discover/about-us
23 Source: https://www.smithelectric.com/about-smith/overview/

5.2.1 ROYAL MAIL

Royal Mail has a fleet of over 33,000 commercial delivery vehicles operating across the UK and has one of the largest fleets in Europe. Royal Mail vehicles travel approximately c.600 million miles (965 million kilometers) a year and use 153 million litres (40.4m US gallons) of diesel. In order to lessen the impact that its transport and distribution operations have on the environment, Royal Mail has purchased both the Smith Edison and Newton all-electric vehicles. The Smith electric vehicles will be deployed in London, both in parcel and post distribution operations. The Edison and the Newton vehicles have restricted top speeds of up to 50mph and are capable of covering 130 miles (209 km) on one battery charge.

5.2.2 ESSEX COUNTY COUNCIL

Essex County Council in the UK has purchased the first Smith Edison 17 seat all-electric minibus. Based on the Ford Transit chassis, the Smith Edison minibus has a top speed of 50mph (80km/h) and a range of up to 80 miles (128km). A full recharge takes 6-8 hours, or 3-4 hours with Smith's new fast charging technology. Essex County Council has deployed the minibus for passenger transport, serving people with learning disabilities, in the Harlow area.

Essex County Council's Yvonne Chappell, Head of Fleet Transport and Operations: "Essex County Council takes sustainable transport very seriously and we want to show our residents how we can all reduce the environmental impact of our traveling. We are proud to be leading the way in the adoption of new electric passenger vehicle technology and to be the first local authority to put this innovative minibus into service."

Smith utilises an under-slung battery module design, so that the 40 kilowatt-hour lithium-ion battery pack does not impinge on the passenger area of the vehicle. Designed for urban operations, the Edison minibus is targeted at applications such as airport passenger transfer, tourist attractions, city trips and closed campus travel on large commercial, military, education and industrial sites.

5.2.3 CEVA LOGISTICS

The Smith Newton, as favoured by CEVA Logistics, is the world's first high performance 7.5 tonne (16,500lbs) electric vehicle. It is the first ever in its class that can compete with its diesel equivalent – but without the polluting effects of 'controlled' (i.e. nitrogen oxide and particulate matter) emissions and CO2 emissions. It is also virtually silent causing negligible noise pollution. The Newton is powered by 278v batteries positioned on the underside of the truck that can propel the vehicle up to 50mph (80km/h). Fully charged, the vehicle has a range of 100 miles (160km). It can be re-charged through a standard three-phase electricity supply. As well as being zero emission, the Newton's body panels are built from an ultra-light, state-of-the-art fully recyclable composite material manufactured by Omnia. This substantially reduces body weight and increases the payload capacity to 4,000kg (8,800lbs).[24]

5.3 SUMMARY

To summarize the aforementioned practices and possible project-based solutions, it is possible to claim that ongoing projects have direct connections with formulized problems and expectations expressed by project's regions. The main task is to conduct the search for technological solutions and on the basis of best practices to assess further practical applications in project's regions. However, it is necessary to explore the possibilities of an adequate adaptation of best practices under local conditions. One of the essential problematic aspects of the project is to estimate possibilities, preparation and existing measures to adapt best practices in regions.

Additionally, it is worth noting that should the "City logistics and distribution" system is developed taking over the distribution of goods, the question of Public Private Partnership (PPP) arises – who is the operator, how will the Law of competition is assured and how will alternatives be forecasted if the existing system will not work properly.

24 More customers' stories are at: https://www.smithelectric.com/customer-stories/

6 FINDINGS AND RECOMMENDATIONS

Considering the situation in the Baltic Sea Region, it is worth noting that this region is distinguished for its unique biodiversity, micro climate that is suitable for the development of public organisations, business clusters and recreational tourism and resort zones. However, at the same time this region is mostly affected by high levels of pollution. Thus, preservation and reduction of pollution are among the top priorities in the European Union. The publication provides an overview on legal aspects and theoretical measures to assess pollution. Specific cities and regions that are taking part in the project "Low Carbon Logistics" were analysed. Regions (project participants) are as follows: Bad Doberan, Germany; Neringa, Lithuania; Olofström, Sweden; Rietavas, Lithuania; Stargard, Poland. The initial research on the situation in the regions was conducted in order to determine the essential problems of Green logistics that are evident in these regions. **Summarizing the information provided by the regions, it is possible to claim, that virtually all the essential problems in regions are linked with a necessity to do the following:**

- **Reduce transport emissions;**
- **Reduce negative impacts imposed by noise;**
- **Optimize transport system and infrastructure.**

Additionally, while considering certain expectations, expressed by regions on the initial interview, the following tendencies and possible changes have been detected:

- Electric cargo;
- Smaller, fully loaded cargo;
- Cargo bikes/e-bikes;
- Logistical (for example: better transport method – joint delivery and inter-modal transport, etc.);
- Co-operative (for example: public-private cooperation, urban consolidation centres);
- Technical (for example: innovative technologies of ICT and ITS);
- Optimizing physical logistics processes by providing a sophisticated IT support;
- Shift to eco-friendly transport carrier; Route and load optimization.

The publication provides an overview of currently applied best practices aiming at reducing CO2 emissions and pollution impacts in other regions and European cities. Generally, the provided practices can be summarized as measures that solve the following problems:

"Last mile" problem – organization of the small, personalized consignment and cargo delivery to the consumer while applying the following:

- Alternative means of transport – e.g., cargo bike;
- Alternative energy sources – e.g., electric vehicles;
- Alternative and innovative technologies – automated vehicles (robots, drones, etc.);
- Reorganization of City Logistics System-organization of delivery systems operating under PPP principles that are serviced by several operators. These operators use full or lower load vehicles possibly powered by alternative energy sources and gears. These independent operators of city logistics service diverse commercial clients providing ordered goods in consolidated consignments.
- Traffic safety and security questions – transport and logistics management that is based on IT and ITS operations.

If project's members – cities and regions were to assess and apply certain measures and technologies of Green Logistics, the following environmental problems will be solved:

- Reduction of CO2 quantities, which is inevitably pertaining to impacts of other pollutants – NOx, PM, etc. As a result, the human health and air quality would be considerably improved;
- Optimized fuel consumption – positive economic effect would be obtained;
- Noise levels would be reduced and safer environment would be established.

The implementation of low carbon logistic distribution systems would result into reduced traffic flows, easier management and safer environment from the perspectives of accident-probability and human impact.

However, it is thus important to understand that technologies or best practices used in certain environments cannot be directly adopted to situations in another city or region. For instance, it is not very wise to mechanically implement technologies of electric cars that are generally used in warm or average temperatures into northern and cold regions. There is a simple explanation – this technology may become impossible to use due to imperfect electric batteries and additional issues arising in a cold climate. Moreover, distribution systems that were developed and optimized for routes in the city X may not work for the city Y, where there is no proper infrastructure – insufficient street network and the like. However, it is very likely that insights provided in this publication will serve as a basis for idea-generation. Each city must assess its own specifics and prepare pilot projects.

One must remember that certain technologies and solutions applied in best practices are faced with additional technical-technological questions:

- Legal regulation – e.g. questions of commerce and free market. If operator servicing independent and competitive entities, such as companies, stores, catering and accommodation service providing companies is selected while developing "City Logistics" system, a question of trade secrets and free competition arises;
- Problem of infrastructure – battery charging stations are necessary for electric cars; alternative streets and roads are required for route optimization and additional logistics buildings and distribution centres cannot operate without vacant land;
- Problem of additional content management – if municipalities are prepared to properly administer and manage newly developed systems and infrastructure.

However, positive result on low carbon levels can only be possible after solving the following questions: proper adaption of the existing best practices, development of technologically, logistically and economically justified reorganization projects.

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