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GREEN URBAN TRANSPORTATION AND GREEN VEHICLES IN FUTURE ERZURUM©

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Abstract

Transportation is one of the most essential services in cities that contribute to the quality of life. As a result, transportation becomes increasingly more important in people's life.

The people who are in position of decision making develop several collaborative strategies to improve effectiveness and efficiency of logistics systems and to reduce the cost of total supply process. Considering especially the phenomenon of global warming and other extra ordinary climatic events, it is obvious that environmental cost of transportation should be considered

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alongside with monetary cost. Consequently, the study focuses on implementations which take place in all around the world that promote vehicles powered by human, renewable, clean or electric energy in an effort to indicate that more environment friendly logistics and transportation activities can be accomplished in Erzurum with the same service level of conventional transportation activities which heavily rely on vehicles emitting hazardous gasses in to the atmosphere.

Keywords: Transportation Services, Clean Energy, Vehicles, Green Urban Logistics

JEL: R- Urban, Rural, Regional, Real Estate, and Transportation Economics (R4)

GELECEĞİN ERZURUM'UNDA YEŞİL ŞEHİR TAŞIMACILIĞI VE YEŞİL ARAÇLAR

Özet
Şehirlerdeki taşımacılık hizmetleri yaşam kalitesine katkı sağlayan önemli hizmetlerden biridir. Dolayısıyla taşımacılık şehirde yaşayan insanlar için gün geçtikçe daha önemli hale gelmektedir.
Şehirdeki karar verme pozisyonunda olan mekanizmalar şehir lojistiğinin sistemlerinin etkinliğini ve verimliliğini artırmak, toplam arz süreci maliyetini azaltmak için iş birliğine dayalı çeşitli stratejiler geliştirmektedirler.
Özellikle artan ve belirginliği gün geçtikçe daha fazla hissettiren küresel ısınma fenomeni ve olağan dışı mevsimsel olaylar göz önünde bulundurulduğunda şehirlerdeki lojistik ve taşımacılık faaliyetlerinin maddi maliyetlerinin yanı sıra çevresel maliyetlerinin de göz önünde bulundurulması gerektiği aşikardır. Dolayısıyla bu çalışmada mevcut hizmet seviyesi korunarak daha çevre dostu lojistik ve taşımacılık faaliyetlerinde bulunulabileceğini ortaya koymak amacıyla yolcu ve ürün taşınması esnasında karbon salan geleneksel araçlar yerine insan gücü ile elektrikle ya da yenilenebilir enerji ile çalışan araçları gündeme alan çalışma ve uygulanmalara odaklanarak bu uygulamaların dünyadaki örneklerini ele almış ve bu örneklerin Erzurum ilinde uygulanabilirliği hakkında öneriler üretmiştir.
Anahtar kelimeler: Ulaşım Hizmetleri, Temiz Enerji, Taşıtlar, Yeşil Şehir Lojistiği.

I. INTRODUCTION

Modern economy world regards global warming as a serious matter. Reducing greenhouse gasses and finding cost effective solutions is a clear indication of development in environmental awareness. Environmental awareness has risen worldwide because the fact that carbon dioxide has the biggest effect (more than 50%) on greenhouse gasses. But if there weren't greenhouse gasses in

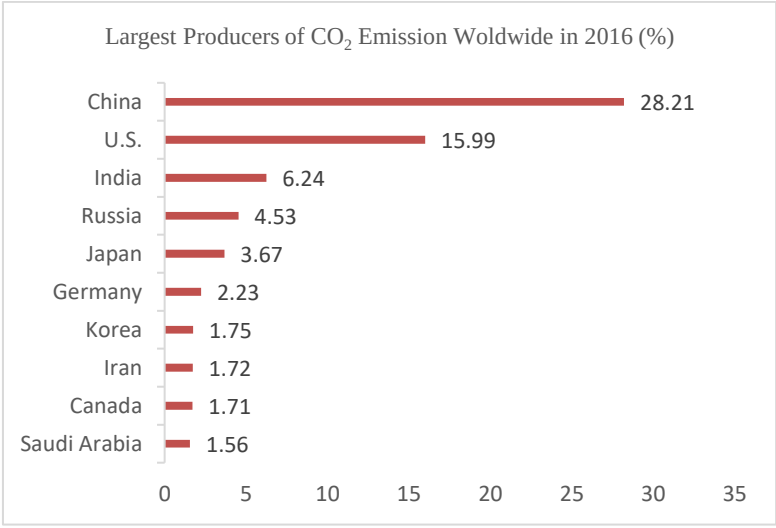
atmosphere, temperature would be at -18 °C. And this situation would cause detrimental consequences for creatures on Earth (Jedliński, 2014: 103). So greenhouse gasses are necessary for life but, world has experienced the warmest period at the beginning of 21st century. And average temperature has risen by 0.8°C. This temperature increase is faster than the increase caused by natural events according to climate scientists (Kamieniecki et al, 2008).

Discussions of ecosystem have emphasized the importance of renewable energy sources and the phenomenon of "green logistics". Moreover, authorities in urban management include sustainable development in their agenda in order to deal with economic and environmental issues in cities (Jedliński, 2014: 104). Consequently, when actions are taken for development, it is necessary to consider its effects not only on economy but also on environment.

Finally, this study focuses on implementations that consider both monetary and environmental effects of urban logistics and provides information about cities which put emphasis on green logistics and sustainable development. And some advices are provided to help boost green logistics activities in Erzurum.

CLIMATE CHANGE AND GREENHOUSE GASSES

Climate change is a negative change driven by actions that caused by human activities which cause pollution in water, air, soil. One of factors which affects humans and environment by causing methane and carbon dioxide to accumulate in atmosphere is greenhouse gas (Ivascu et al, 2015: 703). The main sources of carbon emission are gasses that are emitted by energy, production, non-industry sectors and road transportation activities (Srivastava, 2007: 57). Data which belongs to most emitting carbon countries in 2016 is given in Graphic 1.



Graphic 1. Largest Producers of CO_2 Emission Worldwide (2016)

Source: (www.statista.com/statistics, 2016)

According to Graphic 1, China is the most carbon emitting country. And China is followed by U.S., India and Russia. Most of These countries are industrialized. Citizens of these countries and also whole world are affected by negative effects of carbon dioxide emitted by countries which are shown in Graphic 2.1. Especially countries which are close to sea or ocean lose agricultural lands to rising sea level. 175 countries that are aware of the dangers posed by carbon emissions and global climate change signed Paris Climate Agreement to curb climate change (www.newsroom.unfccc.int, 2017). But rumors about Trump withdrawing from The deal cast a shadow upon counter climate change movements (www.cnbc.com, 2017). Initiatives such as Paris Climate Agreement should be supported by countries bravely.

THE ROLE OF TRANSPORTATION IN EMISSIONS OF GREENHOUSE GASSES

Transportation includes activities of moving people and goods by cars, trains, trucks, ships and other vehicles. Carbon which is emitted by internal combustion engines has the biggest share in greenhouse gasses (www.epa.gov). Cars, pickups, SUVs, light duty vehicles produce more than 50 % of carbon in the whole transportation sector. The other proportion of carbon is emitted by commercial planes, trains, ships and boats. In addition to carbon dioxide, methane (CH4) and nitrous oxide (N_2O) are emitted during moving

goods in refrigerated trucks (www.epa.gov).
The negative effects of transportation should be addressed in order to operate transportation activities in line with green logistics. Automobiles also affect life quality alongside with commercial vehicles in city centers. The biggest examples of cities affected by automobiles in a negative way are Tehran and Paris (www.aljazeera.com/news). Especially when people prefer using their own cars rather than public transport to travel, emission problem gets more complicated. Technological advances should be utilized in green logistics. Without them it is nearly impossible to carry on implementing green logistics activities efficiently. Consequently, transportation activities should be supported by technological developments. A firm which is a member of any supply chain should consider interests of next generation when implementing its activities in business in order to contribute to community and planets by its actions. That is why it should consider negative effects of its activities on the planet (Ivascu et. al, 2015: 704).

Transportation is a part of the carbon emission problem, but can be also a solution to curb the carbon emission problem if transportation is considered as a vital part of green logistics (Cioca et al, 2015: 1637). If EU is taken in to consideration with regard to carbon emissions, most of carbon is produced by electric production.

Table 1. Share of CO_2 Emission by Activity Sectors in The UE States

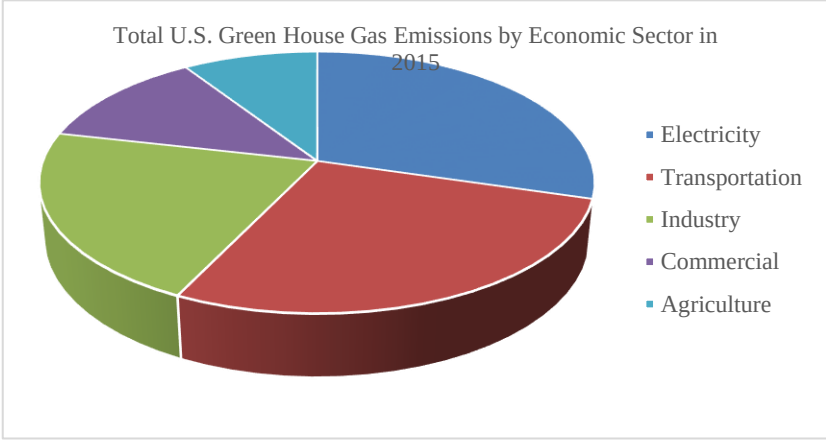
Domain	Share of CO_2 Emission by Activity Sectors in The EU States
Electricity and Heat Production	40.2%
Transport	19.2%
Construction and Manufacturing Industry	16.9%
Rezidential Sector	12.1%
Other Commercial Sectors, Public and Agriculture	6.1%
Other Industries	4.2%

Source: International Energy Agency – IEA (www.iea.org)

According to Table 2, transportation sector is second most carbon emitting

sector in EU.

As second most carbon emitting country, Greenhouse gas emissions by sector in U.S in 2015 is shown in Graphic 1.

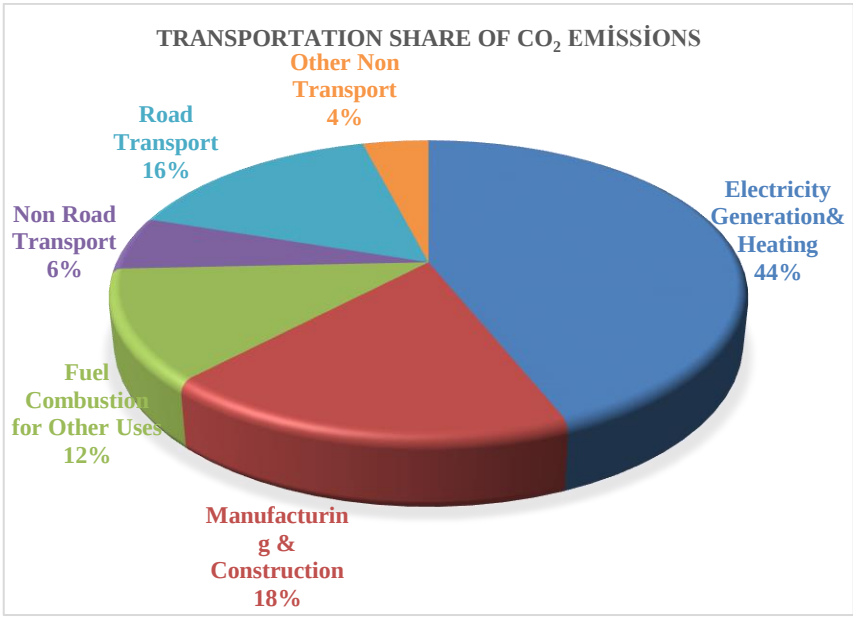


Graphic 1. The Share of Transportation in Green House Gas Emission

Source: (www.epa.gov)

According to Graphic 3.1, most of carbon is emitted by electricity production sector. Electric production sector is followed by transportation. When the U.S. is taken into consideration as second most carbon emitting country, the role of transportation in carbon producing and initiatives to curb carbon emissions in transportation should be seen as vital parts of tackling with greenhouse gas emissions.

As for the World, carbon emissions by economic sector can be seen in Graphic 2.

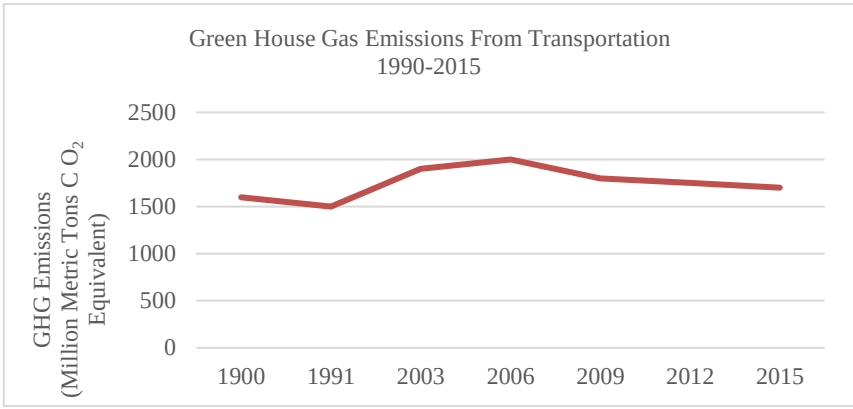


Graphic 2. CO_2 Emissions by sector in The World

Source: (www.oica.net, 2016)

As seen in Graphic 2, 16% of global carbon emissions is caused by road transportation. Increase in demand by people for more comfortable transportation options in developing countries has led to increase in number of cars produced which will eventually void effects of advancement in new cars to reduce carbon emissions. According to estimates of International Energy Agency (IEA), increase in carbon emissions in traffic worldwide will keep pace with increase in carbon emissions in other sectors. When other sectors included, global carbon emissions problem will be more complicated. That is why, share of road transportation in carbon emissions should remain the same at least, if not reduced (www.oica.net, 2016).

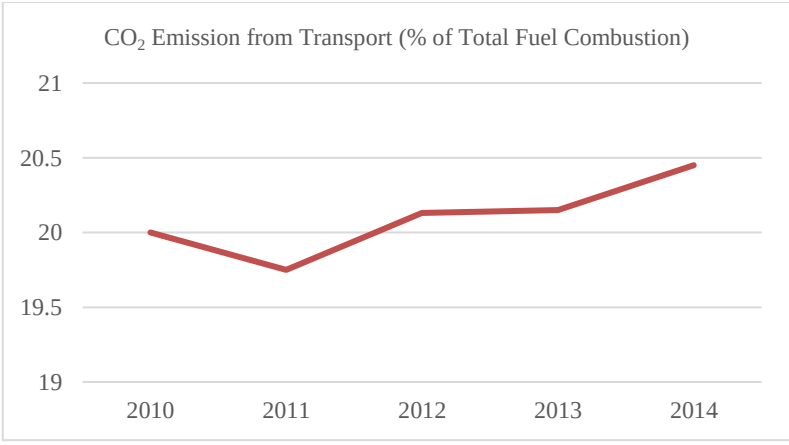
Trends in carbon emissions caused by transportation between 1990 and 2015 in U.S. are shown in Graphic 3.



Graphic 3. Transport Emissions and Trends in U.S.

Source: (www.epa.gov)

Approximately 28% of carbon emissions in 2015 is caused by transportation sector in U.S. consequently this sector is most carbon emitting sector after electric production sector. If general trend between 1990 and 2015 is taken into consideration, increase in demand for transportation sector led to increase in carbon emissions. Miles travelled by light duty motor vehicles increased by 40% between 1990 and 2015 because of Population growth, economic growth and expansion of cities. Share of trucks in new vehicles in 2015 is 43% (www.epa.gov). Trends in carbon emission in the world are shown in Graphic 4.



Graphic 4. CO_2 Emission from The World (2010-2014),

Source: (www.worlbank.org., 2014)

As seen in graphic 3.4, share of transportation in carbon emissions due to internal combustion in 2011(19.75%) is less than the amount of 2010 (20%). But share of transportation in carbon emissions carried on increasing steadily and reached 20.45% in 2014. This trend is a negative indication when it comes to tackling with global warming.

Table 2 represents the situation in Turkey related to total CO_2 emissions by sectors between 2010 and 2014.

Table 2. Total CO_2 Emissions by Sector in Turkey (2014)

Years	Energy	Industrial Process and Product Use	Agriculture	Waste	Transportation	Total (Million Tonnes)
2010	286.0	58.1	39.3	18.1	16.3	411.6
2011	298.2	58.2	41.1	18.4	15.4	431.3
2012	321.3	62.4	45.8	18.0	16.9	464.4
2013	310.0	63.2	49.3	16.2	20.1	458.9
2014	339.1	62.8	49.5	16.1	19.8	487.4

Source: (www.tuik.gov.tr, 2014)

According to Table 2, energy production sector is the most carbon emitting sector in Turkey just as in EU, U.S. and The World. If figures between 2010 and 2014 are examined it can be seen that carbon emissions in energy sector increased steadily between 2010 and 2014 with the exception of 2013. Energy sector is followed by industrial process and product use with regard to carbon emissions.

Transportation sector has a fluctuated structure compared with other sectors related to carbon emissions. Transportation sector emit less carbon dioxide compared to four other sectors. When total carbon emissions are taken into consideration, amount of carbon emissions between 2010 and 2014 increased steadily each year.

Finally, share of transportation in carbon emissions ranks behind other sectors in Turkey unlike in EU, U.S. and The world.

GREEN LOGISTICS

Green logistics is an integrated management of activities that are necessary to meet customer expectations by transferring goods in a supply chain with minimum global costs and external costs such as climate change, air pollution, vibration (Jedliński, 2014: 104). It is thought that green logistics is designed to measure and reduce negative effects of human activities on ecology. The other purpose of designing green logistics is to raise awareness of consequences of activities and to provide potential areas for optimization of activities in a supply chain. Consequently, it is important to provide sustainable and environmental friendly economic growth according to principles of green logistics (Jedliński, 2014: 104).

Green logistics is a management of conflict of interest. Because, on one hand, it supports economic developments and on the other hand, tries to reduce effects of economic developments on environment (Jedliński, 2014: 104). Transportation is one of important elements of logistics systems. Concept of Transportation gets more complex in pinpointing difference between profit and loss. Transportation is a main linkage between natural sources extracted and final distribution point (Ivascu et al, 2015: 706).

TOOLS TO CURB CARBON EMISSIONS

Green logistics is a phenomenon which facilitates flows of material, information and ownership and considers effects of these flows on environment, society and economy (Rodrigue, Slack ve Comtois, 2008). The activities which have negative impacts on environment should be pinpointed and eliminated or at least negative effects of these activates should be reduced in order to implement successful green logistics.

Green City Logistics, Trends and Challenges for Green City Logistics

Urban logistics is an integrated and structured movement of people, information and goods in cities. Concepts of Accessibility, supply of energy and water, network management, transportation and disposal of industrial and municipal waste, environmental awareness have gained great importance in urban logistics. In addition to these concepts, spatial growth of cities, increase in density of cities, increase in number of local factories have attracted attention too (Jedliński, 2014: 106).

Future holds many problems to be solved with regard to urban logistics. For example, population growth will result in spatial growth of cities. Kauf (2016: 160) states that, there are approximately 800 cities which have population of more than one million.

Consumption patterns of population, population age structure and efficient management of natural sources are other parameters to affect green city logistics. For example, number of 80 year old people will increase by four times by 2030. Increase in number of senior citizens will result in customized services and goods. These customized goods and services for the elderly will necessitate new infrastructures for distribution of these goods and services (Kauf, 2016: 160). These new necessities will put pressure on logistics firms.

E- commerce is the other element which puts pressure on logistics infrastructre by resulting in more material handling and increase in number of goods (Kauf, 2016: 160). People now have the luxury to order goods via internet within minutes and obtain their ordered goods within days in their door steps. Dimensional changes in trade structure are another challenges for city logistics. These changes lead to varieties in amount of goods and types of flows. These changes result from distribution of goods in smaller and more frequent amounts. This poses a dilemma for green logistics which on one hand endeavors to distribute goods to consumers without any distributions and on the other hand it tries to reduce effects of carbon emissions on cities (Schönberger and Elbert, 2010). Consequently, when green city logistics activities conducted, the balance between city development and life quality should be set.

Tools to Deal with Carbon Emissions and City Logistics Challenges

When city logistics activities conducted, structures in supply chain should be used by all actors jointly. Joint use of structures might provide efficient processes of transportation and reduce carbon emissions. Joint use of structure might be realized by combined delivery and forming common networks (Kauf, 2016: 162).

Transportation is a major obstacle in improving air quality in cities. That is why, some plans such as use of less carbon emitting trucks and tires, considering carbon emissions figures during procurement of new trucks for the fleet, environment friendly truck driving educational program are developed (Large, et al, 2013: 122).

Qiang (2009: 56) writes about hierarchy of green transportation in his study. Stages of the hierarchy are walking, cycling, public transport, car sharing and lastly personal car driving.

Green transport includes vehicles run on dual energy, solar power, and electricity. Green transport is compatible with environmental development and it is in coordination with public transport. Green transport shares common

ideas with sustainable development which supports human oriented trends rather than car oriented trends (Hua-pu, 2009: 9).
Green transport supports the ideas of reducing single car driving, utilizing public transport, cycling and walking more. Green transport is especially suitable for travelling in short distance (Li, 2016: 763). Consequently, green transport could be regarded as an indispensable part of green city logistics. Curbing carbon emissions which is one of main pillars in green transport shouldn't be only up to firms but it should be regulated by governments in order to be dealt with more effectively. Especially most of EU countries are now regarding carbon emissions problem more seriously. For example, English government considers to ban sales of petrol and diesel powered cars by 2040. French government also considers to take similar measures against sales of those cars.
Some automakers are planning major changes in their production lines in order to set pace with measures that are thought to be imposed by governments. For example, Volvo will discontinue production of pure internal combustion engine cars and it will produce semi or fully electric cars as of 2019 (www.theguardian.com, 2017).

Figure 1 Plugged in: A Tesla Model S recharges at a standard outlet

Source : (www.technologyreview.com, 2017).

It won't be enough for governments to impose only regulations in curbing carbon emissions. The infrastructures should also be ready. Government should improve infrastructures of electric recharging terminals. For example, it is foreseen that electric recharging terminals won't be enough for electric cars to be recharged in UK (www.aljazeera.com/news). The other problem with infrastructure is possibility of overload issue in power grid caused by electric cars plugged in standard outlet. For example, power grid in U.S. is good enough to meet energy demand by electronic cars sold in U.S. But the problem

is sales of electronic cars in U.S. are not distributed equally among states. That is why, there is a problem with distribution of enough electricity among states (www.technologyreview.com, 2017). Consequently, governments should take infrastructure of cities into consideration, when promote use and production of electronic vehicles. Automakers, transport firms and governments can conduct SWOT analysis when they impose use of cars which emit any or less carbon into atmosphere.

SWOT analysis of electric transport vehicles in comparison with internal combustion engines is given in Table 3.

Table 3. SWOT of Electric Freight Vehicles compared to Internal Combustion Engine Vehicles

Strengths	**Weaknesses**
Low fuel costs	High procurement costs
Efficiency of operation in case of government support	Limited loading capacity
Good environmental performance	Limited, unreliable and expensive after-sales support
No noise from vehicle	No better revenues (limited number of customers paying more) for EV deliveries
Positive acceptance by public	Grid issues with large fleet
	Limited availability of vehicles
Opportunities	**Threats**
New(er) vehicles have higher range	Unclear regulation regarding certification
Well-fitting to the specific niches	Better environmental performance of vehicles running on alternative fuels
Availability of public charging points	Low oil prices, and increasing energy prices
Innovative vehicle/battery leasing schemes	
Decrease in battery price	

Source: (Quak et al, 2016: 168)

As seen in Table 1, the most problematic areas of electric vehicles are limited loading capacity, high procurement costs. In addition to the problems related to adoption electronic vehicles in Table 5.1, the other problem with adoption

of electric vehicles is that they have a limited range capacity. Consequently automakers should consider these problems to tackle carbon emissions better.

Examples of Implementations in Tackling Carbon Emissions in the World

Kinds of vehicles that emit any or less carbon into atmosphere can be mentioned as follows (Foltyński, 2014: 53):

All electric vehicles: these vehicles are powered by one electric engines or more. These vehicles are plugged in standard outlet and recharge their batteries. They don't run on petrol or petrol based fuel. Consequently, they don't produce carbon at all.

Plug in hybrid electric vehicles: these cars are plugged in power grid to recharge their batteries. They also run on petrol or petrol derived fuel in order to power their internal combustion engines.

Hybrid electric vehicles combined with an internal combustion engine: an electric motor, a regenerative braking system and batteries are combined with an internal combustion engine in this type of vehicles in order to maintain high fuel efficiency. These vehicles are not plugged in power grid at all. They use mainly an internal combustion engine to operate. And they recharge their batteries from internal combustion engine or regenerative braking activity for supplemental power.

Figure 2. An example of a Cargo Electric Car

There are lots of cities where electric vehicles are used like in figure 5.2. These vehicles are especially suitable for last mile and city logistics. Electric vehicles are being used in Lucaa, which is a historical city in Italy. The other city is Trndheim in Norway where electric vehicles are being used. Mail delivery

service is one of the areas where electric vehicles are used (Foltyński, 2014: 57)

Figure 3. Electric Buses in Den Dosch

Source: (Foltyński, 2014: 58)

Minibuses and 12 meter big busses can be examples of moving people in the city. These busses are powered solely by an electric engine. These buses were used in city of Den Bosch in Holland as a pilot project. Motorized transport accounts for about 30% of the CO_2 emissions in the city. An area in the city designated green zone in order to curb carbon emissions problem. And only electric powered busses mentioned above and other pure electric powered vehicles were allowed to enter to the green zone.

Minibuses are recharged overnight and with this recharged batteries, minibuses can operate from early morning to late night. 12 meter big buses need more battery capacity to run smoothly. Embedding these batteries in 12 meter buses would make them more expensive and heavier. That is why, these buses are recharged during service.

When the buses arrive in the bus stop for passengers to get on buses, they stand on a platform (Figure 5.4 on the right, upper side) at the bus stop and they are recharged quickly by the platform while passengers get on the busses. Buses operate smoothly from early morning to late night while demanding less battery capacity thanks to the recharging platform (Foltyński, 2014: 58).

Electric tricycles can also be used in green logistics. These vehicles are especially suitable for last mile. Last mile is an important compound in city logistics. Notion of last mile is used in telecommunication, but also used in

logistics. Last mile is a distance between final customers and a distribution center where goods are gathered. Tricycles are used as a pilot project in city of Valencia in Spain. Figure 4 depicts the structure of last mile in which tricycles used.

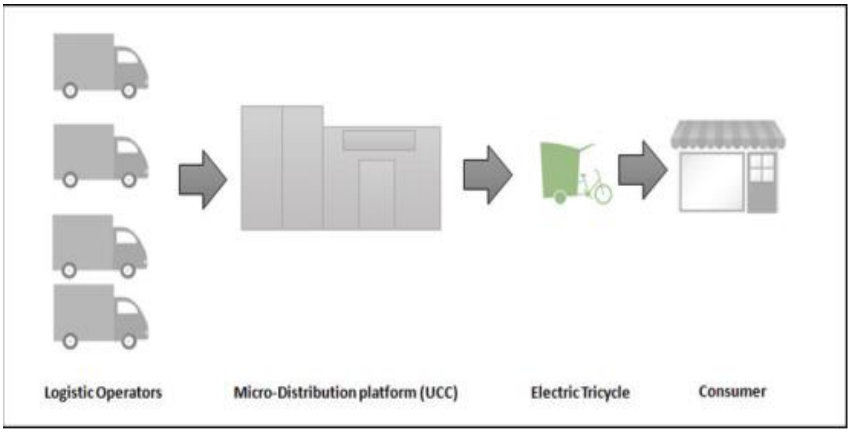


Figure 4. Schematic of the last mile distribution system followed in Valencia´s pilot

Source: (Navarro et al, 2016: 320)

Transport carriers deliver goods to transshipment points that are situated in some parts of Valencia. And tricycles take these goods from transshipment points and deliver these goods to final customers. Tricycles are parked and recharged in the transshipment points. And there is an eco-logistics firm in Barcelona which distributes its goods by tricycles in the city for a few years now (Navarro et al, 2016: 318).

Firms which had a difficulty to transfer their goods inside Cambridge city in England because they had big and bulky vehicles or thought that delivering stuff inside the city wasn't feasible, outsourced their business to a firm that used tricycles to manage their customers' business. The firm took goods from the firms and deliver them to final customer inside the city. This firm was founded in Cambridge in 2005. And now the firm manage last mile delivery of nearly 200 logistics firms. The firm is preferred by clients, because it is punctual and reliable (Schliwa et al, 2015: 55).

Figure 5. An electric tricycle used in Valencia´s pilot

Source : (Navarro et al, 2016: 320).

Transporting stuff by bicycle is not a new idea as seen in figure 5.7. Figure 5.6 depicts (on the left) a bicycle advertisement published by Cycle Trades of America Delivery Work in a newspaper in 1920's. Statement of advertisement as follows;

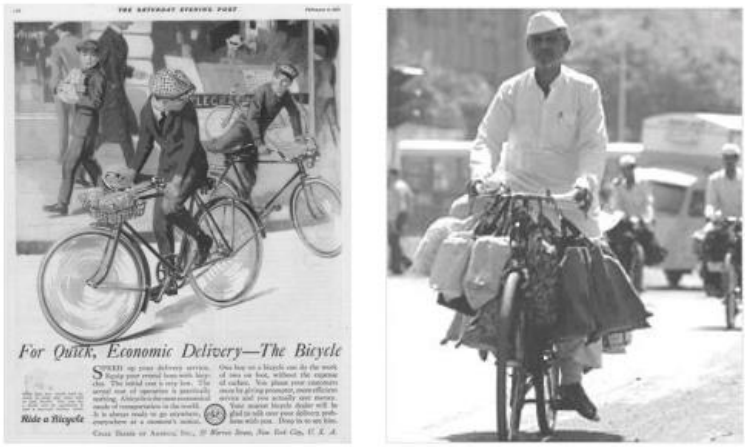


Figure 6. For quick, economic delivery – The Bicycle

Source: (Maes and Vanelslander, 2012: 411).

"Speed up your delivery service. Equip your errand boys with bicycles. The initial cost is very low. The actual cost of operation is practically nothing. A bicycle is the most economical mode of transportation in the World. It is always ready to

go anywhere, everywhere at a moment's notice. One boy on a bicycle can do the work of two on foot without the expense of carfare. You please your customers more by giving prompter, more efficient service and you actually save money. Your nearest bicycle dealer will be glad to talk over your delivery problems with you. Drop in to see him."(Maes and Vanelslander, 2012: 411). Contrary to today, focus was on costs and prices and sustainability wasn't considered important in 1920's when bicycle advisement was published. Probably the oldest Bicycle based logistics system in the world is depicted in figure 5.6 (on the right). Mumbai in India has been aware of the most effective way of distribution since 1890. More than 175.000 lunch boxes are distributed by 4.500 to 5.000 bicycle couriers every day. And authorities state that reliability of this service is high (Maes and Vanelslander, 2012: 411).

II. Turkey and Erzurum in Green Transport

Cities in Turkey are car oriented and infrastructures of cities are not enough for non-motorized transport. Characteristics of spread and growth of cities impede share of public transport to increase in transportation. Authorities are aware of necessity to allocate sources for safe, effective and green public transport in order to deal with traffic congestion caused by increase of population and speed of urbanization. There is a need for regulations and rules nationwide and municipality wide to fully implement green logistics. While different public transport modes are being utilized successfully in metropolitan cities especially, green transport is not well developed in non-metropolitan cities due to lack of technical capacity in municipalities (Sdoukopoulos et al, 2016: 1215).

Infrastructures of railway systems such as subway and trolley have been heavily invested in for the last five years in order to improve public transport in Turkey. As a result, railway systems in İstanbul provide service nearly one million passengers each day (Sdoukopoulos et al, 2016: 1215). And also, introduction of smart card system in Erzurum and other cities may pave the way growth of public transport. Consequently these developments might increase share of public transport in transportation and encourage people to travel less by their private cars and result in less carbon emissions in Erzurum and other cities.

Infrastructure of transport in Turkey is one of problematic areas, because there is a lack of coordination between infrastructure projects and city transportation. And local governments don't comply with the implementation of integration in different city transportation imposed by central government. But local governments in Turkey are willing to implement sustainable transport

modes, seek technical support and allocate resources for sustainable transportation (Sdoukopoulos et al, 2016: 1217).

There are some infrastructure projects in Erzurum. Some areas are designated for bicycle tours in Atatürk University and other areas. There is an area on Dadaşkent Road allocated for pedestrians to walk. But these are mainly intended for sport activities and these roads don't go through important parts of the city. Consequently there are no safe bicycle roads designated for those who want to utilize bicycle to travel from somewhere to another place rather than using for sportive activities in the city.

Turkey is situated in a strategic area. That is why, Turkey can play an important role in logistics sector. Turnover of Logistics activities in Turkish cities is relatively high. But rail way linkage to port cities is not enough. Consequently inland distribution is done by trucks. Authorities in cities demand a better linkage between port and freight villages in order to prevent traffic congestion caused by logistics activities (Sdoukopoulos et al, 2016: 1218). Erzurum needs a better infrastructure in this regard. Because, freight village that is under construction and railway should be linked effectively and efficiently. If this linkage between freight village and railway is well structured, traffic congestion caused by logistics activities might be reduced and carbon emission might be coped with effectively.

Cities in Turkey are interested in information and knowledge related to new green and low carbon technologies which manage distribution, storage and transportation of goods efficiently in the cities. Furthermore, cities should include urban transport master plans in their logistics plan by considering national city logistics plans (Sdoukopoulos et al, 2016: 1218).

There are some tangible endeavors and projects related to green logistics and transport in Erzurum and Turkey in general. For example, Temsa Company introduced a 100% electric bus called MD9 electriCIYY in 2016 .The bus that made its first debut as a prototype in 2016 is shown in figure 7.

Figure 7. 100% electric powered bus, MD9 electriCITY

Source: (www.limitsizenerji.com, 2017)

MD9 electriCITY is recharged fully within 6 hours. And with this 6 hour recharge it travels for 250 km. 50% of the bus is Turkish made design included. The bus will be fully Turkish made by 2020.

Eskişehir Tepebaşı Municipality added four busses which are 100% powered by electric in its city transport fleet in the scope of smart city project. It is expected that these four busses will save 300.000 euros in a year compared to conventional diesel powered buses. Consequently, the buses will pay for themselves within 5 years. And the buses don't emit carbon at all.(www.limitsizenerji.com, 2017).

Any projects related to green transport or electric public transport haven't been realized in a large scale in Erzurum yet. But some citizens in Erzurum adopt use of electric bicycles. Some restaurants use electric or human powered bicycles to take ordered food to their customers. But these restaurants are very few in number.

III. CONCLUSION AND SUGGESTIONS

Carbon increases in winter by nature. And lack of projects related to green logistics in an institutionalized manner cause air quality to decline in Erzurum. Integration of roads and infrastructure of intermodal transport should be organized well in Erzurum where freight village is under construction. Last mile might reduce traffic congestion in the city even after opening of freight village. It is obvious that, going from one point to another in Erzurum doesn't take

much time. Consequently, the city is suitable for last mile, semi or fully electric vehicles can be used in last mile. Medicine is being distributed from pharmaceutical warehouse to pharmacies by diesel cars mostly. But distribution of medicine can be realized by electric vehicles in a safe, fast, reliable and cost effective manner. Central and local governments have a big responsibility for implementation of green transport in the scope of green logistics. Restaurants, food firms, pharmaceutical companies and other firms should be encouraged or even forced to use semi or fully electric vehicles while distributing their goods.

Countries like Norway where winter prevails predominantly should be examined as an example for green transport. And these examples should be implemented in Erzurum.

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