CLEAN TRANSPORTATION

WORKING IN CLEAN TRANSPORT SECTOR

GDAŃSK, 2020

SOUTH BALTIC BRIDGE

FOR GREEN TECH FUTURE!

Materials developed within the framework of the " SB Bridge – building bridges for green-tech future" Project.

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Interreg South Baltic
EUROPEAN UNION

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Abbreviations

GHG	Greenhouse Gas
GMSL	Global Mean Sea Level
BMEP	Brake Mean Effective Pressure
IPCC	Intergovernmental Panel on Climate Change
UNFCCC	United Nations Framework Convention on Climate Change
BAU	Business as Usual
LDV	Light Duty Vehicle
MHDV	Medium and Heavy Duty Vehicle
ICCT	International Council on Clean Transportation
VMT	Vehicle miles traveled
GEM	Greenhouse Emission Model
VECTO	Vehicle Energy Calculation Tool
WHVC	World Harmonized Vehicle Cycle
GVW	Gross Vehicle Weight
ILO	International Labour Organization
UNECE	United Nations Economic Commission for Europe
LNG	liquefied natural gas
CNG	compressed natural gas
TEN-T	trans-European transport network

Introduction

Message to consider:

Do we really need such massive transportation?!

Transport of passengers and goods play in contemporary world crucial role. The net of railroads, roads, air corridors, shipping routes compound with terminals plays the role of bloodstream for economy, enables the mobility and connectivity of people and goods. Transport sustains the activity of many other sectors across the economy, creating jobs, adding economic value and promoting social inclusion.
The environmental impact of transport is significant because transport is a major user of energy, and burns most of the world's petroleum. This creates air pollution, including nitrous oxides and particulates, and is a significant contributor to global warming through emission of carbon dioxide.

General facts

The fact that the transport sector brings many benefits to the European Union member states is incontestable. The industry employs nearly 11 million EU citizens and contributes 5% to the Union's GDP.
The demand for transport of both passengers and goods has been growing steadily.
Europe is connected through a network of roads, railway lines, inland waterways, inland and maritime ports, airports and rail-road terminals. Not counting secondary roads and railway lines, the trans-European transport network (TEN-T) alone consists of more than 138 000 km of railway lines, 136 700 km of roads and 23 506 km of inland waterways. Around 879 million passengers travelled by air in the European Union in 2014, of whom 73 million used London's Heathrow Airport alone. Finally, close to 3.8 billion tonnes of goods were handled in EU ports, 10 % of which was handled by Rotterdam.

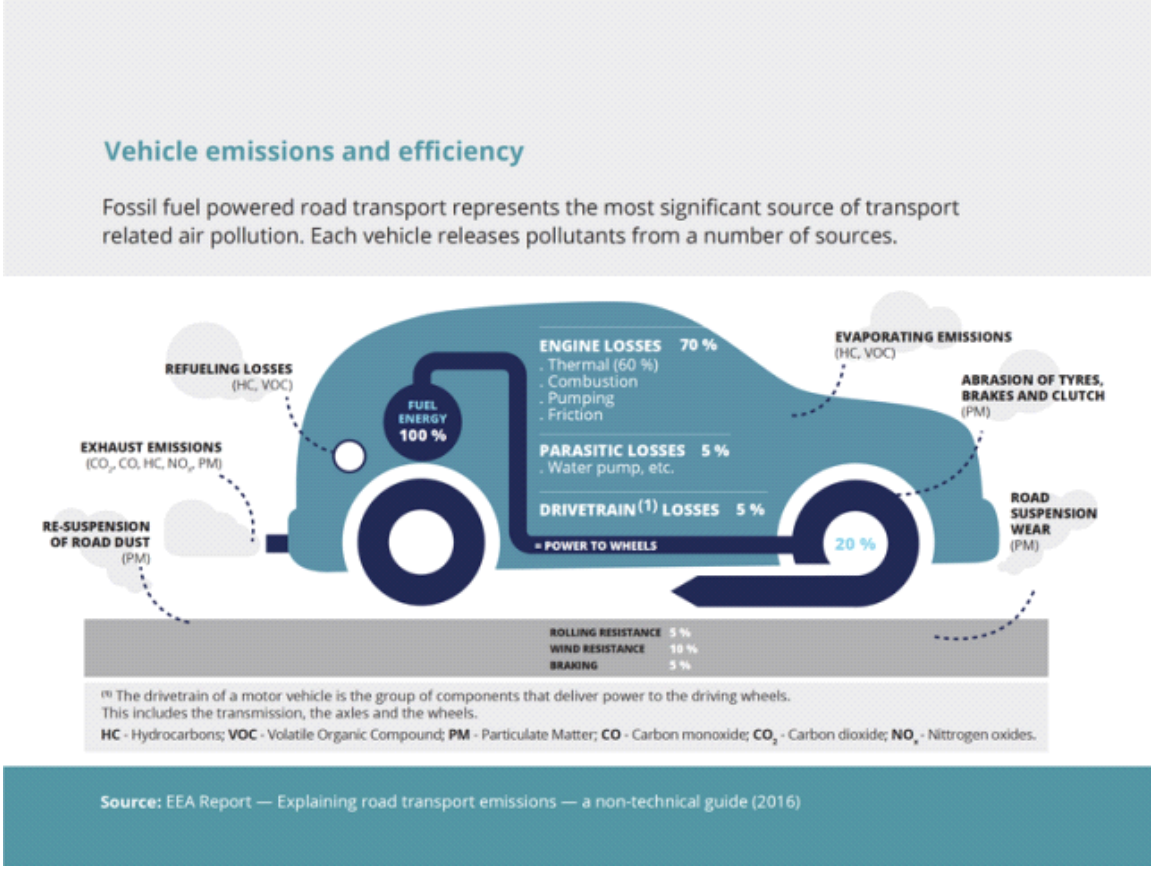
Energy

The growth means that road transport now accounts for almost three quarters of the energy used in transport in the EU.
More and more hybrid and battery-electric vehicles are being sold in the EU. Although they still represent just 1.3 % of all new cars sold,

Emissions

Motorised vehicles need the energy generated from fuel (e.g. petrol, diesel, electricity, natural gas, biofuels) to move. But the high temperature combustion of fossil fuels in engines releases air pollutants and CO2 into the atmosphere. Emissions from different transport modes varied substantially over time. International aviation emissions almost doubled and road transport increased by 17 % in last years, whereas emissions from rail transport and inland navigation declined by more than 50 % and almost 37 % respectively.

The EU's transport sector depends on oil for 94 % of its fuel, 90 % of which is imported. This makes it particularly vulnerable to instability and changes in the global energy market.



TRANSPORT IN EUROPE: KEY FACTS AND TRENDS, EUROPEAN ENVIRONMENT AGENCY

www.eea.europa.eu

The end product (electricity, biofuels, etc.) is not the only factor determining how environmentally sustainable a fuel is. The way the actual fuel is produced should also be taken into account. For example, electricity generated by wind power is certainly cleaner than electricity produced by coal. Transport's demand for energy can be best addressed through a comprehensive analysis and vision for the entire energy system, taking into account the demand from all economic sectors and the supply potential from a mix of energy sources.

Financial incentives

Financial incentives, such as subsidies or preferential tax treatments (e.g. free parking in city centre, possibility to drive on bus lanes, free tolls, lower fuel or registration taxes), play a major role in the consumer's choice of the type of car purchased.

Together with emission limits, taxes can help accelerate reductions by giving consumers incentives for buying low-emission vehicles, creating a market-pull effect.
The following recommendations may encourage the purchase of low-emission passenger cars via taxation policy:

- Create significant tax advantages for low-emission vehicles at the point of purchase. Tax payments or tax advantages at the point of purchase have a stronger influence on consumer choice than annual tax payments.
- Ensure continued tax benefits for low-emission vehicles during their use. Lower taxes and lower total costs for consuming electricity compared with higher taxes and total price at the pump for gasoline and

diesel fuel can serve as an incentive for consumers to opt for a car with an electric drive train.

- Account for the emissions of a vehicle as part of the company-car tax system. Company cars play an important role in Europe as they make up the highest proportion of new-car registrations in markets such as France, Germany, and the United Kingdom.
- Balance and regularly re-adjust the tax system to be self-sustaining. To ensure a self-sustaining tax system, vehicle-related taxes need to take into consideration all vehicles, ensure that high-emission vehicles generate the tax revenue to provide tax breaks for low-emission vehicle

EXAMPLES OF GOOD PRACTICES

POLAND

The Low Emission Transport Fund (FNT) was established in July 2018. Its task is to finance projects related to the development of electromobility and transport based on alternative fuels. The fund is funded by, among others receipts, from the so-called emission fee added to gasolines and diesel oil.

If you purchase a passenger electric vehicle, the maximum amount of support for a person who does not run a business will be 30 percent. purchase price, however, not more than 37.500 zł (ca. 8930 eur)

A subsidy can also be obtained for the purchase of delivery vehicles or trucks. For the most popular vans with GVW up to 3.5 tonnes, the support amount is 30 percent purchase price of such a vehicle, however, not more than 70 000 zł.(ca.16 666 eur)
The Fund is also to support promotion and education on the use of alternative fuels in transport. For this the FNT will have a budget of around PLN 6.7 billion (ca.1 595 000 000 eur) until 2027.

SWEDEN

The Swedish Shipowners Association is aiming for zero CO2 emissions by 2050. Sweden is among the first with significant number of LNG-powered ships, ship-to-ship LNG supply ships, electric ships, methanol-powered vessels.

The company Eric Thun AB operates an LNG-powered ocean-going dry cargo vessel, Viking Lines operates the world's largest LNG-powered passenger ferry between Stockholm and Turku.

Green City Ferries operates an electric ferry between Stockholm and Movitz.

Stena Line is the first shipping company to use methanol as fuel on a large car and passenger ferry operating between Gothenburg and Kiel.

None of this ships are directly powered by solar or wind. The electric ships are powered by electricity from batteries which are charged at the end of their journey. But if the national grid is running mostly on hydropower effectively it is zero- or low-emission shipping, powered for the most part by renewable energy.

DENMARK

Damen Shipyards Group recently signed a contract with leading multinational public transport company Arriva Danmark for five fully-electric ferries, known as the Damen Ferry 2306 E3. Damen E3 vessels are designed with the philosophy of being environmentally friendly, efficient in operation and economically viable. Arriva will operate the ferries for its client, Danish public transport agency MOVIA, in the country's capital city Copenhagen.

A zero emissions, fully electric solution offered the best results in terms of sustainability. Damen has developed a design with a capacity for 80 passengers, tailored so that the vessels can dock – bow first – at the existing jetties.

At the jetties at each end of the route, Damen will install fast charging points, where charging will take just seven minutes.

GERMANY

One of the newest destinations is Hamburg, where the local transit authority has chosen ABB to supply the charging infrastructure for what will be Germany's first fully electric bus depot. The system of 44 digitally networked high-power chargers will be installed on the roof of the Hamburger Hochbahn depot, providing an intelligent and cost-effective approach to overnight charging for the city's large and growing e-bus fleet.

The transportation operator, Hamburger Hochbahn AG, aims to achieve full electrification of its bus fleet by 2030. The Hamburg Senate has mandated the purchase of only zero-emission, fully electric buses beginning in 2020, in keeping with Germany's ambitious clean-energy environmental agenda. In Hamburg, where the bus system carries more than 200 million passengers a year, an all-electric fleet will provide the benefits of cleaner air and lower noise that are the goals of urban transportation planners everywhere.

ABB's fast-charging Terra HP terminals are enabling the e-mobility revolution for electric cars worldwide, providing charging stations being installed in digitally connected networks of the electric equivalent of petrol filling stations – where drivers in as few as 8 minutes can top up their batteries to add as much as 200 kilometers (124 miles) of cruising range.

LITHUANIA

Sustainable transport solutions provider Scania, together with the logistics company Vlantana and natural gas infrastructure developer SG Dujos, have unveiled the first compressed natural gas- (CNG) fuelled truck in Lithuania.

It is an eco-friendly and cost-effective solution enabling reduction of CO2 and other emissions by 15 per cent while offering fuel efficiency.

At present Lithuania has nine gas compression stations for CNG trucks, located in Vilnius, Klaipėda, Šiauliai, and Panevėžys, There is already a network of CNG stations in emerging Europe: there are over ten CNG stations in Estonia, over 20 in Poland (one in almost every large city), as well as a highly-developed network in the Czech Republic.

KNOWLEDGEBASE

Source of knowledge + links

SUBJECT / LINK	SOURCE
General information on climate change, pollution, energy consumption...	
CARBON FOOTPRINT (1)	Carbon Footprint wikipedia.com RETRIEVED 20.06.2020
CARBON FOOTPRINT (2)	Carbon Footprint Calculator carbonfootprint.com RETRIEVED 20.06.2020
CARBON FOOTPRINT (3)	Specific CO2 emissions per tonne-km and per mode of transport in Europe, European Environment Agency, eea.europa.eu RETRIEVED 20.06.2020

NOISE (1)	Noise in Europe, European Commission, ec.europa.eu RETRIEVED 20.06.2020
NOISE (2)	Noise pollution in the EU, European Commission, ec.europa.eu RETRIEVED 20.06.2020
NOISE (3)	Noise, environment and health. European Environment Agency, eea.europa.eu RETRIEVED 20.06.2020
NOISE (4)	SECTION 9 – NOISE LEGISLATION THE ENVIRONMENTAL NOISE DIRECTIVE PDF, RETRIEVED 20.06.2020

General information about clean transportation

TRANSPORT IN EUROPE (1)	Transport in Europe: key facts and trends, European Environment Agency, eea.europa.eu RETRIEVED 20.06.2020
TRANSPORT IN EUROPE (2)	Evaluating 15 years of transport and environmental policy integration, EEA report, European Environment Agency, eea.europa.eu RETRIEVED 20.06.2020
TRANSPORT IN EUROPE (3)	ENVIRONMENTAL EVALUATION OF MEANS OF TRANSPORT sciencedirect.com RETRIEVED 20.06.2020

SHIPPING (1)	The International Council on Clean Transportation, Marine Program, theicct.org RETRIEVED 20.06.2020
SHIPPING (2)	Review of Maritime Transport 2017 Publications from United Nations Trade and Development, Prosperity for all, unctad.org RETRIEVED 20.06.2020
MITIGATION	Report: Using vehicle taxation policy to lower transport emissions: An overview for passenger cars in Europe, The International Council on Clean Transportation theicct.org RETRIEVED 20.06.2020
ELECTRIC DRIVE	Working Paper: Reducing CO_2 emissions from road transport in the European Union: An evaluation of policy options, The International Council on Clean Transportation theicct.org RETRIEVED 20.06.2020
FUTURE VEHICLE (1)	The present and future of electric power steering inderscienceonline.com RETRIEVED 20.06.2020
FUTURE VEHICLE (2)	Video: Detachable Cabin Could Save Lives During Plane Crashes, Futuristic News, futuristicnews.com RETRIEVED 20.06.2020

FUTURE VEHICLE (3)	Article: The Future of Automotive UX from the Designer's Perspective, rightware.com RETRIEVED 20.06.2020
EMISSIONS	Working paper: Reducing CO_2 emissions from road transport in the European Union: An evaluation of policy options, The International Council on Clean Transportation, theicct.org RETRIEVED 20.06.2020
GREEN TRANSPORT (1)	Switch your thinking: Transport ideas, switchyourthinking.com RETRIEVED 20.06.2020
GREEN TRANSPORT (2)	Article: Modes and benefits of green transportation, conserve-energy-future.com RETRIEVED 20.06.2020
GREEN TRANSPORT (3)	Article: The Most Carbon Efficient Ways to Travel, Green Clean Guide greencleanguide.com RETRIEVED 20.06.2020
POST - COVID19	Press Release: Greening the transport sector post COVID19, International Labour Organisation, ilo.org RETRIEVED 20.06.2020

National examples

LITHUANIA	Press, Release, Scania Lithuania unveils CNG-fuelled truck, Emerging Europe, emerging-europe.com RETRIEVED 20.06.2020
GERMANY	Article: Fleet of ABB bus chargers will power Hamburg's drive into the e-mobility future, ABB, new.abb.com RETRIEVED 20.06.2020
DENMARK	Article: Damen embarks on Danish full electric public transport project for Arriva, damen.com RETRIEVED 20.06.2020
SWEDEN	eBook: Climate Change and Renewable Energy: How to End the Climate Crisis, Martin J. Bush, Clean Transpotation in Sweden, RETRIEVED 20.06.2020
POLAND (1)	Website of the Republic of Poland, Ministry of Climate, Low carbon transport fund, gov.pl RETRIEVED 20.06.2020
POLAND (2)	Online legal system, Home page of the parliament of the Republic of Poland, isap.sejm.gov.pl

EXERCISE (1)

CROSSWORD

Background for the teacher:

The terminology used in describing the present situation and trends in reconstructing the transport system worldwide is the task of this exercise - Crossword.

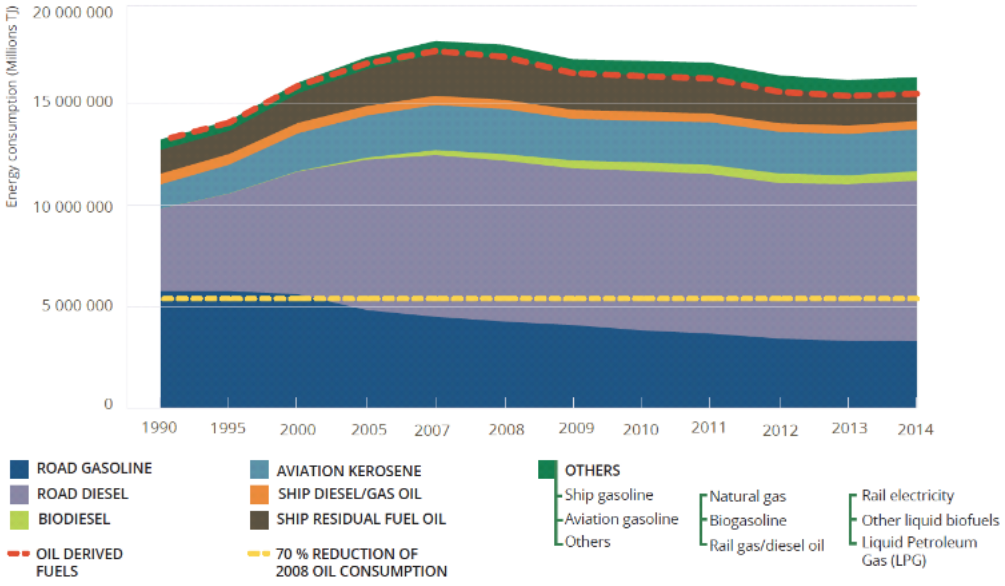


FIG. 1. ENERGY CONSUMPTION BY FUEL TYPE
The picture above shows forms of transport and consumption of fuels used.

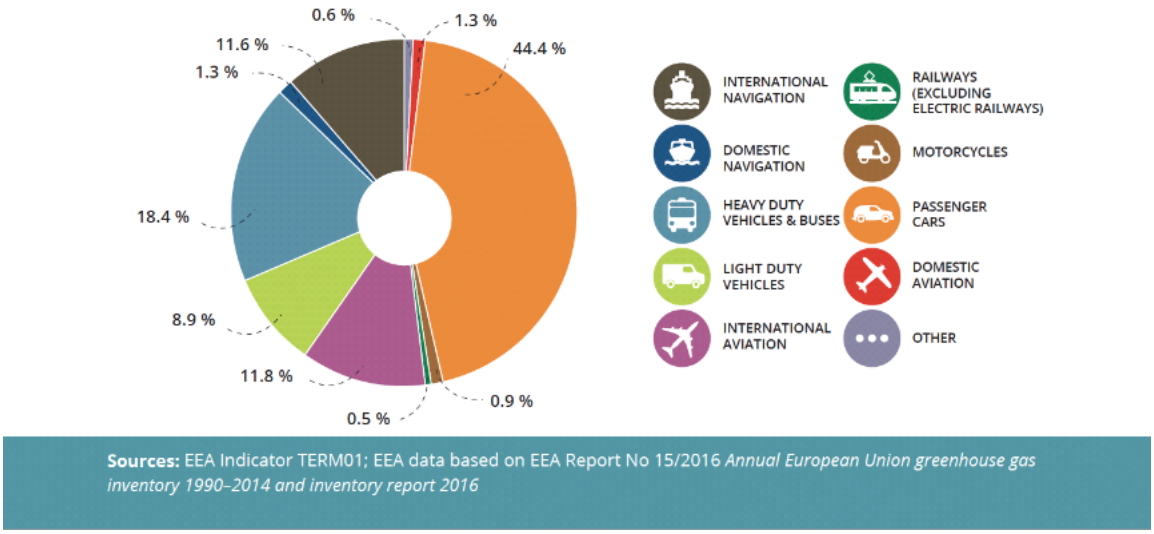


FIG. 2. GHG EMISSIONS RESULTING FROM MEANS OF TRANSPORT OPERATING

EXERCISE (1)

Time: 20 min

	TASK EXPERIENCE	IMPLEMENTATION
1	EXERCISE TITLE:	CROSSWORD - TERMINOLOGY
2	TARGET OF THE EXERCISE:	Students understand and consolidate vocabulary and their definitions connected with clean transport
3	DETAILED DESCRIPTION OF THE EXERCISE:	PAIR WORK. Teacher informs students of the task, asks to work in pairs, gives out printed A4 crossword. Time – 10 min. Teacher asks whether students know the slogan of the cross-word, then reads clues and asks students in random to read their answers. If correct – Teacher asks other students to check their answers and corrects if it's needed. Time – 10 min. Teacher informs students that the words and understanding them will be useful in next classes while studying clean transport issue
4	MATERIALS NEEDED:	Copies of crossword, number depending on number of students / 2, pens
5	EFFECTS:	Students memorize 14 concepts connected with clean transportation and know and understand their meanings.

EXERCISE (1)

KNOWLEDGEBASE

Source of knowledge + links

SUBJECT / LINK	SOURCE
General information about the subject: Crossword	
TRANSPORT IN EUROPE: KEY FACTS AND TRENDS	Transport in Europe: key facts and trends, European Environment Agency, eea.europa.eu RETRIEVED 20.06.2020
EVALUATING 15 YEARS OF TRANSPORT AND ENVIRONMENTAL POLICY INTEGRATION	Evaluating 15 years of transport and environmental policy integration, EEA report, European Environment Agency, eea.europa.eu RETRIEVED 20.06.2020

ENVIRONMENTAL EVALUATION OF MEANS OF TRANSPORT	ENVIRONMENTAL EVALUATION OF MEANS OF TRANSPORT sciencedirect.com RETRIEVED 20.06.2020

1. A CHEMICAL ELEMENT. EFFECTS ON THE EARTH'S CLIMATE IN CAUSING GLOBAL WARMING
2. THE PRODUCTION OR SENDING OUT OF LIGHT, HEAT, GAS, ETC. AT MINIMUM POSSIBLE LEVEL
3. A FORM OF ENERGY FROM CHARGED ELEMENTARY PARTICLES (EG. IN TRAINS, CARS)
4. THE DESIGNING, BUILDING AND FLYING OF AIRCRAFT
5. A COMPLICATED SYSTEM OF ROADS, LINES, TUBES, NERVES, ETC. THAT ARE CONNECTED TO EACH OTHER AND OPERATE TOGETHER
6. THE PROCESS OR A PERIOD OF CHANGING FROM ONE STATE OR CONDITION TO ANOTHER
7. A TRACK WITH RAILS ON WHICH TRAINS RUN
8. THE MIXTURE OF GASES THAT SURROUNDS THE EARTH
9. THE SKILL OR THE PROCESS OF PLANNING A ROUTE FOR A SHIP OR OTHER VEHICLE AND TAKING IT THERE
10. A LEVEL OF QUALITY, ESPECIALLY ONE THAT PEOPLE THINK IS ACCEPTABLE
11. A SUBSTANCE THAT IS DIRTY OR HARMFUL TO LAND, AIR, WATER, ETC. SO THAT IT IS NO LONGER PLEASANT OR SAFE TO USE
12. A PERSON OR COMPANY THAT RUNS A BUSINESS., OR AN AREA OF BUSINESS OR INDUSTRY
13. A WAY THAT YOU FOLLOW TO GET FROM ONE PLACE TO ANOTHER
14. TO GO OR MOVE AT A PARTICULAR SPEED, IN A PARTICULAR DIRECTION, OR A PARTICULAR DISTANCE

1	C	A	R	B	O	N				
2	L	O	W	E	M	I	S	S	I	O	N
3	E	L	E	C	T	R	I	C		
4	A	V	I	A	T	I	O	N		
5	N	E	T	W	O	R	K			

6	T	R	A	N	S	I	T	I	O	N
7	R	A	I	L	W	A	Y			
8	A	T	M	O	S	P	H	E	R	E
9	N	A	V	I	G	A	T	I	O	N
10	S	T	A	N	D	A	R	D		
11	P	O	L	L	U	T	A	N	T	
12	O	P	E	R	A	T	O	R		
13	R	O	U	T	E					
14	T	R	A	V	E	L				

1. A CHEMICAL ELEMENT. EFFECTS ON THE EARTH'S CLIMATE IN CAUSING GLOBAL WARMING
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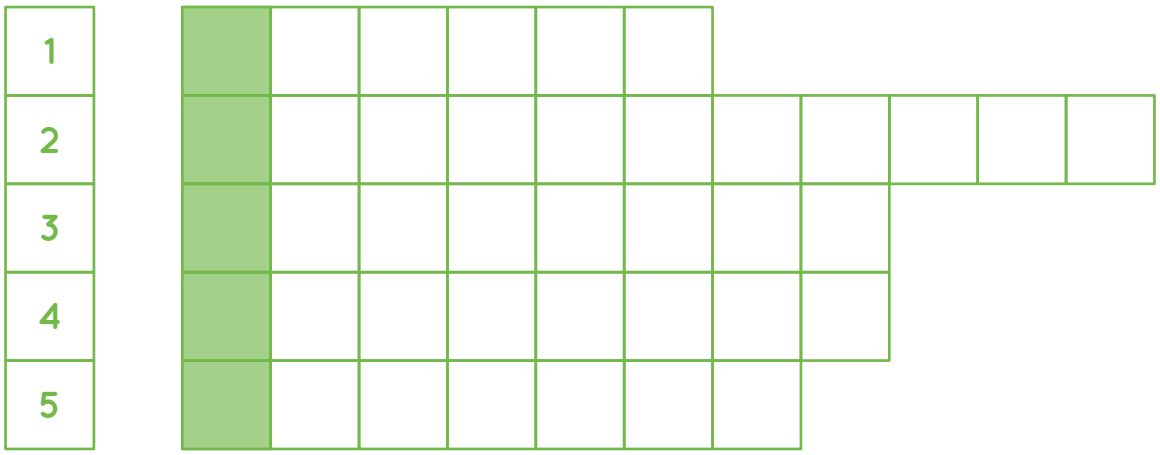

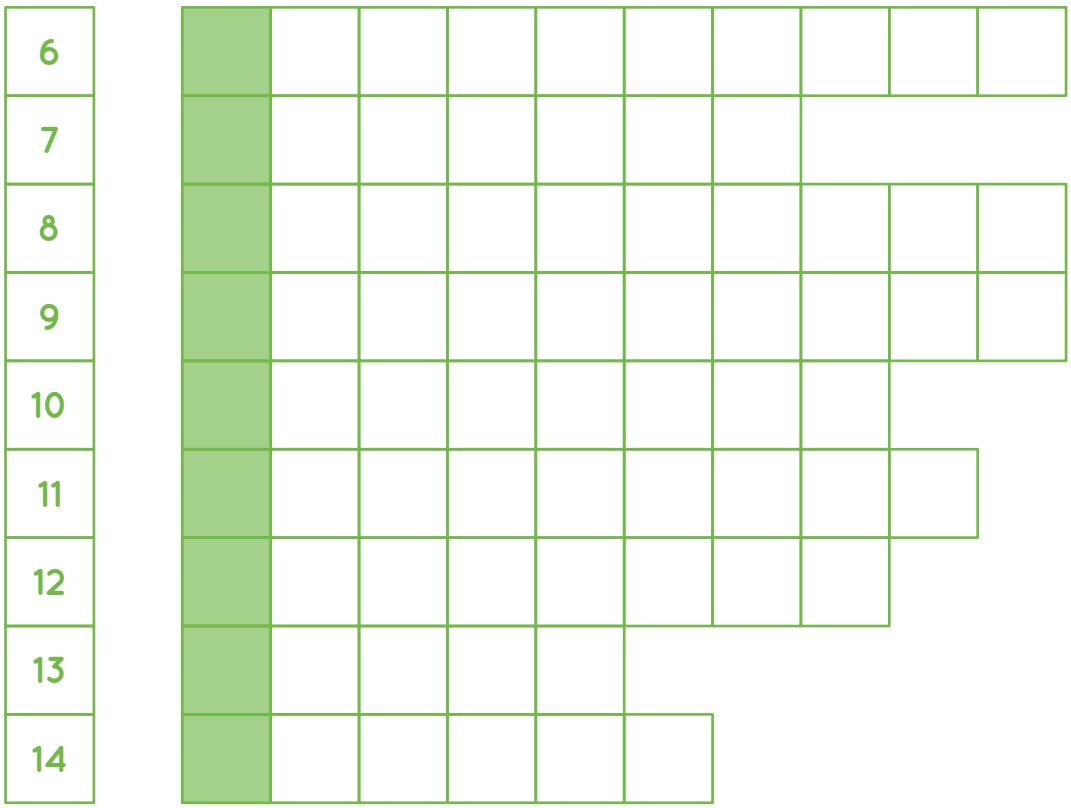

EXERCISE (2)

QUIZ: WATER, AIR, LAND TRANSPORT

FOR GREEN TECH FUTURE!

Background for the teacher:

The exercise shows the wide range of elements building transport system, and consequently the multiple tasks to solve to make it „clean".

The more detailed description of the task area, teacher can find in the **Introduction.**

EXERCISE (2)

Time: 15 min

	TASK EXPERIENCE	IMPLEMENTATION
1	EXERCISE TITLE:	QUIZ - WATER, AIR, LAND TRANSPORT
2	TARGET OF THE EXERCISE:	Students distinguishes forms of land transport, is able to analize different use of it, name fuels, discuss and plan a route for specific goods and use of vehicle. Students improve understanding of environmentally friendly sea and inland water transport. Specify differences in vessel types to transport goods or people. Can name airships. Match the right form of transport with the type of journey, kind of goods.
3	DETAILED DESCRIPTION OF THE EXERCISE:	TEAM WORK. Teacher gives out Quiz sheets. Students choose the Group Leader. Students answer the quiz in groups of 5. Leader takes notes. Each group presents their answers, discuss different choices. Teacher collects the Quiz to mark.
4	MATERIALS NEEDED:	Copies of Quiz – number depending on number of groups, pens

	TASK EXPERIENCE	IMPLEMENTATION
5	EFFECTS:	Students are aware of factors making clean land, water, air transport. Students can match type of journey with the optimum form of transport. Students can make optimal choice of transport in everyday life.

EXERCISE (2)

KNOWLEDGEBASE

Source of knowledge + links

SUBJECT / LINK	SOURCE
General information about the subject: QUIZ	
TRANSPORT IN EUROPE: KEY FACTS AND TRENDS	Transport in Europe: key facts and trends, European Environment Agency, eea.europa.eu RETRIEVED 20.06.2020
USING VEHICLE TAXATION POLICY TO LOWER TRANSPORT EMISSIONS	Report: Using vehicle taxation policy to lower transport emissions: An overview for passenger cars in Europe, The International Council on Clean Transportation theicct.org RETRIEVED 20.06.2020

REVIEW OF MARITIME TRANSPORT 2017 PUBLICATIONS FROM UNITED NATIONS TRADE AND DEVELOPMENT	Review of Maritime Transport 2017 Publications from United Nations Trade and Development, Prosperity for all, unctad.org RETRIEVED 20.06.2020
SWITCH YOUR THINKING: TRANSPORT IDEAS	Switch your thinking: Transport ideas, switchyourthinking.com RETRIEVED 20.06.2020

QUIZ

1) What elements make a "clean" transport? Tick.

- [ ] A. tramways and electric buses
- [ ] B. car sharing
- [ ] C. oil and gas powered buses
- [ ] D. traffic routes for cyclists
- [ ] E. car parks in city centres
- [ ] F. wide pavements and walking paths

QUIZ

2) Which elements are important for building "clean" transport system? Rank them 1 – 5 (the most important)

- [ ] A. EU financing
- [ ] B. local authority decisions
- [ ] C. affordable public transport
- [ ] D. autonomous means of transportation
- [ ] E. innovative research work

QUIZ

3) What are "clean" sources of energy. Tick.

- [ ] A. fossil fuels
- [ ] B. natural gas
- [ ] C. e-gas
- [ ] D. nuclear
- [ ] E. renewables
- [ ] F. fossil liquids

QUIZ

4) What transport would you use / choose to: (name)

A. go to school in winter → .....

B. go to the club / cinema → .....

C. visit an interesting place in a 50 km distance → .....

D. go for 2-week holidays → .....

E. to visit friends in another city → .....

QUIZ

5) Name as many as possible forms of water vessels, which can be used to transport people and goods.

.....

.....

.....

.....

.....

.....

.....

QUIZ

6) Which is more environmentally friendly. Why?

A. SAILBOAT

B. CRUISE

.....

.....

.....

QUIZ

7) What are characteristics of environmentally friendly boat – choose:

- [ ] A. electric-powered
- [ ] B. huuuge
- [ ] C. waste management on boat (liquid + solid)
- [ ] D. wind and/or solar powered
- [ ] E. limited noise
- [ ] F. oil-powered engine

QUIZ

8) Which means of transport (ship, yacht, plane, helicopter, bike, car, tram, train etc) would you employ to transport:

A. coal in bulk → .....

B. a family for holiday (50 km) → .....

C. shopping from the local store → .....

D. tourist group visiting National Park (300 km away) → .....

E. cement (200 km) → .....

F. flowers to the wholesale market → .....

QUIZ

9) Name as many as possible.

A. AIRSHIP TYPES WITH ENGINE:

.....

.....

.....

B. AIRSHIP TYPES WITHOUT ENGINE:

.....

.....

.....

QUIZ

10) Analize list of factors for each form of transport and answer the questions below.

ROUTE CHINA – EUROPE - GOODS

	TIME	COST	CONTAINER LIMIT
PLANE	4-7 DAYS	HIGH	
TRAIN	11-14 DAYS	MEDIUM	50
SHIP	4-7 WEEKS	LOW	NO LIMIT

A. What goods would you transport by plane?

.....

B. What goods would you transport by ship?

.....

C. What goods would you transport by train?

.....

QUIZ

Suggested answers:

1. A, B, D, F
2. Students choice
3. C, E
4. Preferably:
A) municipal transport,
B) walking, bike, municipal transport,
C) train, bike, coach,
D) train, public transport, hitch-hike,
E) train
5. container ships, bulk carriers, cruise ships, ocean liner, multi purpose ship, refrigerated ships, roll on/roll off ships, tankers, barge, coasters, ferries, yachts
6.
A) uses renewable energy, minimum disturb to environment, B) polluter, problematic waste management
7. A, C, D, E
8.
A) ship, train
B) train, public transport
C) walking, bike, scooter
D) train, local transport to the spot
E) Train
F) Cooler-van
9.
A) helicopter, plane, drone,
B) balloon, glider, hang-glider
10.
A) valuable goods, animals, plants, fragile goods,
B) bulk, liquid, containers,
C) bulk, heavy load, containers

EXERCISE (3)

TRAFFIC NOISE

Background for the teacher:

The World Health Organisation recommends that for a good night's sleep, continuous background noise should stay below 30 decibels and individual noises should not exceed 45 decibels. Other issues include hearing problems such as tinnitus, mental health problems and stress.

EXERCISE (3)

Time: 30-35 min

	TASK EXPERIENCE	IMPLEMENTATION
1	EXERCISE TITLE:	TRAFFIC NOISE
2	TARGET OF THE EXERCISE:	Students learn to measure the noise level and find out the dependance on building materials / surrounding applied
3	DETAILED DESCRIPTION OF THE EXERCISE:	Group work - Teacher on previous lesson asks students to bring materials needed for the experiment, On the lesson - Teacher divides class into 2 groups. Each group chooses the Leader. Students build 2, open from the top, corridors 4-5 m long. One is built of soft materials (blankets, styrofoam, pieces of fabric) , the other is built of hard materials (wood, stones, bricks). First group of students makes noise with the use of tuning fork, tuner, metal containers, cans etc. on one end of corridor. Second group with the use of eg. App Sound Meter measures the level of noise on the other end of the corridor. With the second corridor students groups change the tasks. Measuring group – makes noise, noise makers – measure. Group Leader makes notes of the results, the group compares and describes to the class. Teacher asks what forms of noise protection they know / noticed while travelling.

	TASK EXPERIENCE	IMPLEMENTATION
4	MATERIALS NEEDED:	Tuning fork OR tuner OR metal cans, pots, lids. Styrofoam, pieces of soft material, pieces of wood, stones, bricks, e.g. App Sound Meter
5	EFFECTS:	Students can distinguish the difference in noise level depending on the surrounding or materials used in building. Students understand the importance of using specific materials in constructing and architecture.

EXERCISE (3)

KNOWLEDGEBASE

Source of knowledge + links

SUBJECT / LINK	SOURCE
General information about the subject	
TRAFFIC NOISE (1)	Noise in Europe, European Commission, ec.europa.eu RETRIEVED 20.06.2020
TRAFFIC NOISE (2)	Noise pollution in the EU, European Commission, ec.europa.eu RETRIEVED 20.06.2020
TRAFFIC NOISE (3)	Noise, environment and health. European Environment Agency, eea.europa.eu RETRIEVED 20.06.2020
TRAFFIC NOISE (4)	SECTION 9 – NOISE LEGISLATION THE ENVIRONMENTAL NOISE DIRECTIVE PDF RETRIEVED 20.06.2020

EXERCISE (4)

CARBON FOOTPRINT

FOR GREEN TECH FUTURE!

Background for the teacher:

Carbon footprint - the amount of carbon dioxide released into the atmosphere as a result of the activities of a particular individual, organization or community.

Human activity contributes a great deal to greenhouse gas emissions. Carbon footprint — or impact on the environment — measures the greenhouse gases that our decisions are responsible for creating.

EU introducing mandatory CO_2 standards for new trucks in 2025 could prevent about 17 Mt of CO_2 per year in 2030. Accelerating the transition to electric-drive of the passenger car fleet in Europe, with the aim of seeing electric vehicles reach a 23 percent share of the new car market in 2030, could prevent another 19 Mt of CO_2 in that year.

EXERCISE (4)

Time: 15 min

	TASK EXPERIENCE	IMPLEMENTATION
1	EXERCISE TITLE:	CARBON FOOTPRINT
2	TARGET OF THE EXERCISE:	Students understand and consolidate vocabulary and their definitions connected with clean transport
3	DETAILED DESCRIPTION OF THE EXERCISE:	PAIR WORK. Teacher informs students of the task, asks to work in pairs, gives out printed A4 crossword. Time – 10 min. Teacher asks whether students know the slogan of the crossword, then reads clues and asks students in random to read their answers. If correct – Teacher asks other students to check their answers and corrects if it's needed. Time – 10 min. Teacher informs students that the words and understanding them will be useful in next classes while studying clean transport issue
4	MATERIALS NEEDED:	Copies of crossword, number depending on number of students / 2, pens
5	EFFECTS:	Students memorize 14 concepts connected with clean transport-ation and know and understand their meanings.

EXERCISE (4)

KNOWLEDGEBASE

Source of knowledge + links

SUBJECT / LINK	SOURCE
General information about the subject	
CARBON FOOTPRINT (1)	Carbon Footprint, wikipedia.com RETRIEVED 20.06.2020
CARBON FOOTPRINT (2)	Carbon Footprint Calculator, carbonfootprint.com RETRIEVED 20.06.2020
CARBON FOOTPRINT (3)	Specific CO_2 emissions per tonne-km and per mode of transport in Europe, European Environment Agency, eea.europa.eu RETRIEVED 20.06.2020
CARBON FOOTPRINT (4)	Article: The Most Carbon Efficient Ways to Travel, Green Clean Guide greencleanguide.com RETRIEVED 20.06.2020

1) Basing on the table calculate:

MODE OF TRANSPORT	G OF CO_2 PER TON-KILOMETER
AIR CARGO	500
TRUCK	60 - 150
TRAIN	30 - 100
SEA FREIGHT	10 - 40

Carbon footprint of transporting 1000 kg of goods per 150 km and 1000 km and 12 000 km by plane, truck, train and sea freight

MODE OF TRANSPORT	150 KM		1 000 KM		12 000 KM	
	(MIN)	(MAX)	(MIN)	(MAX)	(MIN)	(MAX)
AIR CARGO	.....	.....	.....	.....	.....	.....
TRUCK	.....	.....	.....	.....	.....	.....
TRAIN	.....	.....	.....	.....	.....	.....
SEA FREIGHT	.....	.....	.....	.....	.....	.....

2) Answer the questions:

A. What goods would you transport by plane?

.....

B. What goods would you transport by ship?

.....

2) Answer the questions:

C. What goods would you transport by train?

.....

D. Which of the listed in the table is the most ecological means of transport? Justify.

.....

E. What is geographical meaning of given distances? Regional, continental, global?

.....

Suggested answers:

A. valuable goods, animals, plants, fragile goods
B. bulk, liquid, containers
C. bulk, heavy load, containers
D. train for any distance
E. 150 km – regional, 1 000 km – continental, 12 000 - global

EXERCISE (5)

VEHICLE OF MY DREAMS

Background for the teacher:

Futuristic developments in the transport sector are transforming travel, improving journey times, passenger comfort and safety as well as safe-guarding the environment.

Technological advances in transportation have brought modes of transport usually found in science fiction to life. From super-trains to self-flying helicopters, the way we travel will never be the same.

FIG. 1. TRANSPORT BY DRONE

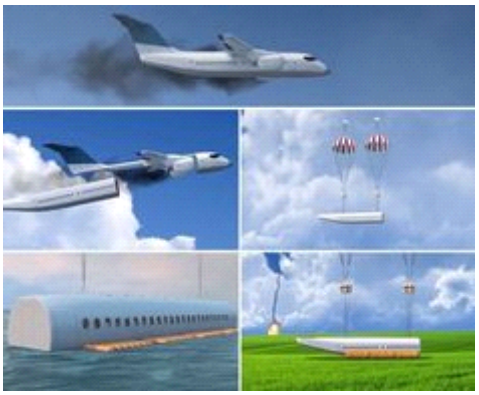

FIG. 2. DETACHABLE CABIN COULD SAVE LIVES DURING PLANE CRASHES

EXERCISE (5)

Time: 35 min

	TASK EXPERIENCE	IMPLEMENTATION
1	EXERCISE TITLE:	VEHICLE OF MY DREAM
2	TARGET OF THE EXERCISE:	Students design a multi-function or multi-user vehicle
3	DETAILED DESCRIPTION OF THE EXERCISE:	GROUP WORK. Teacher divides students into groups of 5. Gives each a piece of paper and markers. Before students start Teacher presents some futuristic designs chosen from internet. Teacher instructs students to start with 5 min brainstorm and decide on basic assumptions of the concept. Students spend 20 min drawing a sketch. Each group presents and very briefly describes the drawing. Teacher recommends students to finish the concept as a homework, and informs that the next lesson will start with presentations of final designs.
4	MATERIALS NEEDED:	Flip charts or sheets of A1 wrapping paper, colour markers

	TASK EXPERIENCE	IMPLEMENTATION
5	EFFECTS:	• training open-mind thinking • training organisational skills • mastering group working, planning • activating for future concepts

EXERCISE (5)

KNOWLEDGEBASE

Source of knowledge + links

SUBJECT / LINK	SOURCE
General information about the subject	
THE PRESENT AND FUTURE OF ELECTRIC POWER STEERING	The present and future of electric power steering, inderscienceonline.com RETRIEVED 20.06.2020
THE FUTURE OF AUTOMOTIVE UX FROM THE DESIGNER'S PERSPECTIVE	Article: The Future of Automotive UX from the Designer's Perspective, rightware.com RETRIEVED 20.06.2020
TOP 10 FUTURE TRANSPORTATION INNOVATIONS	Article: Top 10 Future Transportation Innovations, Marsh and McLennan agency, marshmma.com RETRIEVED 20.06.2020

EXERCISE (5)

FIVE FUTURISTIC MODES OF TRANSPORT TRANSFORMING TRAVEL	Five futuristic modes of transport transforming travel Raconteur, raconteur.net RETRIEVED 20.06.2020
WHEN NEW TECHNOLOGIES COME TOGETHER	When new technologies come together: The coming wave of futuristic transportation, Urban Hub, urban-hub.com RETRIEVED 20.06.2020

Effects

Students will learn what is the transport impact on environment, what are the sources of pollution from different means of transport, what are trends in transportation sector to achieve EU goals .
Students will be able to eliminate „dirty" forms of transport while making decisions, discuss transport impact on the environment in a group, make correct decisions on goods shipment, cooperate with the group in running an experiment.
The basic need for a young person is to find a satisfying/ well paid job opening them possibilities of happy and healthy life.
Taking into account transportation sector ILO and UNECE report Jobs in green and healthy transport: Making the green shift anticipates that greening the transport sector in the post COVID-19 recovery could create up to 15 million jobs worldwide.
The Report projections to 2030 build specific scenarios:
For public transport: PT.1: Doubling investment in public transport; PT.2: Free public transport.
For electrification: E.3: Introduction of a voluntary or mandatory target of 50 per cent of all vehicles manufactured to be fully electric; E.4: Ban on internal combustion engines for light commercial vehicles.
Advancing green and healthy transport has implications for employment throughout the economy and in the transport sector itself. The change in the production structure of, and the demand for, transport services affects employment not just in the transport sector but also in those sectors that provide the necessary inputs, such as manufacturing. All the sectors poised to experience an increase in demand require a skilled labor force.

Anticipating these skills needs and creating the institutional linkages to develop the necessary skills in time are key policy objectives when it comes to achieving employment-friendly green and healthy transport in the ECE region.

Efforts to reduce vehicle fuel consumption will require technicians and engineers who are versed in the retrofitting and conversion of fuel systems. Problem-solving and technical diagnostic skills at a high level are called for among the mechanics who will be servicing and repairing electric vehicles. Similarly, an expansion in the number of electric vehicles will alter the skills profile of fuel station workers.

Clean transportation means also Zero Emission forms like walking and cycling. The tendency not to use a bus or car everywhere is what student will understand from the material prepared.

Cycling in the city needs a well designed bike-paths net. Good practices to follow are Copenhagen (Denmark) and Gdansk (Poland).

Main goal:

Environmental pressures from transport are: greenhouse gas emissions, air pollution, noise, habitat fragmentation and biodiversity.
Understanding what factors make the clean transportation, how to measure our impact on environment, brainstorming ideas of new forms of mobility is the goal of the lesson.
The latest lockdown caused by COVID-19 urges to provide essential mobility services post lockdown. The recovery from the COVID-19 pandemic cannot be a return to business as usual. It must be an opportunity to push the advancement of the sustainable development agenda.

Knowledge and skills:

THE STUDENT WILL FIND OUT:

- WHAT IS THE TRANSPORT IMPACT ON ENVIRONMENT
- WHAT ARE FACTORS MAKING THE VEHICLE „CLEAN"
- WHAT ELEMENTS BUILD CLEAN TRANSPORTATION SYSTEM
- HOW TO MEASURE TRANSPORT IMPACT ON ENVIRONMENT

THE STUDENT WILL BE ABLE TO:

- USE THE TERMINOLOGY CHARACTERISTIC FOR TRANSPORT
- CALCULATE CARBON FOOTPRINT FROM FORMS OF TRANSPORT AND ITS DEPENDENCE FACTORS

SCENARIO

Time	Goals, Objectives, Skills achieved	Materials, Contents	Working methods
	Warm up activities		
5	<u>Greeting students</u> Questions: What forms of transport do you know? Why the transport is not „clean"? What are significant pollutants from transport?	Short reactions noted in two columns: dirty and clean on a board	BRAINSTORMING
	Development and practice		
15	<u>QUIZ</u> Answering the questions students are able to get awarness of the state of environment where dirty or clean transport system works, can apply basic terminology, Teacher finds detailed description of the exercise in Exercise (2)	Copies of Quiz, pens	GROUP WORK, DISCUSSION, JUSTIFYING OPINIONS

Time	Goals, Objectives, Skills achieved	Materials, Contents	Working methods
15	<u>Carbon footprint</u> Gives possibility of gaining awareness of our personal and our surrounding CO2 emission pressure on environment. Teacher gets the details in the Exercise (4)	App – carbon footprint, calculator	GROUP WORK, CALCULATING, COMPARING
	Wrap up		
8	<u>Questions:</u> What should we change to drive to non-polluting transport? Is it wise to count carbon footprint of the transport/travel decisions? Can awareness change our behaviour, life model? How our consumerism influences the need for transportation?	Results from exercises, whiteboard (or) blackboard (or) flipcharts	OUTCOMES FROM GROUPS IN DEVELOPMENT, DISCUSSION, CONCLUSIONS
2	<u>Homework:</u> Using <u>Carbon Footprint Calculator</u> calculate impact of your home, everyday travel to school, last holiday (or planned holiday) journey on carbon dioxid emission	Links to CO_2 calculator	MEMORY NOTES

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