Project co-financed by the European Regional Development Fund

School Low Carbon Footprint in Mediterranean cities

Deliverable 3.3.1
Mobile APP

EDUFOOTPRINT

School Low Carbon Footprint in Mediterranean Cities

PRIORITY AXIS: Fostering Low-carbon strategies and energy efficiency in specific MED territories: cities, islands and remote areas
OBJECTIVE: 2.1 To raise capacity for better management of energy in public buildings at transnational level

DELIVERABLE NUMBER: 3.3.1

TITLE OF DELIVERABLE: Mobile APP

WP n. 3: Testing

ACTIVITY N. 3.3

NAME OF ACTIVITY: Testing in pilot areas

PARTNER IN CHARGE: IRI UL

PARTNERS INVOLVED: ALL PARTNERS

(rev.01 – 09052018)

(rev.02 – 11062018)

Date: June 28. 2018

Executive Summary

1. SCOPE ANT THE CONCEPT OF THE APP ***4***

1.1. Definition *4*

1.2. Edufootprint technical meeting – Treviso 28 august 2017 ..... *5*

1.3. Main characteristics of the app *6*

2. CALCULATION MODEL ***7***

2.1. Basic parameters: *7*

2.2. Edu points *8*

3. APP screens ***9***

3.1. Welcome screen *9*

3.2. My schools *9*

3.3. School information *10*

3.4. CO_2 Footprint *11*

3.5. Information part *12*

1. SCOPE ANT THE CONCEPT OF THE APP

1.1. Definition

A mobile APP for citizens (in particular for school community) with the automatic environmental footprint calculator. It will allow the access to EduFootprint schools' network. It will increase the schools and communities' active involvement.

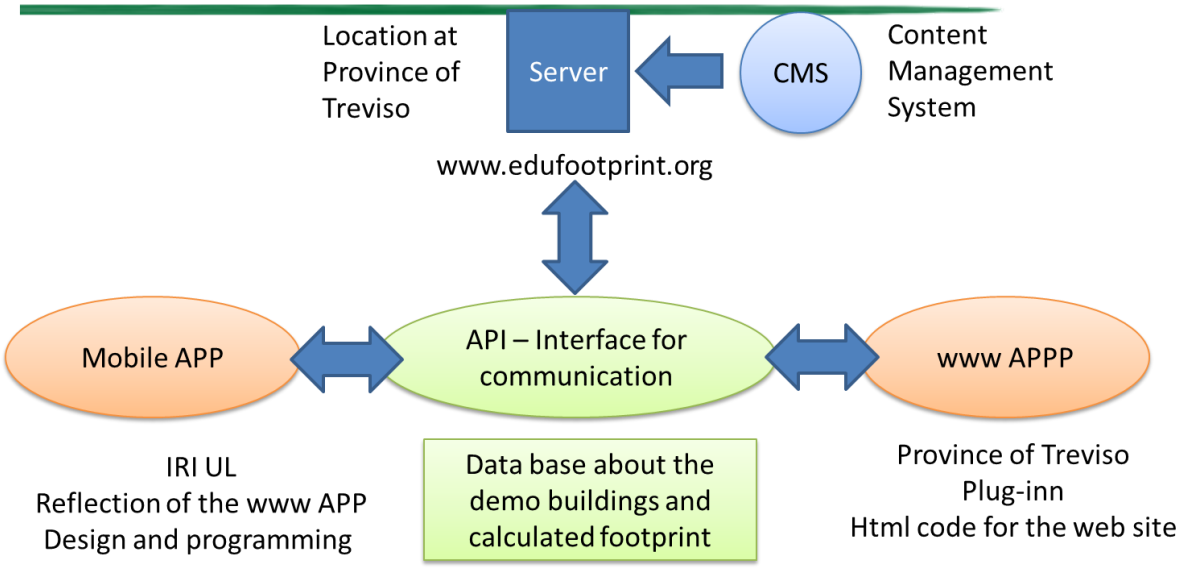
Why APP

- Information about the project
- Information about the CO_2 footprint for demo schools
- Knowledge / measures / actions about CO_2 footprint
- Interactive tool for students / teachers

Main characteristics

- Basic data & logos about EduFootprint project
- Data base about demo buildings – key CO_2 footprint data
- Knowledge base – static information & story telling's
- Gaming / competition – how to decrease the CO_2 footprint

APP is developed as the interface to the www (all the necessary calculating tools, data, information are included at the EduFootprint www)



1.2. Edufootprint technical meeting – T*reviso 28 august 2017*

- IT department of the Province of Treviso is going to develop a web-based database containing the data to be retrieved and shown by the project APP.
- IT department needs to receive the list of 53 schools involved, the list of the parameters to be monitored as far as CO_2 is concerned,
- The IT department will create as many accesses as are necessary for the project buildings mangers to log in and feed the required data.
- The IT company appointed by the IRI UL will develop the APP (software and graphics) adapting it to the standards used by the Treviso IT department in the web-based database, and make it available for the users' download
- The APP could contain: information about the project, information about the CO_2 footprint, knowledge about the measures to decrease the CO_2 footprint, possibly (depending on the costs) some interactive tool for students.
- The main focus of the APP will be the data about the energy consumption of the involved schools, which could be displayed through specific sliders.
- The "rigorous" approach to the calculation of the LCA must not let us to lose a sight of the fact that data collection is only functional for reducing the environmental footprint.
- the calculator should provide a limited number of items in order to be functional
- It is not a priority to know the absolute data, but rather to determine the percentage of reduction of the CO_2 fingerprint compared to the previous year.
- Network of schools: we believe much more in technological and IT systems are open and free for users.
- Electricity consumption per pupil and consumption for heating per pupil are fundamental and priority data,

1.3. Main characteristics of the app

Edu-points Model

- Based on similar / advanced approaches of APP's development;
- Model is Unique for the EduFootprint project;
- Points: calculation of CO_2 emitted / student - normalization

Boundaries

- Minimal and maximal values of the points are related to the data of schools included at EduFootprint project;
- Boundaries can be gained from the data base (problem of the data entry) or determined as a fix values (base-line)

Information

- Information about the project (tips) –designed by IRI UL,
- suggestions / inputs from EduFootprint partners (educational tips) are highly appreciated.

Calculation model

- Basic and understandable parameters are included: kWh of electricity, kWh of thermal energy, kg of the paper and pkm of passenger travelling of km with different means of transport.
- Calculation of the points – model for the calculation is unique for the EduFootprint project, it is based on the CO_2 emission per student (normalization), limited with the boundaries (minimal and maximal values of the data in schools included at the EduFootprint project)
- Movement of the slider gives a possibility to change a points and simultaneously also kg CO_2 emitted (kWh of thermal energy). Higher score gives less CO_2 or more towards green area and vice versa,
- With the changes of the particular points (CO_2 emitted) also the overall points will change – in such a way we have possibilities to observe the changes of CO_2 in relation to the particular parameter and with the points achieved make some kind of competition,
- Tips are included for all parameters, the influence of particular parameter is explained (weight, e.g. thermal energy has 55 % influence to total school emission, electricity 25 %, mobility 19 % and paper 1 %).
- Question mark gives info about the relation of the consumption of particular parameter - to understand the meaning of kWh, this will be explained at the information part (e.g. 1 kWh of electricity means that 10 lights in your class is on for 2 hours or a air conditioning device is on for 1 hour).
- APP will be tested by children and teachers, and after that we will see the usability of our approach.

2. CALCULATION MODEL

- Mocap version: "Primary school Giuseppe Verdi"
- Beta version: "Primary school Ivan Skvarča"

2.1. Basic parameters:

1. Thermal Energy (kWh)
2. Electric Energy (kWh)
3. Paper (kg)
4. Mobility (pkm)

Data for "Primary school Ivan Skvarča"

Total use	Thermal Energy	Electric Energy	Paper	Mobility (aver.)
Sept. 2017 – Jan. 2018 (measured data)				
Parameter	277.904 kWh	73.256 kWh	450 kg	169.950 pkm
Row in Excell base	*111*	*66*	*21*	*134*
Total Emissions	91.982 kg CO_2	32.534 kg CO_2	920 kg CO_2	23.574 kg CO_2
Row in Excell base	*110*	*65*	*18*	*133*
Emission factor	0,33 kg CO_2/ kWh	0,44 CO_2/ kWh	2,04 kgCO_2/kg	0.14 kgCO_2/pkm
Jan. 2018 – June 2018 (estimated data)				
Parameter	388.620 kWh	75.335 kWh	960 kg	135.620 pkm
Emissions	99.098 kg CO2	35.633 kg CO2	1.958,4 kg CO2	18.715 kg CO2

Mobility parameter[1] $=$ **pkm** $*$ **number of working days**

- CAR: $60 * (3\ \text{km}) * 103 + 87 * (2\text{km}) * 103 = 36.462$ pkm (in period sept 2017-jan 2018)

Explanation: 60 students everyday travel by car in average 3 km both directions and 87 personnel in average 2 km, both directions, multiplying 103 working days we get pkm (passenger km)

- BUS: $158 * (5\ \text{km}) * 103 + 481 * (100\text{km}) = 129.470$ pkm (in period sept 2017-jan 2018)

Explanation: 158 students everyday use bus in average 5 km distance both directions, multiplying 103 working days we get pkm, 481 students use bus for excursion, average 100 km, once per period.

- TRAIN: 0 - similar calculation, in case of OŠ Ivan Skvarča train is not used

Total Emission[2]

$$TE = 36.462\ \text{pkm} * 0{,}285\frac{\text{kg}}{\text{pkm}} + 129.470\ \text{pkm} * 0{,}0968\frac{\text{kg}}{\text{pkm}} + 0\ \text{pkm} * 0{,}0649\frac{\text{kg}}{\text{pkm}} = 22.931\ \text{kg}\ CO_2$$

!!!! Note: due to the characteristics of the model at the www data base mobility data has been slightly changed: parameter = 169.950 pkm; Total Emissions = 23.574 kg CO2

[1] $pkm\ (passenger - kilometres) = number\ of\ passengers * distance\ travelled$

[2] *At the first version of the APP for the transportation, a parameter for Total Emission is used as an average for different means of transport for simplification of calculation and possible comparison between different schools.*

2.2. Edu points

For calculation of the edu points each particular parameter and related total CO_2 emission is calculated in relation to the number of students (normalization). Originally developed edu point model gives the possibility of interaction - to play with EDU-POINTs.

$$\text{Normalized Parameter (NP)} = \frac{\text{absolute value of parameter}}{\text{number of students}}$$

$$NP\ (Thermal) = \frac{277.904\ kWh}{481\ students} = 578 \frac{kWh}{student}$$

$$\text{EDU} - \text{POINTs} = 100 - \left(\frac{\text{NP}}{\text{Max NP}} * 100\right)$$ *- Max NP is maximal value of normalized parameter*

$$(Thermal)\ EDU - POINTS = 100 - \left(\frac{578}{1600} * 100\right) = 64$$

	Thermal Energy kWh/student	Electric Energy kWh/student	Paper Kg/student	Mobility Km/student
Upper Limit	1600	376	2,45	1835
Lower Limit	0	0	0	0

.

Example of calculation of points for OŠ Ivan Skvarča (481 students) - Sept. 2017 – Jan. 2018

	Thermal Energy	Electric Energy	Paper	Mobility
Absolute value	277.904 kWh	73.253 kWh	450 kg	169.950 pkm
Normalized Parameter / student	578	152	1	353
CO_2 kg	91.982	32.534	920	23.574
CO_2 kg / student	191	68	2	49
Total Emitted CO_2 per student (TNP CO2) = 310 kg / student				
Upper Limit / student	1.600	376	2,45	1.835
EDU-POINTs	64	59	62	81

Example: calculation of the sum of points for OŠ Ivan Skvarča (481 students)

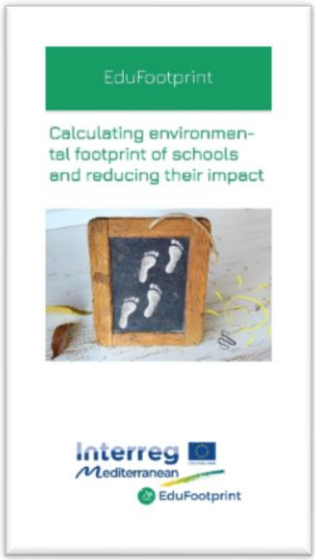
$$\text{SUM} = \text{EDU} - \text{POINTs (thermal)} * \text{weight (thermal)} + \ldots\ldots = 65{,}58$$

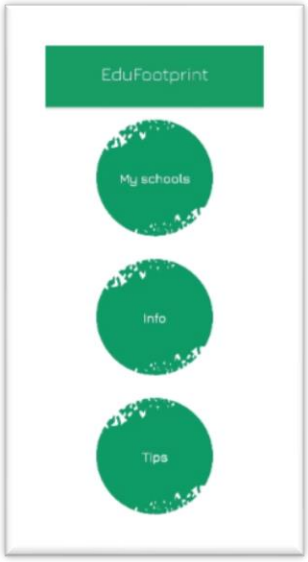
$$\text{weight (thermal)} = \frac{\text{NP } CO_2\text{(thermal)}}{\text{TNP } CO_2} = \frac{191}{310} = 0{,}62$$

	Thermal Energy	Electric Energy	Paper	Mobility
Weight	0,62	0,22	0,01	0,16
EDU-POINTs with weight	39,44	12,99	0,38	12,77
SUM of EDU − POINTs = 39,44 + 12,99 + 0,38 + 12,77 = 65,58				

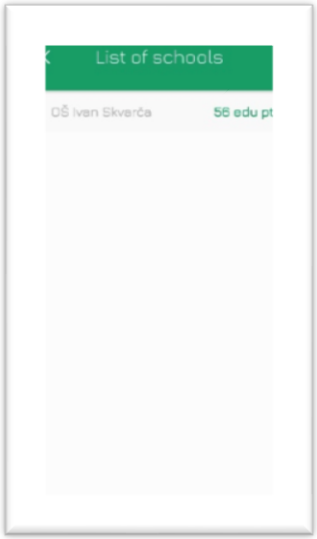
3. APP screens

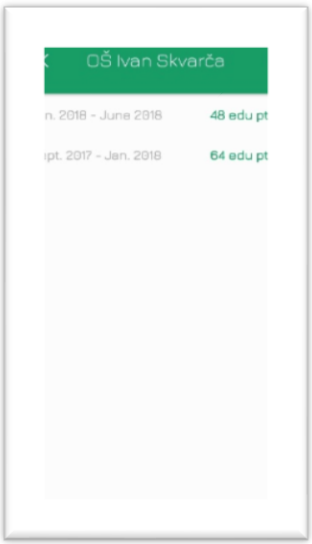
3.1. Welcome screen





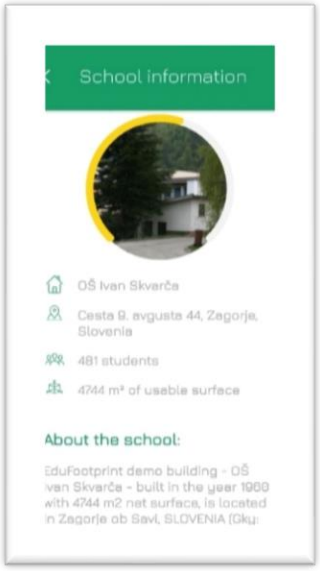
3.2. My schools





3.3. School information

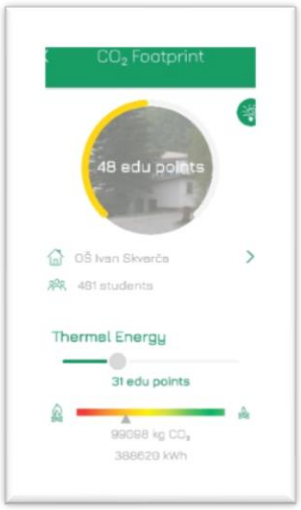
EduFootprint demo building - OŠ Ivan Skvarča *(Name school, row 210)* - built in the year 1960 *(Construction year, row 219)* with 4744 *(Building area, row 220)* m^2 net surface, is located in Zagorje ob Savi *(Address and city, row 213)*, SLOVENIA *(Address and city, row 213)* (Gky: 500465, Gkx: 109873) *(geolocalizzazione, row 227)*.

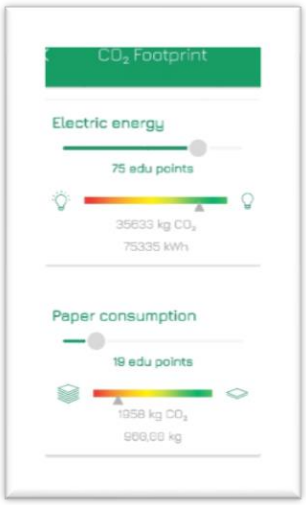


At this Primary school (*Educational stage, row 217*) 481 *(Number of students, row 222)* students (aged from 6 – 15) *(Students' age, row 223)* with 62 *(Number of school staff, row 224)* teachers are educated also about environmental responsibilities. Data concerning the environmental footprint, caused by the educational process, are used to help initiate changes to people's behaviour.

Foto_scuola, row 226

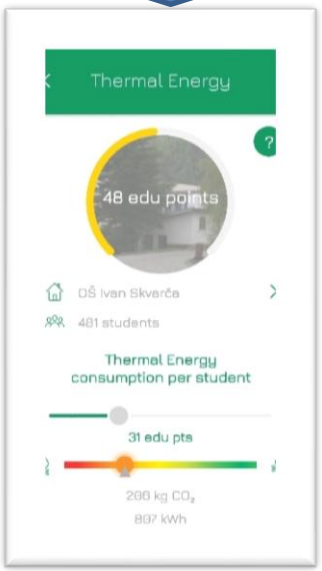
3.4. CO_2 Footprint

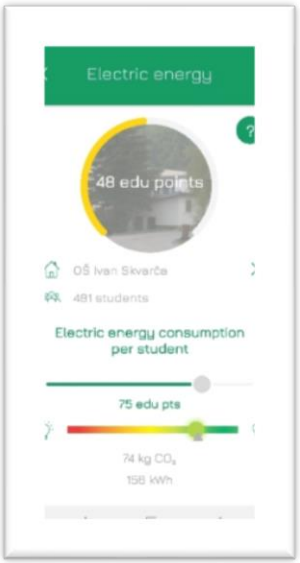


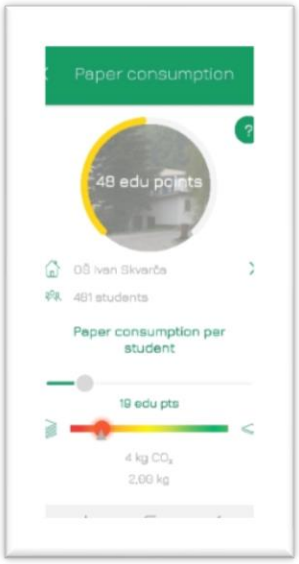


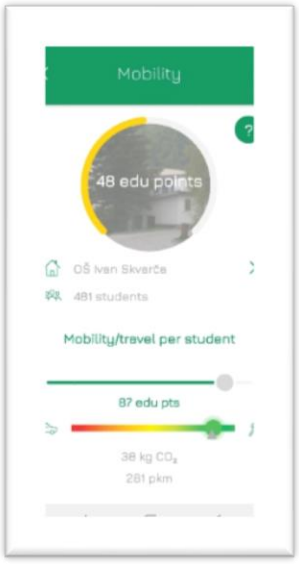
Play with EDU points

Play with the slider and observe the changes in EDU-POINTs – a higher number of points means less energy used and the inclination toward a green environment.

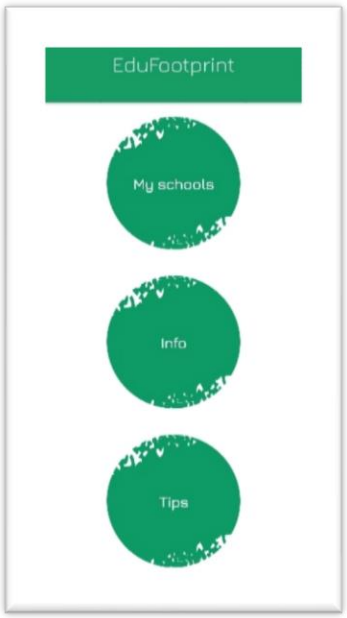








3.5. Information part



Info

EduFootprint App

Improvement of Energy & Resource Efficiency by reducing the Environmental Footprint in public school buildings, while considering the whole life cycle of education service.

- Integrated Energy Strategies tested and transferred in a set of schools of the MED Area
- Life Cycle Assessment approach
- Alignment with local Sustainable Energy Action Plans
- Implementation of technological solutions & horizontal actions
- Co-operation, engagement & behaviour change of school communities

28-month Interreg MED modular (M2) project co-financed by the European Regional Development
Co-financed by: www.interreg-med.eu\EduFootprint

Lead partner

Province of Treviso (Italy) - http://www.provincia.treviso.it/

Project partners

Regional Energy and Environment Agency from North Alentejo (Portugal) - http://www.areanatejo.pt

Institute for Innovation and Development of University of Ljubljana (Slovenia) - http://iri.uni-lj.si

Euromediterranean Centre for Sustainable Development (Italy) - http://www.svimed.eu

PASHKO (Albania) - http://www.pashkoinstitute.org

EGTC Efxini Poli – SolidarCity Network (Greece) - http://www.efxini.gr

Official College of Industrial Engineers of Western Andalusia (Spain) - http://www.coiiaoc.com

Ambiente Italia srl (Italy) - http://www.ambienteitalia.it

RETE ISIDE, Schoolnet for Environment and Energy Saving (Italy) - http://www.reteisideambiente.it

Tips

Global warming

Q: Is a global warming connected to what people do on the planet?

Standard of living has been rising for most of the population for the last 100 years due to the extensive use of fossil fuels. Consequently, climate change makes future pessimistic and we urgently need to decrease the emissions - time has almost run out.

CO_2 emissions

Q: Where do the carbon dioxide emission come from?

CO_2 is an indicator of several greenhouse gases (methane, F-gases, nitrous oxide - we call them CO_2 equivalent). Human caused CO_2 emissions come from the fossil fuels (about 9/10), the rest is from land use and industrial processes. Average emission of CO_2 in EU is ~9 tons per capita yearly.

Life cycle

Q: What does a life cycle of a sheet of paper mean?

Life cycle considers all stages of a certain product's life: from raw materials extraction, rough materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling. Each stage has environmental impacts and with analysis (LCA) we can focus on the important ones.

School buildings

Q: Why do we need public buildings and services?

We spend more than 90% of our time in buildings, and they need to keep use comfortable. Schools' environmental footprint is firstly related to the construction, in the operational phase environmental impact is related to energy, mobility and consumption, including food. Therefore, they consume ~40% of final energy in EU and are responsible for ~1/3 of black carbon emissions.

Thermal Energy

Q: Why heat and how is it produced in building?

Is it not possible to have comfortable environment without heating or cooling? Thermal energy (measured in kWh), produced from different energy sources, is one of the main causes of global warming. In school buildings, thermal energy can cause up to 50 % of CO_2 emissions.

Electric Energy

Q: Which sources are used for production of electricity?

Electric Energy (measured in kWh) is the most valuable form of energy, as it can be easily transported and converted into any other form. It is used for lighting, equipment, sanitary hot water, cooking and building systems. Up to 30 % of CO_2 emissions in school buildings come from electricity use.

Mobility

Q: What means of transport are the least polluting?

Mobility means transportation with different means (car, bus, train, airplane) from one (e.g. home) to another other point (e.g. school). Transport means are driven by fossil fuels that cause global warming and local pollution. In school's mobility can cause up to 30 % of CO_2 emissions.

Paper consumption

Q: Where does paper come from and why is it white?

People are a part of the biosphere, same as forests, and the main source of paper are trees. Even the usage of paper in schools can contribute less than 1 % to the CO_2 emissions, its reduction is important due to the understanding of nature - we need about 7 trees for oxygen to breathe.

Energy efficiency

Q: How do we understand energy efficiency?

Efficiency means doing more with less, energy efficient building use less energy and cause a smaller environmental footprint. For comparing the efficiency of school buildings, we calculate the use of energy per m^2 of building surface or in relation to the number of students.

Edu-points

Q: How can we measure environmental impact of our school?

Environmental impact can be calculated as the use of energy, and with related emission factors as the amount of CO_2 in kilograms. Edu-points are a unique measure for complete assessment of school impact on the environment. It takes into account parameters of the school's CO_2 emissions: thermal energy, electric energy, passenger transportation and use of paper. The range of points extends from 0 (non-efficient school, extreme contribution to the environmental impact or related CO_2 emissions) to 100 (highly efficient school).

Calculation of Edu-points

Q: How can the environmental impact be reflected within Edu-Points?

Edu-points are calculated on the basis of normalisation of each parameter (thermal energy / number of students) in relation to the maximal value of that parameter from all tested schools. Joint score of the Edu-points for the chosen school is a sum of points from particular parameters with consideration of their individual impacts. This helps us to understand which the most important parameters of CO_2 emissions are and where it makes sense to act firstly (Low hanging fruits). With the movement of the slider you can observe the changes in Edu-Points – a higher number of points means less energy used and the inclination toward a green environment.

Info part for particular parameter (?)

Thermal Energy

Zero kWh (100 points): the building is not using heat or is using only solar energy – school with no CO_2 emissions. Higher value of kWh: building is not energy efficient or the users are not acting as environmentally aware (e.g. temperature in classes is too high).

HINT: identify the measures to save Thermal energy and be friendly to nature.

Electric Energy

Zero kWh (100 points): you do not need any electricity from the supplier; you can be self-sufficient with e.g. solar panels on the roof. Higher value of kWh: school is not efficient in saving electricity, users need to act more environmentally aware (e.g. turn off lights).

HINT: The best Watt is a "negaWatt" = electrical power saved

Mobility

Zero km (100 points): you are not using any transport or you are walking / cycling. Higher value of km means, that you travel a longer distance or act more environmentally aware (e.g. use a public transport, more passengers in car). Passenger-kilometres are a combination of all means of transport, the most polluting is the car, followed by bus and train.

HINT: The best way to be healthy is walking or cycling

Paper consumption

Zero kg (100 points): the school is not using any paper. Higher value of kg of paper means that the school and you need to be more environmentally aware (e.g. use electronic devices, eliminate the use of paper towels by shaking your hands 12 times).

HINT: no paper used means you do not need trees to be cut for your paper