

Cities Going Green 2021

PROJECT RESULT 1: Theoretical Framework



Project Erasmus+

Cities Going Green: Application for the
Development of a Green and Smart City

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CONTENTS

DEVELOPMENT OF THE THEORETICAL FRAMEWORK.....	3
OBJECTIVE.....	3
NEEDS ANALYSIS.....	3
TRANSFERABILITY POTENTIAL.....	4
INTRODUTCION TO THE THEORETICAL FRAMEWORK.....	4
1. STEPS OF THE DEVELOPMENT OF THE THEORETICAL FRAMEOWRK.....	4
Best Practices	4
Focus Groups.....	4
Brainstorming workshop.....	10
2. DEVELOPMENT OF THE THEORETICAL FRAMEOWRK.....	10
BEST PRACTICES IN THE PARTNER COUNTRIES:	31
CONCLUSIONS FROM THE ANALYSIS OF DOCUMENTS:	40
COMPOSITION OF LEARNING OUTCOMES.....	51



DEVELOPMENT OF THE THEORETICAL FRAMEWORK

OBJECTIVE

The main goal of the aggregate report is to is the exchange best practices on how EU cities can become greener and to present the data gathered from the previously developed by the project consortium activities which were prepare in order to identify the learning outcomes for each level of the game regarding the green and smart cities.

NEEDS ANALYSIS

Climate change is a global threat. Human factors affect the climate through various behaviors. Common behaviors such as dumbering waste in landfills, burning fossil fuels, agriculture and deforestation are among the factors with which humans affect negatively the environment towards the climate change. A change in the behavioral patterns of all of us is essential in the fight against climate change. Education is among the most important tools, with which we can contribute in the change in the human behavior and on creating awareness on green solutions that can improve our everyday life.

CitiesGoGreen aim to bring together environmental education, the method of gamification and STEM as an educational tool in order to help pupils of the ages 10-12 learn about the green solutions, and how a decision can affect positively or negatively the environment.

The main objectives of the project are the following:

1. To cultivate the environmental consciousness of pupils together with other transversal skills and competences.
2. To develop a theoretical framework based on which it will cultivate the environmental consciousness of primary school pupils of age 10-12 years
3. To engage pupils with STEM and to develop the key skills of pupils through STEM
4. To design a state of the art game that will combine ENVIRONMENTAL CONSCIOUSNESS, Gamification and STEM
5. To develop an assessment tool that will be used prior and after the game to measure the skills gained through the game. The main focus of the assessment tool is the assessment of environmental consciousness. However other skills developed through STEM and through gamification will also be developed.



The objective of this project is to educate pupils in the age of 10-12 years old on the importance of being green, and demonstrating sincere interest in the environment. Through the project pupils will learn more about things like, circular economy, recycling and other important issues related to the protection of the environment. More specifically, the pupils will be able to plan and build their own city using different building blocks provided by the application such as stations for charging green cars, brown recycling bins, shops producing bags from recycled tires etc.

TRANSFERABILITY POTENTIAL

Beyond the project lifetime, the CitiesGoingGREEN's methodology can be transferred and used in other similar projects for specific age groups and specific topics. The methodology can be applied on different age groups, different topics for the development of learning outcomes. Furthermore, the learning outcomes can be used in different settings for the same age group and topics through a different vehicle Result Type Methodologies / guidelines – Methodological framework for implementation Project result 1: Theoretical framework.

INTRODUTCION TO THE THEORETICAL FRAMEWORK

1. STEPS OF THE DEVELOPMENT OF THE THEORETICAL FRAMEOWRK

Best Practices

In order to come up with the composition of the theoretical framework and the learning outcomes the consortium will follow a specific, holistic methodology. The report contains descriptions of 37 *Best Practices, covered 7 main selected topics in the partner countries (Circular economy, Air quality, Green energy, Buildings, Water quality and water management, Public transport and Quality of life)*. This document describes the different types of activities (best practices) implemented in EU countries and the experiences gained from their implementation, so as to be integrated in the Cities Going Green application. The theoretical framework of the Cities Going Green was structured in chapters and presented the main issues that will be tackled by the mobile application as well as the difficulty/advanced level.

Focus Groups

A desktop research was accompanied by three rounds of focus groups with the most relevant target groups (Teachers, Pupils and experts). There were prepared different guidelines to each focus group describing the objectives to identify by teachers, pupils and external experts.



A focus group discussion was an explorative research approach, where a group of participants were discussing selected topics under the guidance of a professional moderator, in this case experts. The goal was to discover real motivations and learning needs from the participants. There were prepared different types of questionnaires to each set of the focus group. To each focus group there were prepared consent form, declaration of participation, focus group guide, the participant list, photos from the session as well as glossary of terms.

PR1A2. Focus groups with teachers and analysis

The objective of the round of Focus Groups for teachers was to identify:

1. the level of knowledge of teachers on the topic
2. the characteristics around the age group of pupils at the age of 10-12
3. the engagement of the teachers on the topic and the project

One focus group was implemented in each country i.e., Poland (Publiczna Szkoła Podstawowa Nr 1 w Grójcu), Cyprus (Apostolos Varnavas Primary School), Estonia (University of Tallinn), Greece (Iera Moni Agiou Iosif/ Ellinogalliki Scholi Jeanne D' Arc) and Spain (Escola A. Aguilera).

Participants' profile:

8-10 participants participated in each focus group.

The group of participants consisted of teachers of pupils at the ages 10-12.

There were no criteria on gender, age or experience. However, it was suggested that the groups should have a diverse representation regarding the above-mentioned characteristics.

As a first step, all teachers participating in the focus groups signed the consent form for their participation in the implementation of the focus groups.

Teachers were informed about the reason for the implementation of this focus group, the ways in which the collected data will be utilized and the process to be followed during and after the activity.

The focus group started with an engagement question, which will act as an “ice-breaker”. After that, the second section of the focus group includes the explorative questions. The focus groups was based on the objectives of each specific target group and the 7 topics. There were prepared 17 questions covering knowledge around the project topics and current level of awareness of pupils at the ages 10-12 regarding green practices.

Questions 1-7: seek to determine the level of knowledge of teachers on the topics decided by the partners and that revolve around several aspects of the environment and related threats and solutions.

Questions 8-9: the determination of characteristics for pupils at the ages 10-12 are the main objective of these questions. These characteristics involved the process of knowledge



acquisition of pupils and their level of awareness on green practices being implemented on a national or European level.

Questions 10-11: here the teachers were asked about their level of awareness on the three basic pillars upon which the project is based, namely Environmental Education, STEM education and gamification. Having determined that, the degree on which subjects related to the above are offered in the country of the teachers.

Questions 12-14: were aimed to examine the level of engagement of the teachers with the topic of the project, as well as with the project itself.

Questions 15-17: at this point, the teachers were asked to contribute their own views about the design and development of the game/ app, both visually and in terms of content.

After the implementation of the focus group activities, all the data were collected and discussed among the partners in each country and later there was a preparation of the focus group report which consists of three separate sections:

- a. Introduction
- b. Data analysis
- c. Conclusions

The Introduction section includes the description of the demographic characteristics of the participants. For this task, the facilitator or the person responsible for the preparation of the reports found all the necessary information from the participant list of the focus group.

The next step was the Data Analysis section in the report. During this process, a summary were prepared about each one of the questions. This summary should include the input that was contributed by the participants, in a way that would provide useful conclusions on the perception and knowledge of the participants. Each summary must was written in the space provided for the corresponding question.

Finally, the Conclusions section aims to narrow down the conclusions made from the focus group. These generalized conclusions were adapted on the objectives that were placed for this specific target group.

The last table in the document consists of a checklist of the documents that should be submitted along with the report.

It was assumed in the partnership that the research in a given partner country would cover a group of at least 8 teachers representing the educational environment. In the final phase, the research sample was extended and included a total of 55 teachers.



PR1A3. Focus groups with pupils and analysis

The aim of this focus group activity was the collection of data from pupils at the ages of 10-12 years old, and the analysis of this set of data in order to extract useful conclusions for the knowledge and perception of this target group. This set of data were used for the development of an online app/ game, through which pupils at the ages of 10-12 will be able to build their own Green City.

The objective of the round of Focus Groups for pupils is to identify:

- 1.** To identify the level of knowledge of the pupils on these specific topics
- 2.** The characteristics of this age group
- 3.** The familiarity of pupils on electronic games and apps
- 4.** Their interest on the topic of climate change and green solutions
- 5.** The level of engagement of the pupils on the project

The consortium sees the participation of the end users on the development of the app as fundamental for the success of the game.

One focus group was implemented in each country i.e., Poland (Publiczna Szkoła Podstawowa Nr 1 w Grójcu), Cyprus (Apostolos Varnavas Primary School), Estonia (University of Tallinn), Greece (Iera Moni Agiou Iosif / Ellinogalliki Scholi Jeanne D' Arc) and Spain (Escuela A. Aguilera). At least 20 participants should participate in each focus group (either in one session or 2 sessions of 10 participants each).

The focus groups were based on the objectives of this specific target group included in the application and the 7 topics. As a first step, the teachers/ headmasters of schools made sure that all pupils' parents/ custodian have signed the consent form for the participation of pupils in the implementation of the focus groups.

Pupils were informed about the reason for the implementation of this focus group, the ways in which the collected data will be utilized and the process to be followed during and after the activity.

At a first stage, the facilitator made sure that the participant list was completed by all participants.

The focus group started with an engagement question, which will act as an "ice-breaker". After that, the second section of the focus group includes the explorative questions begun. The explorative questions were asked without mentioning the topics prepared for the desk research. The initial focus was placed in the identification of the already-existing perception and knowledge of teachers and pupils on the topics of environmental threats and green practices toward environmental sustainability.



Structure of questionnaire

Questions 1-8: were aimed to determine the level of knowledge of pupils on the topics decided by the partners and that revolve around several aspects of the environment and related threats and solutions.

Questions 9-13: the determination of characteristics for pupils at the ages 10-12, the familiarity of pupils on electronic games and apps and their interest on the topics of climate change and green solutions are the main objectives of these questions. These characteristics involve the process of knowledge acquisition of pupils and their level of awareness on green practices being implemented on a national or European level.

Questions 13-15: were aimed to examine the level of engagement of the pupils with the topic of the project, as well as with the project itself. At this point, the pupils were also asked to contribute their own views about the design and development of the game/ app, both visually and in terms of content.

In this section, the participants watched a video/ videos (if there is enough time) and discussed on their views about the content of the video and the knowledge that was acquired.

Finally, the data collection process includes one last Additional Methodological Tool. This tool consists of cards/ boxes (depending on the way that the facilitator will decide to implement it) that correspond to seven topics: Circular Economy, Air Quality, Green Energy, Buildings, Water Quality and Availability, Public Transportation and Quality of Life. The facilitator has two options: Either to print the table with the seven boxes (Method 1) or print and cut the 7 cards for each one of the topics (Method 2). Both Methods are included as an appendix to this document, named Additional Methodological Tool.

In this activity, the pupils were asked to write their ideas/ answers on post-it notes and stick them on the topic for which the note is destined. The facilitators must collect the post-it notes, since they will be used later in the process for the analysis of the data.

The partnership established that at least 20 participants will participate in each focus group (either in one session or 2 sessions of 10 participants each). Participant profiles should consist of pupils at the ages of 10-12. In the final phase, the research sample was extended and included a total of 101 pupils.

PR1A4. Focus groups with experts on the topic

The aim of this focus group activity was the collection of data from experts in fields that are related to environmental education and the environment in general, and the analysis of this set of data in order to extract useful conclusions based on the knowledge and perception of this target group.



The objective of the round of Focus Groups for experts is to:

1. Gather the experts' view on topics related to environmental sustainability
2. Identify the most recent issues and solutions regarding the environment
3. Help the consortium succeed in creating an updated version of the game, relevant to the local, European and global current environmental issues.

Participant profiles should consist of experts on topics related to environmental sciences, environmental education, resource management (related to the topics decided by the partners) and other experts, whose knowledge can contribute in the improvement of the application of the project, the Cities Going Green app.

There were no criteria on gender or age, however the profession and area of expertise should be considered as basic criteria for the selection of the participants. The more relevant these are to the topic and objectives of the project, the more useful the input by the participants will be.

One focus group was implemented in each country i.e., Poland, Cyprus, Estonia, Greece and Spain. The focus groups were based on the objectives included in the application for this specific target group and the 7 topics. At least 5 participants will participate in each focus group/ roundtable discussion.

A focus group discussion was an explorative research approach, where a group of participants are discussing selected topics under the guidance of a professional moderator, in this case experts. The goal is to discover real motivations and learning needs from the participants.

Structure of questionnaire

Questions 1-12: Through Questions 1-12, the experts' views on topics related to environmental sustainability are examined. This input will be crucial for the finalization of the research, since these answers will be coming from people who possess both the knowledge and the expertise in the topics that the project involves.

Questions 13-15: Through the last three questions of this section, the feedback of the experts is requested, in order for the application to be as attractive, relevant and easy to use as possible.

The partnership established that at least 5 external experts will participate in each focus group. In the final phase, the research sample was extended and included a total of 28 experts.

Focus groups were implemented under Project Result 1: Theoretical Framework, Activity 2: Implementation of focus groups with teachers and analysis. The aim of this focus group activity is the collection of data from teachers of pupils at the ages of 10-12 years old, and the analysis of this set of data in order to extract useful conclusions for the knowledge and perception of this target group. This set of data will be used for the development of an online app/ game, through which pupils at the ages of 10-12 will be able to build their own Green City.



Brainstorming workshop

Next step was a **brainstorming workshop**. The aim was to help the consortium to conclude on the main topics that will be stressed in the game and these will be analyzed on the theoretical framework which will lead to the composition of the learning outcomes.

This activity was hold a brainstorming workshop with all the partners of the consortium in an attempt to finalize the main topics and the related theory which is going to be used as a basis for the development of the game.

The brainstorming workshop started with a brief presentation of the project's progress. The next part included the presentation of the findings for the main topics that will be included in the Cities Going Green app. Following that, another presentation took place regarding some of the game's features. This helped the consortium to adjust the next activities in such way, in order to lead to the proper development of the app.

Finally, to design a suitable application, **learning outcomes** were developed by involving consortium members, teachers and students through focus groups, but also subject matter experts in the process (see chapter COMPOSITION OF LEARNING OUTCOMES).

2. DEVELOPMENT OF THE THEORETICAL FRAMEOWRK

According to the structure of the application, the analyzed documents were divided into parts concerning: a short description of the practice, the main goal, participants, impact, duration, good and weaknesses and, above all, tips and advice on the possibility of implementing best practices in the Cities Going Green application. The documents described various types of activities (best practices) implemented in the EU countries and the experiences gained during their implementation. An analysis of the common parts, conclusions and recommendations for use in the Cities Going Green application was given.

Learning about environmental sustainability aims to cultivate a sustainability mindset from childhood “with the understanding that humans are part of and depend on nature” (Greencomp, 2022). Learners are equipped with knowledge, skills and attitudes which help them become agents of change and contribute individually and collectively to shaping futures within planetary boundaries. Learning about environmental sustainability could be a catalyst for change among young and adult generations, by acquiring competences that are related to sustainability (Greencomp, 2022).

Education is a fundamental tool when it comes to the fight against climate change. Knowledge regarding climate change helps young people to understand and tackle the consequences of global warming and encourages them to change their behavior. According to reports, very often, when children are coming across the topic of climate change in the news, it causes them a feel of fear and anxiety. Therefore, there is a clear need for setting



this issue in a safe context so that the children can be educated about it. Children are proven to be more receptive to learning. Education on children regarding climate change can help for various reasons:

- Learn about the issue in safe context
- Behaviour change
- Ease their fear and anxiety on the topic
- Motivate to take action
- Prepare for them for the potential future need of creating climate solutions.

Education can be provided through many formal or informal structures. One very effective technique of transferring knowledge to children and adults is Gamification. Gamification can be defined as a set of activities and processes to solve problems by using the characteristics of game elements. In addition to the environmental consciousness, other skills and competences are important and are being provided to pupils through gamification and STEM. This is aligned with the priorities of the Commission for the development of Key Competences (STEM) and digital skills (GAMIFICATION) Gamification is becoming increasingly used in educational settings as, it 'makes the hard stuff more fun', and is helping to motivate pupils and make them more engaged with the subject matter. STEM is an approach to learning and development that integrates the areas of science, technology, engineering and mathematics.

The objective of this project is to educate pupils in the age of 10-12 years old on the importance of being green, and demonstrating sincere interest in the environment. Through the project pupils will learn more about things like, circular economy, recycling and other important issues related to the protection of the environment. More specifically, the pupils will be able to plan and build their own city using different building blocks provided by the application.

In the 1st phase of the project realization the consortium was working towards the development of a theoretical framework. This framework leads to the composition of two levels of learning outcomes which will be the basis for the development of the app.

Each of the partners: Cyprus, Estonia, Greece, Poland and Spain developed documents in the following areas:

1. Circular economy
2. Air quality
3. Green energy
4. Buildings (intelligent design, green architecture, etc.)
5. Water quality and water management
6. Public transport
7. Quality of life (happiness, green education in schools, etc.)



The aforementioned topics are significant factors toward environmental sustainability, either as a response to certain environmental threats, or as determinants for the equilibrium in various ecosystems, which consequently affect environmental sustainability. The partnership prepared recommendation to each topic.

Circular Economy

A circular economy is a model of production and consumption, which involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products as long as possible (Wikipedia).

In a circular economy, the value of products and materials is preserved as long as possible.

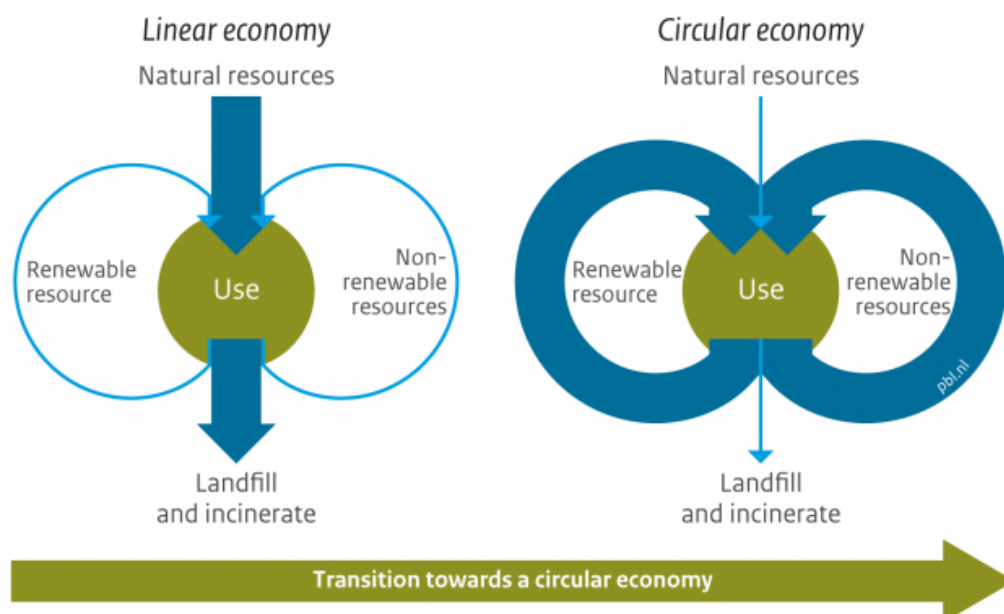
Waste is generated and resources are consumed as little as possible, and when the product reaches the end of its life cycle, it is used to create new value.

This can have greater economic benefits, contributing to innovation, economic growth and job creation.

The circular economy promotes long-term sustainability and competitiveness.

This can have greater economic benefits, contributing to innovation, economic growth and job creation. The circular economy promotes long-term sustainability and competitiveness.

From a linear to a circular economy



Source: PBL 2016

www.pbl.nl



Linear economy problems

- Some resources are becoming scarce. We cannot afford to throw these into landfill – we must extract and re-use the minerals.
- The other problem is the impact of continuous extraction and dumping on our environment. Even best-practice mining uses land that could otherwise be left in its natural state. Clearing land for crops to manufacture clothes means there are less trees and less land for farming. Waste from city areas needs to be transported long distances to landfill sites. This uses significant amounts of energy and contributes to air pollution.

Strategies to Teach

- Strategies aimed at smarter product use and production are most beneficial, changing consumption and production patterns through the use of raw materials and resources and reducing waste generation.
- The second type of strategies are not so radical, but they support the reduction of the consumption of raw materials and resources and thus have a positive impact on our environment by extending the life of products and their parts (e.g., reuse, repair, renovation, remanufacturing, etc.).
- The strategies of the third category are already widely used, but they have so far been the least effective in solving environmental problems. These include strategies for the beneficial use of materials through recycling or energy recovery.

In Building Industry

- Encouraging planning and design based on Building Model Design (BIM).
- Encouraging recycling of materials
- Increasing the energy efficiency of buildings and promoting health friendliness
- Encouraging the use of wood in construction

In Plastic Industry

- Regulation of placing plastic packaging on the market
- Standardization of packaging
- Circular economy is supported by investment principles
- In fulfilling the circular economy goals related to packaging, the highest priorities are:
 - Reduce single-use plastics
 - Increase plastic recycling



In Textile Industry

- Creation of a cooperation platform for the involvement of companies in the field, public institutions and other interested parties
- Development of effective collection and sorting systems
- Encouraging the reuse and recycling of clothing and textiles through the application of various existing recycling technologies

In Forestry and Wood Industry

- Forestry that ensures high-quality raw wood
- Encouraging the use of wood in construction
- Increasing the reuse of wood
- Replacing products based on non-renewable resources with wood-based products (their development and production)

In Food Industry

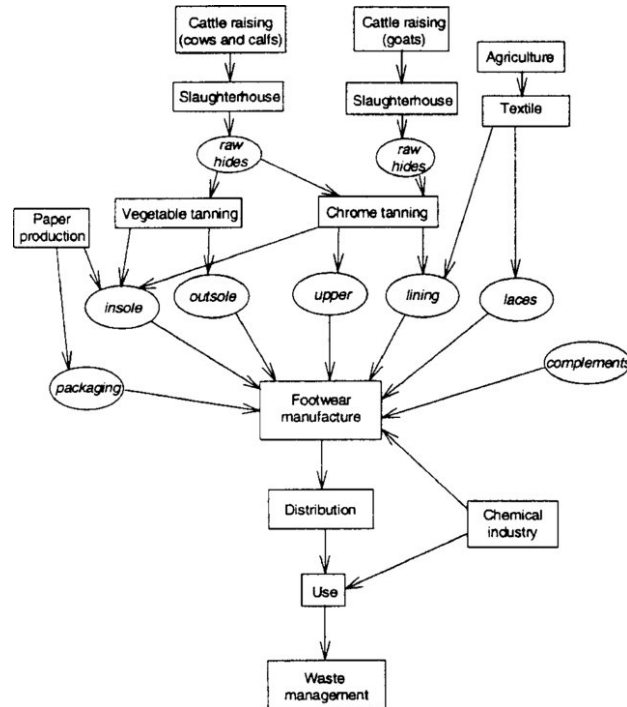
- Supporting the creation of circular economic production processes
- Innovation supporting the circular economy
- Supporting companies in reducing food waste
- Integrating sustainable food use and circular economy into the activities of educational institutions
- Raising the awareness and capacity of all parties on the subject of the circular economy

Strategies To Teach

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Footwear Lifecycle



Summary

In summary, a circular economy is a sustainable model of production and consumption that aims to preserve the value of products and materials, minimize waste generation, and contribute to economic growth and job creation. Strategies to promote a circular economy include smarter product use and production, reduction of raw material consumption, reuse, repair, renovation, and recycling. Different industries, such as building, plastic, textile, forestry and wood, and food, have specific goals and strategies for promoting a circular economy.

In the area concerning the circular economy, the common area of action is waste management and the development of a model of this economy in line with the zero waste idea. For this purpose, intelligent containers for segregated waste can be used and, of course, children and adolescents should be trained. It was a nice idea to create a green influencer character.

Recommendations for use in Green City are the following:

- The application can use the waste management method in accordance with the model presented in the Cypriot and Greek project.
- Make the player aware of the possibility of reusing old tires instead of throwing them in a landfill, there could be a so-called tire collection point in the game. Each of these tires would reduce the CO2 footprint, for example.



- Use the source sorting and door-to-door collection, recycling and reuse model, create a Point Zero Information Center, use the features of the Just Go Zero application. We can use in the game - used equipment, such as a blue garbage can or specially designed vehicles. Zero waste can be one of the goals / challenges of the game.
- In the application, garbage is sorted and collected into Smart containers.
- Create a greenfluencer character so that he can share his ideas on social networks.

Air Quality

Air pollution is mostly invisible to the human eye, but nevertheless affects life on Earth. Air is an element of the environment that knows no boundaries, and it is essential for all life. Therefore, its quality and the impact that each person has on its purity is not insignificant. Protecting air quality is very important for the health and well-being of present and future generations of Earth's inhabitants.

Analyses carried out within the framework of Air Protection Programmes indicate that millions of inhabitants are exposed to poor air quality caused by particulate matter PM₁₀ (Suspended dust PM 10) significantly exceeding the standards. Practically everyone breathes air containing benzo(a)pyrene.

Sources of air pollution

Air pollutants are all substances in the form of gases, liquids or solids (dust), which are not its natural components or occur in concentrations higher than natural.

In the past, the only source of pollution was natural processes, such as: volcanic eruptions, forest fires, atmospheric discharges and the decomposition of organic substances. As a result, these produced: carbon monoxide (II), nitrogen oxides, methane, dust and volcanic gases, e.g. Carbon monoxide.

For many years, societies have believed that it is the industry operating in a given area that is responsible for air pollution. The development of the automotive industry and other industries has increased the demand for energy produced from raw materials such as crude oil, natural gas and hard coal. During their combustion, oxides of carbon, sulfur and nitrogen are formed.

The concept of pollutant emissions is inherently associated with tall chimneys of industrial plants. In fact, urban and rural residents emit significant amounts of pollutants into the air during the heating season, such as PM₁₀, PM_{2.5}, carbon dioxide or hydrocarbons, as well as benzo(a)pyrene. The largest exceedances of pollution standards are due to the combustion of solid fuels in domestic stoves and boilers, as a result of burning garbage (which is considered pathological behavior) and due to the increasing number of cars on the road. In places where pollutant concentration standards are exceeded, smoking in boilers and stoves during the heating season is responsible for almost 60% of the concentration of PM₁₀ particulate matter and 74% of benzo(a)pyrene.



Changing this state requires extensive environmental education on air protection. Increasing public awareness of the impact of air quality on health and the impact of each person on air quality is necessary to achieve the desired effects and change the situation in the perspective of several years. Achieving this is one of the goals of effective environmental education.

Effects of air pollution

Air pollution has a negative impact on the natural environment. Their most dangerous effects are: acid rain, intensification of the greenhouse effect, ozone hole, smog, dust, soil and water pollution. Research shows that in the 20th century the temperature on the surface of our planet increased by 0.6°C.

- 1. Acid rain** is formed when air polluted with sulfur and nitrogen oxides, combining with water or water vapor contained in the air, falls with rain or snow to the ground. This precipitation causes environmental damage, accelerates the corrosion of metals and the destruction of buildings.
- 2. The greenhouse effect** occurs as a result of the accumulation of carbon monoxide and water vapor (as well as methane, nitrogen oxides, CFCs and ozone), which trap heat in the atmosphere. The result is global warming, which can lead to melting of glaciers, rising sea and ocean levels, and climate change.
- 3. Ozone hole** - In the upper atmosphere, at altitudes between 15 and 50 km, our planet is surrounded by an ozone layer (O₃). It is a natural sunscreen that protects the Earth from excessive ultraviolet (UV) radiation. This radiation is necessary for the production of vitamin D in our body, but its excess can contribute to the reduction of the body's immunity and cause skin diseases and even skin cancer, increase in air temperature and climate change.

As a result of environmental pollution, especially in spring over Antarctica and to a lesser extent over the Arctic, the ozone layer becomes thinner and the so-called ozone layer is formed. Ozone hole, through which a significant part of harmful radiation reaches our planet.

Ultraviolet radiation is invisible and imperceptible to us. Burning and pain caused by its excess is a reaction to skin damage. Therefore, you should:

- limit the time spent in the sun in the summer months;
- wear clothes made of thicker, dense fabrics, with long sleeves and legs (average cotton fabric blocks only 20-30% of UV radiation);
- wear a peaked cap or a wide-brimmed hat;
- wear sunglasses with UV filters;
- use creams with UV filters.



- 4. Smog** – Pollutants, the main sources of which are car exhausts, heavy industry and households (heating systems), combined with windless weather and high humidity - fog - create smog. Hovering over a city, smog is particularly dangerous for infants, the elderly, asthmatics, people with respiratory and circulatory diseases.

Based on the mode of formation, place of formation and chemical composition, a distinction is made between London smog (found mainly in the winter months) and Los Angeles type smog (found mainly in the summer months).

The impact of air pollution can have a significant impact on human health:

1. Sulfur dioxide SO₂

- irritation of the eyes, nose, throat;
- diseases of the upper respiratory tract;
- disorders in the circulatory system;
- destruction of vegetable dyes;
- acceleration of metal corrosion.

2. Nitrogen oxides (NO_x)

- irritation of the eyes, nose, throat;
- lung diseases;
- dizziness and headaches;
- destruction of many materials (e.g. alloys)

3. Carbon Monoxide

- highly toxic - even short-term inhalation can cause death

4. Dusts

Substances such as mercury, cadmium, lead and their oxides cause:

- allergies, diseases of the upper respiratory tract
- carcinogenic;
- dying of plants by blocking access to light.

Gaseous pollutants and dust clog the stomata of plants, penetrate inside the plants and destroy chlorophyll.

Air protection

The main sources of air pollution are industry and transport. Gases transported over long distances can contaminate areas far from the source of their emissions. Air protection is therefore a global issue and is regulated by legislation.



Measures to reduce emissions of harmful dust and gases into the atmosphere

- Reducing emissions from mining, metallurgy and power plants.
- Reducing the exploitation of natural resources, reducing electricity consumption and using alternative energy sources.
- Reducing emissions of harmful exhaust fumes by reducing transport, either by purchasing cars with lower emissions or using public transport or cycling.
- Using modern technologies in industry to reduce dust emissions.
- Planting green belts for conservation purposes.

Summary

Education goals

The main goal of environmental education in the protection of air and all elements associated with it must be:

- Indication of reasons why the air should be protected and ways in which it can be done to do it (sensitization to air quality problems is already attempted in children's and young people's education)
- Developing the ability to perceive phenomena related to air quality, including the impact of actions and decisions taken on the quality of the air, the effects of exposure to pollutants in the air and appropriate response in such situations (where to get information about air quality and what daily activities and choices affect the amount of pollution in the air?; how to monitor activities in your area?)
- Shaping the emotional attitude to air protection, including the impact of the air we breathe on the health of children, the elderly and the general public, on the destruction of historic buildings, on the degradation of the environment in which everyone lives
- Forming and strengthening positive beliefs and social attitudes based on awareness of the impact on health and comfort of life and the possibility of influencing the quality of air
- in their place of residence through social attitude and setting examples in the field of:
 - the impact of waste incineration in household hearths,
 - combustion in low-efficiency devices,
 - principles of efficient use of fuels and methods of reducing heat energy consumption,
 - promoting behaviors aimed at giving up the car in favor of public transport, bicycles,
 - principles of social responsibility and reacting to inappropriate behaviour, e.g. neighbors.



- Air pollution is global in nature. It can come from natural sources or be the result of human activity.
- Air pollutants include carbon oxides, sulphur oxides, nitrogen oxides, particulates, freons, among others.
- Adverse phenomena caused by atmospheric pollutants are the greenhouse effect, the ozone hole, acid rain and smog.

Consider how you can contribute to reducing atmospheric emissions.

Think about alternative energy sources.

In the second area of Air Quality, a common area of action is the introduction of electric cars or switching to bicycles in cities to reduce air pollution. On the other hand, “Clean Air” campaigns are carried out, in which polluted air is measured and old furnaces are replaced. All these activities should take place in Green City.

Recommendations for use in Green City are the following:

- In the application, users can return old cars and buy electric ones, checking the costs of purchase and consumption.
- Introduce to Green City sensors measuring air pollution in the area (these can be links to existing applications and websites);
- The automated bus may be one of the facilities included in the Cities Going Green app. Its external appearance (shape, design, colour) is quite attractive to students because it looks like a toy. This can be one of the objects that students ‘unlock’ during the game, earning money or experience points. By clicking on an object, users could read a short description of the object, understand the application and benefits. The fact is that the inclusion of real green solutions that have been tested and their value has been scientifically proven adds value to the application and makes it realistic.
- Students connect the building to a heating or gas network, invest in a new generation of a boiler and high-quality fuel or other modern heat source, plant trees, prepare a leaflet for neighbours “People who burn waste also hurt you.”

Green Energy

Green energy is a term for energy that comes from renewable sources. Green energy is often referred to as clean, sustainable, or renewable energy. The production of green energy doesn’t release toxic greenhouse gases into the atmosphere, meaning it causes little or no environmental impact. For an energy source to be considered green energy, it must fall within the ranges of zero, low or neutral in greenhouse gas emissions during energy generation and operation.



Green energy comes from natural resources like water, wind and sun, which provide the energy we turn into electricity.

More specific the renewable sources of energy are:

- Solar energy
- Wind power (Wind is the cleanest energy source, as it reduces our reliance on fossil fuels and the amount of dangerous CO₂ that pollutes the air).
- Hydropower
- Biomass
- Geothermal
- Tidal energy

As everyday energy consumers, we all should know where our energy is coming from and its effect on the environment.

There are many reasons why we as a society should focus on green resources of energy. First of all, green energy sources are environmental friendly as they have no greenhouse gas emissions and the natural resources of the earth are not extracted so the earth stays mostly intact. In addition, green energy is better for our physical health as it is far less responsible for polluting our air and water. According to the World Health Organization, household and ambient air pollution causes 4.2 million deaths around the world annually. Another advantage of green energy is that the naturally occurring resources used to harness this renewable energy will not deplete over time. Last but not least, by increasing the usage of green energies such as solar panels, wind turbines and other technologies we are reducing our dependency on non-renewable resources such as natural gas and oil which are determined to run-out at some point.

In the third area of Green Energy, the common area of action is the storage of renewable energy and its use in intelligent buildings in the next area. And this is also where the idea of an electric car comes in.

Recommendations for use in Green City are following:

- Storing renewable energy and using it at the lowest point guarantees the lowest price for the consumer - we could bear that in mind when using the practice ideas in the game.
- In the app you can find buildings for improvement and install solar installations in them.
- An option in the application may be to use an electric car instead of a traditional one. It is important for the character to save money first, we want the application to be realistic and not let the children have false ideas that it is easy for everyone to buy an electric car.



In fourth area concerning Buildings, the common area of action is the construction of sustainable energy buildings.

Recommendations for use in Green City are the following:

- Buildings in an application may have a start-up phase where their energy efficiency is not desired. As a result, the player (apprentice) will spend more energy just for building certain buildings. Through modernization, the basic structure of buildings can be retrofitted into more energy-efficient and environmentally friendly buildings with intelligent systems and functions and lower energy and water consumption. This can only be applied to one or two refurbishments where optimal energy efficiency of the buildings in the city will be achieved.
- One of the basic principles of design is to ensure accessibility for people with special needs one of the tasks of the application can be to transform an old building into a new 'greener' and 'smarter' one. Primary school children are not aware of what it means to have green buildings and what they can do.
- We could somehow incorporate what the European Union has committed to - the "3 times 20 target" - 20% less greenhouse gases, 20% better energy efficiency and 20% renewable energy - to build a safe and cleaner energy future.
- For example, it could be a good suggestion that different primary school students design a sustainable building through drawing, and other older students, for example those who participated in the final project, try, if possible, follow the draft of these proposals that the children folded. Students (in this case from the university) participated in this proposal, various students from the project partner schools were able to present their students' proposals for the design of sustainable buildings so that they could be included in the application and be part of the atmosphere of the video game.

In fifth area related to water quality, the common area of action is measuring the quality of this water, information campaigns about the possibility of using e.g. the so-called grey water. At the same time, there was a proposal to introduce the concept of a non-governmental organization and the scope of its activity into the application.

Recommendations for use in Green City are following:

- When it comes to integrating the practice into the application, students might be able to install irrigation or other drinking water saving systems to provide city dwellers with more drinking water. Other uses / practices may also affect the availability of drinking water in the city. Thus, gray water irrigation and other practices can help increase access to drinking water for city dwellers.
- In the game, players could have a list of choices that affect water quality.



- For example, in an application, you could create a cross-reference section to contact NGOs struggling to achieve a more sustainable world. That way, all users who downloaded the app could write to them if they were interested. It would also be nice if some of the buildings in the game had signs advertising all of these NGOs.
- The water quality indicators that are used in the app can also be used as indicators in the Cities Going Green app. It would be nice if the application, even if it is aimed at children, is not childish and uses realistic elements, real data and measurements as much as possible. This will be an added value for the Cities Going Green app.

In sixth area relating to public transport, bicycles are reappearing, unmanned electric minibuses are reappearing, and buses with roof gardens are running around the city.

Recommendations for use in Green City are:

- GREEN CITY residents switch to bikes after receiving a subsidy for their purchase.
- Playing Smart City can be very beneficial for increasing awareness of CO₂ related issues. There may be options in the game to use regular public transport and CO₂ neutral public transport and see the difference in use in numbers or some kind of meter.
- The elements of the application can be elements of the Cities Going Green application, for example: We can have a bar at the top of the screen showing air pollution, then our character can decide what means of transport to use and see the difference in CO₂ emissions. We may also have challenges that may win badges (walk 5 km or use the bus instead of the car etc.).
- Smart City solutions in Radom use intelligent and innovative solutions based on digital technologies that can be used in the project. Students learn about investment methods that can translate into a modern organization of the city's functioning. Creating a holistic system that, through its efficiency and pro-ecology, leads to a higher quality of life for residents.
- Using CO₂ neutral public transport in Smart City can be very beneficial in increasing awareness of CO₂ related issues. There may be options in the game to use regular public transport and CO₂ neutral public transport and see the difference in use in numbers or some kind of meter. Buses with roof gardens will run through the GREEN CITY.

In seventh area concerning the quality of life, the activities concern environmental education in various forms. The app must be designed for educational situations.

Recommendations for use in Green City are following:

- An Ecological Centre may function in Green City.
- In Green City, we could 'build a house' as in best practice with sensors (see Impact).
- One of the actions implemented in the game is gaining "experience points" by the user by:



- Participating in an environmental awareness campaign
 - Organize your own campaign
 - Take individual action
 - Take part in a community action.
- Another idea for the app is to have a bar, similar to in games, indicating the happiness level of the inhabitants based on certain criteria set in the game. The greener the city, the happier the inhabitants, the more they learn and the more actively they raise environmental issues, the happier they are.
- The application can organize meetings between users to clean up a city or area.
 - Educational situations are designed in Green City, responsibility for decisions is taught, parents of children are involved in activities, they are involved in environmental protection work in the immediate vicinity.

Water Quality and Consumption

Water Quality and Management was characterized as a crucial topic toward environmental sustainability by the consortium of the Cities Going Green project.

The importance of water quality and access for the wellbeing of humans is extremely significant, since “absent, inadequate, or inappropriately managed water and sanitation services expose individuals to health risks” (WHO, 2022).

This particular topic is aligned with the United Nations’ Sustainable Development Goals 2015-2030. Some of those goals are SDG 6: Clean Water and Sanitation, SDG 12: Sustainable Consumption and Production and SDG 14: Life Below Water. (UN, 2022) Those Sustainable Development Goals also have an impact on other SDGs and other threats that need to be addressed.

Water Quality and Management involves both the access to potable water and water conservation. Nowadays, water scarcity is either a reality or a visible threat in many countries.

UNICEF (2022) exhibits some truly worrying facts regarding water scarcity and signifies the fact that water scarcity should be considered a serious global threat:

- Four billion people — almost two thirds of the world’s population — experience severe water scarcity for at least one month each year.
- Over two billion people live in countries where water supply is inadequate.
- Half of the world’s population could be living in areas facing water scarcity by as early as 2025.
- Some 700 million people could be displaced by intense water scarcity by 2030.
- By 2040, roughly 1 in 4 children worldwide will be living in areas of extremely high water stress.

In addition, the quality of potable water is compromised because of the negative impact of human activity.



This applies both for water used by humans but also to life underwater. Oil spills, agrochemicals and plastics are some of the modern threats toward the sustenance and balance of food chains and the wellbeing of life underwater (WWF, 2022).

“Whether we live near or far from the ocean, our lives depend on it” (WWF, 2022).

Buildings

Urban design

Urban design is the design of towns and cities, streets and spaces. It is the collaborative and multi-disciplinary process of shaping the physical setting for life – the art of making places. Urban design involves the design of buildings, groups of buildings, spaces and landscapes, and establishing frameworks and procedures that will deliver successful development by different people over time.

Urban design:

- Defines the nature of buildings and the spaces between them.
- Defines how the design itself should be worked out: design processes and outcomes.
- Inspires, illustrates and defines how a place could be improved or protected to bring benefits to investors, developers and wider society.

Urban design draws together the many strands of place making, environmental stewardship, social equity and economic viability into the creation of places with distinct beauty and identity. It creates a vision for an urban area and then deploys the resources and skills needed to bring the vision to life.

Green architecture

Green architecture, or green design, is an approach to building that minimizes harmful effects on human health and the environment. The “green” architect or designer attempts to safeguard air, water, and earth by choosing eco-friendly building materials and construction practices.

Green architecture defines an understanding of environment-friendly architecture under all classifications, and contains some universal consent. It may have many of these characteristics:

- Ventilation systems designed for efficient heating and cooling
- Energy-efficient lighting and appliances
- Water-saving plumbing fixtures
- Landscapes planned to maximize passive solar energy



- Minimal harm to the natural habitat
- Alternate power sources such as solar power or wind power
- Non-synthetic, non-toxic materials
- Locally-obtained woods and stone
- Responsibly-harvested woods
- Adaptive reuse of older buildings
- Use of recycled architectural salvage
- Efficient use of space

While most green buildings do not have all of these features, the highest goal of green architecture is to be fully sustainable. The overarching goals of building “green” are to reduce the social and environmental impacts of the built environment while improving the quality of life for occupants within buildings.

Green buildings

Green buildings are made in accordance with the principles of green architecture. They are designed, constructed, and operated with a focus on conserving energy, sourcing eco-friendly/recycled materials, and preserving the biodiversity of the area.

Think solar panels, commercial composting toilets, and rainwater harvesting. Also, consider things like improved resiliency guidelines that account for natural disasters to create longer-lasting buildings. These initiatives are becoming more commonplace, and they all represent ways that infrastructure can minimize its environmental footprint.

Certified groups and individuals come together to make green buildings a reality. The process begins even before breaking ground with site surveys for topography, drainage/soil samples, and sun patterns. The role of architects and engineers might be to design a natural ventilation system to offset air conditioning use, then to work with builders and local organizations to source sustainable materials.

Once constructed, building tenants play their part to minimize their own energy, water, and general resource use within the structure. Each group fulfills an important role in making the building more environmentally friendly.

Smart buildings

A smart building is an implementation of a smart (connected) world. A smart world, like a smart building is, for the most part, only different from the IoT (internet of things) in name; both the IoT and smart worlds share the same frameworks, benefits, and challenges. The subtle difference between the generic IoT and a type of smart world is that a smart world



usually describes the usage of an IoT network in a specific implementation or industry, in this case, a smart building.

Smart buildings include private homes, offices and commercial buildings, workplaces, and factories and warehouses.

Smart buildings deliver actionable information about a building itself or a specific room inside it so that owners or tenants can better manage it. The term smart building usually refers to commercial buildings, while the term smart home usually refers to private residences, but much of the functionality is the same and so the terms overlap.

The goal of creating a smart building is to reduce operating expenses, improve occupant comfort, automate energy consumption management, track the status of core building assets, and meet global regulations and sustainability standards in the industry.

To be effective, smart buildings require complex monitoring of the IoT networks that control the building system.

Public transportation

Addressing sustainable mobility from the school environment is quite a challenge. It is not a question of working on road safety education, but of committing to an education on mobility understood from the perspective of respect, responsibility and autonomy. In other words, education on mobility is also the education on human values, since we have to commit to the collective well-being and understand the mobility needs and possibilities for each citizen.

Sustainable mobility is characterized by the set of trips that are made with the purpose of traveling the distance from the place of origin to the destination, reducing the produced negative impact on the environment. It concerns both public transport (buses, the metro, train, tram, etc.) and private (pedestrian, bicycle, scooter or electric any vehicles, etc.).

The increase in greenhouse gas emissions caused by transport is of increasing concern, especially in cities, where air pollution rates are beginning to be considered a risk to public health. Sustainable mobility contributes to reducing harmful emissions, and therefore, to reducing air pollution and improving air quality in cities.

Transport has a very considerable weight in the framework of sustainable development due to environmental pressures, the associated social and economic effects and the interrelation with other sectors. The continuous growth that this sector has been experiencing in recent years and its foreseeable increase, even considering the change in trend due to the current situation of generalized crisis, make the challenge of sustainable transport a strategic priority at local, national, European and even global level.

Transport negatively influences the environment in two ways. On the one hand, the pollution caused is one of the main causes of the so-called greenhouse effect (also affecting climate



change) and the emission of toxic substances into the atmosphere has a detrimental impact on our health. On the other hand, the need for new transport infrastructure (highways, railway lines, ports) is imperative, in an effort to reverse or tackle the aforementioned dangers.

Sustainable mobility: good habits to adopt on a daily basis

- A distance which needs 20 minutes of walking to be covered should not be considered as a reason to use conventional and harmful means of transport (just over 1.6 km).
- A 30-minute bike ride (i.e. 9 km) can be used to go shopping or to work.
- 2 hours by train for a business trip and 4 hours by train for a weekend trip are cheaper and more environmentally friendly than the plane.
- Share the car, for example with your co-workers.
- Adopt an efficient driving style: the way you drive also influences fuel consumption.

What are the sustainable transports of the future?

- In recent years, along with traditional bicycles, rollerblades and skateboards, many new forms of transportation have appeared.
- The electric bicycle increasingly replaces the car in medium distances, reducing CO₂ emissions by 100, but also costs.
- The electric scooter emits less CO₂ than the car but more than public transport. In many cases, people prefer not to replace the car with a scooter, but they do so in the case of the use of a bicycle, the bus, the subway or even walking.
- The hydrogen vehicle is a new type of transportation that is increasingly promoted by cities, especially for buses. It must be equipped with fuel cells, which allow hydrogen to come into contact with oxygen and create electricity.

Main goals

- Work on students' previous knowledge to promote reflection on the most important problems of mobility.
- Make students aware of the importance of sustainable mobility and the environmental effect of the different types of transport
- Intelligently and efficiently optimize the use of materials, energy and information and minimize the environmental impacts of urban and interurban transport to meet the mobility needs of goods and people, both locally and globally.
- Reflect on the means of transport that facilitate our mobility and accessibility needs at all times, emphasizing those forms of displacement that contribute to respecting the environment.
- Encourage a critical and constructive spirit to seek possible solutions to the problems of their immediate environment, promoting travel on foot, by bike and by public transport.



- Know the main means of transport in your municipality and the consequences of their use, especially those related to the environment. Making contact with concepts such as carbon monoxide (CO), carbon dioxide (CO₂) and black smoke (HN)
- Produce, consume and move people and goods better, with less and less environmental impact.

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BEST PRACTICES IN THE PARTNER COUNTRIES:

Table 1. List of the examples of good practice by country with the proposal of inculsion in the CitiesGoingGreen application.

The table lists examples of good practice by country, and also proposes the inclusion of examples of good practice in partner penalties in the CitiesGoingGreen application						
Circular economy	Air quality	Green energy	Buildings (intelligent design, green architecture, etc.)	Water quality and water management	Public transport	Quality of life (happiness, green education in schools, etc.)
<p>Cyprus</p> <p>The Holistic Waste Management Program is a rational waste management method that aims to link waste generation to accounting. This means implementing the European Polluter Pays Directive. Citizens can significantly reduce the cost of the waste they pay for by putting the philosophy into practice: reduce, reuse, recycle, save</p> <p>limiting purchases to what we really need. We reduce waste and save money.</p> <ul style="list-style-type: none"> ● Much of the waste generated can be reused after repair or reconstruction ● Waste fees now depend on the amount of waste that is not sorted. In this way, environmentally conscious citizens who produce less waste and segregate it properly, save significant sums of money <p>Environmentally conscious citizens who generate less waste and separate properly save significant sums of money.</p> <ul style="list-style-type: none"> ● Keep the use of purple bags to a minimum. ● Easy and inexpensive production of natural fertilizer for plants and trees from their garden through home composting. The backyard compost bin is provided free of charge to any citizen who has a garden and is interested. 	<p>Car Scrappage POLICY Scheme where owners of cars that had been in use for more than 12 years could apply for a recall of their vehicle and in return receive a subsidy of between €7,500 and €12,000 to buy a new electric car with less than 50 grams per kilometre.</p> <p>The purpose of the car scrapping program in Cyprus was, among other things, to alleviating the very poor air quality in Cyprus by phasing out vehicles with high CO2 emissions and therefore more harmful.</p> <p>Best Practice Objectives:</p> <p>Replacing high CO2 emitting vehicles with less than 50g/km CO2 emitting vehicles.</p> <p>Promoting alternative methods of transport to the use of conventional cars</p> <p>Increasing the use of electric cars in Cyprus, which is still at a very basic stage.</p> <p>This practice can be addressed in the application through the following choice for users:</p> <p>In the case of cars, you could choose to use conventional or electric cars in your cities. Conventional cars will be cheaper, but in the long run they will have a negative impact on air quality in the city.</p>	<p>Hybrid storage systems will be used to retrofit facilities in existing buildings in the historic center of Aglantzia, which will be used by the municipality as a Center for Renewable Energy and Smart Solutions.</p> <p>The emphasis is on preserving the building's cultural heritage value and revitalizing historic buildings and settlements.</p> <p>A space to inform the public about the use of smart technologies in our homes that can offer a transition to a low-carbon economy and a high level of energy saving.</p> <p>For modernization of facilities in existing buildings</p> <ul style="list-style-type: none"> ● Development of an innovative hybrid energy storage concept for cooling and heating, as well as for the production of domestic hot water ● Increasing energy savings, leading to a reduction in greenhouse gas emissions and the use of fossil fuels, thus contributing to the EU's energy security. 	<p>The purpose of this subsidy scheme is to support SMEs and NGOs in transforming their organizations into more energy efficient and environmentally friendly entities.</p> <p>Best Practice Objectives:</p> <ul style="list-style-type: none"> ● Reducing the consumption of conventional, costly and energy-intensive devices and systems. ● Promoting the use of energy-saving and environmentally friendly systems, devices and devices. ● To lay the groundwork for wider implementation of such practices in workplaces and organisations. ● Reducing the energy level of the building by 35% or production processes by 30%. <p>A specific practice can be implemented as a building upgrade in a game/app.</p> <p>Buildings in the application may have an initial phase where their energy efficiency is not desirable. As a result, the player (apprentice) will use more energy just for building certain buildings.</p>	<p>Best Practice Objective:</p> <p>The plan's broader objective was to prevent the consumption and use of drinking water for purposes other than drinking.</p> <p>Best Practice Objectives:</p> <ul style="list-style-type: none"> ● Promoting options that can lead to the protection of drinking water ● Use of greywater that would otherwise go unused ● Reducing the scarcity of drinking water in the implementation area, Cyprus <p>drinking water and gray water can be explained to students.</p> <p>In terms of integrating practice into the app, students could have the option to install irrigation or other drinking water saving systems so that city residents have more drinking water.</p> <p>Other uses/practices may also affect the availability of drinking water in the city.</p> <p>In this way, greywater irrigation and other practices can help increase access to drinking water for city residents.</p>	<p>The Cyprus Ministry of Transport, Communications and Works has issued a grant scheme to promote bicycle use to interested applicants in the country. Under the plan, a citizen is entitled to a subsidy of up to €200 for the purchase of a bicycle. If the price of the bicycle is below €200, the applicant receives the full amount needed for the purchase, while in any other case, the applicant is asked to pay the rest of the amount if it exceeds €200.</p> <p>the order of priorities was respected. More specifically, the first-come, first-served method was implemented because the demand for the subsidy scheme was higher than the available budget.</p> <p>The aim of the plan is to promote the use of bicycles as an alternative means of transport, in the use of cars and other conventional means of transport. This will reduce CO2 emissions and thus improve air quality. In addition, this practice is a great way to promote cycling as a great way to exercise while being more environmentally responsible.</p>	<p>The city's Ecological Center can organize various events and competitions where children have to answer a few questions. As part of the badge, they can make the Library or the Exhibition available free of charge.</p> <p>Best Practice Objectives:</p> <ul style="list-style-type: none"> ● Informing about the flora and fauna of the area, but also about the rocks that make it up, through a small path and exposition of models of important forest habitats (plants, animals) with access for people with disabilities - touch system for the blind ● Promoting the protection of important habitats by working with government departments or organizations ● Promoting the use of European Funds to preserve community traditions ● Strengthening the preservation of the region's culture through sustainable activities <p>Access for people with disabilities - tactile system for the blind for the exhibition in the center</p>



Co-funded by the European Union





<ul style="list-style-type: none"> The paper waste collection service is provided free of charge to the public. The collection is made in a special biodegradable paper bag. The municipality, through the stream of large-size shipments, provides a list of licensed carriers who will transport waste to Green Point for a small fee <p>Different recycling streams – give them a free compost bin as the Municipality does.</p>	<p>On the contrary, electric cars will have a higher initial cost and will require charging stations in the city. However, the long-term impact on the city will be more favorable and will be in the city's interest, both in environmental and financial terms.</p>	<p>The energy storage is a large battery with a capacity of 500 MW, which we plan to build in the shell of Paldiski. If more renewable energy is produced than consumed, the energy storage stores the renewable energy by pumping water from underground reservoirs into Paldiski Bay.</p> <p>Best practice objective: Create the preconditions for an environmentally friendly, uninterrupted and affordable energy supply.</p> <p>Best practice objectives: security of supply or energy security;</p> <ul style="list-style-type: none"> affordability and environmental savings. <p>Storing renewable energy and using it at the lowest point guarantees the lowest price for the consumer – we could keep this in mind when using in-game practice ideas.</p>	<p>Thanks to retrofitting, the basic structure of buildings can be upgraded into more energy-efficient and environmentally friendly buildings with smart systems and functions and less energy and water consumption. This can only be applied to one or two renovations where the optimal energy efficiency of buildings in the city will be achieved.</p>	<p>CWPharma will provide decision-makers, authorities and municipalities with tools and recommendations on the best ways to reduce emissions of active pharmaceutical ingredients (APIs) in the Baltic Sea region. The project focuses on filling the knowledge gaps identified regarding pharmaceuticals in the Baltic Sea. Best practice objective: Reducing emissions of active pharmaceutical ingredients (API) in the Baltic Sea region.</p> <p>Best Practice Objectives:</p> <ul style="list-style-type: none"> optimizes advanced wastewater treatment processes and online control systems and shares knowledge at BSK Advanced wastewater treatment techniques can be used more generally to remove pharmaceuticals from wastewater. 	<p>Through innovative and transformative approaches, they enhance the development and well-being of the people living in these communities with educational information</p> <p>Promotion and preservation of the culture of the area.</p>
<p>Estonia</p> <p>Eesti Energia has developed and introduced a unique and efficient technology for the production of Enfit shale oil, which enables the effective use of broken old tires as a raw material as a result of technological development. Old tires are a good raw material for oil production, because one ton of tires contains about three times as much energy as one ton of oil shale. Thanks to the Enfit technology, up to 10% of oil shale can be replaced with used tires and used to produce oil, gas and electricity. Eesti Energia is also exploring the possibility of reusing other organic petroleum residues (e.g. plastics, waste oils) in the pyrolysis process for the production of new products. Therefore, in the future, the current shale oil plants should develop into important chemical waste treatment plants that will play a key role in the circular economy.</p> <p>Best Practice Objective: To reduce your carbon footprint</p> <p>Best Practice Objectives:</p> <ul style="list-style-type: none"> Lower oil shale production Reuse of tire materials Less landfill contamination by tires 	<p>Since spring 2016, in addition to the monitoring stations, the e-Ninad network has been installed in Muuga Harbour, which consists of 21 odor sensors and complements the existing air quality monitoring system. With the introduction of e-Ninad (e-noses) it is possible to obtain additional information on what gas mixtures are coming from the company (including those located outside Muuga port) so that oil product transshipment companies can take their own measures to minimize unpleasant smell. The e-Ninad project was launched as part of a working group to improve air quality in the area. It is a joint project of oil terminals operating in Tallinn Port and Muuga Port. Best Practice Objectives:</p> <ul style="list-style-type: none"> continuous measurement of air quality automatic notification of competent authorities in case of concentrations exceeding the limit value making the collected data available to the public on an ongoing basis 	<p>POWER HOUSE The Nearly Zero Energy Challenge is an international cooperation project aimed at increasing energy efficiency, which covered a large part of the European Union. Europe, European</p> <p>As the name of the project suggests, the most important challenge for the network organizations was to promote the topic of nearly zero-energy buildings in different Member States.</p> <p>In this context, Housing Europe, with the support of the Intelligent Energy Europe programme, launched the "POWER HOUSE almost zero energy" challenge, initiatives to provide a structure for pan-European knowledge exchange between housing practices, to learn from each other about the practical implications and costs of ambitious energy performance codes, and to inform decision-makers on the results of this exchange.</p> <p>We could see how put into play what the European Union has committed to - the "3 x 20 target" - 20% less greenhouse gases, 20% better energy efficiency and 20% renewables - to build a secure and cleaner energy future.</p>	<p>Sohjo Baltic is researching, promoting and piloting automated, unmanned electric minibuses in the public transport chain, especially in terms of first/last mile connectivity.</p> <ul style="list-style-type: none"> contains guidelines on the legal and organizational configuration needed to run such a service efficiently <p>The autonomous bus project will create knowledge and competences for the city, thanks to which we will be able to use public transport in an even more environmentally friendly and intelligent city in the future. It is an innovative solution that can become a pioneer in today's modern technological era and transport system.</p> <p>In the Smart City game, it can be very beneficial to raise awareness about CO2 issues. In the game, there may be options to use regular public transport and CO2-neutral public transport and see the difference in usage in numbers or some kind of counter.</p>	<p>The advantages of solar and wind energy have been talked about for years, but interestingly, these types of educational institutions are located mainly outside major cities. Another example of this is the reconstructed building of the Primary School in Väätsa. On the roof of the nearly zero-energy school building there are solar panels with a total power of 30 kW and a wind generator with a power of 1.5 kW.</p> <p>Students will be shown the best way to work with solar panels and wind turbines. For example, students can monitor the operation of a wind turbine from a monitor. They see the generator kick in when the wind speed reaches at least seven meters per second. How much electricity does a windmill produce? Best practice objective: To create a learning environment for meaningful integrated learning of practice subjects.</p> <ul style="list-style-type: none"> Practical understanding of how the physics of the environment affects our energy resources Learn how part A hands-on environment where students can apply their knowledge <p>STEAM abstract knowledge visualization</p>	



<p>The use of used tires in the oil industry is subject to many regulations and requirements. One of the biggest problems is related to the REACH registration of oil produced from a mixture of tire chips and oil shale. Applying for environmental permits and conditions related to the use of chips was difficult and time-consuming (including in connection with the adoption of the regulation on the disposal of used tires).</p> <p>To make the player aware of the possibility of reusing old tires instead of throwing them into a landfill, there could be a so-called tire collection point in the game. Each of these tires would reduce the CO2 indicator, for example, but of course it will not replace CO2 pollution unfortunately.</p>	<p>The ambitious four-year CITYMOBIL2 project deployed two fleets of six 10-passenger driverless vehicles in Italy, France, Switzerland, Finland, Greece and Spain. In these vehicles, equipped with location and perception systems, on-board computers were installed to process data and make decisions regarding vehicle control. The vehicles successfully communicated with a centralized management system that made decisions at the fleet level, assigning missions to each vehicle based on transport needs.</p> <p>In the Greek city of Trikala, the vehicles ran six days a week (Tuesday to Sunday), twelve hours a day, and were programmed to run on scheduled and alternate routes on red and blue lines.</p> <p>European cities face four major mobility challenges: congestion, land use, safety and the environment. One of the main causes of such problems is the car ownership rate. The centers of large cities solve this</p>	<p>The Volkswagen Group and Greece have agreed to create a groundbreaking mobility system on the Mediterranean island of Astypalea. New mobility services such as vehicle sharing or carpooling will help to reduce and optimize traffic. The energy will be generated primarily from local ecological energy sources, such as solar and wind energy.</p> <p>Best Practice Objective: The main goal of the project is to create a model island of climate-neutral mobility.</p> <p>As for the Astypalea: Smart and Sustainable Island project, islanders will be able to take advantage of a special subsidy and preferential prices to buy the electric vehicle they want.</p>	<p>Cosmote e-Value, a fast-growing contact center, wanted to cover its housing needs and offer employees the best place to work. In accordance with the environmental strategy of the OTE Group and the Management Board's commitment to planning and implementing projects in accordance with the principles of sustainable development, a modern contact center was established in Kerameikos.</p> <p>OTE Estate carried out the entire renovation, taking into account international standards.</p> <p>The environmentally friendly design of the COSMOTE e-Value "green" building was designed to improve the performance of several indicators, such as energy consumption and near-zero environmental impact.</p>	<p>The Association of Municipal Water Supply and Sewerage Companies, developed and launched the Information System for Monitoring the Quality of Water for Human Consumption. It is an online system that allows water companies to record the results of laboratory analysis of drinking water. It is a tool for continuous monitoring of water quality for human consumption.</p> <p>The purpose of this app is to inform citizens about the quality of the water they consume in an area, whether they live in or visit the area.</p> <p>The mobile phone application contributes to the reliable information of Greek citizens, but also tourists about the quality of drinking water in our country in order to increase confidence in the consumption of tap water. The water quality app is available on all devices.</p>	<p>RQuality was funded and initially implemented as part of the ICARUS H2020 project. ICARUS (Integrated Climate Forcing and Reduction of Air Pollution in Urban Systems) Users are informed about how their lifestyle affects their carbon footprint and the health impact of their consumer activities/choices. The fact that citizens are actively involved in the development of greener cities with clean air by controlling their own actions and behaviors and their impact on the environment.</p> <p>According to customer reviews, the app often has problems working on iOS.</p> <p>The elements of the application can be elements of the Cities Going Green application, for example: We can have a bar at the top of the screen showing air pollution, and then our character can decide what means of transport to use and see the difference in CO2 emissions.</p>	<p>The initial investment can be high and requires the involvement of school management.</p> <p>In the Green City we would „build a house“ as in the given best practice with sensors (see Impact)</p>	<p>Greece</p>	<p>Tilos is the first Zero Waste Island. All waste produced at Tilos is collected and managed in a completely circular manner to eliminate its impact on the environment.</p> <p>The program uses: Blue Bag: The specially designed blue bag is a trademark of JGZT. It is in every household and recyclable materials are stored there. It has a unique QR code, thanks to which the volume of the materials contained in it can be easily recorded after they are weighed on receipt. In this way, every household can easily monitor the level of recycling.</p> <p>App zero: With this app, every household in Tilos can monitor and track in real time the waste cycle they produce and how much of it turns into organic waste or is recycled. In this way, he can set new goals and improve his performance without waste.</p>	<p>Experimental School, the education department, runs classes and biometrics programs in elementary schools that address environmental education and sustainable development. Water, recycling, animal protection, energy urban gardening</p> <p>Best Practice Objective: The aim of the program is for students to get in touch with the concepts of the environment through experiential activities.</p> <p>The aim of the program is: Thanks to their approach, knowledge becomes not only understandable, but also a way of life. One of the actions implemented in the game is that the user gains "experience points":</p> <ul style="list-style-type: none"> • Participating in an environmental awareness campaign • Organize your own campaign • fake individual action
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<p>Door-to-door: A modern fleet of purpose-built vehicles collects and weighs waste from every household and business in Tilos, then transports it to the newly established 3K Circle Innovation Center.</p> <p>Circular Innovation Center 3K: The old landfill has been transformed; it has been cleaned, equipped and now operates as a Circular Innovation Center.</p> <p>Waste is transported here for further sorting and processing for recycling and conversion of bio-waste into fertiliser. The rest is reused or prepared to convert waste into energy.</p> <p>Zero point: Zero Point is located in Livadia, right next to the port of Tilos. This is the place where you can learn more about JGZI, collect equipment, train, get information about the results of the program and find items and gifts made from materials previously considered waste.</p> <p>Upcycling: At Tilos, old furniture or appliances that no longer work, old clothes and fabrics are collected and transported to the Creative Upcycling Center to either be repaired for reuse or become raw material for art and creation.</p> <p>Best Practice Objective:</p> <p>The aim of the best practices is to help the island of Tilos become a zero-waste island. All waste produced at Tilos is collected and managed in a completely circular manner to eliminate its impact on the environment.</p> <p>Best Practice Objectives:</p> <ul style="list-style-type: none"> Elimination of landfills and public dumpsters. Source sorting and door-to-door collection. Compose, recycle and reuse. <p>On the island of Tilos, everyone can take part in the program. Residents and local businesses can:</p>	<p>problem by combining efficient mass transit with policies to reduce car traffic, but peripheral areas and smaller cities remain dominated by private cars.</p> <p>CityMobil has demonstrated how the automation of road vehicles can lead to different transport concepts, from semi-automated car sharing systems that can make urban mobility more sustainable.</p> <p>However, CityMobil also highlighted three main barriers to the deployment of automated road vehicles: the implementation framework, the legal framework, and the unknown broader economic impact.</p> <p>With the spread of autonomous vehicles, travel is expected to become more comfortable and accessible to categories of users - the elderly, people with disabilities - that are currently excluded.</p> <p>Economy:</p> <p>Well-being/quality of life:</p> <p>Redesign of urban space: with fewer private cars in the city, it would be possible to use car parks for other purposes (offices, homes), leading to a new, high-quality urban fabric that is denser without creating the impression of higher density.</p> <p>Environment:</p> <p>Automated highway systems are the most promising technology to increase capacity and reduce CO2 emissions.</p> <p>The automated bus may be one of the features included in the Cities Going Green app. Its external appearance (shape, design, color) is quite attractive to students because it looks like a toy. This can be one of the objects that students "unlock" as they play, earning money or experience points.</p> <p>By clicking on the object, users could read a short description of the object, understand the ipt application and benefits.</p>	<p>Electric mobility and smart mobility will improve the quality of life while contributing to a carbon-neutral future. A holistic, ecological and sustainable action plan will have a positive impact on the daily lives of the island's inhabitants, combined with an innovative public transport system.</p> <p>Need for financing – Electric vehicles are very expensive.</p> <p>An option in the application may be to use an electric car instead of a traditional one. It is important for the character to save money first, we want the application to be realistic and not let children have false notions that it is easy for everyone to buy an electric car.</p>	<p>Best Practice Objective:</p> <ul style="list-style-type: none"> Improvement of working conditions. Reduction of harmful CO2 fluxes. Improvement of the work culture of users. Creating a healthy and safe indoor environment. Availability for mass transport. Facilitating the use of bicycles. Reclaiming the natural environment by creating accessible planting areas. <p>One of the basic principles of design is to ensure accessibility for people with special needs, one of the tasks of the application can be to transform an old building into a new "greener" and "smarter".</p> <p>Children in primary school are not aware of what it means to have green buildings and what they can do.</p>	<p>The water quality indicators that are used in the app can also be used as indicators in the Cities Going Green app. It would be useful if the application, even if it is aimed at children, is not childish and uses realistic elements, real data and measurements as much as possible.</p> <p>This will be an added value for the Cities Going Green app.</p>	<p>We may also have challenges that can win badges (walk 5km or use the bus instead of the car, etc.).</p>	<ul style="list-style-type: none"> Participate in community action <p>Another idea for the application is to have a bar, similar to the games, indicating the level of happiness of the inhabitants based on certain criteria defined in the game. The greener the city, the happier its inhabitants, the more educated they are and the more they actively address environmental issues, the happier they are.</p>
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<p>Spain</p>	<ul style="list-style-type: none"> Visit the Zero Point Information Center in the harbor yard to pick up your non-waste equipment Learn from the Just Go Zero Tilos team how to properly sort everything that is no longer useful to them. Sort waste and have it ready for the Just Go Zero Tilos team to collect directly from their door, on regular days and hours. Receive real-time information via the Just Go Zero app on how much has been recycled. <p>closed-loop waste.</p> <p>Applied solution that can be used by other communities in Greece and abroad to develop a circular economy and export environmental knowledge.</p> <p>An initiative that makes Tilos an international destination for sustainable tourism, creating a new paradigm for Greece.</p> <p>The Green City application can use zero-waste equipment, such as a blue garbage can or specially designed vehicles.</p> <p>Zero waste can be one of the goals/challenges of the game.</p>	<p>The fact is that incorporating real green solutions that have been tested and scientifically proven adds value to the app and makes it realistic.</p>	<p>In a plans of the city of Pontevedra it will foreseen to show the walking distance to the different parts. It was born following the purpose of showing to the citizens that sometimes they have a wrong perception about distances and that it's possible to reach the places without the need of using the car. This map includes the distances among 26 parts of the city and the approximate walking time to those places. It also has the location of public parking, stations, etc. It also promotes the use of the bicycle through the bicycle lanes and the free parking spots distributed around the city.</p>	<p>The overall goal of POWERTY is to increase the use of renewable energy sources in vulnerable groups.</p> <p>Improving the efficiency of social housing is a challenge due to the range of different ownership models in Europe and the lack of incentives for change. This practice demonstrates the benefits of assigning responsibility to a single agency that can identify buildings for improvement, specialize in the appropriate actions, and implement them on a large scale. In this case, they used subsidies</p>	<p>The Solar Decathlon competition is a competition organized by the US Department of Energy, convening universities around the world to design and build a prototype grid-connected energy self-sufficient home that works only with solar energy and uses technologies that allow for maximum energy efficiency. Climate change: Minimize the environmental impact of construction processes. Including comprehensive renewable energy solutions in architectural designs based on sustainable development criteria. Raw materials: Sustainable use of raw materials</p>	<p>Pozos sin Fronteras is a non-governmental organization that is of great importance around the world in terms of water treatment and the fact that wells are created and built in various underdeveloped countries. In addition, this is a great topic to be worked on in all schools today and the great strength of this NGO is being able to contact them to have a short conversation with schools to make students aware of this topic. This is rather little support that NGOs have today. As we know, these are non-profit organizations. Therefore, they need a lot of support from the population.</p>	<p>Barcelona City Council is promoting a strategic plan to introduce electric vehicles in the city, encouraging sustainable mobility and improving air quality by reducing fossil fuel emissions and encouraging local consumption, for the benefit of a positive urban life. Owning zero-emission vehicles in Barcelona diversifies its electric vehicle strategy, meaning you no longer need to be an owner to use them: they are working to connect the city's tram lines, they are involved in Bicing electric bikes, normalizing the use of personal mobility vehicles, and promoting a fleet increasingly low-emission buses, including a significant number of electric buses.</p>	<p>Let's do it! is a global civic movement in which people from all over the world are asked to jointly carry out local and/or national cleanup activities.</p> <p>Best Practice Objectives:</p> <ul style="list-style-type: none"> Find volunteers Look for places that need cleaning up If you want to organize one housekeeping event, you must inform us about it. Let's do it! They will help you with everything. They can provide you with a lot of useful know-how on organizing cleaning, as well as marketing materials to help you promote your event. You will receive
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<p>With this initiative, they intend to help the class convert waste into new useful items. https://www.hazloverde.es/concurso-escolar/</p> <p>Best Practice Objective:</p> <ul style="list-style-type: none"> ● Educational promotion of sustainable habits or responsible consumption. ● Launch a school learning activity program to work on the circular economy, understand responsible production and consumption. ● Turn students into greenfluencers, young people with great ideas, become agents of change in your environment. ● Work on the SDGs in a fun way, thereby achieving student engagement and meaningful learning. <p>Thanks to this school program, Leroy Merlin encouraged classroom activities, which he then posted on his website and proposed a competition for the best initiatives in social networks. It is worth highlighting the one from the third year of the Virgen de Gracia high school as part of the natural science subject, because it is related to the circular economy, giving a second life to the rubber bands of the masks, turning them into an elastic bag. They offer schools educational materials to facilitate and inspire participation in the competition. They offer tips, ideas, and lots of creative techniques to help students become mission masters. They offer 2 hands-on and visual teaching units to take to class with a primary focus on the circular economy and resource sustainability through videos to educate students in the classroom.</p>	<p>The last component of the programme is called "Way to School", within the traffic agents are the responsible to control the school zones. This was made with the idea of giving the chance to the students and kids for going by walking to the school and feeling their city as a safe and sustainable place. It is worth to underline that the map of the city of Pontevedra will show the walking distances to all the parts of the city.</p> <p>Objectives of best practice:</p> <ul style="list-style-type: none"> ● Show the walking distance of the different parts of the city. ● Encourage citizens to walk through walking. ● Promote a healthy lifestyle through walking. ● Use of the bicycle as a sustainable way of transport. <p>Easy to arrive to all the citizens. Cities Going Green: This map could be use in the Application for the Development of a Green and Smart City.</p>	<p>In addition, the installation for the production of solar thermal energy has an on-line and real-time monitoring system that allows you to know the operation of the system at any time, allowing you to analyze the consumption and efficiency of the installation.</p>	<p>Strategies for reducing non-renewable and primary energy in building materials: One of the main goals when designing a home is to use materials that require the least amount of energy to produce and generate the least amount of emissions possible. industrial. that it focuses on too specific a group of recipients. In other words, since it's something related to education, I think what I know could have been done was to broaden the age of the project and adapt the content and outputs to different age groups so students of other age ranges could benefit from it.</p> <p>For example, a good suggestion could be that various elementary school students design a sustainable building through a drawing, and other older students, for example those who participated in the final project, try to follow the design of those proposals as far as possible kids.</p> <p>For example, given that students (in this case, from the university) participated in this proposal, various students from the project's partner schools were able to submit their students' suggestions for designing sustainable buildings so that they could be included in the application and be part of the video game atmosphere.</p>	<p>For example, in the app you can create a section with links to contact NGOs that are fighting to achieve a more sustainable world. This way, all users who downloaded the app could write to them if they were interested.</p>	<p>- Making electric mobility the reference model for motorized transport, both private and collective, both in the city and around the world. Unusual buses with green gardens on the roof are the so-called "green transport" extension of the garden space in the urban environment, increasing the amount of carbon dioxide absorbed and giving public transport a new attractiveness.</p>	<p>a link to the World Clean Up Day knowledge bank to help you create a successful community event. Cities are cleaner, they have a better quality of life. This way you can be sure that more people will join your team. The app can organize meetings between users to clean up the city.</p>
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<p>Poland</p>	<p>The Individual Waste Segregation System (SISO) with the use of intelligent containers "T-Master ELMO" (Electronic Counter of Municipal Waste) is not only contactless containers for waste segregation, but the entire system enabling a multifaceted solution to the problem of waste collection in multi-family housing. Its main advantage is the lack of anonymity - it requires a unique code for each household to use the container. In addition, the solution is more hygienic because the containers open after scanning the code without having to touch the container. Also thanks to built-in surveillance cameras, 70.7% of residents declared a higher level of sense of security. Conscious segregation and the use of appropriate technology bring measurable benefits.</p> <p>In the future, it can bring financial benefits to every household that has a chance to reduce the fee for garbage collection through reliable segregation. Currently, it is the only tool thanks to which city authorities can obtain real-time data on the level of waste segregation in their commune or city.</p> <p>The project also provides for the launch of local raw material collection points, where residents will be able to transfer selected raw materials, e.g. aluminium, recycled paper or glass. Pursuant to the purchase principle, they will receive remuneration for each kilogram of pure fraction donated.</p>	<p>Co-financing the replacement of old and inefficient heat sources for solid fuel with modern heat sources that meet the highest standards and the necessary thermal modernization of the building.</p> <p>It is an investment in healthy and safe home heat, better air quality and ultimately lower expenses because modern appliances use less fuel.</p> <p>The aim of the "Clean Air" Program is to combat smog. Improving air quality and reducing greenhouse gas emissions by replacing heat sources and improving the energy efficiency of single-family residential buildings.</p>	<p>In Poland, there are government programs that support the development of Green Energy and reduce energy consumption, i.e. clean air faster replacement of old coal stoves with more ecological ones, purchase of photovoltaic panels and solar collectors, wind farms in the Baltic Sea, smart energy grid, hydrogen technologies and green cities.</p> <p>They are aimed at strengthening the energy sector through, for example, ecologically heated buildings. They support renewable energy sources and allow the development of new environmentally friendly technologies. However, these activities are insufficient and on a small scale.</p> <p>However, there are companies (not to mention private individuals who install photovoltaic panels) that are investing in "Green energy", because in the long term these new investments in large enterprises will have a significant effect in improving energy efficiency. It will be greener. Also in small and medium-sized cities, which will also significantly reduce the negative impact of industry on the environment.</p> <p>An example is the local company RADKOM, which focuses on RES. As a company dealing with the organization of a waste management system in Radom, the company found a solution to the problem of waste collected at the landfill, which did not bring any benefit to anyone, on the contrary, it was, among others, source of unpleasant odors.</p>	<p>Unfortunately, the idea of smart, greener cities is not popularized in the country. It is true that due to the COVID-19 pandemic, many matters and offices have moved to the Internet, in Poland there is still a long way to go to be called Smart cities, projects, green architecture.</p> <p>There are many solutions that can claim to be "intelligent", for example:</p> <p>Offices in applications, computers controlling traffic, street lighting and indicating free parking spaces, free city internet, integrated transport systems, wristbands monitoring health or portals for learning at home.</p> <p>Noteworthy are Intelligent Transport Systems. In Wrocław, the largest number of projects related to the smart city project is related to moving around the city. One of the key projects was the launch of the Intelligent Transport System (ITS) in 2014, under which 1,285 cameras were installed at 159 intersections in Wrocław. In addition, nearly 650 trams and buses have been equipped with on-board computers and detectors cooperating with the software.</p> <p>The ITS system is also coordinated with the Dynamic Passenger Information System. For most people moving around the largest Polish cities, but also smaller towns, electronic boards informing about the directions and real hours of departures of buses and trams are almost a norm. Moving around the city by public transport, both in Wrocław and m. in Gdansk, they also have the opportunity to see where the bus or tram they are waiting for is located. All you need to do is install the appropriate applications on your phone.</p>	<p>As part of ecological education, 23 students of the fifth grade of junior high school implemented a project entitled "Observation of lichens in the local environment as indicators of air purity - testing the concentration of sulphur oxides in the air for the local environment based on the scale of lichens".</p> <p>The project was carried out using the workshop method, covering 5 teaching hours, one lesson a week. Young ecologists checked the condition of the atmospheric air (concentration of sulphur oxides) in our city and its vicinity, based on the observation of lichens as bio indicators of air purity in sulphur oxides. The observation covered the growth of deciduous trees and shrubs on the main streets of the city, the school grounds, the city park and villages.</p>	<p>To meet the needs of the residents and the latest trends in the transport industry, the city of Radom has developed a strategy entirely devoted to electromobility and the possibilities of its development in the unit.</p> <p>The main assumption is the development of activities aimed at popularizing the idea of zero- and low-emission transport (electro mobile vehicles and vehicles powered by alternative fuels) and reducing the emission of gases harmful to the health of Radom residents, as well as reducing the level of noise generated by the transport sector in the city.</p>	<p>Development of the Urban Radom Functional Area (ROF)</p> <p>The main objective:</p> <p>Preparing local government units (bodies providing vocational education and training and other stakeholders) to take up the challenges of changing the economic structure as a result of the energy transformation.</p> <p>The implementation of the assumptions of environmental education in schools allows for a change in the way we look at the world.</p> <p>Designing educational situations that arouse the child's internal motivation for creative action, meeting his needs, teaching responsibility for decisions made,</p> <p>Involving parents in the implementation of the ecological program through their interest in this issue shapes co-responsibility for the natural environment, i.e. developing awareness of sustainable growth and development.</p>
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		<p>PPUH Radkom Sp. z o.o. however, he found a solution to the problem. Using the emission of biogas, which is generated as a result of the decomposition of organic substances in the deposit of the landfill, the Company started the production of electricity and heat.</p> <p>What is biogas? Biogas is a landfill gas, which is a mixture of various gases produced in chemical processes taking place in the landfill, containing from 40 to 65% methane, approx. 35% carbon dioxide and small amounts of oxygen.</p> <p>Scientists have long warned that such a mixture causes destructive changes in the natural environment, strongly contributing to increasing the greenhouse effect.</p> <p>That is why the idea of using biogas as an alternative energy source appeared a few years ago. The biogas-powered power plant built at that time by RADKOM was one of the first facilities of this type in Poland. Currently, after several years of operation, its functions have been taken over by a much more modern installation - a heat and power plant.</p>	<p>Virtual tickets and e-paper</p> <p>Since 2018, in Wrocław, apart from traditional paper tickets available in stationary machines at stops, there are also virtual ones available in machines installed in trams and buses. The Urbancard system automatically assigns the purchased ticket to the number of the payment card used by the passenger to make the purchase. For the 8.5-year contract under which the system will operate, the city paid the Mint of Poland almost PLN 174 million.</p> <p>In the case of the Gdansk application "Jestem z Gdańska", it is also possible to encode a season ticket on it, thanks to which the plastic card can be left at home, as well as to buy a one-time ride.</p> <p>In turn, in Warsaw, the first e-paper in Poland appeared at bus stops. It is tested at six stops. Each new board located at the stop consists of two parts. The first one contains the timetable of individual tram lines. The second informs about how many minutes the vehicle will leave. The information is refreshed every few seconds.</p> <p>Sounds almost like the description of any dynamic passenger information system. However, as Warsaw officials explain, this is a much more energy-efficient solution. The installed batteries allow the boards to operate for up to seven days, and they can also be powered by photovoltaic cells. In addition, digitally available timetables can be updated with just a few clicks. Traditional paper schedules in display cases had to be replaced manually.</p> <p>City and office in a cell</p>		
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		<p>Its task is to protect the environment through the recovery and processing of biogas generated in a landfill. The combined heat and power plant is the main element of the installation operating at the active landfill site.</p> <p>In the app children can invent what sort of trash can be reuse to get more coins/e-label.</p>	<p>Applications that are specific electronic versions of municipal offices are already standard in a large part of Polish cities. Krakow's "Urząd24", Poznan's "e-Urząd" or Białystok's "e-queue" are some of the many examples of platforms that can be used to submit applications, collect documents or book a place in the queue at the office.</p> <p>The largest Polish cities also create their own applications that are a contact platform between the local government and residents. An example of one of them is the "Smart City Poznań" application, which is used by approx. 10 thousand inhabitants. Thus, nearly 2 percent Poznan residents can report any failures, the location of a hole in the road or a poorly parked car with a few clicks.</p> <p>In the other direction, there are even messages about difficulties in moving around the city. Through the application, residents can also propose their own initiatives: ideas for cultural events or the location of recreational facilities, and then monitor where the submitted application is located in the official machine.</p> <p>The "19115" application, the "Krakowskie Centrum Kontaktów" application, the "Street Bump" application in Łódź operate on similar principles, and among slightly smaller cities, e.g. Gdynia's "Digital Resident Assistant".</p> <p>On the other hand, the Kraków application "Krakówpl" and the Łódź program "Odkoduj Łódź" function as a mobile city guide.</p>			
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CONCLUSIONS FROM THE ANALYSIS OF DOCUMENTS:

- The analysed projects present very well the situations that can be implemented in the Green City application.
- The proposals concern both the city model and detailed procedures, e.g. waste collection.
- The proposals for the application lacked, for example, vertical gardens.
- The application should be equipped with both an educational and executive part (performing individual activities, gaining new levels).

The application should include the possibility of involving young people in various information campaigns and competitions.

In the area of circular economy, the following projects were presented:

1. Holistic Waste Management Program is a rational method of waste management, the aim of which is to link waste generation with accounting. Citizens can significantly reduce the cost of the waste they pay for thanks to the practical application of the philosophy: reduce, reuse, recycle, save limiting purchases to what we really need. The project included ideas for: determining the amount of fees depending on the segregation of waste, minimizing the use of packaging (purple bags), the use of home composters, free collection of paper materials; **RECOMMENDATION - the application can use the method of waste management in accordance with the model presented in the project**
2. Eesti Energia has developed and introduced a unique and efficient technology for the production of Enefit shale oil, which enables the effective use of broken old tires as a raw material as a result of technological development. Old tires are a good raw material for crude oil production because one ton of tires contains about three times as much energy as one ton of oil shale. However, the project can be used in the game: **RECOMMENDATION: to make the player aware of the possibility of reusing old tires instead of throwing them in a landfill, there could be a so-called tire collection point in the game. Each of these tires would, for example, reduce the CO2 footprint, but of course it is not a substitute for CO2 pollution**
3. Tilos is the first Zero Waste Island. All waste produced at Tilos is collected and managed in a completely circular manner to eliminate its impact on the environment. The specially designed blue bag is a trademark of JGZT. It is found in every household and recyclable materials are stored there. It has a unique QR code, thanks to which the volume of the materials contained in it can be easily recorded after weighing them upon receipt. In this way, each household can easily monitor the recycling rate. Application zero: With this application, every household in Tilos can monitor and track in real time the cycle of waste it produces and how much of it is turned into organic waste or is recycled. In this way, it can set new goals and improve its performance without waste. **RECOMMENDATION:**



use the source sorting model and door-to-door collection, recycling and reuse, create a Zero Point Information Center, use the features of the Just Go Zero app. We can use zero in the game - used equipment, such as a blue garbage can or specially designed vehicles. Zero waste can be one of the goals / challenges of the game.

4. Intelligent containers allow you to supervise the correct segregation of waste in multi-family housing. The containers can only be opened after scanning the code, which the inhabitant sticks to the bag with previously sorted garbage. After throwing in the bag and closing the container, the waste is weighed and the data on the amount of fraction ejected is sent and saved in the central SISO system. Each household has an individual account in it. Sensors installed in the baskets monitor the level of their filling in real time, which is important from the point of view of companies emptying them and planning the route of collection vehicles. Direct preview of the current state of generated garbage will certainly affect the awareness of each of us and will enable self-control and optimization of the amount of garbage thrown away. **RECOMMENDATION: in the application, garbage is sorted and collected into Smart containers.**

This company offers a school program of educational activities aimed at students of primary and middle schools to work on the circular economy, responsible consumption (SDG-12) and encourages the attitude of improving our environment with their own hands in a creative and original way, turning the student into a protagonist . It proposes a competition adapted to the new educational law, and all educational materials are adapted to the curriculum. The program also includes workshops aimed at teaching students to respect ecological habits. **RECOMMENDATION: create a greenfluencer character so they can share their ideas on social networks.**

In the area of air quality:

1. **POLICY** Car Scrappage Scheme, under which owners of cars that have been used for more than 12 years could apply for a recall of their vehicle and in return receive a subsidy of between 7,500 and 12,000 euros to buy a new electric car with an emissions below 50 grams per kilometer. **RECOMMENDATION: in the application, users return old cars and buy electric ones, checking the costs of purchase and consumption.**
2. Since spring 2016, in addition to monitoring stations, the e-Ninad (e-noses) network has been installed in Muuga Harbor, which consists of 21 odor sensors and complements the air quality monitoring system used so far. **RECOMMENDATION: introduce to Green City sensors measuring air pollution in the area (these can be links to existing applications and websites).**
3. Automated vehicles (buses). **RECOMMENDATION** The automated bus can be one of the facilities included in the Cities Going Green application. Its external



appearance (shape, design, color) is quite attractive to students because it looks like a toy. This can be one of the objects that students ‘unlock’ during the game, earning money or experience points. By clicking on an object, users could read a short description of the object, understand the ipt application and benefits. The fact is that the inclusion of real green solutions that have been tested and their value has been scientifically proven adds value to the application and makes it realistic.

4. “Clean Air” is the first nationwide program of subsidies for the replacement of old stoves and insulation of single-family houses. The aim of the Program is to fight smog. Improving air quality and reducing greenhouse gas emissions. During the preparation for Green Cities, students can think about co-financing smoke exchange and heating the house. **RECOMMENDATION:** students connect the building to the heating or gas network, invest in a new generation of a boiler and high-quality fuel or other modern heat source, plant trees, prepare a leaflet for the neighbors “ People who burn waste also harm you”.

In the area of Green Energy:

1. Hybrid storage systems will be used to upgrade existing buildings in the historic center of Aglantzia, which will be used by the municipality as a Center for Renewable Energy and Smart Solutions. a space for informing the public about the use of smart technologies in our homes that can offer a transition to a low-carbon economy and high levels of energy savings. For modernization of facilities in existing buildings. **Development of an innovative hybrid energy storage concept for cooling and heating, as well as for the production of domestic hot water. Increasing energy savings, leading to a reduction in greenhouse gas emissions and the use of fossil fuels, thus contributing to the EU’s energy security. Storing renewable energy and using it at the lowest point guarantees the lowest price for the consumer - we could bear that in mind when using the practice ideas in the game.**
2. The energy storage is a large 500 MW battery that we plan to build in the Paldiski shell. If more renewable energy is produced than consumed, the energy storage stores renewable energy by pumping water from underground reservoirs into Paldiski Bay. **Storing renewable energy and using it at the lowest point guarantees the lowest price for the consumer - we could bear that in mind when using the practice ideas in the game.**
3. The overall goal of POWERTY is to increase the use of renewable energy sources in vulnerable groups. Improving the efficiency of social housing is a challenge due to the wide variety of ownership models in Europe and the lack of incentives for change. This practice shows the benefits of assigning responsibility to one agency that can identify buildings for improvement, specialize in relevant activities and implement them on a large scale. In addition, the installation for the production of solar thermal energy has



an on-line and real-time monitoring system that allows you to know the operation of the system at any time, allowing you to analyze the consumption and efficiency of the installation. **In the application, you can find buildings for improvement and install solar installations in them.**

The Volkswagen Group and Greece have agreed to create a groundbreaking mobility system on the Mediterranean island of Astypalaia. New mobility services such as vehicle sharing or carpooling will help reduce and optimize traffic. The energy will be generated primarily from local green energy sources such as solar and wind energy. The main goal of the project is to create a model island of climate-neutral mobility. **RECOMMENDATIONS: An option in the application may be to use an electric car instead of a traditional one. It is important for the character to save money first, we want the application to be realistic and not let the children have false ideas that it is easy for everyone to buy an electric car.**

In the area of buildings:

- 1.** The purpose of this subsidy scheme is to help SMEs and NGOs transform their organizations into more energy-efficient and environmentally friendly entities. Best practice goals are to reduce the consumption of conventional, costly and energy-intensive devices and systems. Promoting the use of energy-efficient and environmentally friendly systems, devices and devices. To lay the foundations for the wider implementation of such practices in workplaces and organizations. Reducing a building's energy level by 35% or production processes by 30%. A specific practice can be implemented as an improvement to buildings in the game / app. **RECOMMENDATION The buildings in the application may have an initial phase in which their energy efficiency is not desired. As a result, the player (apprentice) will spend more energy just for building certain buildings. Through modernization, the basic structure of buildings can be retrofitted into more energy-efficient and environmentally friendly buildings with intelligent systems and functions and lower energy and water consumption. This can only be applied to one or two refurbishments where optimal energy efficiency of the buildings in the city will be achieved.**
- 2.** Cosmote e-Value, a rapidly growing contact center, wanted to cover its housing needs and offer employees the best place to work. In line with the environmental strategy of the OTE Group, a modern green contact center was established in Kerameikos. One of the basic principles of design is to ensure accessibility for people with special needs one of the tasks of the application can be to transform an old building into a new 'greener' and 'smarter' one. **Primary school children are not aware of what it means to have green buildings and what they can do.**
- 3.** "POWER HOUSE almost zero energy!" a cooperation project aimed at increasing energy efficiency. The most important challenge for the network organizations was to promote



the theme of nearly zero-energy buildings in different Member States. We could somehow incorporate what the European Union has committed to - the “3 times 20 target” - 20% less greenhouse gases, 20% better energy efficiency and 20% renewable energy - to build a safe and cleaner energy future.

4. The Solar Decathlon competition is a competition organized by the US Department of Energy, bringing together universities from around the world to design and build a prototype energy self-sufficient grid connected home that works exclusively with solar energy and uses technologies that allow for maximum energy efficiency. An example would be a good suggestion for different primary school pupils to design a sustainable building through drawing and other older pupils, for example those who participated in the final project try, if possible follow the draft of these proposals that the children made. Students (in this case from the university) participated in this proposal, various students from the project partner schools were able to present their students' proposals for the design of sustainable buildings so that they could be included in the application and be part of the atmosphere of the video game.

In the area of water quality:

1. The goal of the best practice was to prevent the consumption and use of drinking water for purposes other than drinking, while at the same time reducing the drinking water shortage in the area of implementation, Cyprus. Along with the implementation of other measures and the modernization of the water management infrastructure, this plan also contributed to overcoming the extreme shortage of drinking water in the following years. Cyprus is now considered a self-sufficient country with regard to drinking water. When it comes to integrating the practice into the app, students might be able to install irrigation or other drinking water saving systems to give city dwellers more drinking water. Other uses / practices may also affect the availability of drinking water in the city. Thus, gray water irrigation and other practices can help increase access to drinking water for city dwellers.
2. CWPharma provides tools and recommendations on how best to reduce active pharmaceutical ingredient (API) emissions in the Baltic Sea region. Best practice target: Reduction of active pharmaceutical ingredient (API) emissions in the Baltic Sea region. The advanced wastewater treatment techniques proposed by the company can be applied more generally to the removal of pharmaceuticals from wastewater. Users are informed about how their lifestyle affects their carbon footprint and the health impact of their actions / consumer choices. In the game, players could have a list of choices that affect water quality.
3. Pozos sin Fronteras is a non-governmental organization that is important all over the world in terms of water treatment and the creation and construction of wells in various underdeveloped countries. For example, you can create a cross-referenced section in your



application to contact NGOs struggling to achieve a more sustainable world. That way, all users who downloaded the app could write to them if they were interested. It would also be nice if some of the buildings in the game had signs advertising all of these NGOs.

4. The Association of Municipal Water and Sewerage Companies in Greece has developed and launched an Information System for Monitoring Water Quality for Human Consumption. It is an online system that allows water companies to record the results of laboratory analyzes of drinking water. It is a tool for continuous monitoring of the quality of water for human consumption. The mobile application contributes to the reliable information of Greek citizens, but also tourists about the quality of drinking water in the country in order to increase confidence in the consumption of tap water. The water quality indicators that are used in the app can also be used as indicators in the Cities Going Green app. It would be nice if the application, even if it is aimed at children, is not childish and uses realistic elements, real data and measurements as much as possible. This will be an added value for the Cities Going Green app.

In the area of public transport

1. The Cypriot Ministry of Transport, Communication and Works has issued a subsidy plan to promote the use of bicycles to interested applicants in the country. According to the plan, a citizen is entitled to a subsidy of up to EUR 200 for the purchase of a bicycle. If the price of the bicycle is less than 200 euros, the applicant receives the full amount needed for the purchase, while in any other case the applicant is asked to pay the rest of the amount if it exceeds 200 euros. The plan aims to promote the use of bicycles as an alternative means of transport, which will lead to a reduction in the use of cars and other conventional means of transport. **RECOMMENDATION - GREEN CITY residents switch to bikes after receiving a subsidy for their purchase.**
2. Sohjoa Baltic researches, promotes and pilots automated, unmanned electric minibuses in the public transport chain, especially in the field of first / last mile connectivity of automated public transport. The project of the autonomous bus will create knowledge and competences for the city, thanks to which we will be able to use public transport in the city in an even more environmentally friendly and intelligent way in the future. It is an innovative solution that can become a pioneer in today's modern technological era and transport system. Playing Smart City can be very beneficial for increasing awareness of CO2 related issues. There may be options in the game to use regular public transport and CO2 neutral public transport and see the difference in use in numbers or some kind of meter.
3. RQuality was funded and initially implemented by the ICARUS H2020 project. In the app, users are informed about how their lifestyle affects their carbon footprint and what the health impact of their actions / consumer choices is. It is important that citizens are actively involved in the development of greener, clean air cities by controlling their own



actions and behaviors and their environmental impact. The elements of the application can be elements of the Cities Going Green application, for example: We can have a bar at the top of the screen showing air pollution, then our character can decide what means of transport to use and see the difference in CO₂ emissions. We may also have challenges that may win badges (walk 5 km or use the bus instead of the car etc.).

4. The Electromobility Development Strategy for the Municipality of the City of Radom defines the planned directions of changes in the area of emission-free transport implementation. On the basis of the main goal of the strategy, three strategic goals were developed: Zero-emission public transport (zero-emission buses for public transport in Radom). Electromobility city - emission-free cars, development of a network of generally available chargers. Ecological inhabitants - educational activities for the inhabitants of the city, with particular emphasis on children and adolescents. Thus, the knowledge-based ecological lifestyle will be promoted, inter alia, by as part of workshops or municipal thematic competitions. Thanks to this, decisions regarding the choice of a given means of transport will become more informed and attitudes favoring electromobility will be created. Cycling in the city will also be supported by the Radom City Bike system. **Smart City solutions in Radom use intelligent and innovative solutions based on digital technologies that can be used in the project. Students learn about investment methods that can translate into a modern organization of the city's functioning. Creating a holistic system that, through its efficiency and pro-ecology, leads to a higher quality of life for residents.**
5. Barcelona City Council promotes a strategic plan to introduce electric vehicles in the city, encouraging sustainable mobility and improving air quality by reducing fossil fuel emissions and encouraging local consumption, for the benefit of a positive living in the urban community. Electric mobility and smart mobility will improve quality of life while contributing to a carbon neutral future. A holistic, ecological and sustainable action plan will have a positive impact on the daily life of the island's inhabitants, combined with an innovative public transport system. Another proposal is the unusual buses with green gardens on the roof are the so-called "Green transport". The project is to expand the garden space in an urban environment, increase the amount of carbon dioxide absorbed and make public transport a new attraction. Each garden located on a transport roof consists of a metal frame and a durable waterproof material in which the plants are placed. Using CO₂ neutral public transport in Smart City can be very beneficial in increasing awareness of CO₂ issues. There may be options in the game to use regular public transport and CO₂ neutral public transport and see the difference in use in numbers or some kind of meter. Buses with roof gardens will run through the GREEN CITY.

In the area of quality of life

1. The Ecological Center in the city can organize various events and competitions where children have to answer a few questions. As part of the badge, they can provide the



Library or the Exhibition free of charge. Access for the disabled - a touch system for the blind for the exhibition at the Center. **The Ecological Center may function in Green City.**

2. In the reconstructed building of the Väätsa Primary School, there are solar panels on the roof with a total capacity of 30 kW and a wind generator with a capacity of 1.5 kW. Visiting students will learn about working with solar panels and wind turbines. i Students can monitor the operation of the wind turbine from the monitor. They see the generator start when the wind speed reaches at least seven meters per second. How much electricity. Old school is a hands-on environment in which students can apply their knowledge. **In Green City, we could 'build a house' as in best practice with sensors (see Impact).**
3. Experiential School, the educational department of the QualityNet Foundation in the field of non-formal education to design and develop educational programs that contribute to shaping responsible citizens of tomorrow. The organization conducts biometric classes and programs in primary schools that relate to empirical programs on environmental education and sustainable development. One of the actions implemented in the game is gaining “experience points” by the user by:
 - Participating in an environmental awareness campaign
 - Organize your own campaign
 - Take individual action
 - Take part in a community action.

Another idea for the app is to have a bar, similar to in games, indicating the happiness level of the inhabitants based on certain criteria set in the game. The greener the city, the happier the inhabitants, the more they learn and the more actively they raise environmental issues, the happier they are.

4. Let's do it! is a global civic movement in which people from all over the world are asked to jointly carry out a local and / or national cleaning action. **The application can organize meetings between users to clean up a city or area.**
5. The implementation of the assumptions of environmental education in schools allows for a change in the perception of the world. It develops not only knowledge, but also skills and competences. key youth, such as critical thinking, expressing opinions, teamwork or, increasingly important in the modern world, empathy and mindfulness. It motivates to action, promotes the practical use of acquired knowledge and prepares to face challenges. Designing educational situations that awaken the child's internal motivation to act creatively, meet their needs, teach them to be responsible for decisions made. Including parents in the implementation of the ecological program through



their interest in this issue shapes co-responsibility for the natural environment, that is, developing the awareness of sustainable growth and development. Ecological education at PPUH RADKOM is primarily the implementation of information and educational campaigns aimed at the community of Radom and the Radom subregion, the aim of which is to raise environmental awareness in the areas of: climate, environment and energy. Involving children in recycling programs and other environmental improvement activities can be fun. **Educating children about the importance of recycling and the environment provides a path to a greener future. Educational situations are designed in Green City, responsibility for decisions is taught, parents are involved in the activities and children are involved in environmental protection work in the immediate vicinity.**

Tips and Hints

Education, is a fundamental tool when it comes to the fight against climate change. Knowledge regarding climate change helps young people to understand and tackle the consequences of global warming and encourages them to change their behavior. According to reports, very often, when children are coming across the topic of climate change in the news, it causes them a feel of fear and anxiety. Therefore, there is a clear need for setting this issue in a safe context so that the children can be educated about it. Children are proven to be more receptive to learning. Education on children regarding climate change can help for various reasons:

- Learn about the issue in safe context
- Behaviour change
- Ease their fear and anxiety on the topic
- Motivate to take action
- Prepare for them for the potential future need of creating climate solutions.

Education can be provided through many formal or informal structures. One very effective technique of transferring knowledge to children and adults is Gamification. Gamification can be defined as a set of activities and processes to solve problems by using the characteristics of game elements. In addition to the environmental consciousness, other skills and competences are important and are being provided to pupils through gamification and STEM.

1. When preparing for Green Cities, students can think about subsidizing smoke exchange and home heating, which allows them to:
 - Take care of your home budget and learn
 - Find out how to save on your energy bills
 - Take care of your health
 - Care for the environment



For this purpose, the application should include a quiz (simulation of the situation of energy consumption or the possibility of thermal insulation of the building by the resident and checking energy consumption before and after) - or connect the building to the heating or gas network, invest in a new generation of boiler and high-quality fuel or other modern heat source.

2. As part of the Take care of the surrounding greenery campaign, city residents plant trees and shrubs that produce oxygen and absorb some of the pollution.
3. As part of the action “Give a good example to educate the youngest. Talk to your family about air protection - in the application you can create a family quiz to solve together.
4. Carrying out a social campaign in the application and social media - React to the behavior of your neighbors People who burn waste also harm you. Maybe your neighbor. you do not yet know the local anti-smog resolution, which is to ensure the improvement of air quality in your region? Tell him it’s a piece of legislation that restricts the use of solid fuel boilers.
5. Limit car driving - city residents in the application change to bicycles and electric cars, use public transport.
6. Education on effective waste management. Do not produce new ones, but put the existing ones into circulation. More and more waste must be sorted, recycled, reused and less and less incinerated. Using the model of the city of Radom.
7. Electromobile city - The creation of an electromobility city will consist in the introduction of zero-emission cars to the local government that will meet the requirements set out in the Act on electromobility and alternative fuels, and the development of a network of public chargers adapted to passenger cars, which will directly translate into the promotion of the use of zero-emission vehicles in the city by increasing the convenience of access to charging points.
8. Ecological residents - The implementation of the objective will be based on educational activities for the inhabitants of the city, with particular emphasis on children and youth. Thus, an ecological lifestyle based on knowledge will be promoted, e.g. as part of workshops or urban thematic competitions.
9. Using the project “The smart city model” in Poznań is characterized by quality, widely understood savings (including time, energy, space) and pragmatics.
 - Taking care of the environment and limiting climate change.
 - Development of blue and green infrastructure, implementation of projects improvement of the environment.
 - Building a circular economy – optimal using the city’s available resources.
 - Education.



- 10.** Educating children about climate change - preparing children for the potential future need to create climate solutions. Transfer of knowledge about ways, methods and environmental protection. Developing the ability to perceive unfavorable phenomena in the environment. Striving to develop the need for contact with a clean and uncontaminated environment
- 11.** Conducting a competition aimed at persuading children and youth to implement the principles of environmental protection and proper waste management in everyday life. The assumption of the competition is to change the approach of children and young people to the role of both school and home in the process of caring for the natural environment, in particular getting acquainted with the issues of selective collection and recycling of waste at the level of the immediate environment, through:
- promoting the principles of selective waste collection among children and youth,
 - dissemination and consolidation of ecological attitudes,
 - raising ecological awareness of children and youth,
 - strengthening responsibility for the condition of the natural environment and the immediate surroundings,
 - inspiring action to improve the condition of the environment,
 - expanding knowledge on the principles of proper waste handling and management.

The competition consists of four tasks:

- Task 1 “You segregate waste - you save the environment!”
- Task 2 “Show eco-efficiency on stage”
- Task 3 “Second life of waste”
- Task 4 “Waste management is important, see for yourself!”

Teachers and their students can join the competition in the application, they are involved in the organization of eco-actions promoting the subject of sustainable development. All children from the school and their parents participate in the action.

- 12.** Real companies can be involved in the competitions and collect, for example, as in the examples given: “Children collect caps for milk jugs, caps for carbonated drinks bottles, caps for laundry bottles, caps for dish detergents, lids for jars with peanut butter, bottle caps with vitamins and others. Almost every day, children bring caps in bags to their teachers. Radkom’s activities can also be used.



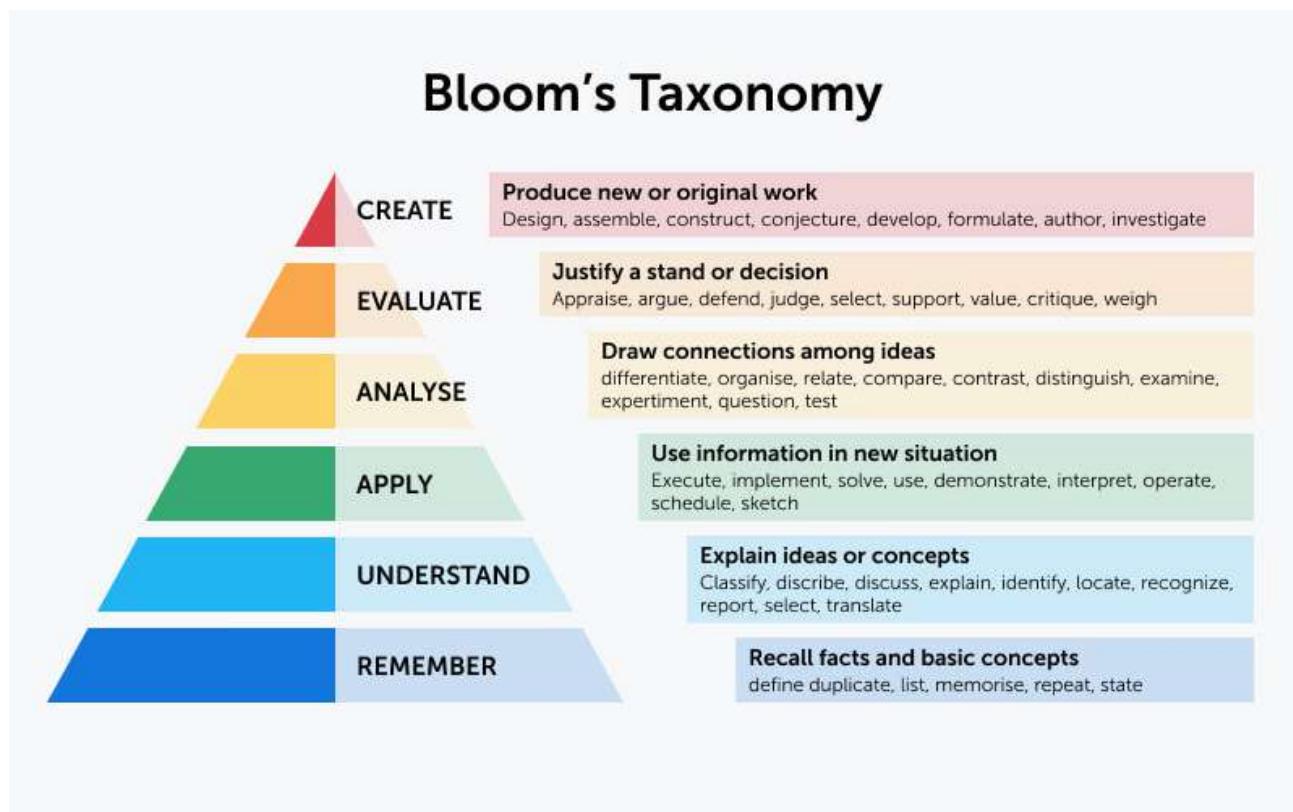
COMPOSITION OF LEARNING OUTCOMES

Objective of the current document:

This document includes the learning outcomes and possible actions for the project's main topics, namely:

- Circular Economy
- Air Quality
- Green Energy
- Water Quality and Management
- Buildings
- Public Transportation
- Life Quality (to include several features from the above topics)

The composition of the learning outcomes for the purpose of the Cities Going Green project, is based on the theory of Bloom's Taxonomy for the classification of the various stages of learning.





1. Circular Economy

TOPIC	LEARNING OBJECTIVES Knowledge	ACTIONS
Circular Economy	<p>Through the use of the Cities Going Green app, the pupils will be able to:</p> <p>LO1: Understand the value of products and materials, and the concept of using waste as a resource for a new value cycle.</p> <p>LO2: Understand economic benefits and greater good for the human society and environment, and the concept of long-term sustainability.</p> <p>LO3: Understand the 8 principal concepts of circular economy: Refuse, Rethink, Reduce, Reuse, Repair, Refurbish, Remanufacture, Repurpose, Recycle</p>	<p>Easy level Actions</p> <p>Action 1 (LO1, LO2) – Map the waste collecting possibilities around the facility; discuss the possibilities of using certain types of waste as a resource for something new; discuss the limited availability of natural resources. Build toys from hygienically acceptable waste (empty bottles, etc.).</p> <p>Action 2 (LO2) – Students design a play where the environment and society talk with each other in order to find a balance between what the society needs and what the environment can offer. Students present the play to a wider audience (parents, teachers, other students).</p> <p>Advanced level Actions</p> <p>Action 3 (LO3) – Students design a poster about the 8 principal circular economy concepts and present it in a school science day or other similar event.</p> <p>Action 4 (LO3) – Students design a board game where the 8 principal circular economy concepts are arranged in a way that leads to long-term sustainability. Students teach this game to teachers or parents in some special school event.</p>

2. Air Quality

TOPIC	LEARNING OBJECTIVES Knowledge	ACTIONS
Air Quality	<p>Easy level</p> <p>Through the use of the Cities Going Green app, the pupils will be able to:</p> <p>Learning Outcome 1 (LO1) Define the types of the environmental pollution:</p> <ul style="list-style-type: none"> list the types of environmental pollution describe the smog list the types of smog explain the term “carbon footprint” describe the concept of the ozone hole <p>Learning Outcome 2 (LO2) Determine the quality of the environmental components:</p> <ul style="list-style-type: none"> list air quality indicators list the applications showing air quality <p>Learning Outcome 3 (LO3) Assess the current state of the environment:</p> <ul style="list-style-type: none"> describe the state of the environment in the neighbourhood <p>Learning Outcome 4 (LO4) Identify the sources of air pollution:</p> <ul style="list-style-type: none"> list vehicles with high CO2 emissions and vehicles with lower CO2 emissions list alternative methods of transport how the heating method at home affects air quality name various renewable energy sources <p>Learning Outcome 5 (LO5) Select methods of air protection against pollution:</p> <ul style="list-style-type: none"> list various alternative energy sources explain why trees and shrubs produce oxygen and absorb some pollutants. 	<p>Easy level Actions</p> <p>LO1 Actions</p> <p>Create leaflets and folders specifying the types of contamination.</p> <p>Create a website with information on current pollution in the city.</p> <p>Publish information about smog in the city on the website.</p> <p>LO2 Actions</p> <p>Measure air quality and describe it.</p> <p>Use air quality applications and put the data on the page or create air quality measurement applications.</p> <p>LO3 Actions</p> <p>Describe the state of the environment on the website.</p> <p>LO4 Actions</p> <p>Publish information on CO2 emission factors on the website.</p> <p>Indicate and promote alternative methods of transport.</p> <p>Organize “Car Free Day” or “Let’s Switch to Bicycles” campaigns.</p> <p>Publish information on the website in the form of, for example, a comics on renewable energy and alternative heating methods.</p> <p>LO5 Actions</p> <p>Establish and describe on the website the process of establishing a vertical garden.</p>



<p>Air Quality</p>	<p>Advanced level Through the use of the Cities Going Green app, the pupils will be able to:</p> <p>Learning Outcome 6 (LO6) Define the types of environmental pollution:</p> <ul style="list-style-type: none"> list the types of environmental pollution describe the impact of environmental pollution on human health and the natural environment define the term smog list the types of smog explain the term “carbon footprint” list the pollutants in the air we breathe describe the concept of the ozone hole <p>Learning Outcome 7 (LO7) Determine the quality of the environmental components:</p> <ul style="list-style-type: none"> list air quality indicators list applications showing air quality describe the degree of environmental pollution in the area based on the application <p>Learning Outcome 8 (LO8) Assess the current state of the environment</p> <ul style="list-style-type: none"> describe the changes that will take place in the environment list corrective actions for contaminated sites describe environmentally friendly means of transport describe the role of green areas in absorbing pollutants from the air <p>Learning Outcome 9 (LO9) Identify sources of air pollution:</p> <ul style="list-style-type: none"> compare vehicles with high CO2 emissions to vehicles with lower CO2 emissions mention alternative methods of transport than the use of conventional cars realize that the way homes are heated affects air quality explain what renewable energy, low emissions and smog are <p>Learning Outcome 10 (LO10) Select methods of air protection against pollution:</p> <ul style="list-style-type: none"> define alternative sources of energy explain why trees and shrubs produce oxygen and absorb some pollutants. list activities related to the reduction of pollutant emissions to the atmosphere. 	<p>Advanced level actions</p> <p>LO6 Actions Create a website on environmental pollution of a city or region. Upload videos showing the impact of environmental pollution on the website. Show the phenomenon of smog on the website and place information about smog in a city or region on the website. Explain on the website the phenomenon of carbon footprint and ozone holes.</p> <p>LO7 Actions Put air quality quizzes on the website. Link to air quality applications on the website.</p> <p>LO8 Actions Announce a competition for the idea of How to fix the air quality Place the competition works on the website and select the winner Announce a competition for a vertical garden Place the competition entries on the website and select the winner.</p> <p>LO9 Actions Organize campaigns promoting the use of alternative methods of transport Post videos about renewable energy on the website Put quizzes on renewable energy on the website.</p> <p>LO10 Actions Promote information on the impact of urban greenery on the quality of air in the city.</p>
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3. Green Energy

TOPIC	LEARNING OBJECTIVES	ACTIONS
Green Energy	<p>Through the use of the Cities Going Green app, the pupils will be able to:</p> <p>LO1: Name the sources electric energy is coming from and categorize them into non-renewable and renewable</p> <p>LO2 : Choose green energy sources and justify their choice</p>	<p>Easy level Actions</p> <p>Action 1 (LO1, LO2) – Drag and drop ‘green’ technologies to the map in order to produce energy (electricity)</p> <p>Action 2 (LO1) – update those technologies to maximise output level</p> <p>Advanced level Actions</p> <p>Action 3 (LO1, LO2) – Implement ‘green’ culture in enterprises in the game to lower CO2 levels</p> <p>Action 4 (LO2) – Full ‘green’, utilise only green technologies and initiatives in the game</p>



4. Water Quality

TOPIC	LEARNING OBJECTIVES Knowledge	ACTIONS
Water Quality & Management	<p>Through the use of the Cities Going Green app, the pupils will be able to:</p> <p>LO1: To name threats that are related to irresponsible water consumption or poor water quality</p> <p>LO2: To list possible measures/ tools that can tackle threats related to water scarcity and/ or poor quality of water</p>	<p>Easy level Actions</p> <p>Action 1 (LO1, LO2) – Trace leaking faucets, pipes etc. and stop water waste</p> <p>Action 2 (LO1, LO2) – Pick trash/ plastic bottles/ plastic bags from lakes better water quality & better for underwater ecosystems</p> <p>Advanced level Actions</p> <p>Action 3 (LO1, LO2) – Awareness Raising Campaign for Saving Water (Posters/ Electronic Signs etc.)</p> <p>Action 4 (LO2) – Water Quality Monitoring & Reward/ Penalty System</p>

5. Buildings

TOPIC	LEARNING OBJECTIVES Knowledge	ACTIONS
Buildings	<p>Through the use of the Cities Going Green app, the pupils will be able to:</p> <p>LO1: Define what means to build “green” by naming various components of green building design.</p> <p>LO2: Make and apply design choices to make a building greener</p>	<p>Easy level Actions</p> <p>Action 1 (LO1, LO2) – Apply energy-saving solutions, e.g., installing solar panels, thermal insulation, recycling: more bins inside and outside of the building.</p> <p>Action 2 (LO2) – Update those technologies to maximise output level, e.g., resize solar panels – make them bigger, improve thermal insulation (provided that you have enough coins/points).</p> <p>Advanced level Actions</p> <p>Action 3 (LO1, LO2) - Apply energy-saving solutions, e.g., using urban/vertical gardening to improve air quality and keep a steady temperature.</p> <p>Action 4 (LO1, LO2) – Improve accessibility (which is a vital part of green building design) by installing ramps for wheelchairs and braille signs.</p>

6. Public Transportation

TOPIC	LEARNING OBJECTIVES Knowledge	ACTIONS
Public Transportation	<p>Through the use of the Cities Going Green app, the pupils will be able to:</p> <p>LO1: Identify which transport means are less polluting.</p> <p>LO2: Identify the range of pollution of each kind of transport.</p> <p>LO3: Raise awareness and promote the use of public transportation.</p>	<p>Easy level Actions</p> <p>- ACTION 1 (LO1, LO2) If the children can win ‘coins’, they will be able to buy sustainable transports to include them in the city.</p> <p>- ACTION 2 (LO1, LO3) To know the name of the different transports and the range of pollution of each one, the APP could include some little games like a memory to refresh the contents.</p> <p>Advanced level Actions</p> <p>- ACTION 3 (LO1, LO3) To have a pollution measurer and change the transportation means to see if this measure gets greener, so they can work with the different range of pollution of each transportation means.</p> <p>- ACTION 4 (LO3) Pupils could create with another platform like CANVA some advertising posters and they could include them in the game to raise awareness in the city about the use of public transportation.</p>



7. Life Quality

TOPIC	LEARNING OBJECTIVES Knowledge	ACTIONS
Life Quality	<p>Easy level Through the use of the Cities Going Green app, the pupils will be able to:</p> <p>Learning Outcome 1 (LO1) Determine the importance of the municipal greenery:</p> <ul style="list-style-type: none"> ● understand that greenery is an important element of our surroundings ● describe the role of green in air purification ● describe urban greenery ● name vertical gardens <p>Learning Outcome 2 (LO2) Define the concept of energy and its importance in the quality of life:</p> <ul style="list-style-type: none"> ● name and list energy sources ● describe recycling ● understand the concept of energy and its forms of use in our everyday life ● discover the need to save in simple ways ● name the energy footprint ● list alternative energy sources as a rescue for the natural environment <p>Learning Outcome 3 (LO3) Define the importance of ecological culture in the quality of life:</p> <ul style="list-style-type: none"> ● Know what ecological culture is, based on respect for nature and its inviolable laws; ● acquire the skills to care for the environment in everyday life, in the household (the student segregates waste, saves water, electricity, soil) ● name the problems related to the development of civilization, ● have knowledge about health, its values and its dangers ● justify the need to minimize municipal waste in your environment, ● understand ecological processes ● explain what the quality of life is. <p>Learning Outcome 4 (LO4) Acquire the ability to work in a team:</p> <ul style="list-style-type: none"> ● work and collaborate in a group by implementing team projects ● get involved in activities that increase the awareness of the school community about the impact of the quality of the environment on the quality of life. 	<p>Easy level Actions</p> <p>LO1 Actions Create the website Urban greenery - a better life for the inhabitant Put the story of Peter on the page in the form of a comic, who learns the importance of greenery in the city</p> <p>LO2 Actions Prepare comics about energy sources and recycling</p> <p>LO3 Actions Organize a campaign "Who segregates better" - promoting the skills to care for the environment in everyday life, in the household (the student segregates waste, saves water, electricity, soil) Prepare another part of the comic book for the minimization of waste Analyze comic book scenarios in the team (or classroom)</p> <p>LO4 Actions Plan vertical gardens at school and set them up. Implement a competition for the most beautiful vertical garden.</p>



<p>Life Quality</p>	<p>Advanced level</p> <p>Through the use of the Cities Going Green app, the pupils will be able to:</p> <p>Learning Outcome 5 (LO5)</p> <p>Determine the importance of the urban herbaceous:</p> <ul style="list-style-type: none"> ● understand that greenery is an important element of our surroundings ● characterize the role of greenery in air purification ● describe the concept of urban greenery ● explain the concept of urban gardening ● describe the nature of vertical gardens <p>Learning Outcome 6 (LO6)</p> <p>Define the concept of energy and its importance in the quality of life:</p> <ul style="list-style-type: none"> ● name and list energy sources ● characterize the recycling process ● understand the concept of energy and its forms of use in our everyday life ● learn about the relationship and place of energy in ecosystems ● link energy consumption with key environmental problems ● discover the need to save in simple ways ● define the energy footprint ● calculate your energy footprint ● cooperate and work in a team ● know alternative energy sources as a rescue for the natural environment <p>Learning Outcome 7 (LO7)</p> <p>Define the importance of ecological culture in the quality of life:</p> <ul style="list-style-type: none"> ● know what ecological culture is, based on respect for nature and its inviolable laws; ● acquire the skills to care for the environment in everyday life, in the household (the student segregates waste, saves water, electricity, soil) ● know the problems related to the development of civilization ● acknowledge health, its values and its dangers ● justify the need to minimize municipal waste in your environment ● understand ecological processes ● explain what the quality of life is ● name at least five examples of the impact of the quality of the environment on the quality of life <p>Learning Outcome 8 (LO8)</p> <p>Possess the ability to work in a team:</p> <ul style="list-style-type: none"> ● work and collaborate in a group by implementing team projects ● get involved in activities that increase the awareness of the school community about the impact of the quality of the environment on the quality of life. 	<p>Advanced level actions</p> <p>LO5 Actions</p> <p>Calculate the energy footprint and develop a project to reduce such footprint</p> <p>LO6 Actions</p> <p>Organize the campaign “Who segregates better” - promoting the skills to care for the environment in everyday life, in the household (the student segregates waste, saves water, electricity, soil)</p> <p>LO7 Actions</p> <p>Makes a film about examples of the impact environmental quality has on quality of life</p>
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