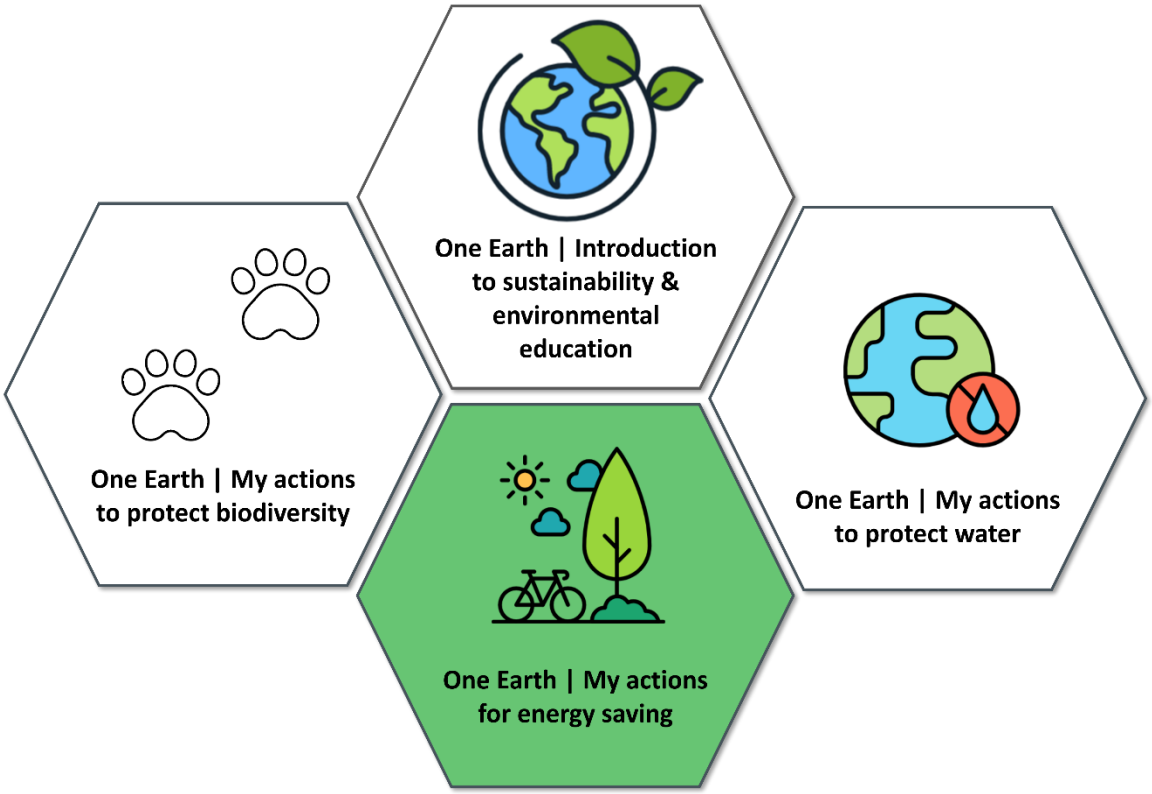
Teacher Academy Project
TEACHING SUSTAINABILITY



SUSTAINABILITY AND ENVIRONMENTAL EDUCATION

Learning and Teaching Package 3

UNIT 4: ONE EARTH | MY ACTIONS FOR ENERGY SAVING

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Contents

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Overview

This Learning and Teaching Package (LTP) approaches the relation between environmental education and sustainability. The LTP is organized in four units structured around one common theme: One Earth. Each unit approaches one sustainable development goal (SDG). Different educational resources and pedagogical approaches are suggested to promote knowledge and sustainability competences in primary school students' necessary to develop actions to protect biodiversity and water, and energy saving.

Access to affordable, reliable, sustainable, and clean energy is the focus of SDG 7. **The content covered in Unit 4** of this LTP aims to improve students' understanding of the concept of energy, the distinction between non-renewable energy resources and renewable energy resources. The objective is to better understand how small individual choices for a more sustainable lifestyle can have an impact on saving energy and contribute to the adoption of energy-saving behaviours.

The materials aim to give ideas to bring them into teacher education and schools and can be adapted for various contexts and enriched further. The Unit finishes with a Follow-Up Activity for teachers to reflect on their practice in view of integrating the topic of sustainability into their practice, and includes TAP-TS Roadmap that can be seen as a visualisation of materials design, and a Template for developing teaching and learning materials with guiding questions.

Pedagogical Approach

This unit is focused on action-oriented learning. Using a hands-on approach and collaborative learning, the students are going to participate in discussions and reflections about energy consumption, its impact, and sociopolitical actions to mitigate that impact. STEAM education and interdisciplinary work also are educational approaches of this unit, proving students learning experiences through inquiry, dialogue, and critical thinking. The activities are carried out in teamwork, focus on real-life situations and challenges that aim to adopt energy-saving behaviours and enable students to intervene in the community to solve problems related to energy consumption.

Sustainability and Environmental Education: Importance of the theme

Sustainability and environmental education are relevant objectives across all educational levels. Fostering sustainable behaviours is the major aim of education for sustainable development, and the utilization of specific educational resources, such as those addressing the issue of plastic pollution, can significantly contribute to this endeavor (Linhares & Cavadas, 2021). Moreover, exploring the most effective educational approaches for cultivating sustainability competencies among students, such as problem-based learning (e.g. Cavadas & Linhares, 2022), remains a subject of ongoing educational research.

Piloting of the materials within TAP-TS

Part of the materials from Unit 4 were explored at ALE1 – for Primary school 2023 during an online workshop organized as follows: a webinar and a self-study. The course had the participation in service teachers, student teachers and teacher educators. The materials were available on the TAP-TS Moodle platform https://tap-ts.eu/course/view.php?id=13#section-4

UNIT Overview

Main Topic	Target Group	Duration	Knowledge Area/ Subjects in School	Activities	Suggestions for Possible assessment
Recognize the human impact on natural resources and act to promote sustainable consumption and production patterns	Pre- and in-service teachers' materials are provided for students in school (6-12y.o.)	Min 420 min	Knowledge area: Environmental Education Science, Technology, Arts & Mathematics Citizenship education	**Start-Up:** Activity 1. What is energy? Activity 2. What are energy sources? Activity 3. What energy sources are used to generate the energy you use? **Development**: Activity 4. How is energy used at home? Activity 5. What is energy efficiency? Activity 6. Is energy accessible to everyone? Activity 7. How does a Wind turbine work? Let´s build one! **Consolidation:** Activity 8. How can we act in the community to promote energy saving? Activity 9. How can I save energy? **Follow-up:** Activity 10. Reflection about teacher practice	Rubric to students evaluate their progress.

Intended Learning Outcomes	**Having worked through the activities and materials, students will be able to:** ✓ Understand the concept of energy, non-renewable and renewable energetic sources. ✓ Understand the meaning of "energy efficiency" and the utility of "EU energy labels". ✓ Reflect how energy consumption is related with their individual lifestyle' choice. ✓ Reflect about "Energy poverty" and understand that access to energy is unequal. ✓ Identify their individual sustainability potential for energy saving and actively contribute to improving community and global perspectives on energy consumption.
Prior Competencies	optional/ideal: Unit 1. Introduction to Sustainability and Environmental Education You can also explore LTP 2 Sustainability and Digitality Unit 3
Required materials	• Laptop or tablet • Writing materials, worksheets, and interactive presentations. • Wind turbine - Small hobby motor, 6-12 volts; Red, high-intensity LED; Four craft sticks; Small paper cup for fan blades; Medium cup for base; Hot-glue gun and glue; Scissors (not shown); Drill bit that matches the size of the motor shaft; Fan or windy day.
Cooperation/ Networking	• Local environmental NGO's • Renewable Energy Communities • Local renewable energy company • Children's family and Local Community
Practical Notes for Teachers	The estimated time for delivering the tasks of Unit 4 can be adapted by the teacher according to their context and learning objectives. Depending on the age of the primary students, certain materials will have to be adapted. The full pack of activities can be carried out through project work, but teacher can also decide to develop only some of the proposed activities students. The creation of the wind turbine requires the purchase of mini motors with a power of 6-9V and LEDs, which are easily bought online.

Addressing GreenComp

Embodying sustainability values		
X	1.1 Valuing sustainability	To reflect on personal values; identify and explain how values vary among people and over time, while critically evaluating how they align with sustainability values.
X	1.2 Supporting fairness	To support equity and justice for current and future generations and learn from previous generations for sustainability.
	1.3 Promoting nature	To acknowledge that humans are part of nature; and to respect the needs and rights of other species and of nature itself in order to restore and regenerate healthy and resilient ecosystems.
Embracing complexity in sustainability		
	2.1 Systems thinking	To approach a sustainability problem from all sides; to consider time, space and context in order to understand how elements interact within and between systems.
X	2.2 Critical thinking	To assess information and arguments*, identify assumptions, challenge the status quo, and reflect on how personal, social and cultural backgrounds influence thinking and conclusions.
X	2.3 Problem framing	To formulate current or potential challenges as a sustainability problem in terms of difficulty, people involved, time and geographical scope, to identify suitable approaches to anticipating and preventing problems, and to mitigating and adapting to already existing problems.
Envisioning sustainable futures		
X	3.1 Futures literacy	To envision alternative sustainable futures by imagining and developing alternative scenarios and identifying the steps needed to achieve a preferred sustainable future
	3.2 Adaptability	To manage transitions and challenges in complex sustainability situations and make decisions related to the future in the face of uncertainty, ambiguity, and risk.
	3.3 Exploratory thinking	To adopt a relational way of thinking by exploring and linking different disciplines, using creativity and experimentation with novel ideas or methods.
Acting for sustainability		
	4.1 Political agency	To navigate the political system, identify political responsibility and accountability for unsustainable behaviour, and demand effective policies for sustainability.
X	4.2 Collective action	To act for change in collaboration with others.
X	4.3 Individual initiative	To identify own potential for sustainability and to actively contribute to improving prospects for the community and the planet.

UNIT DESCRIPTION

Start-Up

The aim of the start-up activity is to introduce the topic of energy. This activity is designed to identify students' existing knowledge and foster understanding of the concepts at hand. By encouraging discussions and teamwork, students reflect on the advantages and disadvantages associated with the use of renewable and non-renewable energy sources.

Estimated Duration 70 min/120 min

Activity 1. What is energy?

This activity aims to identify students' existing knowledge and at the same time motivate them and arouse their curiosity about the subject of energy.

GreenComp Reference

1.1 Valuing Sustainability

1.2 Promoting Nature

Preparation for Activities: This introductory activity aims to identify the students' conceptions about energy, in order to understand what they already know and what aspects the teacher could focus on, to clarify doubts and deepen the students' knowledge. To this end, the topic of energy includes individual work and teamwork. Students should have access to a computer or tablet, or cellphone.

A Note for a Teacher: The suggested video can be subtitled in different languages: https://audiovisual.ec.europa.eu/en/video/I-196315?lg=EN%2FPT;

Description

What is energy?

1. Watch the video "What is energy?" .
2. Distribute the **Worksheet 1 "What is Energy?"** to each student and ask them to solve the tasks.

10 min

	3. Organize students in working pairs. They should analyze their answers given and discuss eventual differences. The answers given by the groups should be later discussed in the class.	
Activity 2. What are energy sources? Through collaborative work, the aim is that students distinguish different energy sources and identify renewable and non-renewable types of energy. **GreenComp Reference** *1.3 Valuing Sustainability* *1.3 Promoting Nature*	**Preparation for Activities:** To deliver this activity, students must be organized in groups and share ideas for completing the tasks. Each group should have access to a computer, tablet or cellphone. **A Note for a Teacher:** The suggested video can be subtitled in different languages: What are the EU's energy sources?	20 min
	Description **What are energy sources?** 1. Watch the video What are the EU's energy sources? 2. Organize students in small groups and ask them to reflect about energy/energy source. Suggested questions to stimulate discussion: • What is an energy source? • Can you name three different types of renewable energy? • Can you name three different types of non-renewable energy? • What are fossil fuels, and why are they considered non-renewable? • How does wind power work to generate electricity? • Can you think of an example of a device that runs on solar energy? 3. Each student must analyze the information in the **interactive presentation** and answer a **quiz**.	

Activity 3. What energy sources are used to the generate the energy you use? Identify how energy is produced in the EU and how renewable energy consumption has evolved. It is also intended that students identify individual action to save energy in everyday activities and reflect on their role on saving energy. **GreenComp Reference** *1.1Valuing Sustainability* *1.3 Promoting Nature* *3.3 Exploratory Thinking* *4.2 Collective Action*	**Preparation for Activities:** To deliver this activity, students must be organized in groups and share ideas when solving tasks. Each group would have access to a computer, tablet or cellphone. **A Note for a Teacher:** If needed, the following resources can also be explored: Enerdata; Energy Literacy	
	Description **What energy sources are used to generate the energy you use?** 1. Students, in small group work, should analyse the graphic of the **Worksheet 2. Energy production in Europe**. To support their analysis, students can solve the questions proposed on the worksheet. Students' answers should be discussed in the class. 2. Each student should individually explore the **Infographic. Renewable energy in Europe** [click on the button "Want to know more? And after that click on button "The Map "and then start] and understand how energy consumption has evolved in their country between 2005 and 2020. 3. Watch the video Energy let's save it!. 4. Discuss with students the most relevant information present in the video. Suggestions topics for discussion: (1)explore simple measures to save energy in daily activities, not only contributing to environmental preservation but also saving money; (2)discuss the role each measure plays in energy conservation. 5. Organizing, in a small group work, a **role-playing activity** about the "Solar Energy issue" to help them understand this thematic. To each group is assigned a role (e.g., homeowners, community members, loggers, environmentalists, and government officials).	40 min / 90 min [with role-playing]

	 The dilemma to be discussed is: **the community is deciding whether to invest in solar energy for their town to reduce environmental impact, but this option contribute to deforestation.** Each group should prepare its argument based on various sources of information and after that present their viewpoints to the other groups, considering the benefits and potential concerns related to solar energy adoption. Finally, it´s crucial to reiterate the importance of considering various perspectives when making decisions about energy sources.  Provide some research sources for each role: Solar Energy without Deforestation Siting Solar Without Cutting Down Trees European parliament Citizen for a responsible solar Solar Energy, Wildlife, and the Environment Solar energy- European commission Forbes home	

Development

Non-renewable energetic resources, such as oil, gas, and coal, are scarce and cause a huge impact on air pollution. Renewable energetic resources, such as wind, water, and sun, are greener and can contribute to a more sustainable planet. Therefore, activities for the participants reflect on the impact of these energies are going to be provided on this unit. A set of activities is presented to explore primary school students' understanding about energy waste at their homes and actions to prevent it.

Estimated Duration 160 min

Activity 4. How is energy used at home?

Identify situations in which energy is wasted at home and reflect on behaviours that lead to this waste. Consolidate the idea of the importance of adopting energy-saving behaviours.

GreenComp Reference

1.1Valuing Sustainability
1.3 Promoting Nature
3.3 Exploratory Thinking
4.3 Individual Initiative

20 min

Preparation for Activities: This activity involves individual work and sharing ideas in the class group. Students should have access to a computer or tablet, or cellphone.

A Note for a Teacher: If needed, the following resources can also be explored: About the energy label and ecodesign

This activity can be also extended with LTP 2 Unit 3 Activities.

Description

How is energy used at home?

1. Ask students what they know about electricity and in which situations electricity is used at their homes. You may also ask if they save electricity in their daily life and how they do it.
2. Ask students to explore the interactive presentation **How is energy used at home?** and solve the tasks.
3. Engage students in a discussion for them to share their answers and promote reflection on their individual use if energy and the use that leads to energy waste.

<table>
<tr><td></td><td>4. Focus the importance of adopting energy-saving behaviours.
5. Conduct the discussion to address the existence of electrical equipment that consumes less energy, as a starting point for the next activity.</td><td></td></tr>
<tr><td rowspan="2">Activity 5. What is energy efficiency?

Understand the concept of energy efficiency and make conscious choices based on the information on the energy label of electrical equipment.

GreenComp Reference
1.1Valuing Sustainability
1.3 Promoting Nature
3.3 Exploratory Thinking
4.3 Individual Initiative</td><td>A Note for a Teacher

Efficiency means getting more for less. Energy efficiency involves using everyday appliances while consuming less energy. EU energy labels can aid in recognizing equipment that utilizes minimal energy. Through this activity, students will identify the concept of energy efficiency, its benefits, and learn how to interpret and apply EU energy labels.</td><td rowspan="2">20 min</td></tr>
<tr><td>Description

What is energy efficiency?

1. Show the video “What is energy efficiency?”.
2. Suggested questions to stimulate discussion:

• What is energy efficiency?
• What are the advantages of energy efficiency?
• What are the EU energy labels?
• How can we save energy using the EU energy labels?

3. Present the case study: “Your fridge is damaged, and your family needs to buy a new one. You are undecided between two fridges (Fridge A and Fridge B).” using the Worksheet 3. EU Label case study. Ask students to work in groups and answer the questions presented on the worksheet.</td></tr>
</table>

	Didactic suggestions: Before introducing the case study, the teacher can contextualize the importance of the EU energy label by bringing an example of a label to the classroom to better explain the information it contains and the meaning of the color code, understanding its relevance in choices aware of what we must do as consumers. After students' work, teacher can lead a discussion around the case study, **highlighting how they can reduce energy consumption** through this knowledge in their everyday lives. **A challenge** can be given to students: Find energy labels at home, photograph them, and present them on the class and discuss it with your colleagues.	
Activity 6. Is energy accessible to everyone? In this activity, the social aspect of sustainability is intertwined with the issue of energy poverty. It promotes principles such as quality of life, equality, respect, and responsibility. Additionally, it provides opportunities to foster critical thinking.	**Preparation for Activities:** Organize the students in pairs or small groups. Promote reflection around a picture to understand the importance of providing clean and affordable energy for everyone. **A Note for a Teacher:** - Smart and simple technology can bring improvements in the lives of millions of people (in this case access to electricity with all the related improvements to daily life); - Renewable energy, such as wind energy can be manageable and affordable also for poor people, it is not exclusive to the wealthy. This activity can be also extended with LTP 2 Unit 3 Activities. **Description** **Is energy accessible to everyone?**	30 min

GreenComp Reference *1.1Valuing Sustainability* *1.3 Promoting Nature* *2.2 Critical Thinking* *3.3 Exploratory Thinking* *4.3 Individual Initiative*	1.  Ask students this question: **"Is energy accessible to everyone?".** The objective is to encourage reflection on whether every individual and household has the same access to energy. 2.  Teacher can also ask students **"What energy poverty means?"** Each pair of students should discuss their ideas about both issues and share them with the class. Teacher can use a flipchart to register the main ideas, together with the class, formulate a definition of the concept (for example: Energy Poverty is not having access to enough non-polluting energy to meet day to day living requirements). 3.  Explore the picture presented on the **Worksheet 4**. **Inequal access to electricity** with students to promote discussion about the inequal access to energy. 4.  Suggested questions to stimulate discussion: • Is there universal access to sufficient energy to meet everyone's needs? • What are the consequences of not having access to energy? • What types of problems can people have without access to electricity in their homes? • How can energy poverty be tackled? • Do you know what are renewable energies? How could renewable energies help these children to have access to electricity, improving their well-being?  The suggested main ideas to focus discussion: The access to energy is unequal. Some countries produce enough energy for their population needs and others do not. The absence of electricity access makes it challenging to complete homework in the evenings. 5.  Create a simulation to students understand how we are dependent on electricity. Suggestion: Darken the entire classroom and ask students to read or characterize what they observe, for example a book.	

	6.  Explore the **Interactive Map. Electricity access 2020.** The students can then be divided into working groups, with each group assigned a specific question or topic to explore using the map. For instance, questions such as 'How many people lack access to electricity?' or 'What percentage of the population has access to clean fuels for cooking?' Each group will then present their findings and conclusions after analyzing the map. **Additional Resources:** A Guide to Understanding and Addressing Energy Poverty Energy poverty Commodities at a glance: Special issue on access to energy in sub-Saharan Africa	
Activity 7. **How does a wind turbine work? Let´s build one!** This activity - involves STEM skills to design and make a model wind turbine - challenge students to find a way to produce electrical energy from a renewable	**Preparation for Activities:** The teacher needs to previously prepare the materials for each working group create a wind turbine: • Small hobby motor, 6-12 volts; • Red, high-intensity LED; • Four craft sticks; • Small paper cup to create the turbine blades; • Medium cup for base; • Hot-glue gun and glue; • Scissors; • Drill bit that matches the size of the motor shaft; • Fan or windy day.	90 min

source such as wind, to solve the problem of lack of electricity grid and access to electricity. **GreenComp Reference** *1.1Valuing Sustainability* *1.3 Promoting Nature* *3.3 Exploratory Thinking* *4.3 Individual Initiative*	**Description** **How does a wind turbine work?** 1. Following the previous activity, the teacher can challenge students to find about a way to produce electrical energy from a renewable source, such as wind, to solve the problem of lack of electricity and access to electricity. The teacher can present the following situation: **"Imagine life without electricity. How can we produce electricity from wind?**", explore their answers and create a wind turbine. 2. Show the video "Easy do it yourself wind turbine". The video explains all steps to create a wind turbine. Students will discover how the force of wind creates movement and how this can be used to generate energy. 3. Before the work groups start creating the wind turbine, the teacher can explore the **Poster. How does a wind turbine work? Let´s build one!**, based on the video and together: • formulate a problem-question that you will try to answer with the practical activity (Fill in the poster). • explore with students the materials they should use, considering the content of the video and the procedures they should carry out. • explain that each group must film the construction of wind turbine and publish the result of their work and the conclusions they reached on a digital educational resource, such as Padlet® or similar. 4. In the class, promote a final reflection on the importance of renewable energy, such as wind energy. Systematize these ideas on the board, for example. **Additional Resources:** Energy kids; Game for kids; Wind energy for kids; Energy efficiency & savings	

Consolidation

Small forms of intervention are suggested to mobilize the knowledge acquired from previous activities and, simultaneously, raise awareness in the surrounding community.

Estimated Duration
100 min

Activity 8. How can we act in the community to promote energy saving?

Small forms of intervention are suggested to mobilize the knowledge acquired from previous activities and, simultaneously, raise awareness in the surrounding community.

GreenComp Reference
1.1Valuing Sustainability
1.3 Promoting Nature
3.3 Exploratory Thinking
4.2 Collective Action

40 min

Preparation for Activities: Based on the lessons learned in this unit, students will be able to consolidate and apply their knowledge through several initiatives. They may only carry out one of them, depending on the time available to do so. For this activity, the teacher should organize working groups and share ideas in the class, as well as plan and organize the various initiatives with the students.

Description

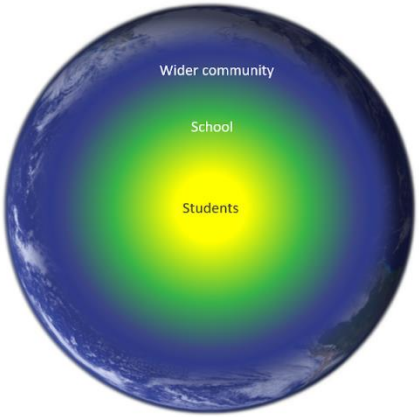
How can we act in the community to promote energy saving?

1. Students, previously, share with family and friends the most common ways of wasting energy at home and what behaviours they should adopt to save energy. Through dialogue, share in the class the measures taken by each family to save energy in their homes.
2. Promote the activities "How is energy used at home?" and "What is energy efficiency?" with students from other classes, as a way of raising awareness among the educational community guided by the teacher.
3. Organize a webinar on the topic "Does everyone have access to energy?" with NGO representatives to address the issue **or** organize a debate/discussion at school with guests from different sectors of society to discuss the role of renewable energy in underdeveloped countries (the discussion can start from the

	ideas in the text: Africa's renewable energy potential). The students should ask guests questions previously thought out with the help of the teacher. 4. Systematize on a padlet or jamboard what you have learned through these activities (highlight what you can do to save energy in your day-to-day life and explain why it's important for citizens to adopt energy-saving behaviours).	
Activity 9. How can I save energy? By acting for sustainability, students will develop their critical thinking about energy consumption and also contribute to the community empowerment concerning this issue [to save energy]. **GreenComp Reference** *1.1Valuing Sustainability* *1.3 Promoting Nature* *4.2 Collective Action* *4.3 Individual Initiative*	**Preparation for Activities:** The teacher should arrange working groups and explain that, for this activity, students will need to use a cellphone or camera. Selecting the location(s) for the exhibition is crucial to ensure maximum visibility to reach as many people as possible and effectively convey the message. Contact those responsible for the location(s) to make authorization requests and organize the information to publicize the initiative on the school's social networks, newsletter and/or local newspaper. **A Note for a Teacher:** It´s important promote awareness that: With small actions, it is possible to make a big difference. Citizens have the power to reduce their energy consumption and help the planet [each of us must make our commitment to the environment…and spread the word]. **Description** **How can I save energy?** 1. In group work, ask the students to identify and take pictures of the situations representing appropriate energy use and opportunities for reducing energy consumption.	60 min

	2. They can create a poster with examples of labels to promote appropriate behaviour to reduce energy consumption, such as the following example of a **Poster. Labels energy saving** . 3. The students should do a collective exhibition in the school and/or another public place with the photos and associated messages about ways to save energy in their community. 4. Each work group is also responsible for placing/sticking labels next to situations that aim to involve energy saving as a reminder. 5. Publicize the initiative on the school's social networks, newsletter and/or local newspaper. 6. The teacher and students will also be able to define an action plan at school and identify stakeholders (students, teachers, director, educational action assistant, technicians, etc.), recognize how electricity is consumed at school (computers, light, refrigerator, heaters/air conditioning) and think about measures to adopt to reduce energy consumption at school. 7. Ask students to fill the **worksheet 5**. **Self-evaluation**.	

Follow-Up

The aim of the follow-up activities is to reflect about the teacher practices.		**Estimated Duration 40 min**
Activity 10. Reflection about teacher practice This is a collective discussion aimed to reflect about teacher practices and the contribute of the previous activities to develop sustainability competences.	**How can I mobilize the activities in my teacher practice?** Please reflect on two or three of the following dimensions at three levels of engagement (students - teacher; school; and wider community and beyond):  **Dimension 1. Learning objectives:** In what ways do these activities contribute to the global educational goals for your students? You might consider in particular LTP methods, materials, tools and activities you would or have implemented/transferred from the TAP-TS LTP into your regular teaching curricula.	40 min

	Within the school or learning context, how have the activities helped the learners in terms of embodying sustainability values, acting for a sustainable future and/or envisioning a more sustainable future? How have the activities added to the knowledge and understanding of the learners in terms of working with others in the broader community to create inclusive visions for a more sustainable future? **Dimension 2. Integration with different subjects:** In what ways the activities could engage your students with different knowledge areas and subjects of the curriculum? In what ways these activities could be connected with different subjects of the curriculum? How have the activities contributed to collaboration with others at school or institutional level to approach a sustainability issue from different perspectives, knowledge areas and contexts? In your opinion, do the LTP materials, tools and methods you have implemented also offer potential for use in other subjects? If so, in which subjects? How have the activities encouraged students to draw on different perspectives, and subject knowledge to identify interconnections, and reflect on one's own environmental, cultural and economic impact? **Dimension 3. Inclusion:** Can the previous activities contribute to all students' participation and learning? What actions can you take to ensure the learning of all students? How have the activities contributed to engage with different perspectives to consider sustainability challenges and opportunities?	

	How do the activities help reflect on, identify, envision or even shape the trajectory towards a collective preferred future that includes various perspectives, cultures, traditions, and are grounded in values for sustainability? **Dimension 4. Environmental / Sustainability awareness:** To what extent do the activities promote awareness and responsibility among your students? Did the implemented LTP materials, methods or tools increased or rather limited the opportunity to increase students´ environmental awareness? How have the activities encouraged the students to be aware of their individual and collective impact on nature, and provided opportunities to restore it at school level? How have the activities contributed to grasp connections and interactions between natural events and human actions? **Digital resources and equipment:** Do the current resources and equipment available in your institution adequately support the activities you have selected and implemented from LTP materials, or are there enhancements needed? How did you try to enable students to use resources for learning at school in a sustainable way? Did the activities encourage students to assess and question their needs to carefully manage resources in the pursuit of longer-term goals and common interests? How did the activities help them to think critically about information sources and communication channels on sustainability to assess the quality of the information they provide?	

Community involvement:

- To what extent can you involve the local community or connect with community issues related to the sustainability theme approached?
- Have the selected and implemented LTP methods, tools and materials encouraged you to initiate cooperation with external partners (associations, companies, NGOs, etc.) to enrich learning experiences? If so, in which areas are you aiming for cooperation?
- To what extent do the activities engage in democratic decision making and civic activities for sustainable development?
- How does your teacher practice encourage students' intentions and willingness to give back to the community and nature?

Assessment and feedback :

- Have you adapted the original assessment methods or the requirements for students after integrating the LTP materials, methods, or tools into your existing teaching concept? If yes, in which way/how?
- To what extent does your teaching practice encourage students to use evidence, combine knowledge and resources to analyse and evaluate futures and their opportunities, limitations and risks, and contribute to decision-making at school level.
- To what extent does your teaching practice encourage students to use evidence, combine knowledge and resources to analyse and evaluate futures and their opportunities, limitations and risks, and contribute to decision-making, and become agents of change.

Glossary

Energy: Energy is the ability to do work, the ability to make a change. Everything that happens in the world involves the exchange of energy in some way, involves a change of some kind. When we use energy, we do not use it up; we convert one form into other forms. Energy can be categorized in many ways-by the forms it takes, by what it does, by the changes it makes, and by the effects we can see or feel or measure (The NEED project).

Renewable energy: Is energy derived from natural sources that once used are quickly replenished, and can be used again and again (Understanding Renewable Energy. UNEP).

Non-renewable energy: Energy sources that cannot be replaced once used up (within a human lifetime). (Understanding Renewable Energy. UNEP).

Fossil fuels: Fuels such as coal, oil, gas which are mined from the Earth and are burnt to release energy, and greenhouse gases as a byproduct. They are formed from broken down plants and animals that died a very long time ago. (Understanding Renewable Energy. UNEP).

Energy sources: There are many different sources of energy, but they are all either renewable or non-renewable energy sources. Non-renewable energy sources – Petroleum, Hydrocarbon gas liquids, Natural gas, Coal, Nuclear energy. Renewable energy sources - energy from the sun, energy from heat inside the earth/earth thermal energy, wind energy, Biomass from plants (form organics materials), Hydropower from flowing water (Energy Information Administration; United Nation).

Energy efficient: Describes products and actions that use less energy due to advanced technology and equipment (Alliant Energy Kids).

Wind farm: A wind farm is an area of land containing wind turbines that generate electricity. There may be just a few wind turbines, or hundreds of them. Because wind turbines need a lot of space, they are often located in fields on farms (Alliant Energy Kids).

Energy poverty: Energy poverty occurs when a household must reduce their energy consumption to a degree that negatively impacts their health and wellbeing. It is mainly driven by 3 underlying root causes: a high proportion of household expenditure spent on energy, low income and low energy performance of buildings and appliances (Energy poverty. European Commission).

Energy access: A household having reliable and affordable access to both clean cooking facilities and to electricity, which is enough to supply a basic bundle of energy services initially, and then an increasing level of electricity over time to reach the regional average (Energy access. International Energy Agency).

Glossary of Icons

 - Video

 - Quiz

 - Worksheets

 - Various Media, e.g. Learning Apps

 - Text to Read, or engage in active listening to others

 - A question to Respond or a Question for Reflection

 - A Discussion

 - Focusing Activity

 - A Reflection Activity

 - An Activity for Action

 - A Map

 - Taking a picture

 - a short note for a teacher

 - a group exchange

Worksheets and links

Start-Up

Activity 1. What is energy?

- Video What is energy?
- Worksheet What is energy?

Activity 2. What are energy sources?

- Video What are the EU's energy sources?
- Genially® Energy sources – renewable and non-renewable

Activity 3. What energy sources are used to the generate the energy you use?

- Worksheet Energy production in Europe
- Video Energy let´s save it?

Development

Activity 4. How is energy used at home?

- Genially® How is energy used at home?

Activity 5. What is energy efficiency?

- Video What is energy efficiency?
- Worksheet EU Label case study

Activity 6. Is energy accessible to everyone?

- Worksheet Inequal access to electricity
- Interactive Map Electricity access 2020.

Activity 7. How does a Wind turbine work? Let´s build one!

- Video Easy do it yourself wind turbine

- **Poster**  **How does a Wind turbine work? Let´s build one!**

Consolidation

Activity 9. How can I save energy?

- **Poster**  **Labels energy saving**
- **Worksheet**  **Self-reflection**

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TAP-TS Roadmap

TAP-TS Roadmap has three main goals: (1) for the TAP-TS partners as a roadmap to design LTPs; (2) for teachers and student teachers to design materials for teaching sustainability; (3) evaluation of LTPs. Explore the visualisation on the next page.

TAP-TS Roadmap: the Steps / stages in the TAP-TS LTPs Design Journey	
1: Clarify the Goal	Our overarching goal is to enable learners and teachers to think and act sustainably. To actively participate in the discourse on sustainability, the topics must also be addressed - sustainably - in schools and universities. The goal of TAP-TS is to create learning and teaching packages for this purpose in the following areas: 2.1 A Sustainable Europe. 2.2 Sustainability and Digitality. 2.3. Sustainability and Environmental Education. 2.4 Climate Crisis Resilience. 2.5 Dealing with Climate Disinformation. 2.6 Green Citizenship in/for Europe. 2.7 Sustainable Entrepreneurship Education.
2: Competency Areas	The LTPS should be aligned with the interconnected four competences defined in the Green Comp Framework: • Embodying sustainability values • Embracing complexity in sustainability • Envisioning sustainable futures • Acting for sustainability
3: Networking & Bundle Expertise	There are many exciting topics. 1. Find a focus: what driving question is at the centre of your LTP. 2. See what resources are available (competencies, teaching-learning materials, etc.). 3. Network with colleagues and partner institutions regionally and nationally.
4: Working through the design process	Teaching Sustainability should be: action-oriented learning; hands-on; focussing on real life challenges; stimulate creative collaboration between teachers and learners; visions-oriented; participatory and action oriented . Approaches to teaching sustainability may be inquiry-based learning; explorative learning; networked learning; participation learning aimed at problem framing. Teaching Sustainability may incorporate the following activities: collaborative projects, future framing workshops, research and analysis, discussion.
5: ASSESSMENT DESIGN And REFLECTION	In Education for Sustainability assessment can be multifaceted and primarily encourage reflection and be evidence based. There is not always ONE right answer. The goal should be to RAISE QUESTIONS. TS is not about teaching the „right“ behaviour, but about practising a critical perspective. Give TS an important place in curricula and implement credits, badges, or awards for it.
6: PUBLISH TO TAP-TS PLATFORM	Can you and where can you publish your materials under a Creative Commons license as free as possible. Because that is sustainable!

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ROADMAP Developing TAP-TS Materials

1 CLARIFY THE GOAL

A goal of TAP-TS is to create learning and teaching packages that would enable teachers and learners think and act sustainably. Find a focus based on SDGs, GreenComp Framework or a sustainability problem; and define learning objectives within the seven TAP-TS themes.

1. A Sustainable Europe.
2. Sustainability and Digitality.
3. Sustainability and Environmental Education
4. Climate Crisis Resilience. 5. Dealing with Climate Disinformation. 6. Green Citizenship in/for Europe. 7. Sustainable Entrepreneurship Education.

2 PLAN

Consult the TAP-TS LTPs Architecture.
The LTPs Units should address the interconnected competences as defined e.g. in the Green Comp Framework:

1. Embodying sustainability values
1.1 Valuing sustainability | 1.2 Supporting fairness | 1.3 Promoting nature
2. Embracing complexity in sustainability
2.1 Systems thinking | 2.2 Critical thinking | 2.3 Problem framing
3. Envisioning sustainable futures
3.1 Futures literacy | 3.2 Adaptability | 3.3 Exploratory thinking
4. Acting for sustainability
4.1 Political agency | 4.2 Collective action | 4.3 Individual initiative

See GreenComp for details

3 BUILD NETWORK AND GROW EXPERTISE

See what resources are available and could support your LTP (teaching-learning materials, etc.).
Network with colleagues and partner institutions regionally and nationally.
Describe possible collaborations with the 'world of work'.

4

LEARNER CENTERED & INCLUSIVE
REFLECTION FOR ACTION
TRANSFORMATIVE
COLLABORATIVE PRO TS
FUTURE WORKSHOP
DISCUSSIONS
REFLECTION
RESEARCH & ANALYSI
TEACHING SUSTAINABILITY
ACTION-ORIENTED
ENTREPRENEURIAL
HANDS-ON
REINFORCING COLLABORATION
INTERDISCIPLINARY
EXPLORATIVE LE
VISIONS-ORIENTATED
PARTICIPATIVE

5 DO IT! HAVE FUN! DISCUSS! BE CREATIVE!

6 REFLECT

In Education for sustainability assessment is multifaceted, and primarily encourages reflection ifor action and future- oriented aimed to raise questions and practise a critical perspective.

There is no ONE right answer! Give TS an important place in curricula and implement credits, badges or awards for it.

7 SHARE

Publish and share your materials under a Creative Commons license as open access. Because that is sustainable!

Link to GreenComp:
https://publications.jrc.ec.europa.eu/repository/handle/JRC128040

Teaching Sustainability: Learning activity Template

1. Introduce yourself!

My name:
My country:
My role:
My school:
My class:

2. OVERVIEW

Provide a brief description of the learning activity, including information about the targeted age group and duration. Clearly state the motivation behind your learning activity and explain which elements of the curriculum your learning activity is related to.

Age Group:

Duration:

Related Themes of Sustainability:

Description:

3. LEARNING OUTCOMES

What are the learning outcomes of this learning activity, and which key GreenComp competences does it promote?

4. LEARNING APPROACH

Having in mind the learning outcomes, what active learning approaches will be applied?

Specify the engagement strategies and sequence of learning tasks that students will develop in the context of the activity. Explain how GreenComp competences will be promoted.

What will be the role of the teacher, and what will be the students' role? How will the students work—individually or in groups?

5. DIGITAL RESOURCES

Which digital technologies, including tools, services, and resources, will be utilized in the activity? Additionally, how will these digital technologies be effectively integrated to enhance lesson outcomes and student understanding?

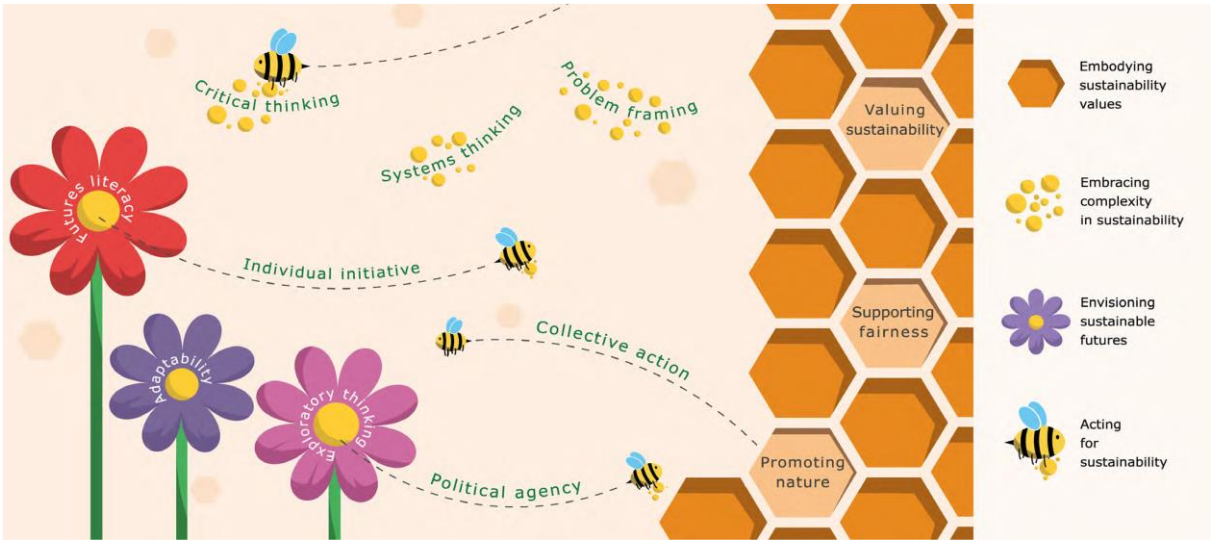
6. ASSESSMENT

What assessment strategies and instruments will be employed to evaluate student learning?

GreenComp Framework: the European Sustainability Competence Framework

Within the TAP-TS Project, *GreenComp (Bianchi et al., 2022)* serves the following purposes: design of learning and teaching packages; development of TAP-TS professional development activities, (self)-reflection, and evaluation. The aim of GreenComp is to foster a sustainability mindset by helping teachers and students develop the knowledge, skills and attitudes to think, plan and act with empathy, responsibility, and care for our planet.

Visual representation of *GreenComp:*



GreenComp consists of 12 competences (in bold) organised into the four areas (in italics) below:

- *Embodying sustainability values, including the competences*
- **valuing sustainability**
- **supporting fairness**
- **promoting nature**

- *Embracing complexity in sustainability, including the competences*
- **systems thinking**
- **critical thinking**
- **problem framing**

- *Envisioning sustainable futures, including the competences*
- **futures literacy**
- **adaptability**
- **exploratory thinking**

- *Acting for sustainability, including the competences*
- **political agency**
- **collective action**
- **individual initiative**

Reference: Bianchi, G., Pisiotis, U., Cabrera Giraldez, M. GreenComp – The European sustainability competence framework. Bacigalupo, M., Punie, Y. (editors), EUR 30955 EN, Publications Office of the European Union, Luxembourg, 2022; ISBN 978-92-76-46485-3, doi:10.2760/13286, JRC128040.

Project partners

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