



**SOLAR**

Adult education and sustainable practices:  
Sun's light and heat as renewable energy sources

# **SOLAR TRAINING TOOLKIT FOR ADULT EDUCATORS**



Project n. 2022-1-IT02-KA220-ADU-000087707

# PROJECT CONSORTIUM



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Project n. 2022-1-IT02-KA220-ADU-000087707



**Co-funded by  
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# INDEX

	<b>Pag.</b>
<b>01. Introduction</b>	<b>5</b>
<b>02. What is electrical power</b>	<b>7</b>
<b>03. What is meant by consumption</b>	<b>18</b>
<b>04. What is energy efficiency means</b>	<b>27</b>
<b>05. Understanding energy bills</b>	<b>35</b>
<b>06. Why it is better to use electricity than gas</b>	<b>40</b>
<b>07. How electricity is produced</b>	<b>48</b>
<b>7.1 Renewable energies in Europe</b>	<b>51</b>
<b>08. The sun as an infinite resource of production</b>	<b>57</b>
<b>8.1 What do solar panels look like?</b>	<b>60</b>
<b>09. Photovoltaic technologies</b>	<b>65</b>
<b>10. Pros and Cons of photovoltaic technology</b>	<b>72</b>
<b>11. Some factors to consider...</b>	<b>76</b>
<b>11.1 Storing electricity</b>	<b>77</b>
<b>11.2 Heating water with the sun</b>	<b>79</b>
<b>11.3 New consumer habits</b>	<b>80</b>
<b>11.4 Future innovations: the smart grid</b>	<b>81</b>
<b>11.5 Effects and environmental impact</b>	<b>82</b>
<b>12. Conclusion</b>	<b>84</b>



**1.**

# **INTRODUCTION**

**A**lbert Einstein, with his wisdom, stated a timeless truth: “The purest source of energy is the Sun.” Today, these words resonate more than ever in the context of an energy revolution that is transforming our approach to energy, putting an end to centuries-old dependence on non-renewable fossil fuels. The installation of solar panels on homes, once unthinkable, is becoming increasingly common, marking a shift towards a clean and renewable energy source.

In the current contemporary era, characterized by a growing environmental awareness to address climate change and mitigate the rise in Earth’s temperatures, renewable sources play a crucial role. However, more than renewable energy generation, the reduction of consumption is of paramount importance. This goal aims to make our buildings capable of performing the same, if not better, functions while consuming fewer resources.

This guide will take you through the world of electrical energy, providing a comprehensive overview of how it works and how to harness it to its fullest potential. You will explore the process of capturing and converting solar energy, transforming sunlight into an (almost) infinite resource ready to power our homes. We will analyze the strengths and weaknesses of this energy source and how we can leverage it to reduce overall consumption.

The focus will not only be on producing clean and local energy but also on energy efficiency. The first source of clean energy is, indeed, energy savings. This guide will teach you the behaviors to adopt to consume less and contribute to creating a better world for present and future generations.

Whether you are new to the world of energy or renewable systems, this collective exploration will guide us through the potential of the Sun in shaping a sustainable and energy-independent future. Together, we will discover how the Sun can lead us towards a better world where energy is clean, sustainable, and accessible to all.



# 2.

## **WHAT IS ELECTRICAL POWER**

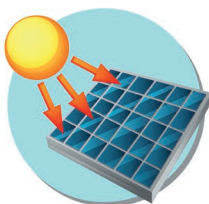
**E**nergy is one of the key concepts in physics and is defined as the ability of a body or, more generally, a physical system to perform work, and the measure of this work is also a measure of energy. A body that possesses energy is therefore capable of performing work, and the work of a force allows some of the energy to be transformed from one form to another. In a simple way, energy is like the “fuel” that powers everything that happens around us. Just as to turn on a light bulb you need electricity, to play soccer and see the ball in motion you need kinetic energy.

Energy is governed by a series of laws, known as the **Laws of Thermodynamics**. The first law, also known as the principle of conservation of energy, states that energy can neither be created nor destroyed, it can only be transformed. Just as, for example, in nature, solar energy becomes chemical energy through photosynthesis in plants, humans also transform solar energy into electrical energy. There is nothing in nature that violates this principle: the total energy of the Universe is constant, even though it can be transformed and transferred.

The **Second law of Thermodynamics** tells us in what “direction” transformations occur: It is impossible to carry out a transformation whose only result is to transfer heat from one body at a given temperature to another at a higher temperature.



THERMAL  
ENERGY



RADIANT  
ENERGY

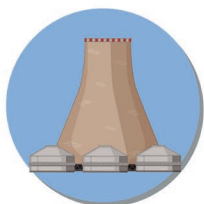


LIGHT  
ENERGY

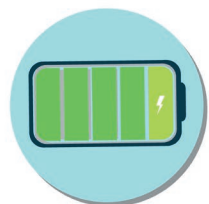


CHEMICAL  
ENERGY

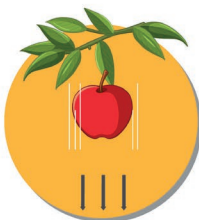
## TYPES OF ENERGY



NUCLEAR  
ENERGY



ELECTRICAL  
ENERGY



GRAVITATION  
ENERGY



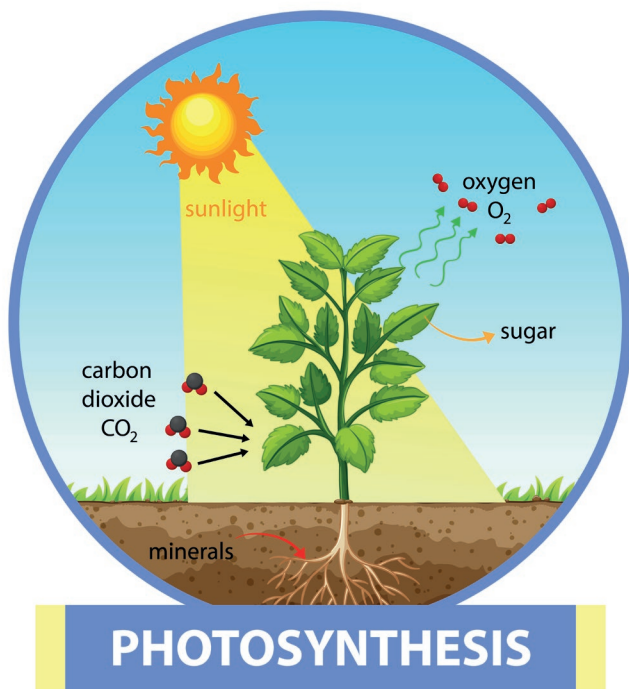
MECHANICAL  
ENERGY

This means that heat always flows from the hotter body to the colder one and not the other way around.

That is, there are irreversible natural phenomena which, once they have occurred, can no longer proceed in the opposite direction to reestablish the initial situation. This observation leads us to define the concept of entropy, which represents the degree of disorder in a system. Entropy can increase as a result of irreversible processes, such as the diffusion of heat from a warmer to a cooler zone. Systems naturally tend toward disorder until they reach a new equilibrium.

Various forms of energy exist in the world. By form of energy is meant the way it manifests itself i.e., how humans see or perceive its effects.

We usually distinguish mechanical energy, associated with the displacement of a body by a force; thermal energy, or heat, associated with the agitational motion of the particles that make up matter; electromagnetic, or radiant, energy, associated with the emission of electromagnetic radiation; chemical energy, associated with the bonding forces between atoms in molecules; nuclear energy, resulting from the bonding forces between the particles of the atomic nucleus; and finally electrical energy, which we will elaborate on below.



Today, in fact, electric energy powers most of the devices around us, yet we do not see it, feel it or physically perceive it. It is generated by the orderly movement of electrical charges, that is, by the attraction and repulsion of particles in the atom that have a positive (proton) or negative (electron) charge.

Imagine that electrical energy is like the invisible air that surrounds us. We perceive it, it can interact with us, and it surrounds us all the time. But we do not see it, but if it were not there it would be impossible for us to live.

This invisible energy can be set in motion in different ways, such as when the wind blows. This movement creates a kind of “flow of electricity” through wires, just like water flowing in a river. If it were absent, our devices could not function, because for them it is as if they could not breathe their oxygen: electricity.

The orderly motion (in the sense of having a definite direction and flow) of electric charge takes the name, in physics, of electric current .

“Electricity” can be directed to our homes, where it is used to run lights, electrical appliances and much more. It is somewhat like the beating heart of our modern society, powering everything that makes our days more comfortable and enjoyable.

While it might sound a bit complicated, we can think of electricity as a valuable resource that helps us connect with the world around us. It is an example of how science and technology can work together to improve our quality of life.

So when we turn on a lamp or listen to the radio, we can remember that all of this is made possible through the magic of electricity.



# **EXA MPLE.**

## **THE ELECTRIC TOASTER**

**Overview:** the electric toaster is a ubiquitous kitchen appliance that exemplifies the principles of electrical energy in everyday life. It provides a practical and relatable example for students to understand how electrical energy is harnessed and utilized. Functionality:

**Input:** The toaster is connected to a power source, typically a wall outlet, supplying it with electrical energy.

**Conversion:** When the toaster is turned on, electrical energy is converted into heat and light energy. This transformation occurs within the toaster's heating element.

**Output:** The heat generated by the heating element is then applied to slices of bread, causing them to toast. The process is quick and efficient, demonstrating how electrical energy can be converted into a different form to perform a specific task.

## KEY COMPONENTS

**Heating Element:** The heart of the toaster, the heating element, is usually made of nichrome wire. When electrical current passes through it, resistance generates heat.

**Thermostat:** Many toasters are equipped with a thermostat to control the toasting process. It regulates the temperature of the heating element, ensuring consistent toasting results.

**Timer:** To control the toasting duration, a timer is often integrated. It allows users to customize the toasting level based on their preferences.

## EDUCATIONAL ACTIVITIES

**Circuit Exploration:** Students can explore the basic circuitry inside a toaster. Identify the power cord, heating element, and other components that contribute to its functionality.

**Power Consumption Analysis:** Calculate the energy consumption of the toaster based on its power rating and the time it takes to toast bread. Discuss the concept of power and energy efficiency.



**Safety Discussions:** Emphasize the importance of electrical safety when using appliances. Discuss safety features in modern toasters, such as automatic shut-off mechanisms.

## RELATED CONCEPTS

**Resistance:** Discuss how the heating element's resistance plays a crucial role in converting electrical energy into heat, illustrating the concept of electrical resistance.

**Energy Transformation:** Explore the conversion of electrical energy into heat and light, highlighting the broader concept of energy transformation. By dissecting the electric toaster as an example, students can gain a practical understanding of electrical energy, its conversion, and its application in everyday appliances. This hands-on approach helps demystify complex concepts and makes learning about electrical energy more engaging.



**EXE  
CISE.**

**UNDER  
STANDING  
ELECTRICITY  
ENERGY**

# EDUCATIONAL ACTIVITIES

**Objective:** To explore the concept of electricity energy through a simple and interactive activity.

**Materials Needed:**

- Small flashlight or LED bulb
- Battery (compatible with the flashlight or LED bulb)
- Wires with alligator clips
- Paper clips
- Cardboard or a small box
- Safety gloves (optional)

## ACTIVITY STEPS

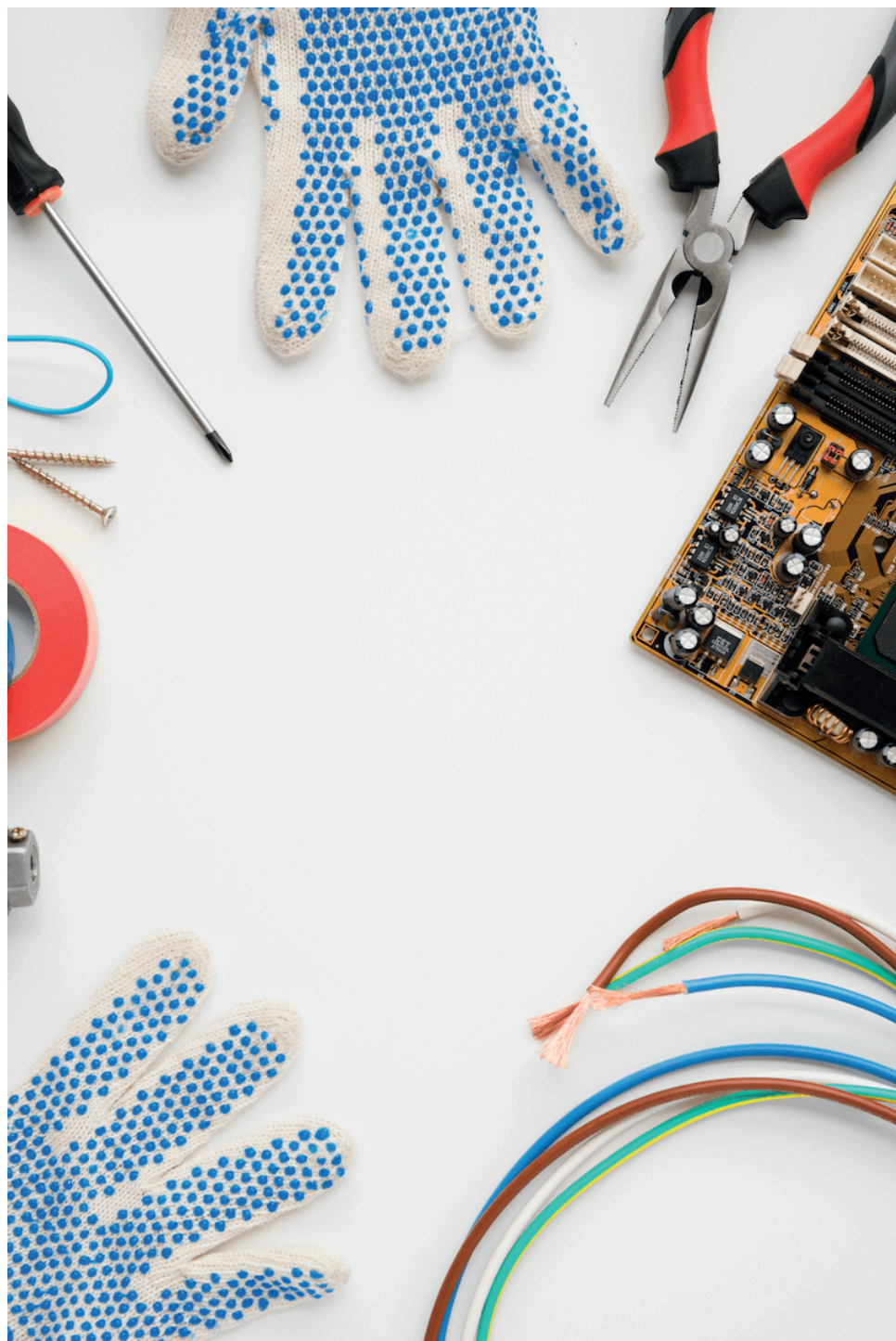
**1. Introduction (5 minutes):** Begin by discussing the basic idea of electricity energy with the participants. You can use simple language to explain that electricity is a form of energy that we use to power various devices in our daily lives. Mention that it involves the flow of electrons.

**2. Demonstration (10 minutes):** Show the participants the components you've gathered for the activity: flashlight or LED bulb, battery, wires, and paper clips. Briefly explain the role of each component in the circuit.

**3. Building a Simple Circuit (15 minutes):** Divide participants into small groups. Provide each group with the materials and ask them to build a simple circuit using the flashlight or LED bulb, battery, and wires. Encourage them to work together, discussing the purpose of each component.

**4. Experimenting (15 minutes):** Once the circuits are built, ask participants to explore and experiment. What happens if they disconnect a wire? What if they add more batteries? Encourage them to make observations and discuss the changes they observe.

**5. Concept Discussion (10 minutes):** Gather participants and facilitate a discussion about their observations.



## ASK QUESTIONS LIKE

- What did you notice when the circuit was complete?
- How did the brightness of the bulb change when you added more batteries?
- What happened when you disconnected a wire?

**6. Reinforcement (10 minutes):** Reinforce the key concepts of electricity energy, such as the flow of electrons in a closed circuit and how the components work together to produce light. Emphasize safety precautions when working with electricity.

**7. Reflection and Summary (5 minutes):** Ask participants to reflect on what they've learned during the activity. Summarize the key points, ensuring everyone understands the basic concept of electricity energy.

## SAFETY TIPS

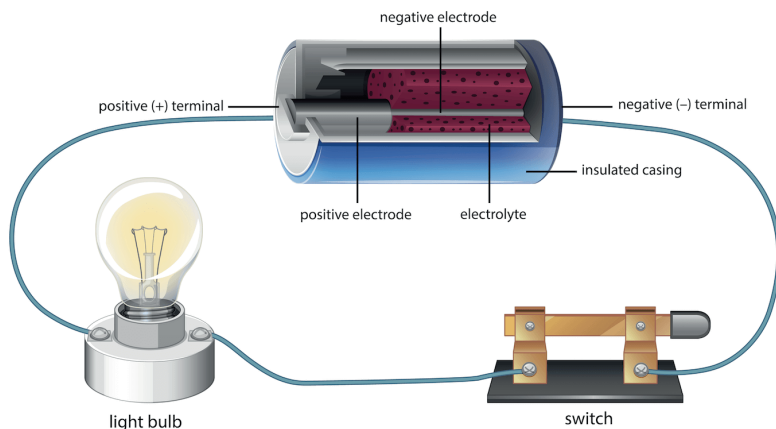
**Always prioritize safety.** Remind participants not to touch exposed wires or connect the circuit directly to the power source.

**Provide safety gloves** for those who prefer extra protection.

**Monitor the activity closely**, especially if working with younger participants.

This interactive activity aims to make the concept of electricity energy tangible and fun for participants, promoting a deeper understanding of how circuits work.

**Objective:** Engage adult learners in a practical and collaborative activity to raise awareness about energy consumption and encourage sustainable practices.



# 3.

## **WHAT IS MEANT BY CONSUMPTION**



**E**nergy consumption refers to the amount of energy used to power various human activities, industrial processes, transportation systems, electrical appliances, heating and cooling systems, and many other Aspects of modern life. In other words, it is the measure of how much energy is utilized to support human activities and operate structures and technologies.

The consumed energy can be derived from various sources, including fossil fuels (such as oil, coal, and natural gas) and renewable sources (such as the sun, wind, water, and geothermal heat). Energy consumption is a crucial indicator for assessing the use of energy resources and the associated environmental impact. Here are some examples of what energy consumption might entail in different environments:





**Residential:** The energy consumed in homes for lighting, heating, cooling, the use of appliances, and cooking.

**Commercial:** The energy used in shops, offices, hotels, and other commercial buildings for lighting, heating, air conditioning, and business equipment.

**Industrial:** The energy consumed in industrial production processes, such as production lines, machine tools, furnaces, processing equipment, and assembly.

**Electricity Production:** The energy used to operate power plants that generate electricity from sources such as coal, gas, nuclear, wind, solar, and water.

**Utilities:** The energy used in public services, such as urban heating, the supply of drinking water, and wastewater treatment facilities.

Monitoring and managing energy consumption have become increasingly important to promote energy efficiency, reduce greenhouse gas emissions, and encourage sustainable resource use. Measuring and understanding energy consumption in different sectors are fundamental for developing policies and strategies aimed at more sustainable energy production and consumption.

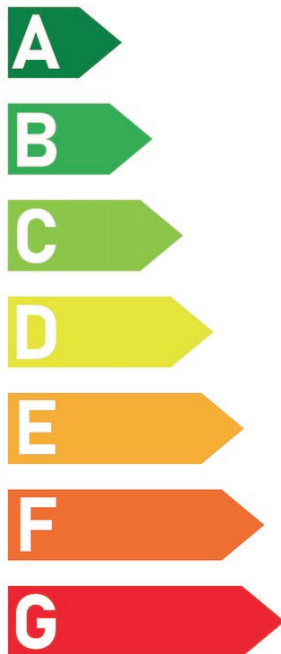


# ENERGY LABEL

In 1995, the European Union created “energy labels” to establish an unambiguous classification system for the energy consumption of household appliances ranging from A to D. Later, as technology developed, the plus symbol began to be added to the letter A until, in 2021, the European Community introduced the new energy label. Instead of A’s with the plus symbol, there is a scale from A to G, where A is bright green and indicates the highest energy efficiency, while G is red and indicates the least efficient class. The most common household appliances belong to classes A and B.

The goal of introducing this system is to raise awareness among manufacturers and citizens toward energy consumption and facilitate a conscious choice regarding the environmental impact of one’s purchases. In the new energy label, in fact, it is possible to scan a QR code to obtain additional information.

In addition, the European Community has launched the BELT (Boost Energy Label Take up) project on the site of which there is a calculator that allows people to know how much the purchase of an appliance of a certain energy class can save in terms of consumption, electricity and CO2 emissions.



**EXE  
RCISE.**

**ENERGY  
CONSUMPTION  
AWARENESS  
CAMPAIGN**

## STEP 1: INTRODUCTION (15 MINUTES)

**1.1 Overview Presentation:** Provide a brief presentation on the significance of energy consumption, its impact on the environment, and the importance of fostering a culture of sustainability.

**1.2 Discussion:** Engage participants in a brief discussion about their current knowledge and attitudes towards energy consumption.

## STEP 2: DATA COLLECTION (30 minutes)

**2.1 Individual Energy Logs:** Distribute energy log templates to each participant. Instruct them to maintain a log for a week, recording their daily energy-related activities (e.g., electricity usage, transportation habits, appliance usage).

**2.2 Group Discussion:** Form small groups to discuss the challenges and observations noted in their energy logs. Encourage participants to share insights and potential areas for improvement.

## Step 3: DESIGNING AWARENESS CAMPAIGN (45 MINUTES)

**3.1 Brainstorming Session:** Facilitate a brainstorming session where groups identify creative ways to raise awareness about energy consumption within their community or workplace.

**3.2 Campaign Elements:** Ask groups to outline key elements of their awareness campaign, including messaging, target audience, and delivery methods (e.g., posters, workshops, social media).

## STEP 4: IMPLEMENTATION (60 MINUTES)

**4.1 Campaign Execution:** Allocate time for each group to implement a part of their awareness campaign. This could involve creating posters, preparing short presentations, or developing social media content.

**4.2 Practice Session:** Allow groups to rehearse their presentations or activities within their small groups, providing constructive feedback.

## **STEP 5: CAMPAIGN PRESENTATION AND REFLECTION** (30 MINUTES)

**5.1 Campaign Showcase:** Each group presents its awareness campaign to the entire class. Encourage creativity and effective communication.

**5.2 Reflection:** Facilitate a discussion on the overall experience. What did participants learn from implementing the campaign? What challenges did they face, and how did they overcome them?

## **STEP 6: ACTION PLANNING** (20 MINUTES)

**6.1 Individual Action Plans:** Ask participants to develop individual action plans outlining how they will incorporate energy awareness activities into their teaching practices.

**6.2 Group Sharing:** Provide a platform for participants to share their action plans within small groups, fostering collaboration and the exchange of ideas.

## **STEP 7: TOOLKIT RESOURCES AND CLOSING** (15 MINUTES)

**7.1 Resource Review:** Highlight specific resources within the toolkit that support ongoing efforts to teach about energy consumption. Include relevant lesson plans, articles, or multimedia materials.

**7.2 Closing Remarks:** Conclude the activity by summarizing key takeaways and expressing appreciation for the participants' engagement.

**Conclusion:** the "Energy Consumption Awareness Campaign" activity enhances participants' understanding of energy consumption and empowers them to actively contribute to creating a culture of sustainability.

# Weekly Schedule

Note here the use of electricity, transport habits, use of electrical devices

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
6 am							
7 am							
8 am							
9 am							
10 am							
11 am							
12 pm							
1 pm							
2 pm							
3 pm							
4 pm							
5 pm							
6 pm							
7 pm							
8 pm							
9 pm							
10 pm							
11 pm							
12 am							

# AWARENESS CAMPAIGN



Name .....

MAIN TOPICS

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TARGET

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COMMUNICATION  
CHANNELS

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# 4.

## **WHAT ENERGY EFFICIENCY MEANS**

**N**ow let's imagine that energy is a fuel we use to run things, such as our homes, cars, and even electronic devices. Energy efficiency is like the smart way we can use this "fuel" more wisely and economically. Think of a car: if we can make it travel a greater distance with the same amount of fuel, then we say that car is energy efficient. The same concept applies to anything that uses energy, such as a light bulb, a refrigerator or a computer. When these things are designed to do their job with as little energy as possible, we are talking about energy efficiency.

In practice, energy efficiency translates into savings. By using less energy to achieve the same results, you can save money on your energy bills and at the same time reduce your environmental impact. This is important because energy production often involves the use of natural resources and can generate harmful emissions to the environment.

So improving energy efficiency helps both your wallet and the planet by making sure we get more for less.

Obviously in a residential environment, given small volumes of energy, a small amount of energy can be saved that is really impactful on a large scale. However, there are a number of tricks we can easily put in place.





## GOOD ENERGY - SAVING PRACTICES

Turn off unused appliances, the stanby consumes power.



Make washing machine, dishwasher and dryer fully charged and with ECO programs.



Do not use the refrigerator below 3 degrees and defrost regularly



Adjust the temperature of the water heater to not more than 60 degrees and prefer showers to the bath

Adjust the heating temperature to no more than 19 degrees



Choose led bulbs and turn off the light when you leave the room

Uses insulating fixtures and shutters to counteract the heat and cold



In summer it adjusts the air conditioner to not less than 25 degrees and uses the "dehumidifier" mode



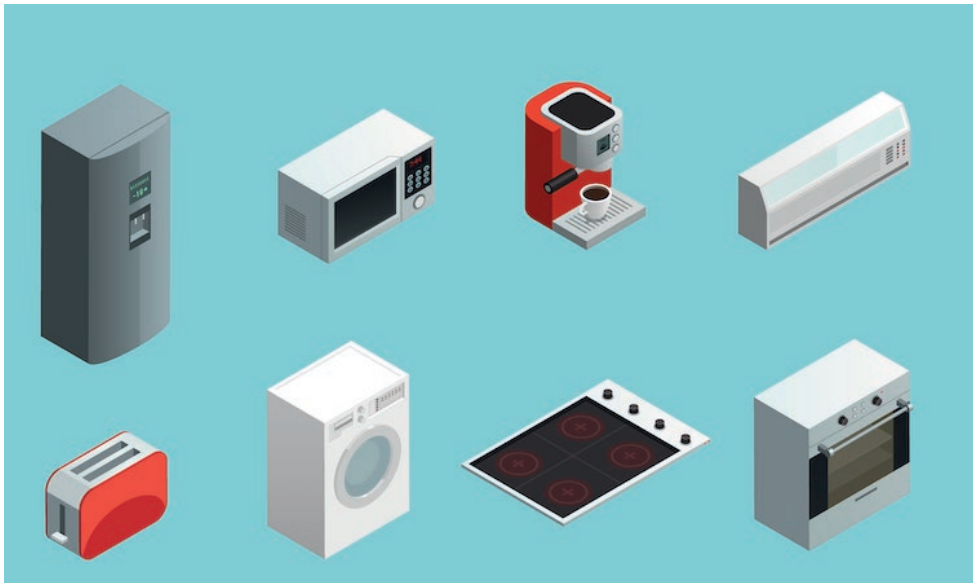
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## Example

The water heater is one of the most energy-intensive appliances, so the advice is to turn it on only when it is actually being used. An excellent practice is to install a device that allows the water heater to be turned on and off according to a set time schedule.

- **Use energy-efficient light bulbs.**
- **Turn off the light when leaving the room.**
- **Do not keep the refrigerator open more than necessary and do not set the temperature to less than 4 degrees.**
- **Use the washing machine with a full load and prefer low-temperature washing.**
- **In general turn off appliances when not in use.**

In addition, it is good to know that household appliances are not all the same; each one has different consumption and different electrical power. Appliances that are always on are the ones that consume the most energy; in particular, the refrigerator and freezer have the highest incidence, accounting for about 30 percent of total annual electricity consumption. Then there are the devices with external power supply (remote control, display, led) that consume a lot even in standby.



European targets on energy conservation are broader than the practices described above, and involve activities that contribute, in the aggregate, to less heat and energy loss from buildings in order to make it less necessary to heat rooms or consume energy.

The ultimate goal is to make buildings gas-free and nZEB (**nearly Zero Emission Building**), meaning that the energy that is used to heat/cool rooms and for appliances in homes is minimal and comes mainly or exclusively from renewable sources. In short, the balance between energy produced and energy consumed is equal to (**Zero Energy Building**) or close to (**Near Zero Energy Building**) zero.

**Read more:** [https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/nearly-zero-energy-buildings\\_en](https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/nearly-zero-energy-buildings_en)

# **GOOD PRAC TICE.**

**ENERGY  
EFFICIENCY  
ACTION PLAN  
WORKSHOP**

**Objective:** Guide adult learners in developing personalized and actionable energy efficiency plans that can be implemented in both their personal and professional lives.

## STEP 1: INTRODUCTION (15 MINUTES)

**1.1 Icebreaker:** Begin with an engaging icebreaker that relates to energy efficiency. For example, ask participants to share a habit they practice to save energy at home or work.

**1.2 Overview:** of the Workshop: Provide a brief overview of the workshop's objective: to create individualized action plans for enhancing energy efficiency.

## STEP 2: UNDERSTANDING ENERGY EFFICIENCY (30 MINUTES)

**2.1 Interactive Presentation:** Deliver a presentation on the principles and importance of energy efficiency. Include real-world examples and success stories to inspire participants.

**2.2 Group Discussion:** Facilitate a discussion about participants' current practices related to energy efficiency and their perceptions of its impact.

## STEP 3: EXPERT INSIGHTS (20 MINUTES)

**3.1 Guest Speaker or Expert Video:** Bring in a guest speaker or utilize a pre-recorded video featuring an expert in energy efficiency. Allow participants to gain additional insights and practical tips.



## STEP 4: CLOSING AND FOLLOW-UP (10 MINUTES)

**4.1 Closing Remarks:** Conclude with appreciation for participants' engagement and commitment to energy efficiency. Emphasize the potential collective impact of individual actions.

**4.2 Follow-Up Information:** Provide information on post-workshop support, such as follow-up emails with resources, reminders, and opportunities for continued collaboration

**Conclusion:** The "Energy Efficiency Action Plan Workshop" empowers adult learners to take concrete steps toward energy efficiency in their daily lives.

By guiding them through self-assessment, goal setting, collaboration, and expert insights, this good practice ensures a comprehensive and actionable approach to incorporating energy efficiency principles into both personal and professional spheres.

# **5.**

## **UNDER STANDING ENERGY BILLS**

In order to understand energy and energy bills as much as possible, it is first of all necessary to make a clear distinction between two units that are easily confused with each other: the kilowatt and the kilowatt-hour.

**kW (kilowatt):** The kilowatt is a unit of power, representing the amount of work that can be done in a given period of time. It is similar to how fast something can be done. For example, a light bulb might have an output of 60 watts (0.06 kW), which means it is using energy at a rate of 0.06 kilowatts.

**kWh (kilowatt hour):** The kilowatt hour is a unit of energy measurement. It represents the amount of energy used over a period of time. In order to understand energy and energy bills as much as possible, it is first of all necessary to make a clear distinction between two units that are easily confused with each other: the kilowatt and the kilowatt-hour.





In short, you can think of power (kW) as how fast something is using energy, while energy (kWh) is the total amount of energy consumed over time.

Another important element to consider both while accepting a contract with a distributor and in order to save as much as possible on the cost of electricity are the time bands, which can be divided into “peak”/“off-peak” or F1, F2, and F3.

In the context of electric tariffs, higher tariffs are often applied during the “peak” bands and lower tariffs during the “off-peak” bands. This system encourages consumers to shift energy consumption to low demand hours, thus helping to balance the overall power grid.

Within the F1, F2, F3 bands, a similar approach to the division into “peak” and “off-peak” bands is maintained, again with the aim of encouraging as much as possible consumers to use energy at times of the day with lower energy demand.

# ACTIVITY.

**Empower adult learners to understand energy bills, distinguish between key terms and strategize for optimal energy consumption**

# WORKSHOP

## 1. PRESENTATION ON TIME OF USE:

Explain the concept of time-of-use, including peak and off-peak hours. Discuss how time-of-use affects energy costs and consumer behavior.

## 2. INTERACTIVE SCENARIO ANALYSIS:

Provide scenarios where participants analyze the impact of shifting energy usage from peak to off-peak hours.

Encourage discussions on potential saving.

## 3. GUEST SPEAKER OR EXPERT PANEL (30 MINUTES)

Invite guest speakers and exhibitors specialized in energy consumption and efficiency in order to promote a timely debate with competent people.



# **6.**

## **WHY IT IS BETTER TO USE ELECTRICITY THAN GAS**

**T**here are several reasons why electricity is cleaner than gas. First, it does not produce direct emissions of pollutants into the air, such as carbon dioxide and other harmful gases. This helps reduce greenhouse effect and climate change.

In addition, electricity from renewable sources, such as the sun and wind, are steadily increasing. Natural gas, on the other hand, is a nonrenewable fossil resource that will be depleted over time.

The use of electricity is also safer, eliminating the risk of gas leaks that can be dangerous. Gas can cause explosions or fires if not handled properly. Electricity is safer to use in homes and buildings.

Modern electrical appliances and systems are often more energy efficient than gas-powered appliances. This means that the same result can be achieved using less overall energy.

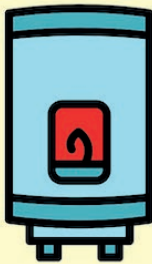
Electricity can be used in many different ways, is more flexible, and unifies systems to as to light lamps, run appliances, and power electric vehicles. Gas has more limited use, mainly for heating and cooking. The infrastructure for electricity distribution is often larger and reaches more places than gas lines.



This makes electricity more affordable for many people. Electricity technologies and solutions are advancing rapidly, with increasing investment in renewables and energy storage. This leads to a steady improvement in available electricity options.

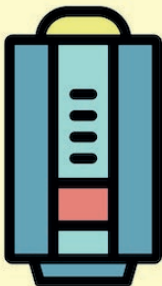
In summary, using electricity instead of gas is generally better for the environment, safer, and offer more opportunities for energy efficiency and technological innovation.

## GAS



- Less energy efficient
- Slowly being banned in the world
- Lower cost

## ELECTRICITY



- Higher cost
- More energy efficient
- Better control of heating

**EXAM  
PLE.**

**“ENERGY  
MAKEOVER”  
WORKSHOP  
FOR ADULT  
LEARNERS**

**Background:** Picture an engaging workshop where adult learners participate in an “**Energy Makeover**” program, focusing on transitioning from traditional gas-powered heating to efficient electric heating in their homes.

## STEP 1: “MY ENERGY PORTRAIT” ACTIVITY (1ST WORKSHOP)

**1.1 Energy Usage Self-Assessment:** Begin with a hands-on activity where participants assess their current energy usage, including gas consumption for heating.

**1.2 Discussion Session:** Facilitate a group discussion on the environmental impact of gas heating and its potential risks. Introduce the concept of transitioning to electric heating.

## STEP 2: “ELECTRIC HEATING 101” SESSION (2ND WORKSHOP)

**2.1 Interactive Presentation:** Deliver an interactive session explaining the basics of electric heating, emphasizing safety, efficiency, and environmental benefits.

**2.2 Comparison Activity:** Engage participants in a simple comparison activity between gas and electric heating, showcasing the potential for energy savings.

## STEP 3: “PLAN YOUR ENERGY MAKEOVER” WORKSHOP (3RD WORKSHOP)

**3.1 Individualized Action Planning:** Guide participants through a hands-on session where they plan their energy makeover, considering factors like home size, heating needs, and budget.

**3.2 Case Study Discussion:** Present a real-life case study of a home successfully transitioning to electric heating, discussing the outcomes and lessons learned.





## STEP 4: “SMART TECHNOLOGIES FOR ENERGY EFFICIENCY” (4TH WORKSHOP)

**4.1 Smart Thermostats Demo:** Introduce smart thermostat technology through a live demonstration, highlighting how it optimizes heating schedules for energy efficiency.

**4.2 Hands-On Practice:** Provide participants with hands-on practice using smart thermostats, fostering confidence in integrating these technologies into their homes.

## STEP 5: “SHOW AND TELL” ,COMMUNITY EVENT

**5.1 Home Energy Showcase:** Host a community event where participants showcase the changes they’ve made, share their experiences, and demonstrate the impact on their energy bills.

**5.2 Q&A and Open Discussion:** Facilitate a Q&A session where participants can



ask questions and discuss challenges and successes, creating a supportive learning community.

## STEP 6: “ENERGY AMBASSADORS” PROGRAM (ONGOING)

**6.1 Ambassador Selection:** Identify participants interested in becoming “Energy Ambassadors” to continue promoting energy-efficient practices within the community.

**6.2 Monthly Meet-ups:** Organize monthly meet-ups for Energy Ambassadors to share updates, new findings, and strategies for sustaining energy efficiency.

## STEP 7: “ECO-FRIENDLY COOKING WORKSHOP”

**7.1 Cooking Class:** Extend the concept of energy efficiency to the kitchen by organizing a cooking class using electric appliances, showcasing their efficiency compared to gas.

**7.2 Taste Testing and Recipe Sharing:** Conclude the workshop with a taste testing session and participants sharing electric cooking recipes they've discovered during the class.

## STEP 8: "SUSTAINABLE LIVING EXPO"

(COMMUNITY EVENT)

**8.1 Interactive Expo Booths:** Host an expo where participants set up booths showcasing their energy-efficient home improvements, sharing tips with others in the community.

**8.2 Guest Speakers and Exhibitors:** Invite guest speakers and exhibitors specializing in sustainable living to inspire further environmentally friendly practices. By framing the transition to electric heating as an "Energy Makeover" program with interactive workshops, practical activities, and community engagement, adult learners can actively participate and implement changes in a realistic and enjoyable manner.

# **7.**

## **HOW ELECTRICITY IS PRODUCED**

**E**lectricity is produced through a variety of processes that harness different sources, each with distinct characteristics and environmental impacts, and we can divide them into two main sectors: fossil and renewable.

## FOSSIL ENERGY

Fossil energy is produced through the extraction and combustion of non-renewable natural resources, such as coal, oil, and natural gas. These fossil fuels contain stored energy from the remains of living organisms of the past, which decomposed and fossilized over millions of years. The main aspects of fossil energy include:

- **Coal:** Extracted from mines, coal is burned to generate heat, which then powers electric turbines. However, its use is associated with high levels of greenhouse gas emissions, particularly carbon dioxide (CO<sub>2</sub>), contributing to climate change.
- **Oil:** A versatile energy source, refined into various products like vehicle fuels and fuels for electricity generation. The use of oil is also linked to CO<sub>2</sub> emissions and geopolitical issues related to global oil reserves.
- **Natural Gas:** The cleanest fossil fuel in terms of CO<sub>2</sub> emissions compared to coal and oil. It is often used for electricity generation and heating. However, the extraction process can cause local environmental issues.



# RENEWABLE

Renewable energy sources harness inexhaustible natural resources such as sunlight, wind, Earth's heat, and water currents to produce energy. These sources are considered environmentally friendly and sustainable as they do not deplete resources like fossil fuels.

**Solar Energy:** Collected through photovoltaic panels that directly convert sunlight into electricity. It is a clean source, with the sun being an unlimited resource, but production varies based on solar radiation and requires a large panel surface.

- **Wind Energy:** Utilizes wind turbines to capture the kinetic energy of the wind and convert it into electricity. It is also clean, but wind availability varies based on geographical location.

- **Hydropower:** Harnesses the force of moving water to turn turbines. It is one of the most mature renewable sources and can provide a constant flow of energy but requires favorable water conditions.

- **Geothermal Energy:** Harnesses heat from the Earth's interior. It is used for direct heating or to generate electricity through geothermal plants.

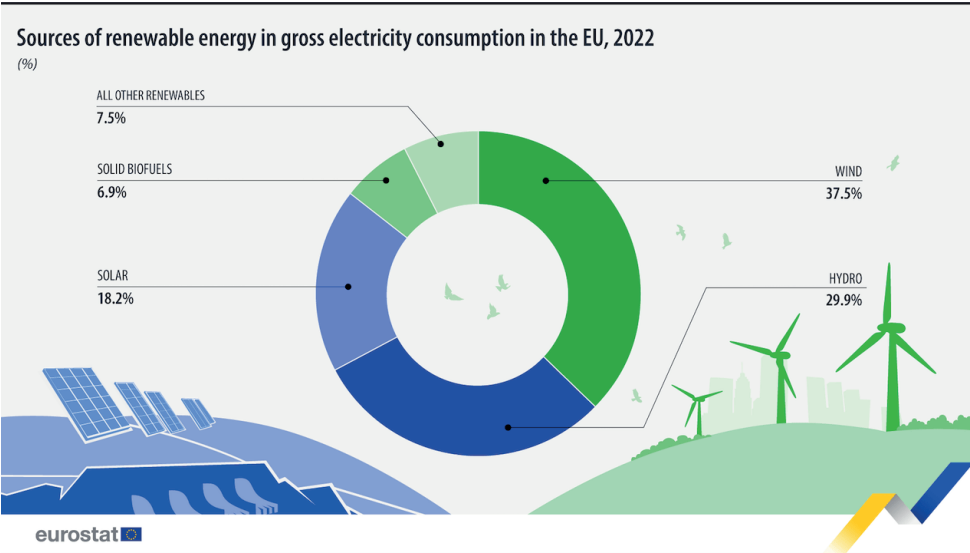


# RENEWABLE ENERGIES IN EUROPE

Energy production from renewable sources has seen a steady increase in recent years in Europe. According to Eurostat, the European Union’s statistical office, the share of renewable sources in Europe’s gross energy consumption has reached 23 percent in 2022. Renewable energy sources include wind energy, solar energy (thermal, photovoltaic and concentrating), hydropower, tidal energy, geothermal energy, ambient heat captured by heat pumps, biofuels and the renewable part of waste.

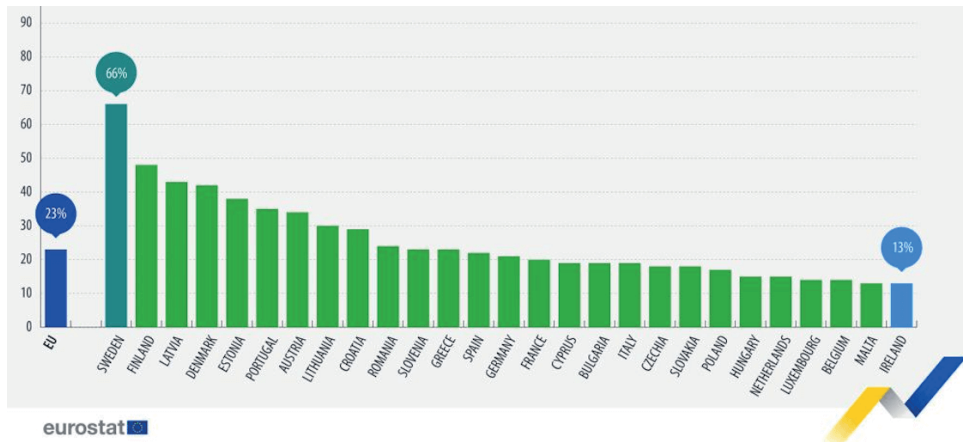
Since the early 2000s, there has been exponential growth, particularly in wind and solar power, which have grown from an annual output of 50 TWh to more than 600 TWh collectively. This is a sustained growth rate, with an increase of over 1100% in wind and solar power generation alone. While the growth in hydropower has been more gradual. Obviously these are aggregate figures, but there are differences between countries.

Again according to Eurostat, Sweden takes the lead in energy consumption from renewable sources (about two-thirds of the total in 2022) followed by Finland. Less virtuous countries include Malta (13.4 percent), Belgium (13.8 percent) and Luxembourg (14.4 percent).



The European Community has set ambitious goals with respect to the use of renewable energy and more generally in the context of combating climate change with the so-called **European Green Deal**.

This program plans to significantly reduce carbon emissions. The goal is to reduce greenhouse gases by 55 percent in 2030 compared to 1990, and achieve carbon neutrality by 2050.



## AREAS OF FOCUS FOR KEY POLLUTERS INCLUDE:

- **Transportation:** Prioritize mass public transportation, favor trains over flights, promote electric cars and green hydrogen fuel.
- **Industries:** Mitigate the impact of emissions by developing sustainable production methods, reducing reliance on the grid and promoting greater self-production and consumption.
- **Residential and commercial buildings:** Improve energy efficiency to move closer to near-zero-emission building (nZEB) standards.
- **Agriculture:** Encourage sustainable practices such as Agrivoltaics, incorporating photovoltaic systems on crops and integrating technologies to continuously monitor plants and reduce energy consumption.

In conclusion, the EU Green Deal represents a bold and collective effort to combat climate change, touching on critical sectors in transport, industries, residential



and commercial buildings, and agriculture. By setting ambitious goals and promoting innovative and sustainable practices, the European countries involved are charting a course toward a greener and more resilient future.

**To know more:**

<https://www.consilium.europa.eu/en/infographics/fit-for-55-how-the-eu-plans-to-boost-renewable-energy/>

# WORK SHOP.

POWERING  
TOMORROW A  
SUSTAINABLE  
ENERGY  
WORKSHOPS

## Methodological Instructions:

- **Objective Clarification:** Clearly articulate the workshop's objectives: raising awareness, promoting understanding of sustainable energy, and encouraging practical application.

- **Audience Analysis:** Understand the participants' knowledge levels, interests, and expectations regarding sustainable energy to tailor the workshop content effectively. Provide a concise overview of the workshop's agenda and the importance of sustainable energy.

- **"Fossil vs. Renewable":** Fossil fuels and renewable energy sources represent two distinct approaches to meeting our energy needs, each with its own set of advantages and challenges.

Fossil fuels, including coal, oil, and natural gas, have been the primary sources of energy for decades. They offer high energy density, making them efficient for power generation and transportation. However, the extraction and burning of fossil fuels contribute significantly to environmental issues such as air pollution and greenhouse gas emissions, leading to climate change.



On the other hand, renewable energy sources, such as solar, wind, and hydropower, harness energy from sustainable and naturally replenished resources. Unlike fossil fuels, renewables produce little to no emissions during operation. They contribute to a cleaner environment and reduce dependence on finite resources. However, the intermittent nature of some renewable sources, like solar and wind, poses challenges for consistent energy production.

The ongoing debate between fossil and renewable energy revolves around environmental impact, sustainability, and the transition towards greener alternatives. Striking a balance and transitioning towards a more sustainable energy mix is crucial for addressing both current and future energy challenges.

- **Interactive Presentation:** Utilize engaging visual aids and real-world examples to explain the differences between fossil and renewable energy sources.
- **Group Discussion:** Encourage participants to share their thoughts, experiences, and questions related to fossil and renewable energy.

**8.**

**THE SUN  
AS AN INFINITE  
RESOURCE OF  
PRODUCTION**

**T**he sun is a virtually inexhaustible source of energy that has fueled life on Earth for billions of years. Its immense amount of energy emitted in the form of light and heat represents a key resource for power generation through solar energy. That is why the sun is considered a virtually infinite source of energy production:

It is estimated that the sun was born about 4.6 billion years ago and is expected to shine for about another 5 billion years. This means that we still have an enormous amount of time in which the sun will continue to shine and provide energy to Earth

Every second, the sun emits an incredible amount of energy. This energy reaches Earth in the form of sunlight, which can be converted directly into electricity through photovoltaic panels or used to heat fluids that power electric turbines.

The sun is not a resource limited to specific regions. Although the amount of sunlight can vary from place to place and according to the seasons, virtually every part of the planet receives at least some amount of solar energy. Solar energy has been used for millennia to obtain light and heat and to dry agricultural products such as hay. More recently, solar energy has been used to generate electricity mainly through photovoltaic technology.





Solar energy is a clean and sustainable energy source. It produces no harmful emissions during generation, helping to reduce air pollution and climate change. Research and development in the field of solar technologies is leading to an increase in the efficiency of photovoltaic panels and thermal capture systems. This makes it possible to capture more and more energy from the sun and harness it efficiently.

Over the years, the cost of producing and installing solar panels has decreased significantly. This makes solar energy increasingly affordable and competitive with traditional energy sources.

Although solar energy has some limitations, such as variability in weather conditions and panel efficiency, its essentially inexhaustible nature makes it one of the most promising resources for addressing the energy and environmental challenges of the future.

## WHAT DO SOLAR PANELS LOOK LIKE?

Most people know Albert Einstein and believe that his most important work was on relativity. However, Einstein did not receive the Nobel Prize for that study. In fact, the Nobel committee awarded his 1905 research that described light energy in discrete “packets”: all forms of energy exist only in discrete, whole-number quantities, or “packets,” called quanta. This principle is fundamental to understanding the photoelectric effect and the operation of the solar cells that make up a solar panel.

The photoelectric effect is the effect that light can have on an electron. Most simply, light, or photons, increases the energy of electrons.

Electrons are usually at their lowest energy level called the electron fundamental state. When electrons absorb energy they move to a higher level, that is, they are in an excited state.

Solar panels, thanks to their solar cells made of a semiconductor material, usually silicon, make it possible to absorb photons: when sunlight hits the solar cells, the material absorbs photons and the absorbed photons excite the electrons of the silicon atoms, causing them to become “excited” and free from their normal positions, this “movement” generates electric current: the excited electrons create an electric current as they move through the semiconductor material.

When the light is no longer sufficient, the movement of electrons stops.

The generated electricity then passes through an inverter and connects to the distribution grid or is used on-site. This is, in general, the operation behind a photovoltaic panel.



# LES SON PLAN.

**HARNESSING  
THE SUN:  
UNDERSTANDING  
SOLAR ENERGY**

**Objective:** By the end of this lesson, adult learners will understand the principles of solar energy, its advantages, and its role in sustainable energy production.

**Duration:** 1.5 hours

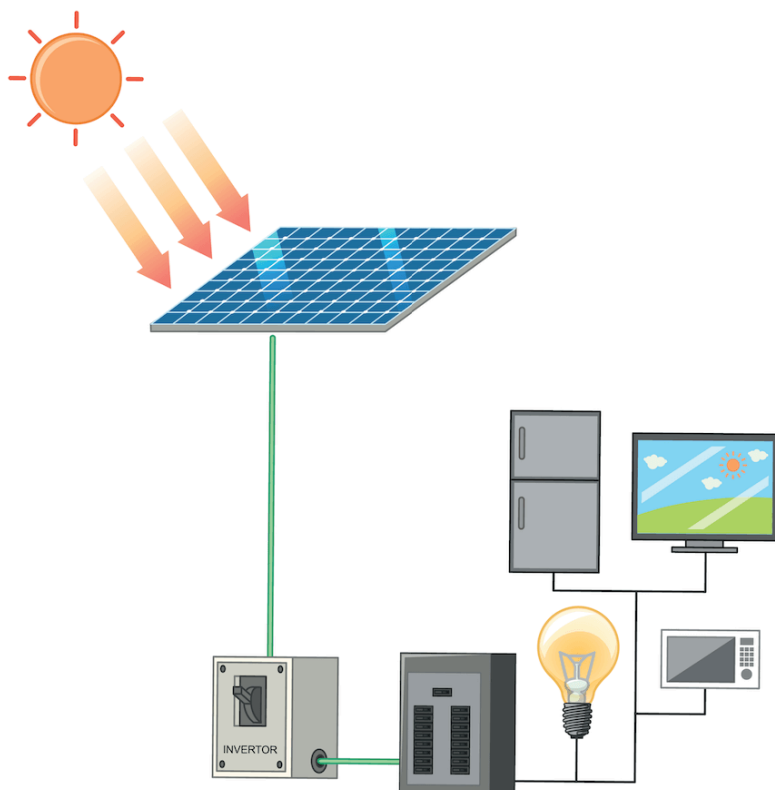
## 1. INTRODUCTION (15 MINUTES)

Welcome and Icebreaker: Greet participants and engage them with a brief icebreaker. For example, ask participants to share one thing they find interesting about renewable energy.

Overview of the Lesson: Provide a brief overview of what the lesson will cover, emphasizing the importance of solar energy in the context of sustainability.

## 2. UNDERSTANDING SOLAR ENERGY (30 MINUTES)

Introduction to Solar Energy: Present a brief history of solar energy and its importance in the context of renewable resources.



### 3. SOLAR ENERGY BASICS:

Explain the basic principles of how sunlight is converted into electricity through photovoltaic panels. Use visuals to enhance understanding.

- **Group Discussion:** Facilitate a discussion on the potential applications of solar energy in various aspects of daily life. Encourage participants to share any personal experiences or insights.

- **Advantages of Solar Energy (20 MINUTES)**

Interactive Presentation: Present a slide show or interactive presentation outlining the advantages of solar energy, including its environmental benefits, sustainability, and economic advantages.

- **Case Studies:** Share real-world case studies showcasing successful solar energy projects and their positive impact on communities.

### 4. TECHNOLOGICAL ADVANCES AND FUTURE

#### PROSPECTS (20 MINUTES)

Technological Developments: Discuss recent technological advancements in solar energy, such as improvements in photovoltaic efficiency and energy storage solutions.

- **Group Activity:** Divide participants into small groups and assign each group a specific area of technological advancement in solar energy. Ask them to discuss and present their findings to the class.



## 5. OVERCOMING CHALLENGES (15 MINUTES)

- **Challenges in Solar Energy:** Discuss challenges associated with solar energy, such as intermittency, storage issues, and initial costs.

**Brainstorming Session:** Engage participants in a brainstorming session to generate ideas on how these challenges can be addressed or mitigated.

## 6. Q&A AND DISCUSSION (15 MINUTES)

- **Open Floor for Questions:** Invite participants to ask questions or share any thoughts or concerns they may have.

- **Facilitated Discussion:** Lead a discussion around potential solutions to challenges, encouraging participants to express their opinions and insights.

## 7. CONCLUSION AND NEXT STEPS (10 MINUTES)

- **Key Takeaways:** Summarize the key points discussed during the lesson.

**Next Steps:** Provide information on additional resources, readings, or local initiatives related to solar energy for those interested in further exploration.

- **Closing Remarks:** Thank participants for their active participation and interest in understanding solar energy.

- **Note to Facilitator:** Create an environment that actively encourages participation and inclusivity among participants. Adjust the session's pace according to their engagement levels and existing knowledge to optimize learning outcomes.

Utilize multimedia, real-world examples, and practical applications to diversify instructional methods and enhance comprehension. Foster a culture of curiosity and critical thinking, stimulating active involvement and enriching the overall learning experience.

# 9.

# **PHOTOVOLTAIC TECHNOLOGIES**

**T**here are several types of photovoltaic technologies that directly convert solar light into electrical energy. Each technology has unique characteristics in terms of efficiency, cost, applications, and materials used. Here's an overview of the main photovoltaic technologies:

### **Monocrystalline Silicon (c-Si):**

Monocrystalline silicon photovoltaic panels are among the most common. They are made from single crystals of silicon, giving them high efficiency and yield. They are easily recognizable by their black cells with rounded edges. However, they are more expensive to produce compared to other technologies.

### **Polycrystalline Silicon (mc-Si):**

Polycrystalline silicon photovoltaic panels are made from small crystals of silicon and have slightly lower yield compared to monocrystalline. They are often recognizable by their dark blue cells with sharper angles. They are cheaper to produce but also slightly less efficient.

### **Thin-Film:**

This category includes various technologies such as amorphous silicon (a-Si), cadmium telluride (CdTe), and copper indium gallium selenide (CIGS). These technologies use thin layers of semiconductor materials directly on substrates like glass or metals. They are often more flexible and lighter than silicon-based technologies but may have lower efficiencies.



### **Tandem and Perovskite:**

Tandem cells combine different layers of materials with different absorption bands to capture a broader range of solar wavelengths. Perovskite cells are an emerging technology that has shown great potential for efficiency and reduced costs. They are made using a material called perovskite but are still in the development phase.

**Organic and Plasmonic:** These experimental technologies aim to use organic materials or plasmons to capture and convert solar light. They are still in the research and development phase and are not widely used commercially.

The choice of photovoltaic technology depends on specific requirements, such as the required efficiency, budget, installation size, and environmental conditions. Ongoing research and innovation in the industry are leading to constant advancements in the performance and costs of photovoltaic technologies, contributing to making solar energy increasingly accessible and competitive.

box





# THE ENERGY COMMUNITY

**A**n interesting way of harnessing solar energy that has been gaining popularity in recent years is that of the energy community. An energy community consists of a series of buildings, on which photovoltaic panels have been mounted (or even near wind farms), where energy is shared directly among the buildings. For example, if building A produces 10kW but consumes 8kW it gets 2kW extra, while building B produces 10kW but consumes 12kW, thanks to the energy community building A can sell the excess energy directly to building B.





# CASE STUDY:

**ADOPTION  
OF PHOTOVOLTAIC  
TECHNOLOGIES  
IN A RESIDENTIAL  
COMMUNITY  
BACKGROUND**

**Background:** A residential community, GreenVista, consisting of 100 homes, aimed to transition to sustainable energy sources to reduce its carbon footprint and lower electricity costs for residents. The community decided to implement various photovoltaic technologies to harness solar energy.

### Implementation:

- **Monocrystalline Silicon (c-Si) Panels:** Installed monocrystalline silicon panels on rooftops due to their high efficiency. This technology was chosen for its aesthetic appeal and ability to generate substantial power in limited space.
- **Thin-Film Technology:** Utilized thin-film technology, specifically copper indium gallium selenide (CIGS) panels, on larger community spaces and common areas. These panels were chosen for their flexibility and ability to adapt to different surfaces.



- **Energy Storage Systems:** Integrated energy storage systems using lithium-ion batteries to store excess energy generated during peak sunlight hours. This stored energy is utilized during the evening, reducing reliance on the grid and ensuring a continuous power supply.

## RESULTS:

- **Reduced Energy Costs:** Residents experienced a significant reduction in energy costs as the solar panels generated a substantial portion of the community's electricity needs. This led to overall cost savings for residents.

- **Lower Carbon Footprint:** The adoption of photovoltaic technologies substantially lowered the community's carbon footprint. GreenVista became a more environmentally sustainable neighborhood, contributing to broader environmental conservation goals.

- **Community Awareness and Engagement:** The installation of diverse photovoltaic technologies sparked community interest and engagement. Residents participated in workshops and informational sessions, fostering a sense of environmental responsibility and knowledge about solar energy.

- **Government Incentives:** The community leveraged government incentives and rebates for renewable energy adoption. This financial support helped offset the initial investment costs, making the transition to photovoltaic technologies more economically viable.

- **Scalability and Future Expansion:** The success of the initial photovoltaic installations paved the way for future scalability and expansion. GreenVista is now considering additional technologies like tandem cells and perovskite cells to further enhance efficiency.

## Conclusion:

The GreenVista case study illustrates the successful integration of diverse photovoltaic technologies in a residential setting, showcasing the benefits of reduced costs, lower environmental impact, community engagement, and the potential for future expansion and innovation in sustainable energy solutions.

# 10.

## **PROS AND CONS OF PHOTOVOLTAIC TECHNOLOGIES**

**S**olar energy, among renewable resources, is one of the most promising for several reasons, including its scalability. If you have a roof, you can consider installing a solar system, creating a mini “power station” at home.

This concept of self-production reduces various challenges in the electrical infrastructure, including less strain on the structure and fewer system losses due to the Joule effect. However, there are aspects to consider, so it's essential to distinguish the pros and cons of solar energy use.

## PROS

**Renewability:** Solar energy harnesses sunlight, an infinite and universally available resource, making it virtually limitless over time.

- **Clean Environment:** Solar energy production does not emit greenhouse gases or atmospheric pollutants, contributing to reducing environmental impact and mitigating climate change.

- **Simple Maintenance:** Solar installations require minimal maintenance. Photovoltaic panels have few moving parts and can last for decades with regular and minimal maintenance, usually requiring only the cleaning of accumulated dirt.

- **Decentralized Distribution:** Solar systems can be installed locally, reducing dependence on large power plants and improving energy resilience in communities.

- **Technological Growth:** Ongoing research and development continuously improve the efficiency of solar panels and reduce costs, making solar energy increasingly competitive compared to conventional sources.

## CONS

- **Variability:** Solar energy production is influenced by weather conditions and the day-night cycle. This means that solar energy is not constantly available, requiring energy storage systems or integration with other sources to ensure a continuous supply.
- **Efficiency:** Not all locations receive the same amount of sunlight. The efficiency of solar panels can vary based on geographical location, the angle of sunlight incidence, and weather conditions.
- **Space:** Generating large amounts of energy requires a considerable surface area to accommodate solar panels. This can be a challenge in urbanized areas or limited land spaces.
- **Waste Management:** Solar panels contain materials that require proper waste management at the end of their lifespan.

Despite these challenges, solar energy is continuously growing due to technological advancements, supportive policies, and increasing environmental awareness. The combination of advanced storage systems and improvements in solar panel efficiency can help overcome many of the current challenges.

# SOLAR PANELS



## PROS

CLEAR ENVIRONMENT

SIMPLE MAINTENANCE

DECENTRALIZED  
DISTRIBUTION

TECHNOLOGICAL GROWTH



## CONS

VARIABILITY

EFFICIENCY

SPACE

WASTE MANAGEMENT



# **11.**

## **SOME FACTORS TO CONSIDER...**



**T**he installation of a photovoltaic system, technically speaking, is not overly complex. However, at the same time, for the system to be as productive and profitable as possible, a series of precautions are necessary during the design phase to ensure that the system is utilized to its maximum potential.

Some factors to be particularly considered are:

## 11.1 STORING ELECTRICITY

Technologies for storing electrical energy are essential for balancing the supply and demand of electrical energy, optimizing the use of intermittent renewable sources, and ensuring the stability of electrical grids.

Renewable energy sources, such as the sun and wind, are often intermittent and not always available in line with our consumption needs. Storage technologies allow the accumulation of excess produced energy to be used when sources are inactive, ensuring a more stable and continuous supply of clean energy.

At the same time, there are several challenges, with the main ones being:

**High initial costs:** Many storage technologies have high initial costs, both in terms of capital investment and maintenance. This can make them less cost-effective compared to other solutions, especially in areas with relatively low energy prices.

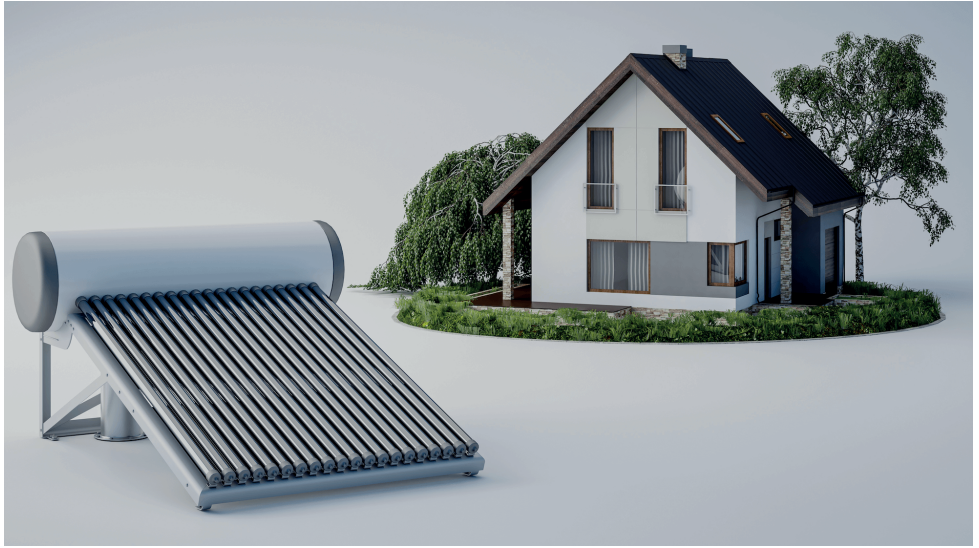


- **Energy efficiency:** All storage technologies involve energy losses during the charging and discharging process. These losses can impact the overall system efficiency and the amount of energy actually available for use.
- **Durability and decay:** Like phone batteries, batteries used for buildings are subject to the so-called “memory effect.” After several charge/discharge cycles, batteries support storing a lower amount of energy and consequently have less autonomy.
- **Environmental impact:** Although many storage technologies contribute to reducing greenhouse gas emissions, some may involve the extraction or use of rare or toxic materials, causing negative environmental impacts in the production or disposal phase.
- **Limited size and capacity:** Some storage technologies may have limitations in terms of storage capacity or physical footprint. This can be a limiting factor for large-scale applications or in confined spaces.

In general, the effectiveness of energy storage technologies depends on the specific context, including energy costs, network balancing needs, and environmen-



tal conditions. Technological development is constantly researching the recycling of existing batteries and the use of more commonly available, less impactful raw materials with a reduced “memory effect.”



## 11.2 HEATING WATER WITH THE SUN

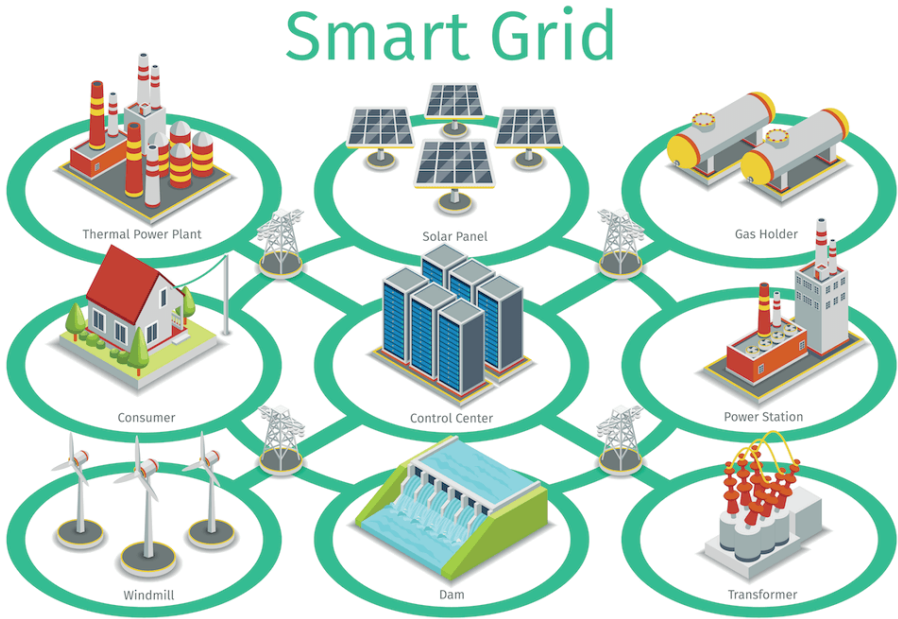
Heating water using photovoltaic energy is an interesting application that can contribute to reducing the use of conventional energy sources and greenhouse gas emissions. However, it should be noted that the process of heating water through photovoltaic panels is less efficient than the direct production of electrical energy. This is because converting solar energy into heat requires higher efficiency than converting it into electrical energy.

There are mainly two ways to use photovoltaic panels to heat water: through photovoltaic-thermal systems and through heat pumps.

- **Photovoltaic-Thermal Systems (PVT):** To heat water with photovoltaic panels, a system called “solar thermal collector” is used. This collector resembles a large black panel with thin tubes inside. Cold water is passed through these tubes. When the sun hits the black panel, heat is absorbed and transferred to the water flowing in the tubes. As the water passes through the tubes, it heats up thanks to the solar-collected heat. This warm water can then be used for domestic purposes, such as heating water for showers, laundry, or space heating.

- **Photovoltaic Heat Pumps:** This is a more efficient option for heating water using photovoltaic energy.

## 11.3 NEW CONSUMER HABITS



With a photovoltaic system, you might be more inclined to use electrical energy during daylight hours when your system is producing energy.

As discussed in Chapter 5, usually the nighttime period corresponds to lower energy costs. Therefore, in the absence of a photovoltaic system, it is common to wait until night to use large appliances. The implementation of a photovoltaic system allows planning the use of high-energy-consuming appliances, such as washing machines, dishwashers, and ovens, during peak solar production hours.

## 11.4 FUTURE INNOVATIONS: SMART GRIDS

In recent years, there has been increasing talk in Europe about smart grids, an advanced system for managing and distributing electrical energy that incorporates digital technologies, sensors, communication devices, and data analytics to improve the efficiency, reliability, and sustainability of traditional electrical networks. In the electricity world, smart grids aim to overcome some of the challenges and limitations of conventional electrical grids. Here are some of the main goals and advantages of smart grids:

- **Advanced Monitoring and Control:** Smart grids allow real-time data collection through sensors and devices installed in various parts of the network. This data is used to monitor the state of the electrical infrastructure, identify any faults or interruptions, and manage energy distribution more efficiently.

In essence, smart grids represent a step forward in the evolution of energy infrastructure, enabling greater flexibility, reliability, and efficiency in the production, distribution, and consumption of electrical energy.

## 11.5 EFFECTS AND ENVIRONMENTAL IMPACT OF PHOTOVOLTAIC TECHNOLOGIES

Photovoltaic technologies, which convert solar energy into electricity, are considered a clean and renewable energy source. However, these technologies can also have some effects and environmental impact. Here are some aspects to consider:

- **Production of solar panels:** The production of photovoltaic panels involves the extraction and processing of materials such as silicon, glass, and metals. These activities can generate greenhouse gas emissions and have local environmental impacts, especially if not managed sustainably.

- **Embodied energy:** The production of solar panels requires the use of energy, especially in the manufacturing process of silicon and the production of electronic components. However, most solar panels recover the energy used during their operational life.



- **Waste management:** At the end of their useful life, solar panels can become electronic waste. Proper management of this type of waste is essential to avoid negative environmental impacts. Some materials in the panels can be recycled, but complete recycling is still in development.

- **Land impact:** The installation of large photovoltaic systems may require significant space and impact land use. However, many installations can coexist with other activities, such as agriculture, minimizing the impact.

Chemicals used: Some chemicals used during the production of solar panels can be harmful to the environment if not handled properly. The industry is working to reduce the use of hazardous substances and improve management practices.

- **Energy lifecycle:** Despite the energy embodied in production, photovoltaic panels tend to quickly repay the energy used during their lifecycle, producing clean energy for many years.

- **Biodiversity impact:** If not carefully planned, large-scale solar installations could have effects on local biodiversity, such as influencing the behavior of birds



or insects. Sustainable design practices can help mitigate these effects. In general, despite some impacts, photovoltaic technologies remain a relatively clean and efficient option for electricity production. Efforts continue to improve the sustainability of the lifecycle of solar panels and further mitigate the environmental impacts associated with this technology.

**12.**

**CONCLUSION**



It has been a long journey for the European Union to get to where we are today, from 1965 when the only source of renewable energy was hydropower to today, when renewable energy production has finally surpassed fossil energy, aiming for a more sustainable way of living and learning step by step the process of energy transformation.

In summary, solar energy emerges as a crucial and sustainable solution to our energy needs. It not only diversifies our energy sources, but also contributes significantly to reducing our environmental impact.

Advances in solar technology make it increasingly efficient and economical. Understanding how solar panels are produced highlights the importance of sustainable production practices and how long it has taken to get to where we are now. In addition, the role of batteries in storing solar energy addresses concerns about reliability.

In a broader context, solar energy aligns with the global shift toward renewable energy, as evidenced by initiatives such as the EU's Green Deal. The adoption of solar energy is not just a technological advance, but a key step toward a cleaner, greener future.

For that reason, solar energy stands out as a key player in the transition to sustainable energy, offering a promising path to a greener and more resilient world.

For the reasons listed above, it is evident how the issue of adult education with respect to sustainable practices becomes a central issue in promoting conscientious and informed citizenship. This toolkit is intended to be an agile tool for those working in adult education and environmental education and is an updated and flexible means of addressing ecological issues in the context of education.

It is aimed at teaching individuals and businesses about environmental issues, empowering them to manage or adapt their lifestyles and ecosystems to achieve sustainable living.

In practical terms, adult environmental education strives to translate complex environmental concepts into accessible knowledge, making it understandable to individuals from diverse backgrounds. This includes imparting knowledge about renewable technologies such as solar energy, explaining their benefits and encouraging sustainable practices. The overall goal is to equip global citizens with the knowledge and skills needed to lead sustainable lives within their societies.

In the context of our exploration of solar energy, the role of adult environmental education becomes particularly pertinent. As we delve into the complexities of solar technology, understanding its production processes, applications and environmental implications, adult education serves as a conduit for the dissemination of this knowledge. It not only increases individual awareness, but also empowers learners to make informed decisions that contribute to a more sustainable future.

This dynamic educational approach becomes a catalyst for societal transformation, promoting a sense of responsibility and collective action to achieve sustainable coexistence. While we support solar energy, we also recognize the integral role of adult environmental education in shaping a more informed, engaged and environmentally aware global citizenry.





Project n. 2022-1-IT02-KA220-ADU-000087707



**Co-funded by  
the European Union**

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.