Iceland Liechtenstein Norway grants

A guide on energy efficiency literacy for strengthening energy efficiency behaviours and habits among the youth in the context of youth work

Youth Energy Literacy

What's inside

About this module

Energy efficient use of school buildings

Iceland Liechtenstein Norway grants

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The module

The module looks at how the students' energy consumption behaviours and habits can be changed towards the energy efficient use of school buildings. The challenge is in overcoming the unresponsiveness of the school building users in changing their behaviours. In fact, most students are often unaware of their energy consumption behaviours and habits, and even more so, of the potential energy savings that can be obtained simply by taking a more active role in the use and management of their energy consumption. So the manual highlights that it is very necessary to raise awareness and identify the most effective interventions for the school staff, teachers, and students that support both the development of energy saving behaviours and habits and the consolidation of these behaviours and habits. Though the energy efficiency knowledge of the school staff, teachers, and students is the most essential starting point in improving awareness, it is not enough to initiate the lasting change in energy saving behaviours and habits, which requires a proactive role of the school's staff, teachers, and students.

Therefore, the school must work to strengthen the capacity of students to apply energy efficiency literacy knowledge, skills, and attitudes that lead to change in energy saving behaviours and habits. So, a high level of energy efficiency literacy enables the students to analyse, reason, and communicate effectively as they pose, solve, and interpret their energy saving and usage behaviours in a variety of situations. Thus, this would then reflect efforts in creating more sustainable energy saving and usage habits. Indeed, energy efficiency literacy also shares characteristics and learning objectives with the domains of science and technology literacy, which incorporate dimensions of knowledge, attitude, skills, behaviour, and civic engagement. Hence, an energy literate student should: have the basic understanding of the science and how energy is used and saved in everyday life; understand the impact that the energy production and consumption have on different spheres of environment and society; be sensitive to the needs for energy conservation as well as the to dire need to develop alternatives to fossil fuel-based energy resources; be cognisant of the impact of personal energy-related decisions and actions on a community; and strive to make the choices and decisions that reflect such attitudes with respect to energy resource development or energy consumption.

Module glossary

- ***Air pollution:***
  Refers to the unwanted particles, mist or gases put into the atmosphere as a result of motor vehicle exhaust, the operation of industrial facilities or other human activity.

- ***Energy:***
  Refers to the capacity for doing work. Forms of energy include: thermal, mechanical, electrical and chemical. Energy may be transformed from one form into another.

- ***Energy resources:***
  Refer to everything that could be used by society as a source of energy.

- ***Energy literacy:***
  Refers to an iteration of literacy that is viewed as an essential tool that sensitises citizens to create sustainable energy consumption behaviours and habits, which impact knowledge, skills, attitudes, values, decisions, and actions related to energy use.

- ***Energy efficient building:***
  Refers to a zero-emission building that produces enough renewable energy to compensate for the building's greenhouse gas emissions over its lifespan.

- ***Energy efficiency:***
  Refers to the practice of using less energy to provide the same amount of useful output.

- ***Energy consumption:***
  Refers to the amount of energy consumed in the form in which it is acquired by the user. The term excludes electrical generation and distribution losses.

- ***Energy conservation:***
  Refers to the actions and effort taken to reduce wasteful energy consumption by end-users by using fewer energy services.

- ***Energy saving:***
  Means using energy more efficiently and effectively, which helps to conserve resources and reduce environmental impacts, while at the same time generating financial savings.

- ***Fossil Fuel:***
  Refers to a fuel source such as oil, condensate, natural gas, natural gas liquids, or coal, formed in the earth from plant or animal remains.

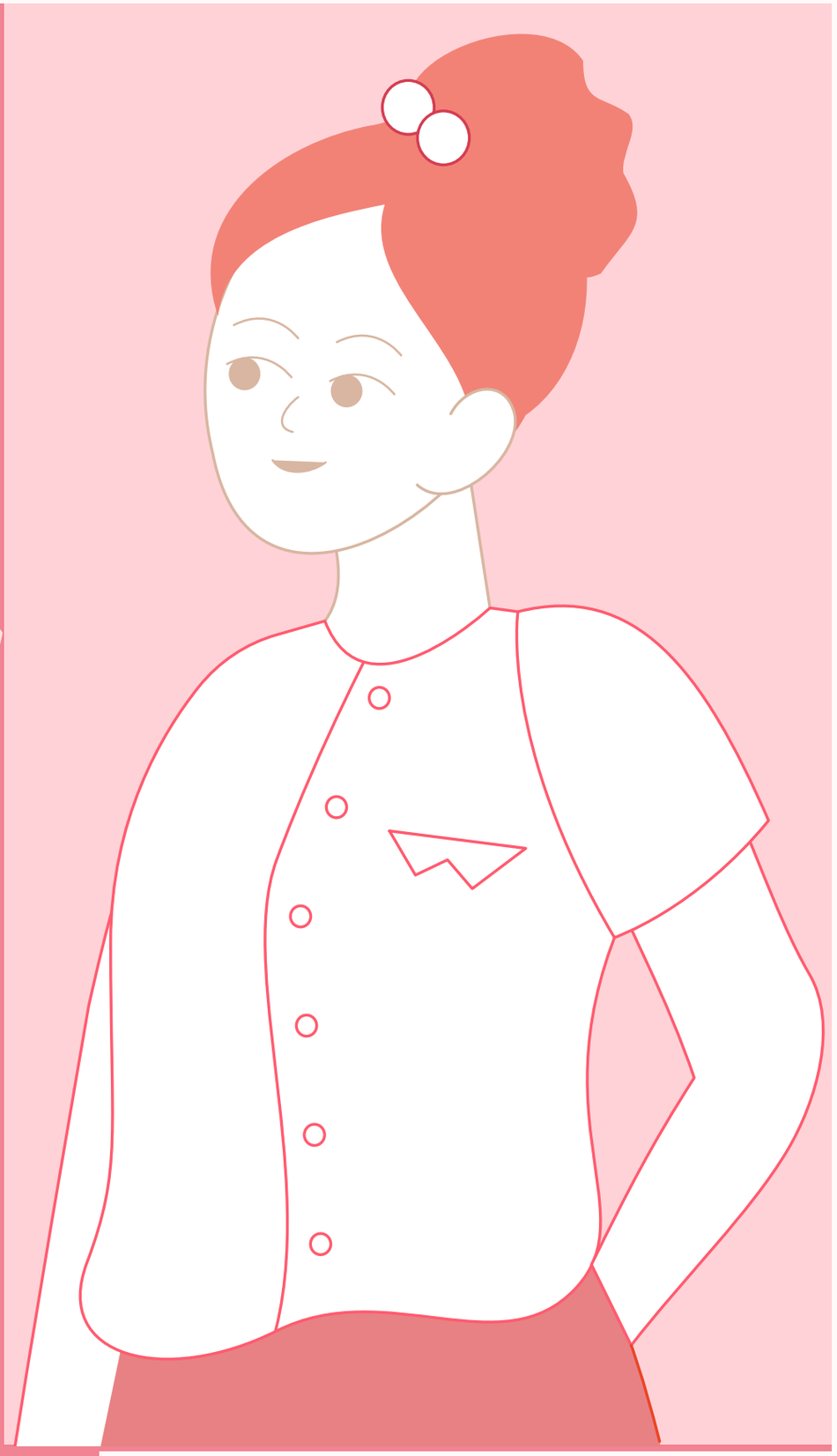
- ***Greenhouse Gases:***
  Refer to the types of gas that contribute to the greenhouse effect by absorbing infrared radiation. Greenhouse gas emissions from oil and natural gas development include carbon dioxide (CO2), methane, nitrous oxide, and ozone.

- ***Literacy:***
  In the context of education, literacy refers to the capacity of students to apply knowledge and skills in key subject areas and further to be able to analyse, reason, and communicate effectively as they pose, solve, and interpret problems in a variety of situations (UNESCO, 2006)..

- ***Renewable energy:***
  Refers to energy derived from natural sources that are replenished at a higher rate than they are consumed. Sunlight and wind, for example, are such sources that are constantly being replenished. Renewable energy sources are plentiful and all around us.

SECTION-1

Basics of energy efficiency literacy



1.1. Energy efficiency literacy

With techniques and technologies available to improve energy efficiency, the impacts that any specific solutions may have on the energy efficient use of the school buildings differ significantly from one school to the other. And with the many schools having a large number of staff, teachers, and students, it means that their behaviours is typically the best area of energy efficiency literacy to improve. But behavioural change requires a concise sustainable knowledge, skills, attitudes, or tools, among the staff, the teachers and the students and clear policies for them to follow. Thus, ensuring that the staff, teachers, and the students are aware of the energy they use, and both the monetary and environmental impacts of that usage, is the most powerful tool in achieving energy efficient use of school buildings. This is also due to the lack of continuous, targeted, and organised energy-saving campaigns to address the inexistent energy-saving culture and behaviours among the staff, teachers, and students. Hence, such a lack of energy-saving culture, knowledge, skills, attitudes, or tools, and policies; necessary to bring about the energy saving behavioural changes is regarded as illiteracy, innumeracy, and apathy. Therefore, ensuring energy efficient use of the school buildings should start by focusing on a systematic and organised information of staff, teachers, and students on the energy saving and renewable energy habits and behaviours. Hence, raising the staff, teachers, and students' awareness on the energy efficient use of school buildings both promises and secures the existence of the energy responsible consumers in the future. It suggests that all the students and their teachers should be exposed to concepts and methods of the ecologically sustainable development as part of the formal education. And so, the role the school plays is fundamental for the success of this endeavour coupled with the fact that energy awareness is basically formulated in youthhood. Furthermore, the students are more receptive to new concepts and can act as educational agents or the opinion leaders who grow as environmental conscious citizens.

Hence, education plays a pivotal role in instilling energy efficient behaviours and habits in society as there is a strong link between the individuals' level of education attainment and the likelihood of them adopting some energy efficient measures and accepting the need for interventionist government policies to encourage a more rational use of energy. That is, energy waste in the school buildings could be better remedied by education and legislation rather than by the advanced technological solutions. That is, the probability of achieving the most sustainable energy use in school buildings increases with the energy efficiency literacy levels of the staff, teachers, and students, which demonstrate the importance of creating more energy literate society through youth's energy efficiency literacy education. The manufacturers are encouraged by market forces to develop energy efficient technologies to reduce the greenhouse gas emissions. However, energy-related education is a macro-level tool, since it is provided centrally, and helps an individual to apply and use such energy efficient technologies. Therefore, there is a need for central interventions in the school curriculum set-up: *e.g. through student-centre energy efficiency literacy education programmes*. So, through such a student-centre energy efficiency literacy education, the students can be involved in more effective energy education process, who in turn, would pass part of this literacy to their parents from the everyday knowledge they get from school. Thus, the introduction of official energy efficiency literacy programmes in school modules seem necessary because they are effective.

1.2. Energy efficiency literate youth

Schools are invaluable best platforms for promoting youth energy efficiency literacy. By incorporating energy efficiency literacy programmes into school core curriculum, the teachers can ensure that every student is exposed to the principles of an energy-saving culture, knowledge, skills, attitudes, tools, and policies which are necessary to bring about their behavioural changes. Indeed, the one most often overlooked aspect of achieving energy efficient use of school buildings is *energy efficiency literacy*. Though the term energy efficiency literacy embodies more than just the knowledge, it also includes a citizenship understanding of energy that encompasses both affective and behavioural aspects. So, energy efficiency literate youth:

1. Is one who has a sound conceptual knowledge base and a thorough understanding of how energy is used in everyday life and the impact energy production-consumption has on all spheres of environment;
2. Is sympathetic to the need for energy conservation and developing or using alternatives to fossil fuel-based energy resources.
3. Is cognisant of the impact that personal energy-related decisions and actions have on environment and society; and
4. Strives to make choices and exhibit the behaviours that respect the use of sustainable energy resources and energy saving techniques.

Energy efficiency literacy among the students focuses on the development of 4 domains: ***cognitive*** *(knowledge)*, ***capability*** *(skills)*, ***affective*** *(attitudes, values)* and ***behavioural*** *(behaviours, habits)*. Thus, energy efficiency literacy can help pave the way towards a more energy secure future by empowering the students to choose appropriate energy related behaviours in daily life. Therefore, by empowering the youth with knowledge and understanding of energy-saving practices, school environments can make significant impact in conserving energy and promoting a sustainable future. That is, education is a powerful tool that shapes the students' behaviours and influence their decisions, and creates sustainable school environments. When it comes to the energy efficient use of school buildings, educating students is crucial for driving positive change such as fostering a culture of energy efficiency through educational programmes and/or initiatives that empower students to make informed decisions about their energy consumption, which creates significant impacts in reducing energy waste.

Hence, this calls on schools and teachers to formulate policies and initiatives that prioritise sustainability to address pressing ecological concerns. Thus, the schools have unique opportunities to shape the future by integrating energy efficiency education into their curriculum. And by teaching students about the importance of energy conservation, the school instils sustainable habits early on, and prepare the next generation to make informed decisions about energy saving and consumption. Further, school can serve as a testing ground for energy efficient technologies and practices. By implementing energy-saving measures such as smart lighting, or efficient HVAC systems, and/or using renewable energy sources, the school serves as examples for students looking to reduce their carbon footprint. These initiatives not only benefit the environment but also provide valuable research and practical insights that can be shared with other industries. Moreover, schools benefit from fostering a culture of energy efficiency through education. Training programmes that focus on energy-saving techniques equip the employees with the skills and the knowledge needed to identify energy inefficiencies in the schools and implement effective solutions. So, by educating employees about energy efficiency, the school can reduce their operational costs while demonstrating their commitment to sustainability.

Here are how the schools can use different learning mythologies on energy efficiency literacy:

1. **Experiential learning:** Schools can organise hands-on experiences like gardening projects or waste reduction initiatives, exposing students to real-life environmental challenges and practical solutions.
2. **Collaborative and problem-based learning:** Schools can work with local communities and businesses to enhance learning experience. This can provide students with opportunities for internships, research projects, and community engagement focused on sustainability. Moreover, competitions, interactive games, and social engagement tools are effective methods to encourage students' involvement and facilitate them to achieve high energy efficiency literacy levels.
3. **Digital learning:** E-learning platforms offer a convenient, accessible way to disseminate environmental knowledge. Online courses, webinars, and interactive modules enable the students to gain insights into sustainable practices and become environmentally conscious.

1.3. Energy efficient school buildings

Who is responsible for ensuring that all the students and the teachers have energy efficient school buildings? In the case of Norway, kindergarten and primary schools fall under the responsibility of the municipalities. Thus, each municipality is responsible for ensuring that the pupils and the teachers all have energy efficient school buildings. Whereas secondary schools fall under the responsibility of the counties. Thus, each county is responsible for ensuring that students and teachers have energy efficient school buildings. Hence, under their respective responsibilities, both the municipalities and the counties are independent to meet their responsibilities, but they must adhere to governmental regulations. Energy efficient school buildings are the primary focus for municipalities and counties as they look to meet the targets set by the government while making cost savings by reducing energy consumption, the one way that schools can minimise their spending, whilst reducing greenhouse gas emissions and improving learning environment.

For the municipalities and counties looking to improve their school buildings energy efficient, their first port of call is to identify where changes, both in culture and processes, need to be made, to tackle their energy usage and carbon footprint. The best place to start in making school buildings energy efficient, is to identify the sources of energy waste, whether that is from old

inefficient technologies, and down to behaviours such as leaving windows open when radiators are in use, and/or keeping lights on when they are not needed. Replacing the inefficient technologies with more efficient upgrades not only make the building more effective performance-wise but this also helps to bring down costs significantly. Therefore, conducting a site walk in collaboration with the school principals, teachers, pupils, and students who are familiar with the day-to-day use of the building, helps to establish areas for improvement. The user participation is very important in making school building energy efficient. Thus, many issues are easily addressed in the longer term by simply speaking with the staff and pupils to encourage behavioural changes among the users of the school buildings. It is essential to implement measures that reduce energy consumption such as lighting sensors that ensure that lights are only on when needed. But also installing smart energy control systems that allow for more precise control which give schools the ability to adjust energy usage quickly and easily in real-time.

Municipalities and counties should get students and teachers involved not only when it comes to school buildings use but also during the renovation and/or the construction processes. Getting students involved in any energy efficiency initiatives the municipality or the county is working on is important as it not only helps to educate them on important environmental issues but also it inspires them to play an active role in reducing their own energy use. Thus, offering both engaging and interactive workshops and presentations on the climate change, to enable pupils to learn about energy savings, is a great start. Setting up eco-clubs to boost energy awareness and encourage discussions, research and/or learning around the subjects such as climate change, environmentally friendly, sustainability, a circular economy, as well as a sustainable consumption and production, etc. is the starting point in encouraging behavioural changes among the pupils and students toward energy efficient use of school buildings. And in particular, involving pupils in competitions, such as the mini switch off walk arounds, and/or rewarding them for their energy saving efforts, is particularly effective. But this also implies that, the teachers should be equipped enough to discuss all those subjects with the pupils and students and allow them to present evidence of the savings they have achieved for their school, either as individuals or in groups, during lessons. This keeps them engaged in energy saving efforts and encourage them to feel pride in the role they play. For example, some schools regularly hold initiatives and campaigns where students are urged to go around switching appliances off to save energy. The changes in usage are monitored through meter readings and the pupils receive certificates or eco-awards from teachers. The today generation loves demonstrating how they are making a difference towards climate justice. That is, encouraging behavioural changes among the pupils and students toward energy efficient use of school buildings, require that actors address energy efficiency using the language that focuses on the things that matters to the young people today, and those are climate change and a healthy natural environment.

The next thing to consider in making the school buildings energy efficient, is investing in new technologies. Aside from replacing inefficient resources, investing in the new energy efficient technologies is at the forefront of any energy efficiency plans to maximise both financial and energy savings. As lighting accounts for a significant proportion of electricity expended within the school, upgrading old, inefficient lights to more modern light emitting diode (LED) lighting alternatives must be achieved to offer the school the most effective ways to reducing its own energy consumption. Furthermore, installing lighting controls and motion sensors reduces energy usage, while the longer lifespan of LEDs decreases maintenance requirements and costs. New LED lighting also improve the aesthetics of old buildings and enhance both the learning and teaching environments. Moreover, simple steps such as adding insulation and heating controls, that substantially reduce energy usage and bills, is something that should be mastered in school buildings. Using the renewable energy options such as solar PV and heat pumps offer great methods to help future proof the buildings. As the cost of Solar PV is becoming more affordable, this is a great measure for the schools looking to lower their own carbon footprint and to reduce their dependency on grid electricity. Solar PV installations are also a popular way to raise awareness of the sustainability agenda among students and local community. So, energy efficiency requires implementing multiple measures at the same time rather than investing in just one type of technology or renewable energy option. It is the most effective way of maximising energy, carbon, and cost savings. For example: a school can begin addressing their energy usage by installing LED lighting but a school taking a holistic approach would consider whether they could also install lighting sensors, energy management systems, new insulation, low-carbon heating, and solar PV within the same project.

1.4. Youth energy efficiency knowledge

Among the seventeen goals drafted by the United Nations, four of them are strictly related to the buildings sector. And since the students and teachers care about these sustainable development goals, and hence, encouraging the energy efficient use behavioural changes among students and teachers should be discussed and taught from this point of view. The youth should be taught on how an energy efficient use of school buildings is a core part the sustainable development goals, climate justice, as well as healthy nature and environmental the youth care more about today.

Energy is central to nearly every major challenge and opportunity the world faces today. Focusing on universal access to energy, increased energy efficiency, and increased use of renewable energy through new economic and job opportunities is crucial to creating more sustainable and inclusive communities, and resilience to environmental issues like climate change. Buildings are responsible of about 40% of total primary energy consumption; this has dramatically increased in the past decades because of population growth. And since more people spend time indoor, more energy is needed to ensure the thermal environment quality. So, proper design, construction, and operation of buildings lead to significant energy saving. So, building in an energy efficient way provides key solutions to energy shortages, carbon emissions, and their serious threat to our living environment.

Investments in infrastructure, transport, irrigation, and energy as well as information and communication technology are all crucial to reach sustainable development and to empowering communities in many countries. It is recognised that growth in productivity and incomes; improvements in health and education outcomes all require investment in infrastructure. Infrastructures have to become more and more resilient to be adaptable to the fast growing of the cities, in particular; roads, railways and other means of transport have to be thought in a smarter way to make the cities more efficient and the people easier to move. New strategy to make infrastructure flexible to the existing cities' patterns have to be thought.

Smart cities are hubs for ideas, commerce, science, productivity, social development and much more. At their best, cities have enabled people to advance socially and economically. With the number of people living within cities projected to rise to 8 billion people by 2030, it is important that efficient urban planning and management practices are in place to deal with challenges. Future cities have to become smart: a smart city is a designation given to a city that incorporates information and communication technologies to enhance the quality and the performance of urban services such as energy, transportation and utilities to reduce resource consumption, wastage, and overall costs. An overarching aim of a smart city is to enhance the quality of living for its citizens through smart technology.

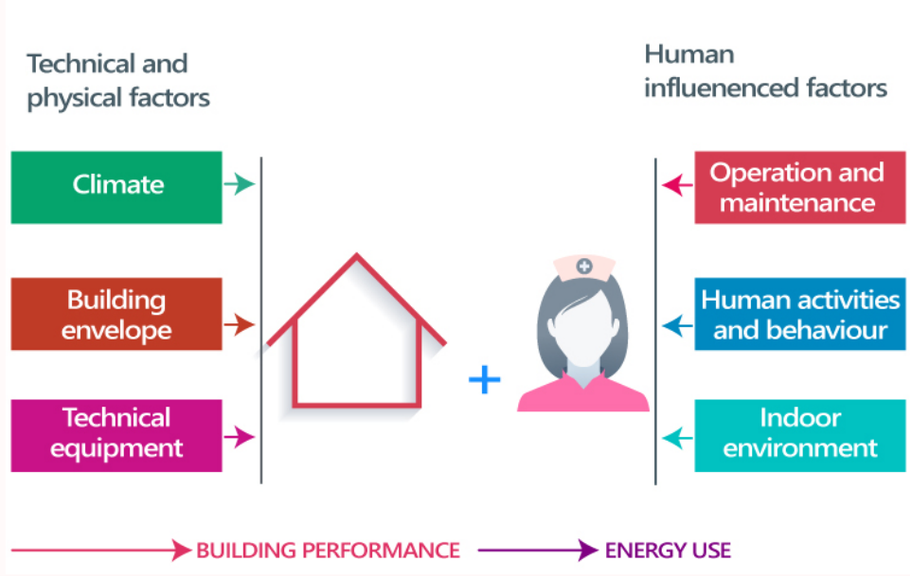
Sustainable consumption and production is about transforming our current throwaway economy into an economy where waste is eliminated, resources are circulated, and nature is regenerated. It is about promoting the renewable resources, energy efficiency, sustainable infrastructure, and providing access to basic services, green and decent jobs, and a better quality of life for all. Sustainable consumption and production aims at doing more and better with less. Net welfare gains from economic activities should be increased by reducing the resource use, degradation, and pollution along the whole life cycle, while increasing the quality of life. Indeed, this is the very definition of energy efficiency: using of less energy to perform the same task or produce the same result. Energy-efficient school buildings use less energy to heat, cool, and run appliances, and electronics, and energy-efficient facilities use less energy to produce goods.

According to European Union's energy performance of buildings directive, an energy efficient building is a building with almost zero energy demand whose demand is covered significantly by renewable sources. In Norway, although not part of the EU, a definition of an energy efficient building has been proposed as follow: ***a zero-emission building that produces enough renewable energy to compensate for the building's own greenhouse gas emissions over its lifespan.*** The definition takes in account the emissions, and not only the energy demand of the buildings. ZEB Research Centre has defined different levels of zero emission buildings depending on how many phases of building lifespan. The buildings sector is responsible of 39% of the total global emissions. This value is going to increase dramatically in the next thirty years. Since buildings hold such higher percentage of emissions, it will not be possible to reach the climate goals without eliminating or at least decreasing such emissions by 2050. Hence, the focus on decreasing emissions related to the building sector should be the main goal regarding energy and emissions in school buildings. Considering not a single a school building but the whole neighbourhood, makes it much easier to meet the ambition regarding energy and emissions. Instead of making one hundred zero emissions school buildings, it is therefore more beneficial to build a zero emissions neighbourhood. So, this requires setting energy efficiency policies at all levels of governance; addressing social, organisational, and economic factors of sufficient and efficient behaviour and decisions; which include the analysis and modelling of energy efficiency performance, and energy management systems or services.

Energy efficiency increases both the resilience and reliability of the electric grid, and provides environmental, community, and health benefits. Hence, making energy-efficient upgrades to the school buildings such as adding insulation, using LED lighting, and installing heat pumps that reduce energy use, improve the students and the teachers comfort. Energy-efficient school buildings cost less to heat, cool, and operate, which improves community resilience and address energy equity by bringing efficient, cost-effective technologies, and infrastructure to underserved communities. Furthermore, reducing energy use is essential in the fight against climate change because all traditional power plants that burn fossil fuels release greenhouse gases and contribute to air pollution. Moreover, energy-efficient school buildings are better equipped to switch to the more renewable energy, which does not produce harmful emissions. This also reduces the amount of electricity on the grid at one time known as load; minimising congestion and stress on the electric grid. Thus, less load prevents power disruptions. Reducing fossil fuel use results in the cleaner air, water, and land, all of which directly affect human health, especially young people and people with conditions that are exacerbated by pollution.

1.5. Youth energy efficiency skills

Sustainability is not only about nature and environment. It has a vital impact on our communities as well, which is why, many benefits of sustainability include also health, economic, and social benefits. Improved air quality and better lighting in school building lead to better student learning conditions. This also lowers the rates of asthma and school absences. Energy efficient schools offer unique opportunities to teach students about sustainability, as the schools can also become learning labs for the students. And students who learn about energy efficiency in the classroom often bring their gained knowledge home and they are always aware of the importance of applying this knowledge through their skills and attitudes. The students learn that the six factors which influence the most energy consumption of a building: the building body; climate; the technical equipment and the energy systems; operation and maintenance; human activities and behaviour; and indoor environment. These factors are divided in two different categories: Physical factors: building body; climate; and technical equipment belong to energy systems. And Human influential factors: maintenance; human activities and behaviour belong to operation.



Factors that influence energy consumption in a building are both technical and human. The question one could ask is why would this matter and how is this relevant to teachers, pupils, and students? The fact is that one cannot encourage behavioural changes among teachers, pupils, and students on energy efficient use of school buildings, if indeed teachers, pupils, students do not have any knowledge, skills, and attitudes on how they themselves influence energy use in a school building and why having energy efficient school buildings matter. It is important because these are key knowledge, skills, and attitudes that the youth do not learn in schools but they are then somehow expected to know and apply them. Thus, we should be careful in blaming the students and staff that they are not doing enough to be more energy efficient. Even though the most students and staff can relate to the human influential factors, they should also have the basic knowledge, skills, and attitudes on what are and how the physical factors such as the building body and the technical equipment of the building are used to build the low energy use in school buildings using passive techniques: low embodied energy materials and what that means.

Low energy school building has specific design that demands less operating and life cycle energy and that is built according to conventional criteria. It uses both sustainable techniques and system to reach comfort with a low energy use and low GHGs emissions. The main approach that is followed to improve the energy usage of a building, and consequently its emissions, is the use of passive techniques, the use of the low embodied energy materials and the adoption of systems based on renewable energies. **E.g.,** using high levels of air tightness and insulation can reduce heat loss from the building, and hence, its needing of heating during winter. Dense materials is used in the building construction to create thermal mass, which reduces temperatures flow by storing heat and releasing it during the day; this helps to limit overheating during hot seasons or when the level of occupancy in the building is higher. Buildings can be designed to make the best use of sunlight by orientating them relative to south and arranging windows to maximise daylight and allow sunlight in during winter, and to limit direct sunlight penetration during summer as it can cause overheating. Use of high efficiency, low emissivity glazing allows high levels of daylight in whist reducing heat losses through windows. Passive design can use wind-driven and stack-driven natural ventilation to provide cooling in summer without the need for air conditioning. To minimise heat losses during cold weather, airflow is reduced to the minimum needed to provide fresh air.

Teaching students to be mindful of how they use energy early on, requires them to learn about such topics to ensure a better future for them and the planet. **For example,** they should know that different school's classrooms or levels may have different temperature needs, and hence, different energy use. They should know that better insulation of a school building increases the value of the building as well as its lower energy use and costs. Knowing that insulating heating pipes; using energy efficient ventilation and cooling systems; making use of daylight in the classrooms; and improving window glazing reduce energy losses, use, and costs put the students in the position to demand changes if it seems that their own school buildings are not built in an energy efficient manner. This could be simply done by the students and/or the teachers taking on the initiative of establishing energy-efficiency team at their schools. Getting teachers, students, and administrators on the same page takes time and energy. Thus, it is no surprise that many schools struggle to put energy efficiency tools in place. That is why a good team is critical as its primary job is to build awareness of energy efficiency. The team might also brainstorm energy saving ideas for schools; teach other students about energy waste and energy saving tips for school. Students who know how the energy is used, saved, and wasted, change simple behaviours such as turning off the lights and powering down computers when not in use; which are the most effective energy-saving tips for schools.

1.6. Youth energy efficiency behaviours

Using both school buildings and the building systems as intended, such as using heating and lighting control effectively contribute to reducing energy wastage, save money and emissions. If building systems are poorly operated and/or maintained, the heating costs increase. Hence, the school administration has to ensure that systems are serviced at least annually and adjusted for optimum efficiency. This makes sure that temperature controls are set and adjusted to reflect different uses and activities in different areas school building and in classrooms. The school administration should check timers so that they reflect the actual hours of use and are set to the right date and time (particularly after the clocks go forward or back). Moreover, the school administration should limit the ability for individual students to change heating controls, and/or only enable very small adjustments. In

each morning, the teachers should make sure that all sources of draughts are identified, and appropriate draught proofing is fitted. If the classroom is too warm and heating is on, the students should be encouraged to adjust the temperature control rather than opening windows. Though overheating in the summer can be a problem. The school should encourage the staff and students to either open windows or use air-conditioning, but never both. Poor control of a classroom space can lead to discomfort, so it is important that the staff both understand and know how to adjust the temperature, ventilation, and lighting in their classrooms so that the learning conditions can be adjusted to achieve the desired comfort levels.

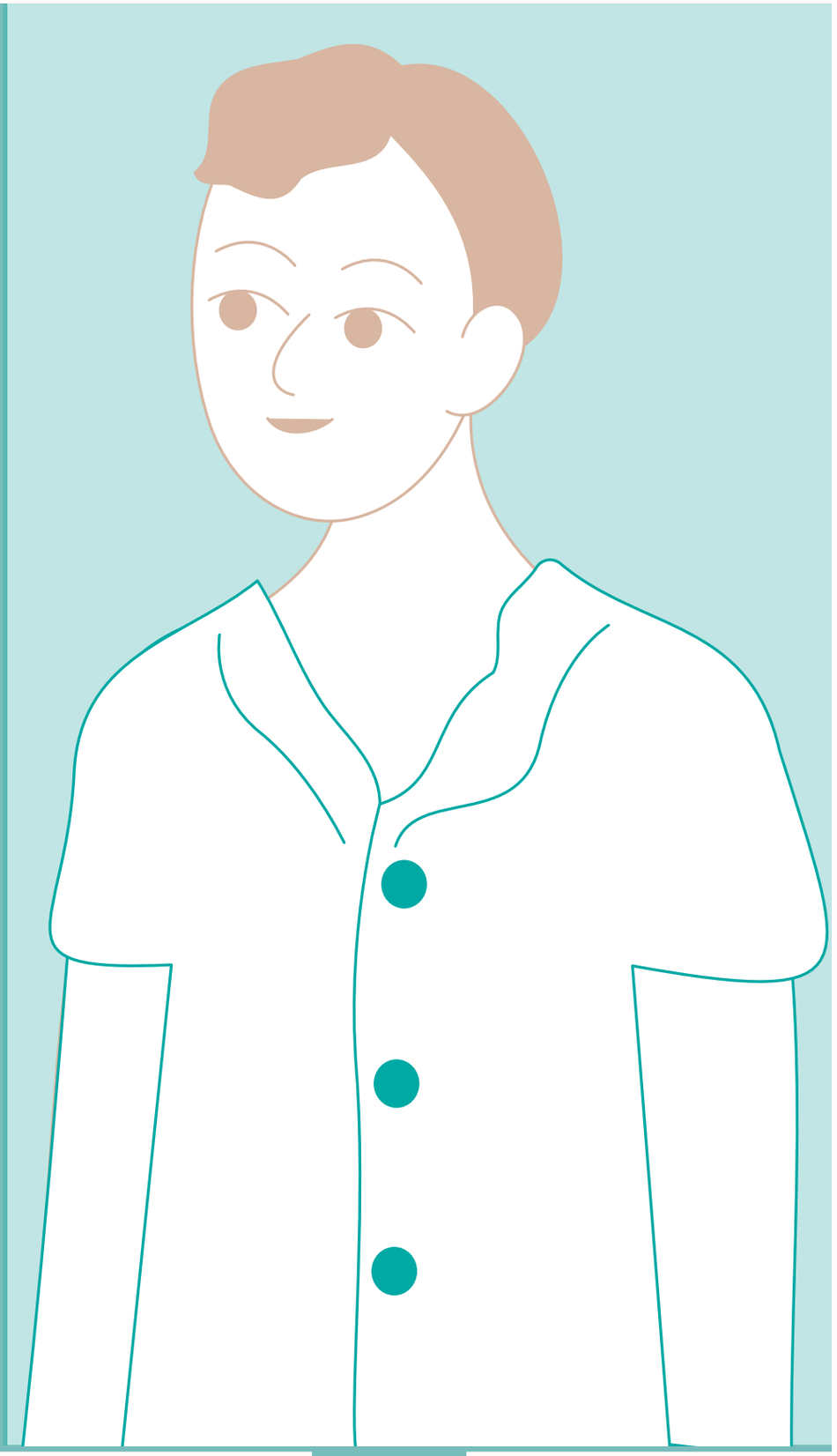
On regularly basis, students should be encouraged to make small changes by starting with the basics, such as switching off lights, electrical equipment when they are not in use. Labelling light switches is a simple way to ensure that the lights are only turned on when it is required. Removing obstructions from windows and radiators to make the best use of daylight and to make sure that heating systems are operating efficiently, is another basic thing to be aware of. The students and staff should be encouraged to keep doors closed wherever possible to stop warm or cool air from escaping. Schools could also encourage the groups of eco-champions who check at the end of each day, for equipment or lights that have been left on, switch them off and inform the staff responsible. There are a number of housekeeping measures or management procedures that could be put in place which do not have a cost attached to them such as active management: understanding how buildings, equipment, and building systems work and how much of energy they use help students use them more efficiently.

Schools should have strong policies on cutting back on energy use from lighting such as installing energy efficient lighting which can reduce energy consumption: installing lighting controls; using occupancy lighting sensors in the areas that are infrequently used; replacing failed lamps with energy efficient ones, which last longer in many cases. Turning off the lights when the rooms are not in use. Even something as simple as shutting off lights when a student is the last to leave a room help to save energy; or turning off the lights that are not being used in classrooms and other areas, such as empty bathrooms and unoccupied multi-purpose rooms. Teachers should remind the students to turn off lights when they do not need them, which saves energy and keeps the classrooms cooler. Schools should also be built to use natural light when the sun is bright, which saves energy from heating and cooling. Further, the students should be encouraged to close the door when they leave or enter the room, be aware of that leaving doors wide open results in a loss of heat or cool air, which can increase the need for energy use to heat and cool the room. Closing doors to classrooms, keeps the heat and cold inside the room and save energy in the process, which reduces energy use from electronics. Moreover, the global focus on environmental issues has generated a lot of interest and support within schools to change behaviours. Many schools have active pupils and staff engagement which allows them to translate their own concerns about the environment into practical action within and outside of their schools. Many of these practices encourage students to walk, take public transportation, and ride bicycles to school whenever possible. Teachers recruit students or help them by giving them ideas for how to save energy at school. One other great way to get students organised has been starting the official school clubs and science projects. In some of these clubs and science projects teachers ask the students to create signs for an energy saving class project. Students post these signs about conserving energy around school: *posting signs that remind people of the specific things they can do to save energy and also some signs that raise awareness about saving energy in the general way*. For example, might hang up signs next to light switches around the school with reminders like "Remember to turn off the lights when you leave"

Schools should also have practice in place of setting up recycling stations. Recycling is a great way to save energy because this reduces the need to produce new materials. And school should also have the tools in place to share energy information with pupils and staff, which encourages shared ownership of the issues by involving the staff and the pupils. This is relevant as it has been pointed out that to identify where the energy savings can be achieved, starts by looking at how energy is currently being used. Making staff and pupils aware of the energy they are using, and what it is costing in both monetary and environmental investment, can help them to understand how their habits have impact on their energy use and how changing them can have positive effects. Engaging the pupils with meter readings, energy management statistics and comparisons of numerical data helps them to improve numeracy skills, develop their own understanding of energy and how it is used, which influences longer-term behaviour at school and home.

SECTION-2

Energy efficiency literacy education



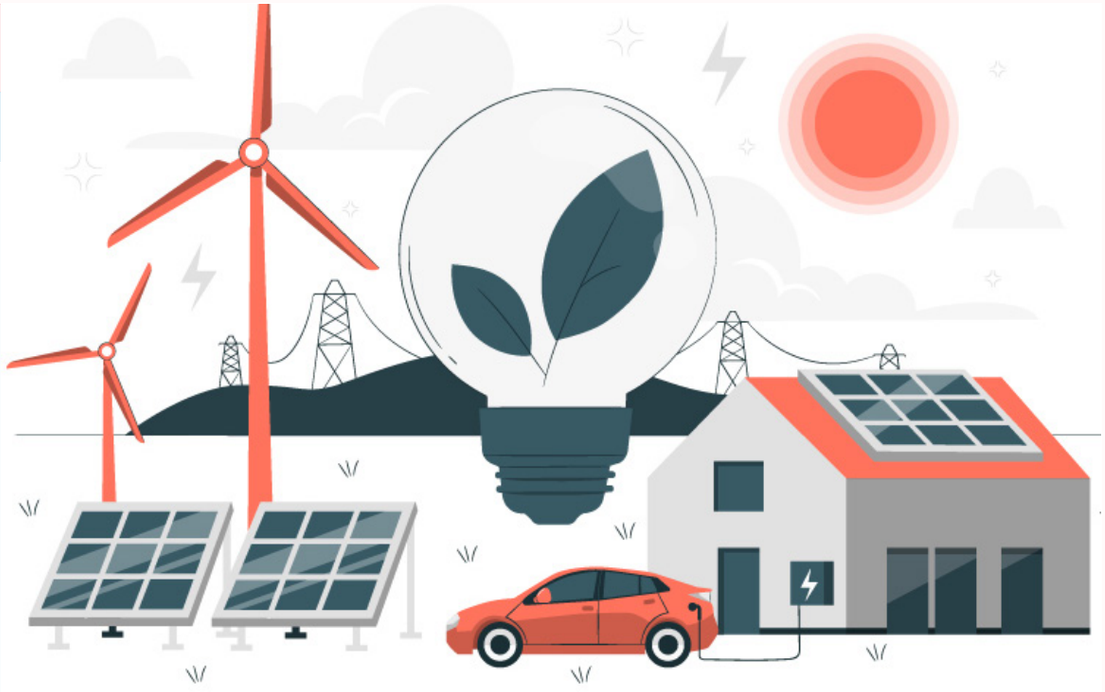
2.01. Understanding sustainable energy

2.01.1. Activity context

Sustainable energy refers to energy sources that are not depleted when used and have minimal environmental impact. These sources include renewable energy such as solar, wind, hydro, geothermal, and biomass. Unlike fossil fuels, sustainable energy options are abundant, clean, and have a significantly lower carbon footprint, making them a viable alternative for a greener future.

Benefits of education on sustainable energy:

1. **Creates awareness:** It helps students understand the environmental impact of conventional energy sources and encourages them to adopt cleaner alternatives
2. **Building Knowledge:** It provides students with a comprehensive understanding of sustainable energy technologies, which empowers students to make informed decisions and actively participate in the transition to renewable energy sources.
3. **Promoting innovation:** It fosters innovation by inspiring young minds to explore renewable energy solutions and develop new technologies. It encourages students to think creatively, address energy challenges, and contribute to the development of sustainable energy systems.



2.01.2. Reflecting on experience workshop activity

This activity encourages participant to look back on their personal behaviour to prepare them for new behavioural learning and change. It is used to help them identify their past experiences that the activity wants to invoke and to do so in an engaging manner. A simple and adaptable approach is to have participants break into small groups and briefly answer these questions:

1. How is your school helping the students understand the environmental impact of conventional energy sources and encourages them to adopt cleaner alternatives?
2. How is your school providing the students with a comprehensive understanding of sustainable energy technologies, to empower students to make informed decisions?
3. How is your school fostering innovation by inspiring young minds to explore renewable energy solutions and develop new technologies?

2.02. Why energy efficiency literacy matters

2.02.1. Activity context

In its effort to make school buildings energy efficient, a municipality understands that it is obliged to increase its renewable energy resources for its high schools to save more energy and reduce the CO2 emissions. Unfortunately, the growth of renewable electricity in the municipality is slow although there is a high private initiative. So, the potential for energy efficiency improvements in the municipality is large because energy intensity (total energy consumption divided by Gross Domestic Product) is higher than the majority of other municipalities. This is also due, in part, to the absence of continuous, targeted, and organised energy-saving campaigns coupled with the fairly inexistent energy-saving culture.

Such a lack of energy knowledge and energy-saving culture is regarded as energy efficiency illiteracy by the municipality. So, the municipality aims to put a lot of emphasis on the school's systematic and organised information of students on energy efficiency literacy, energy saving, and renewable energy attitudes. For the municipality, raising students' awareness on these matters promises and secures the existence of energy efficiency literate and energy responsible consumers in the future. The municipality's agenda suggests that all students and their teachers should be exposed to concepts of energy efficiency literacy and methods of ecologically sustainable development as part of their formal education. The role of the school is fundamental for the success of this endeavour coupled with the fact that energy awareness is basically formulated during basic school education.

2.02.2. Reflecting on experience workshop activity

This activity encourages participant to look back on their personal behaviour to prepare them for new behavioural learning and change. It is used to help them identify their past experiences that the activity wants to invoke and to do so in an engaging manner. A simple and adaptable approach is to have participants break into small groups and briefly answer these questions:

1. How is your school playing a pivotal role in instilling energy efficiency literacy and energy efficient behaviour and habits among the students and teachers?
2. Do you agree that children and youth are more receptive to concepts of energy efficiency literacy and can act as agents and grow as environmentally conscious citizens?
3. How is your school integrating energy efficiency literacy in its curricula to ensure that students and teachers develop energy efficiency behaviours and energy-saving culture?

2.03. Renewable energy-generating capacity

2.03.1. Activity context

Energy is central to nearly every major challenge and/or opportunity the world faces today. Focusing on universal access to energy, increased energy efficiency and increased use of renewable energy through new economic and job opportunities is crucial to creating more sustainable and inclusive communities and resilience to environmental issues like climate change. Buildings are responsible of about 40% of total primary energy consumption; this has dramatically increased in the past decades because of population growth. Since more people spend time indoor, more energy is needed to ensure the thermal environment quality. So, proper design, construction, and operation phase of the buildings give a significant energy saving; building energy efficiency provide key solutions to energy shortages, carbon emissions, and their serious threat to our living environment.

So, decreasing of the emissions related to the school buildings should be the focus, where reaching the goals regarding energy and emissions in school buildings are addressed from the perspective a wider point of view. Instead of making one hundred zero emissions school buildings, it is more beneficial to build a zero emissions neighbourhood. So, this requires setting energy efficiency policies at all levels of governance; addressing social, organisational, and economic factors of sufficient and efficient behaviour and decisions; which include analysis and modelling of energy efficiency performance, and energy management systems or services.

2.03.2. Reflecting on experience workshop activity

This activity encourages participant to look back on their personal behaviour to prepare them for new behavioural learning and change. It is used to help them identify their past experiences that the activity wants to invoke and to do so in an engaging manner. A simple and adaptable approach is to have participants break into small groups and briefly answer these questions:

1. How can sustainable construction, energy efficiency appliances, and energy-saving behaviours contribute to reducing emissions and promoting climate change mitigation?
2. How do energy efficient school buildings offer sustainable learning environments and increase the level of comfort which enhances the quality of students' lives?
3. How can schools use small technical interventions to move towards sustainable energy; enhance school building comfort, and save nature, energy and money?

2.04. Investing in infrastructure and energy

2.04.1. Activity context

Investments in infrastructure, transport, irrigation, energy as well as information and communication technology are all crucial to reach sustainable development and empower communities in all countries. It is recognised that growth in productivity and incomes; improvements in health and education outcomes require investment in infrastructure. Infrastructures must become more and more resilient to be adaptable to the fast growing of the cities; particularly, roads, railways, and other ways of transport must be thought of in a smarter way to make cities more efficient and people easier to move. New strategy to make infrastructure flexible to the existing cities' patterns must be thought of.

Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation means to:

- Develop quality, reliable, sustainable infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all.
- Promote inclusive and sustainable industrialisation and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, double its share in developing countries.
- Increase the access of small-scale industrial and other enterprises, in particular in developing countries, to financial services, including affordable credit, and their integration into value chains and markets.

2.04.2. Reflecting on experience workshop activity

This activity encourages participant to look back on their personal behaviour to prepare them for new behavioural learning and change. It is used to help them identify their past experiences that the activity wants to invoke and to do so in an engaging manner. A simple and adaptable approach is to have participants break into small groups and briefly answer these questions:

1. What does SDG-9 "Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation" have to do with energy consumption?
2. How does quality, reliable, sustainable, and resilient infrastructure support efficient use of energy that contributes to sustainable human and environment well-being?
3. How does increased access to information and communications technology, and affordable access to the Internet contribute to energy efficiency literacy?

2.05. Affordable, safe, and sustainable cities

2.05.1. Context

Smart cities are hubs for ideas, commerce, productivity, social development and much more. At their best, cities enable the people to advance socially and economically. With the number of people living within cities projected to rise to more than 5 billion people by 2030, it is important that efficient urban planning and management practices are in place to deal with the challenges. Future cities must become smart: a smart city is a designation given to a city that incorporates information and communication technologies to enhance the quality and the performance of urban services such as energy, transportation, and utilities to reduce resource consumption, wastage, and costs through smart technology.

- Ensuring access for all to adequate, safe and affordable housing and basic services, and upgrade the slums. And strengthening efforts to protect and safeguard the world's cultural and natural heritage.
- Providing access to safe, affordable, accessible, and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities, older persons.
- Enhancing inclusive and sustainable urbanisation and capacity for participatory, integrated, and sustainable human settlement planning and management in all countries. And substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including energy and water-related disasters.

2.05.2. Reflecting on experience workshop activity

This activity encourages participant to look back on their personal behaviour to prepare them for new behavioural learning and change. It is used to help them identify their past experiences that the activity wants to invoke and to do so in an engaging manner. A simple and adaptable approach is to have participants break into small groups and briefly answer these questions:

1. What does SDG-11 "Make cities and human settlements inclusive, safe, resilient, and sustainable" have to do with schools' energy saving and consumption policies?
2. How can access to safe, affordable, accessible, and sustainable transport systems contribute to sustainable energy saving behaviours and habits among students?
3. How can integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change contribute to energy efficiency education?

2.06. Sustainable consumption and production

2.06.1. Context

Sustainable consumption and production is about transforming our throwaway economy into one where waste is eliminated, resources are circulated, and nature is regenerated. But it is also about promoting resource and energy efficiency, sustainable infrastructure, and providing access to basic services by reducing resource use, degradation, and pollution along the whole life cycle, while increasing quality of life. This is the very definition of energy efficiency and energy-efficient school buildings are the ones that use less energy to heat, cool, and run energy-efficient appliances and facilities.

Changing habits such as opening curtains for natural light; covering pans when boiling, spending less time in shower; producing own energy like installing small-scale solar installations to power the building and comparing energy providers available to choose renewable energy sources. Energy-efficient school buildings cost less to heat, cool, and operate, which improves community resilience and addresses energy equity problems. So, reducing energy use is essential in the fight against climate change because traditional power plants that burn fossil fuels release greenhouse gases and contribute to air pollution. Energy-efficient school buildings are better equipped to switch to renewable energy that does not produce harmful emissions. Reducing fossil fuel use results in cleaner air, water, and land, all of which directly affect human health, especially young people and people with conditions that are exacerbated by pollution.

2.06.2. Reflecting on experience workshop activity

This activity encourages participant to look back on their personal behaviour to prepare them for new behavioural learning and change. It is used to help them identify their past experiences that the activity wants to invoke and to do so in an engaging manner. A simple and adaptable approach is to have participants break into small groups and briefly answer these questions:

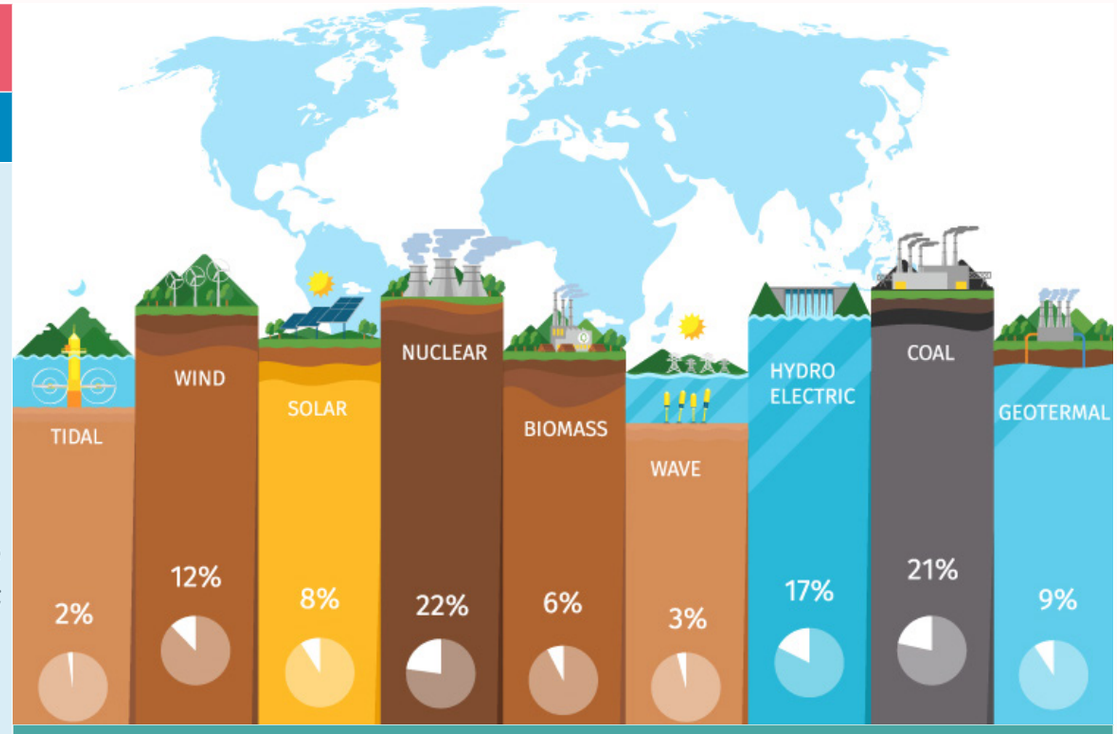
1. What does SDG-12 "Ensure sustainable consumption and production patterns" have to do with how the schools use and conserve energy and manage their waste?
2. How does making energy-efficient upgrades to schools such as adding insulation, using LED lighting, installing heat pumps improve students' comfort and performance?
3. How does reducing schools' energy use contribute to the fight against climate change, which have considerable environmental, community, and health benefits?

2.07. Why saving energy is not optional

2.07.1. Context

Saving energy is not optional. If we continue at this rate, we will eventually exhaust our energy sources, which will force us to reduce our consumption one way or another. Cutting down on our energy consumption benefits society in two ways: It reduces greenhouse gas emissions and get us into good habits in transitioning into an energy efficient society; contributing to:

- **Lower air pollution:** it has a great range of positive side-effects on health and mental wellbeing; food, the water of the rivers, lakes, and oceans that surround us; and all animals, whether they fly or swim the seas, etc.
- **Less toxic waste:** fuels-based energy creates toxic waste either during the production, generation, and use phases. If we reduce our energy consumption, future generations, and other living beings we're sharing this beautiful blue planet with, will not have to deal with toxic waste's consequences.
- **Less exploitation of natural resources:** Earth does not revolve around us. We are part of Earth, and we are part of our ecosystem. And as such, we underlie the law of nature. In nature, when a species procreates uninhibited and continuously increases its consumption as a result, the entire species will meet its demise sooner rather than later, when all the resources have been exhausted. And this is where we are headed. Is the human species being indeed more aware and smarter than other animals, as we always claim and act accordingly.



2.07.2. Assimilating and conceptualising workshop activity

This activity encourages participant to practice and involve themselves in new behaviours and skills. It provides participants a safe environment in which to try out new things before putting them into practice in the real world. A simple and adaptable approach is to have participants break into small groups and briefly answer these questions:

1. Various sources of energy can be used to power human activities, and often this energy must be transferred from source to destination. How many sources do you know?
2. Energy decisions are influenced by economic, political, environmental, cultural, social factors. Explain how each factor influences your energy behaviour, decisions, actions?
3. The quality of nature, environment, and life of individuals on Earth is affected by the energy choices of human species. How are your energy choices making a difference?

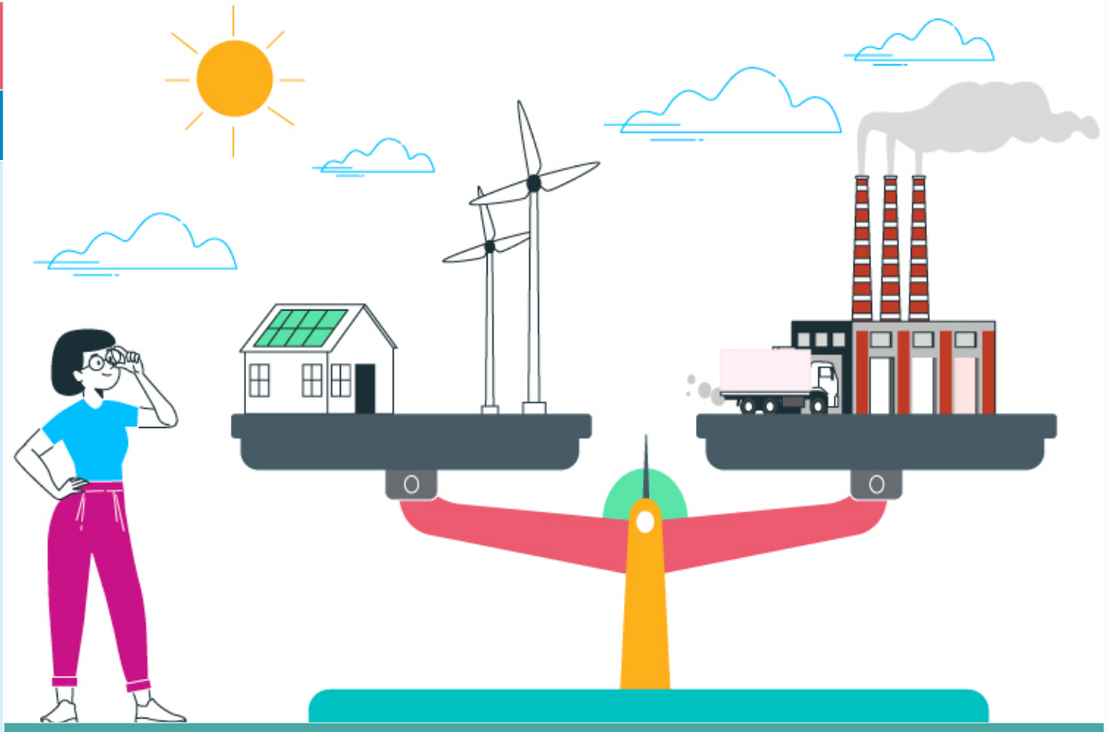
2.08. The importance of energy efficiency

2.08.1. Context

Energy efficiency refers to utilising less energy to perform the same tasks or achieve the same results. By implementing energy-efficient practices, both students and schools can significantly reduce their carbon footprint and lower energy costs. In addition to energy efficiency practices, other emissions reduction opportunities for the school include actions such as: making water and wastewater systems more energy-efficient; reducing solid waste sent to landfills; capturing and using methane produced in current landfills; reducing leakage from refrigeration equipment; and using refrigerants with lower global warming potentials.

Here are some key reasons why energy efficiency is important:

- **Environmental protection:** Energy efficiency helps in reducing greenhouse gas emissions, which are major contributors to climate change. By conserving energy, we can mitigate the environmental impacts associated with conventional energy generation.
- **Cost savings:** Energy-efficient practices can lead to substantial cost savings. By adopting efficient technologies and practices, students and schools can reduce their utility bills and operational expenses.
- **Resource conservation:** Energy efficiency helps in preserving finite resources such as fossil fuels. By using energy wisely, we contribute to the conservation of these resources for future generations.



2.08.2. Assimilating and conceptualising workshop activity

This activity encourages participant to practice and involve themselves in new behaviours and skills. It provides participants a safe environment in which to try out new things before putting them into practice in the real world. A simple and adaptable approach is to have participants break into small groups and briefly answer these questions:

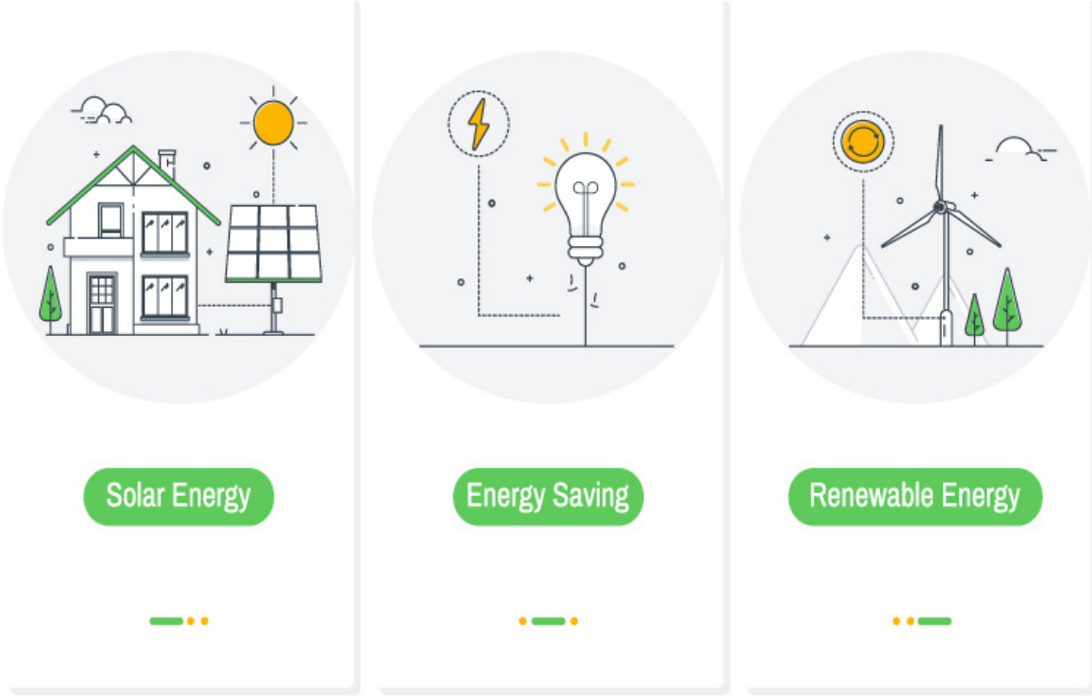
1. Energy efficiency helps to reduce greenhouse gas emissions. So, how does it contribute to mitigating environmental impacts associated with conventional energy generation?
2. Energy-efficient practices lead to substantial cost savings. How do students' adaptation to energy efficient technologies reduce schools utility bills and operational expenses?
3. Energy efficiency helps to preserve finite resources such as fossil fuels. How can we use energy wisely to the conservation of finite energy resources for future generations?

2.09. Why education for energy efficiency

2.09.1. Context

Education plays a pivotal role in fostering energy efficiency and driving behavioural change. Here are a few effective education initiatives that can raise awareness and promote energy-efficient practices:

- **Energy-efficient curriculum:** Integrating energy efficiency into the educational curriculum at all levels of schools can help shape attitudes and behaviours of students toward energy conservation. By incorporating lessons on energy use, renewable energy sources, and energy-saving techniques, schools can empower future generations to become environmentally responsible citizens.
- **Energy workshops:** Organising energy workshops can provide students with practical knowledge and skills to reduce energy consumption. These initiatives can educate the students on identifying energy-saving opportunities, understanding energy-efficient technologies, and implementing energy management strategies.
- **Awareness campaigns:** Public awareness campaigns are essential to engaging a broader audience and effectively communicate the benefits of energy efficiency. Through various media channels, such as television, radio, social media, and online platforms, these campaigns can emphasise the importance of energy conservation, highlight success stories, and provide practical tips for energy-saving practices.



2.09.2. Assimilating and conceptualising workshop activity

This activity encourages participant to practice and involve themselves in new behaviours and skills. It provides participants a safe environment in which to try out new things before putting them into practice in the real world. A simple and adaptable approach is to have participants break into small groups and briefly answer these questions:

1. What kind of lessons on energy use, renewable energy sources, and energy-saving techniques would you want your schools to offer to empower students?
2. What kind of energy workshops would you want your schools to offer to provide students with practical knowledge and skills to practise energy saving behaviours?
3. Can you use this opportunity to create a media-based awareness campaign on energy efficiency to engage students by providing practical tips for energy-saving practices?

2.10. Practising energy efficient behaviours

2.10.1. Context

Schools have strong policies on cutting back on energy use from lighting such as installing both energy efficient lighting and controls lighting which accounts for around half of the electricity used in a typical school. Hence, schools can reduce their energy consumption by installing lighting controls; using occupancy lighting sensors in areas that are infrequently used; replacing failed lamps with energy efficient ones, which last longer in many cases.

This also comes to students' behaviours and small actions such as encouraging and reminding students to turn off the lights when rooms are not in use. Even something as simple as asking students to shutting off the lights when the students is the last to leave a room help to save energy. Turn off the lights that are not being used in classrooms and other areas, such as empty bathrooms and unoccupied multi-purpose rooms all are actions that contribute to an energy saving culture. And when teachers remind students to turn off lights when they do not need them saves energy and keeps classrooms cooler.

But schools should be built to use natural light when the sun is bright, which saves energy from heating and cooling. Further, students should be encouraged to close door when they leave or enter the room to be aware of that leaving doors wide open results in a loss of heat or cool air, which can increase the need for energy use to heat or cool the room. So, students become aware that they can keep the heat and cold inside the room and save energy in the process, which reduces energy use.

2.10.2. Assimilating and conceptualising workshop activity

This activity encourages participant to practice and involve themselves in new behaviours and skills. It provides participants a safe environment in which to try out new things before putting them into practice in the real world. A simple and adaptable approach is to have participants break into small groups and briefly answer these questions:

1. Have your school taken steps in installing lighting controls; using occupancy lighting sensors in areas that are infrequently used; and utilising energy efficient lamps?
2. Have your school taken steps in improving students' energy efficient behaviours such as encouraging and reminding students to turn off lights when the rooms are not in use?
3. Is your school built to use natural light as the sun is bright to save energy from heating and cooling? If not, which steps can you take to call the school to take actions for 1 and 2?

2.11. Every choice one makes has an impact

2.11.1. Context

The global focus on environmental issues has generated a lot of interest and support within schools to change behaviours. Many schools have active pupils and staff engagement which allows them to translate concerns about the environment into practical action within and outside of their schools. Many of these practices encourage students to walk, take public transportation, or ride bicycles to school whenever possible, which gives them ideas for how to save energy at school.

One other great way students are organised has been starting official school clubs and science projects, where the teachers can help students create signs for class projects. Students post these signs about conserving energy around school: such as posting signs that remind people of specific things, which they can do to save energy and some signs that raise awareness about saving energy in a general way. For example, hanging up signs next to light switches with reminders, like **"Remember to turn off the lights when you leave."**

Schools have tools in place to share energy information with pupils and staff, which encourages shared ownership of the issues by involving staff and students. This is relevant as it has been pointed out that to identify where energy savings can be achieved, starts by looking at how energy is being used. Thus, making staff and students aware of the energy they are using, and what it is costing in both monetary and environmentally, helps them understand how their habits have an impact on energy use and how changing them can have positive effects.

2.11.2. Assimilating and conceptualising workshop activity

This activity encourages participant to practice and involve themselves in new behaviours and skills. It provides participants a safe environment in which to try out new things before putting them into practice in the real world. A simple and adaptable approach is to have participants break into small groups and briefly answer these questions:

1. How does encouraging students to walk, take public transportation, and ride bicycles to school whenever possible improve the energy saving culture among students?
2. How can energy efficient clubs and science projects in your school contribute to energy awareness of the students and strengthen their energy efficient behaviours?
3. How can your school involve staff, teachers, and students in identifying energy loss and use in order to find inclusive and sustainable energy savings solutions?

2.12. Factors that influence energy loss, use

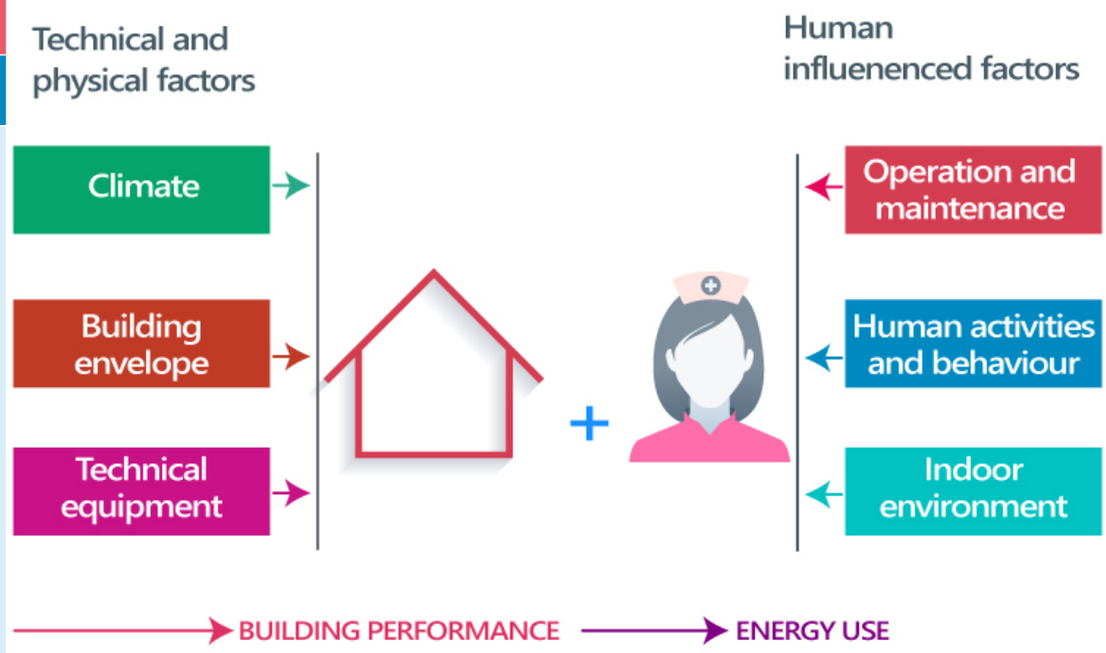
2.12.1. Context

An energy efficient school transforms the health and wellbeing of its students and staff. After all, energy efficient school is not only about saving energy, nature, and environment. An energy efficient school has a vital impact on society as well, which is why many impact of energy efficiency include economic, and social benefits.

Improved air quality and better lighting lead to better student learning and performance. It also lowers the rates of asthma and school absences. Energy efficient schools have a unique opportunity to teach students about associations between energy efficiency, sustainability, and climate change as schools can become learning lab for students. And students who learn about energy efficiency, sustainability, and climate change in classroom bring their knowledge home and they are always aware of the importance of applying this knowledge through their skills and attitudes.

These students are aware of the factors that influence the most energy consumption of a building such as the building body; climate; technical equipment and energy systems; operation and maintenance; human activities and behaviour; and indoor environment. Factors can be divided in 2 different categories:

1. **Physical factors:** climate; building body, and technical equipment belong to energy systems; or
2. **Humanly factors:** operation and maintenance; human activities and behaviour; and indoor environment quality. These are all factors that are easily influenced and vary from user to user.



2.12.2. Assimilating and conceptualising workshop activity

This activity encourages participant to practice and involve themselves in new behaviours and skills. It provides participants a safe environment in which to try out new things before putting them into practice in the real world. A simple and adaptable approach is to have participants break into small groups and briefly answer these questions:

1. In your understanding, how does an improved air quality and better lighting condition lead to better health and wellbeing and better student learning and performance?
2. How can your school become a living laboratory to better teach the students about the associations between energy efficiency, sustainability, and climate change?
3. In your understanding, how do physical and humanly influential factors interact to influence the most energy loss and consumption of your school buildings?

2.13. Establishing an energy-efficiency team

2.13.1. Context

Teaching students to be mindful of how they use energy early on, requires them to learning about these to ensure a better future for them and the planet. For example, they should know that different school's classrooms or levels may have different temperature needs, and hence, different energy use. They also should know that good insulation of school buildings increases the value of the building and lower its energy use and costs.

Knowing that insulating heating pipes; using energy efficient ventilation or cooling systems; making use of daylight in a classroom; and improving window glazing reduce energy losses, use, and costs put the students in the position to demand changes if it seems that their school buildings are not built in an energy efficient manner. This could be simply done by the students taking on the initiative of establishing energy-efficiency team at their schools. And a good team is critical to build awareness of energy efficiency of school and students.

Such team might brainstorm energy saving ideas for schools; teach other students about energy waste and energy saving tips for school. Students who know how energy is used, saved, and wasted change behaviours such as turning off lights and powering down computers when not in use which are most effective energy-saving tips for schools. Energy efficiency ideas begin with awareness of where school wastes its energy. Thus, school support is essential. Having the principal endorse students' energy efficiency team raises its profile and signals to others that the school is united and committed to the project.

2.13.2. Planning for application workshop activity

This activity provides a stimulus for implementing and utilising new learning outside workshop's context. It prepares participants for and increases the likelihood of transfer of learning. A simple and adaptable approach is to have participants break into small groups and ask each participant to complete an action plan at the conclusion of the workshop:

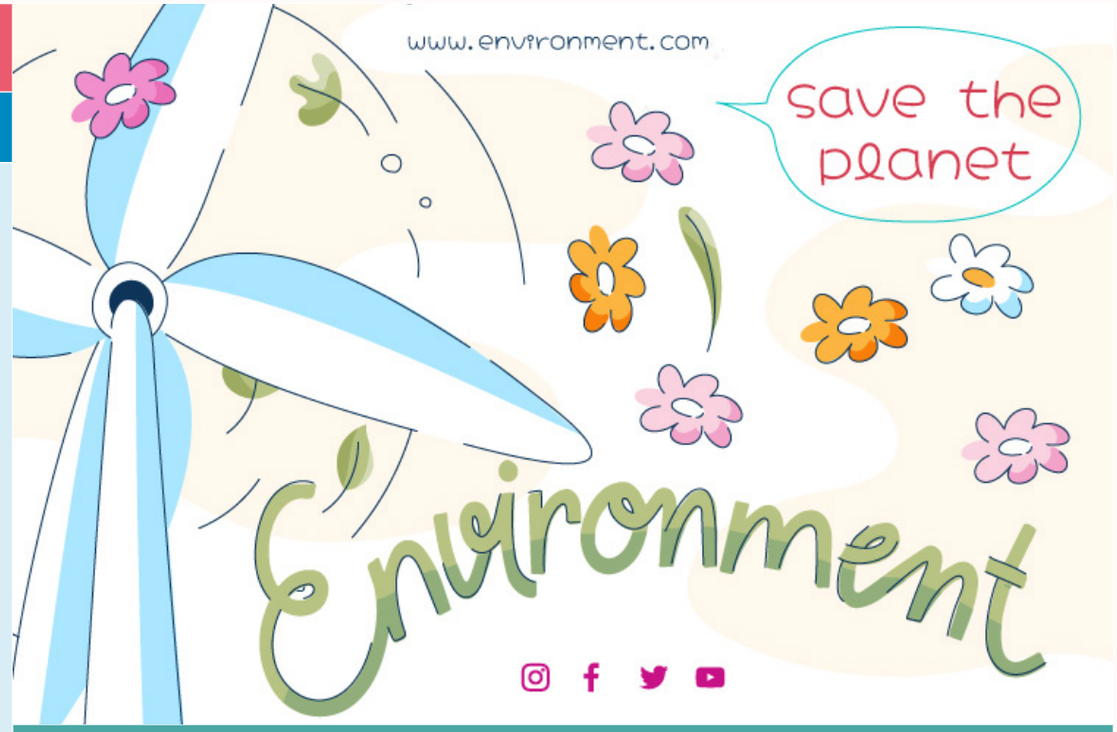
1. How does learning about being mindful of how we use energy from childhood contribute to ensuring a better future for different generations and the planet?
2. How are students in your school taking actions and initiatives to ensure that the school buildings are built or renovated in an energy efficient manner?
3. You now want to establish an energy-efficiency team at your schools, brainstorm the idea and create an action plan for your team for the next academic year?

2.14. Create school energy efficiency charter

2.14.1. Context

A municipality wants to implement a project to increase energy efficiency in school buildings and promote energy efficiency awareness across the community. The municipality also wants to disseminate project information to create the best opportunities for the lasting energy efficiency knowledge transfer by using a dedicated project website and social media to publish news and updates to promote citizens' interest in the project activities. In particular, the website will be the core dissemination tool to highlight the project concepts, allowing visitors to view project progress, while Instagram, Facebook, and Twitter will be used to publish photos, videos, highlights, stories, with the parental permission.

To support information and communication, project's website will be maintained and updated beyond the completion of the project. The activities carried out will be designed to make energy saving an integral part of educational activities to promote energy efficiency awareness. Thus, the first step is the constitution of Energy Efficiency Team of each of the schools involved in the project; including a reference teacher, and a few students, teachers, and staff selected by each school, to implement the activities, and support energy efficiency awareness. In each school, Energy Efficiency Team members will be involved in an Energy Efficiency Training to identify the possible actions to promote energy saving and reduce energy consumption. This entailed the identification of a series of good practices to be included in a common Energy Efficiency Charter, the school slogan, and the design of the activities to be carried out within the project.



2.14.2. Planning for application workshop activity

This activity provides a stimulus for implementing and utilising new learning outside workshop's context. It prepares participants for and increases the likelihood of transfer of learning. A simple and adaptable approach is to have participants break into small groups and ask each participant to complete an action plan at the conclusion of the workshop:

1. Does your school implement projects that aim at increasing energy efficiency in school buildings and promote energy efficiency awareness in school neighbourhoods?
2. Help your school to constitute an energy efficiency team that includes a reference teacher, and students, teachers, and staff support energy efficiency awareness initiatives within the school and its neighbourhoods?
3. Now help your team to identify a series of good practices on energy efficiency awareness to create a common school energy efficiency charter and the team slogan?

2.15. Work a case study on energy efficiency

2.15.1. Context

A Living Lab Project was set up in public schools owned by a municipality to motivate students to increase energy efficiency in school buildings and promote energy awareness across the community. Students, teachers, and staff from eight schools were involved in unconventional educational activities aimed at highlighting energy issues in a multidisciplinary framework and enhancing students' skills in different subjects using:

School race: a competition among schools to reduce energy consumption by adopting a series of common good practices identified, included in an Energy Efficient Charter. Participating schools were in competition to achieve the highest percentage of energy savings by implementing actions listed in The Energy Efficient Charter. Reward offered by municipality for winning school was 50% of the savings obtained on the energy bill.

Art for energy: an artistic competition between students to support a creative approach to the energy efficient concepts through an artistic vision. All the creative works produced were published on the schools' website and social media sites, with permission from parents and teachers and a public vote was called to the best art works.

Play for energy: The purpose was to use the concept of serious gaming to help students know more about energy issues through games. To this end, a collection of games on energy themes were made available. This collection inspired teachers and students in the creation of new games utilising different educational software provided by the schools.

2.15.2. Planning for application workshop activity

This activity provides a stimulus for implementing and utilising new learning outside workshop's context. It prepares participants for and increases the likelihood of transfer of learning. A simple and adaptable approach is to have participants break into small groups and ask each participant to complete an action plan at the conclusion of the workshop:

1. Help your school to create an idea of a race competition on energy saving by adopting a series of good practices included in the energy efficient charter that your team created during 2.14. Create school energy efficiency charter?
2. Help your school to create an idea of an art for energy competition to support a creative artistic vision to energy efficient among students and teachers at school through?
3. Help your school to create an idea of a play for energy competition by using the concept of serious gaming to help students know more about energy through games?

2.16. Energy efficient behaviour of students

2.16.1. Context

To strengthen energy efficient behaviours among students, a municipality wants to update its curricula by using data from an Energy Efficiency Instrument to measure energy efficiency literacy levels among secondary students. The instrument is set up as a questionnaire described below, which is closely aligned with criteria that describe energy efficiency literacy in terms of students' broad energy-related knowledge and cognitive skills, and affective aspects such attitudes, values, and behaviour. The instrument used among secondary students as a valid and reliable quantitative measure. Thus, the municipality can use the results to improve its understanding of energy efficiency literacy levels of secondary students at the selected schools.

The instrument seeks to examine the following questions:

- *How do students perform, on the four instrument subscales of energy efficiency literacy: cognitive (knowledge); capability (skills); affective (attitudes, values); and behavioural (behaviours, habits)?*
- *What are specific content areas in which the students demonstrate general proficiency or lack of proficiency? How do these align with energy efficiency content of educational materials currently used in schools?*
- *Is there a relationship between students energy attitudes, values, behaviours, and cognitive understanding of the broad energy efficiency topics?*
- *How does performance vary with respect to specific content areas and between male and female students?*

The intent is that the results inform improvement of energy efficiency educational curricula and materials to improve students' engagement in energy efficient behaviours.

2.16.2. Planning for application workshop activity

This activity provides a stimulus for implementing and utilising new learning outside workshop's context. It prepares participants for and increases the likelihood of transfer of learning. A simple and adaptable approach is to have participants break into small groups and ask each participant to complete an action plan at the conclusion of the workshop:

1. How can your school use research-based data to improve its understanding of the energy efficiency literacy levels of the students and the teachers at school?
2. How can you rate the energy efficiency literacy level of students at your school in terms of students' broad energy-related knowledge, cognitive skills, and affective aspects such attitudes, values, and behaviours?
3. Help your school to create a questionnaire for an energy efficiency instrument that can be used to measure the energy efficiency literacy levels among the students?

2.17. The levels of energy efficiency literacy

2.17.1. Context

After using The Energy Efficiency Instrument, the municipality found that students scored well on a few basic questions, but failed to reach adequate levels of energy efficiency literacy:

- **Energy conservation:** one-third of students recognised energy conservation as the fastest and most cost-effective way to address energy needs, while less than half realised that we cannot produce more energy than it consumes.
- **Power and energy:** Few students showed an understanding of the relationship between electric power (in terms of kilowatts) and electric energy (kilowatt-hours). When asked to identify the unit we use to measure electric energy, only 10% of the students correctly selected kilowatt-hours, 42% selected kilowatts, and 38% selected volts.
- **Practical school energy use:** Students had difficulties in identifying specific school energy use patterns. Slightly more than one-third realised that heating and cooling rooms uses the most energy, while a substantial number of students misidentified lighting as a major energy consumer.
- **Energy resources:** Fewer than one third could identify coal as the most abundant fossil fuel. Less than 25% recognised the impact of fuels for producing energy in their schools.
- **Renewable energy:** More than half of the students were able to define and identify renewable energy resources, and a similar portion recognised the limitations of switching transportation systems over to electricity.

2.17.2. Planning for application workshop activity

This activity provides a stimulus for implementing and utilising new learning outside workshop's context. It prepares participants for and increases the likelihood of transfer of learning. A simple and adaptable approach is to have participants break into small groups and ask each participant to complete an action plan at the conclusion of the workshop:

1. In your understanding, how can you describe *energy efficiency literacy* and how does energy efficiency literacy contribute to energy saving culture and behaviours?
2. In your understanding, how can you describe these terms: *energy conservation; power and energy; practical school energy use; energy resources; and renewable energy*?
3. Help your municipality to create a series of energy policies to make energy efficiency literacy compulsory in primary and secondary education in order to produce a more energy literate society?

2.18. Energy conservation and awareness

2.18.1. Context

Efficiency awareness among the most students and staff is still abstract. The level of high energy efficiency awareness needed is still underdeveloped; so, most schools cannot provide better energy conservation programmes, which require the students' energy efficiency awareness or energy efficient habits where students are conscious of how they use energy. Without this awareness, students are not conscious of their use of energy, how much they use, and how much it costs which influence energy bills. But it is not feasible for students to reduce their energy consumption if they do not have the energy awareness.

To bring about energy conservation and awareness in schools, the municipality should seek to determine:

- *The energy saving awareness among the students;*
- *The behaviour on usage of energy among the students;*
- *The relationship between energy efficiency awareness and energy usage behaviour among the students.*

Indeed, students with high energy efficiency awareness levels are more interested in practising energy-saving behaviour since the energy efficiency awareness literacy comprises three decisive parts, which are information, decisions, and actions. Ideally, most students have a low level of awareness on energy saving since students lack information associated with the utilisation of heating, lighting, and turning off devices to prevent stand-by consumption. Thus, they make uninformed decisions and cannot take actions.

So, with increased energy efficiency awareness efforts at school level, it is possible to cultivate sustainable energy consumption habits among students in longer term.

2.18.2. Assimilating and conceptualising workshop activity

This activity provides workshop participants with new information. These activities can provide outside information in the form of theories, data and facts, or can inform the group about itself or individuals about themselves. A simple and adaptable approach is to have participants break into small groups and briefly answer these questions:

1. What is your level of understanding the importance of energy saving behaviours and habits and how can you sum up that level among the members of your group?
2. What is the energy saving behaviours and habits being practised by students at you school, do you think that the students are energy efficiency literate?
3. What is the type of energy wastage management practices that are being applied by your school to save energy, and what is the level of awareness on energy wastage and energy saving among the students?

2.19. Code of practice on energy efficiency

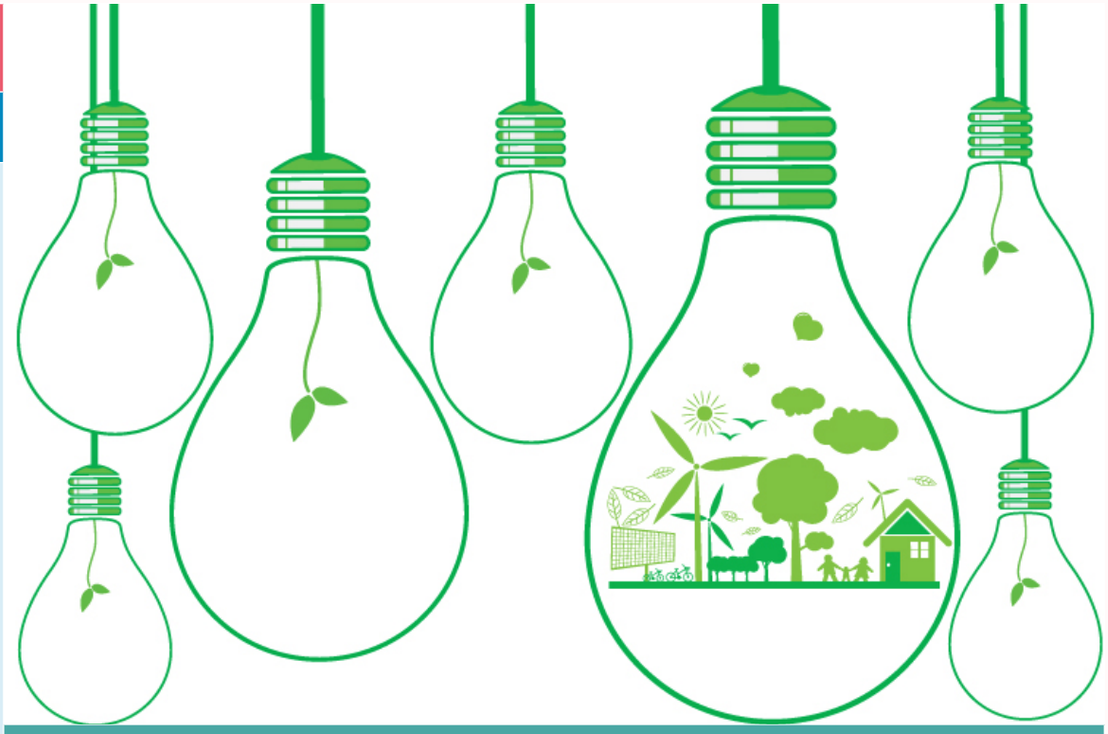
2.19.1. Context

High level of electricity consumption in school buildings by students increases in energy bills which eventually raise the financial burden of managers in school building:

- *This can be attributed, in part, to gross energy wastage due to inefficient electricity utilisation, where it can be seen in the significant wastage percentage of electrical energy used in school buildings.*
- *It is common to find lamps and fans switched on in classrooms, even air-conditioners still turned on when there is no occupant. The situations are not only found in the lecture halls but also in labs and offices when there is no occupancy.*

Electrical energy is wasted every day due to lack of energy efficiency awareness among students; in fact, energy efficiency awareness is the first step in achieving energy sustainability. Without energy efficiency awareness among students, efforts to promote energy conservation cannot be achieved and only lead to energy wastage. As such, it is a must to develop and implement measures to reduce electricity consumption, and thus, cut down electricity bills of school buildings to as low as possible. As evidence to encourage sustainable energy saving practices in school buildings, a municipality wants to introduce A Code of Practice on Energy Efficiency and Use of Renewable Energy for school buildings.

Hence, students should play a critical role in this instance and should bear their responsibilities to use energy in an effective and efficient way.



2.19.2. Planning for application workshop activity

This activity provides a stimulus for implementing and utilising new learning outside workshop's context. It prepares participants for and increases the likelihood of transfer of learning. A simple and adaptable approach is to have participants break into small groups and ask each participant to complete an action plan at the conclusion of the workshop:

1. What educational activities could be organised in the different subjects within you school on energy efficient literacy? Which classes should be involved?
2. What strategies could be used to promote energy efficient behaviours and boost energy efficiency awareness? Which are the most viable communication channels to use?
3. Help your municipality to create a code of practice on energy efficiency and the use of renewable energy in school buildings to encourage the school and the students to use energy in an effective and efficient way?

2.20. Measures to reduce energy consumption

2.20.1. Context

Reduction in energy consumption can be achieved through effective demand side management (DSM) practices. DSM is the implementation of policies and measures which serve to control, influence, and generally reduce energy demand. So, effective demand-side management in school building can be realised through:

- *Raising awareness among teachers, staff, and students;*
- *Managing school building operations;*
- *Upgrading of equipment; and*
- *Installation of energy management devices.*

First two approaches are behaviour-based, work synergistically with each other, and implemented without capital investment. The first is focused on shifting behaviour among teachers, staff and students, while the second is concerned more specifically with shifting awareness among the staff and the custodial staff who manage school building operations. The third and fourth approaches require capital investments. Thus, behaviour-based strategies offer a rewarding pathway for energy conservation. They are both accessible and relatively inexpensive for schools to implement, and yet capable of yielding significant results.

A key focus is on raising awareness among teachers, staff, and students about energy-saving opportunities. So, this points to the fact that behavioural change towards energy efficiency is key to effective DSM in school buildings. Energy savings could be achieved by teachers, staff, and students working to promote the adoption of energy-conserving behaviours without a need of capital investment in equipment or devices.

2.20.2. Planning for application workshop activity

This activity provides a stimulus for implementing and utilising new learning outside workshop's context. It prepares participants for and increases the likelihood of transfer of learning. A simple and adaptable approach is to have participants break into small groups and ask each participant to complete an action plan at the conclusion of the workshop:

1. How can energy saving culture and habits could be achieved by teachers, staff, and students working to promote the adoption of energy-conserving behaviours?
2. How often does your school check and support the energy efficiency behaviour and awareness among staff and custodial staff who manage school building operations?
3. Help your school develop a guide with good practices on energy efficiency available at EU level. Which of these practices could be successfully applied in your school to reduce energy consumption and increase students' energy efficiency behaviour and awareness?

Module references

Energy efficient use of school buildings

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- **AlFaris, F., Juaidi, A., & Manzano-Agugliaro, F. (2016).** Improvement of efficiency through an energy management program as a sustainable practice in schools. Journal of Cleaner Production, 135(1), 794–805. https://doi.org/10.1016/j.jclepro.2016.06.172
- **Arambula Lara, R., Pernigotto, G., Cappelletti, F., Romagnoni, P., & Gasparella, A. (2015).** Energy audit of schools by means of cluster analysis. Energy and Buildings, 95(15 May), 160– 171. https://doi.org/10.1016/j.enbuild.2015.03.036
- **Bernardo, H., Gaspar, A., & Henggeler Antunes, C. (2018).** A combined value focused thinking soft systems methodology approach to structure decision support for energy performance assessment of school buildings. Sustainability, 10(7), 2295. https://doi.org/10.3390/su10072295
- **Carter, K. (2014).** Learning energy systems: An holistic approach to low energy behaviour in schools. In PLEA 2014 Conference Proceedings, PLEA (Passive and Low Energy Architecture), Ahmedabad, India. Retrieved March 17, 2022, from https://www.pure.ed.ac.uk/ws/porta lfiles/portal/18926124/Paper_2912_PR.pdf
- **Chen, S. J., Chou, Y. C., Yen, H. Y., & Chao, Y. L. (2015).** Investigating and structural modeling energy literacy of high school students in Taiwan. Energy Efficiency, 8(4), 791–808. https://doi.org/10.1007/s12053-015-9327-5
- **Chung, W., & Yeung, I. M. H. (2020).** A study of energy con- sumption of secondary school buildings in Hong Kong. Energy and Buildings, 226(1 November), 110388. https:// doi.org/10.1016/j.enbuild.2020.110388
- **Cornelius, M., Armel, K. C., Hoffman, K., Allen, L., Bryson, S. W., Desai, M., & Robinson, T. N. (2014).** Increasing energy- and greenhouse gas-saving behaviors among ado- lescents: A school-based cluster-randomized controlled trial. Energy Efficiency, 7(2), 217–242. https://doi.org/10. 1007/s12053-013-9219-5
- **Da Cruz Antunes, J. M. (2019).** Energy saving potential of secondary schools with low investment. NWE ENERGE - Project: "Energizing Education to Reduce Greenhouse Gas Emissions." Master thesis. Faculty of Science, Uni- versity of Luxembourg.
- **Dascalaki, E., & Sermpetzoglou, V. (2011).** Energy performance and indoor environmental quality in Hellenic schools. Energy and Buildings, 43(2–3), 718–727. https://doi.org/10.1016/j.enbuild. 2010.11.017
- **DeWaters, J. E., & Powers, S. E. (2011).** Improving energy liter- acy among middle school youth with project-based learning pedagogies. 2011 Frontiers in Education Conference (FIE), 12–15 October 2011, pp. T1D-1-T1D-7. https://doi.org/10. 1109/FIE.2011.6142961.

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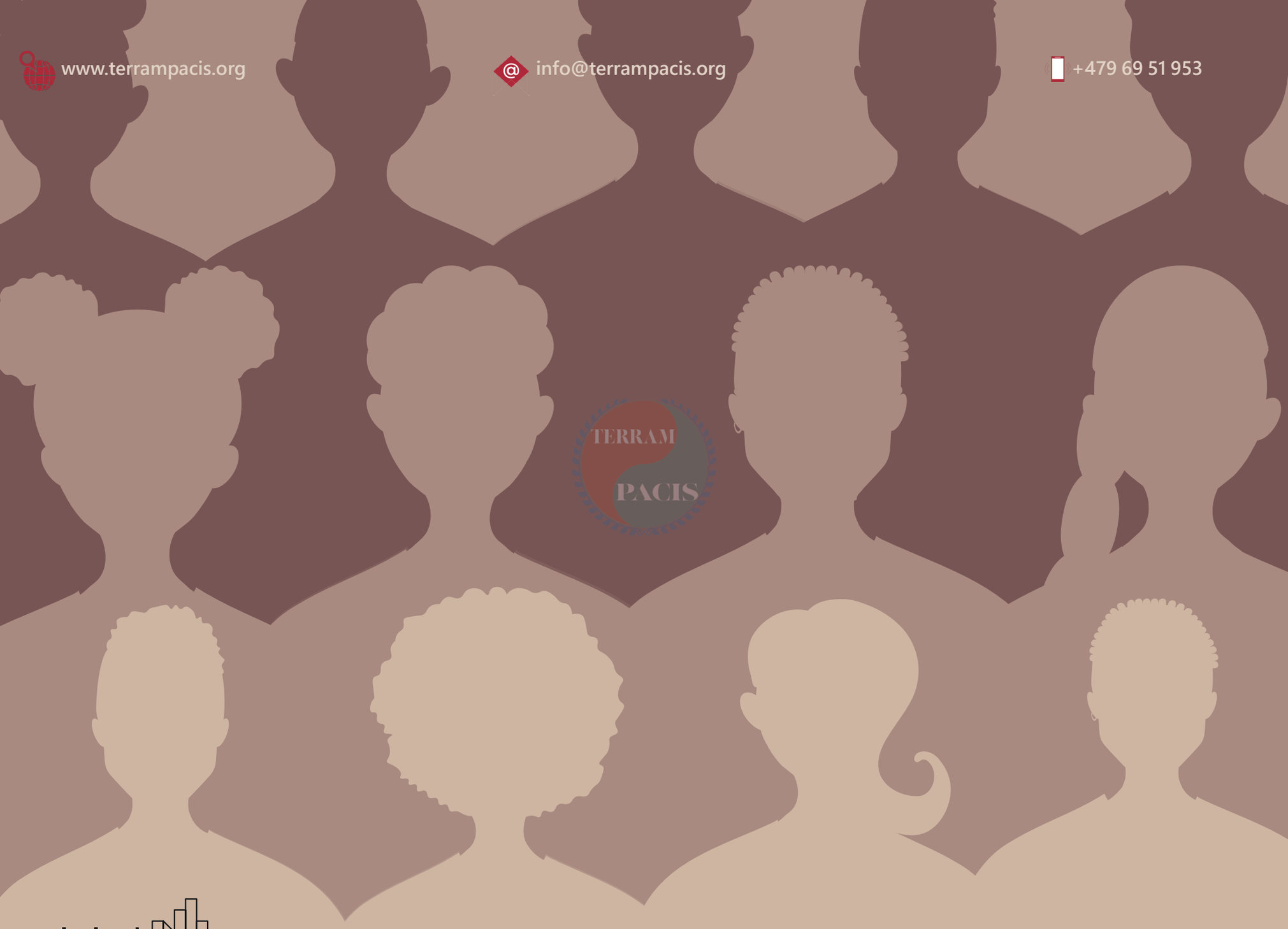

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