RESUMEN DE LA ESTRATEGIA DE ESCUELAS CON CERO EMISIONES DE CARBONO EN EL MAR MEDITERRÁNEO

ESPAÑA

Output 3.2

Energy Smart Mediterranean Schools Network ESMES project

Date: 24 March 2023

INTRODUCCIÓN

El proyecto ESMES (acrónimo de *Energy Smart Mediterranean Schools Network*) es un proyecto que tiene como objetivo la rehabilitación de edificios públicos haciéndolos más eficientes energéticamente y optimizando su producción de energía renovable. El proyecto se ha dirigido a los centros educativos con ciclos formativos de cada país para rehabilitarlos desde el punto de vista energético. Profesores y estudiantes han participado activamente en las diversas actividades que se describen a continuación.

El proyecto ha intervenido, principalmente, desde 3 niveles diferentes:

The project will intervene at 3 main levels:

1. Las instalaciones en edificios públicos, que serán de dos tipos:
    a. Producción de energía renovable a través del diseño inteligente y la implementación de sistemas fotovoltaicos.
    b. Medidas de eficiencia energética. Al mismo tiempo, el proyecto implementará medidas de eficiencia energética en los edificios seleccionados para disminuir su consumo de energía.
2. Organizar un concurso escolar con el fin de crear conciencia sobre los problemas de ahorro de energía de la comunidad escolar.
3. El proyecto también tiene un fuerte componente de cooperación transfronteriza entre países, contemplando intercambios de experiencias para mejorar las mejores prácticas y conocimientos en beneficio de las instituciones públicas y de las políticas y estudios energéticos.

Más información sobre el proyecto ESMES en http://www.enicbcmed.eu/projects/esmes

Por otra parte, mediante la componente 3 del proyecto se ha pretendido desarrollar el conocimiento y las capacidades operativas de las instituciones de energía y educación nacionales/regionales/locales para planificar, implementar y evaluar rehabilitaciones energéticas que sean sostenibles, rentables y adaptadas a los tipos y usos de edificios, cargas de energía y zonas climáticas.

Uno de los entregables más relevantes del WP3 son las estrategias de eficiencia energética en edificios escolares que pretende guiar las futuras rehabilitaciones de edificios, a través de combinaciones apropiadas de soluciones de energía sostenible y fuentes de financiación y respetando los marcos legales existentes sobre edificios públicos de cada uno de ellos. países de los socios del proyecto.

El objetivo del presente documento es proporcionar a los responsables de la toma de decisiones una estrategia para descarbonizar los centros escolares de secundaria y primaria del mediterráneo español basada en la sensibilización de la comunidad escolar sobre el uso de la energía, al mismo

tiempo que proporciona un repositorio de soluciones sostenibles y mejores prácticas adecuadas para las escuelas.

El documento desarrollado está en lengua inglesa, por lo que su aprobación por parte del Consorci de la Ribera se ha realizado un resumen del mismo en lengua oficial.

RESUMEN EJECUTIVO

Este documento proporcionará a los encargados de tomar decisiones ejecutivas, una estrategia sobre cómo garantizar que las escuelas públicas logren ser autosuficientes energéticamente hablando, allanando el camino para un desarrollo sostenible de los centros educativos que, además, fomente la educación sobre el desarrollo sostenible. Se presentan varias buenas prácticas y tecnologías de eficiencia energética y energía renovable, con recomendaciones y conclusiones clave basadas en el contexto local.

La estrategia actual está orientada a que las escuelas contribuyan a la transición energética por medio de la reducción de los gases de efecto invernadero como consecuencia del aumento de las fuentes de energía renovable y la reducción de la demanda de energía de los edificios escolares. La estrategia seguirá el camino definido por la legislación de las autoridades nacionales, regionales y de la Unión Europea (UE) al asumir los objetivos energéticos mencionados.

Además, en el caso de España, donde el mantenimiento de los edificios y la gestión de las instalaciones de las escuelas primarias son competencia de las autoridades locales, es crucial que las escuelas primarias formen parte de los planes de acción locales del Pacto de las Alcaldías, ayudando así a sus autoridades locales a lograr los Objetivos climáticos y energéticos de la UE.

OBJETIVOS ESTRATÉGICOS ESPECÍFICOS

El Plan Nacional Integrado de Energía y Clima 2021-2030 (PNIEC) establece los siguientes objetivos a alcanzar en 2030:

- Reducción del 23% de las emisiones de gases de efecto invernadero (GEI) en comparación con 1991;
- 42% de participación de energías renovables en el uso final de la energía;
- 39,5% de mejora en la eficiencia energética;
- 74% de participación de las energías renovables en la generación de electricidad.

A nivel local, los signatarios del Pacto de los Alcaldes se comprometen con los siguientes objetivos para 2030:

- Reducción del 40 % de GEI para 2030 en comparación con el año de referencia.
- 27 % de mejora de la eficiencia energética.
- 27 % de participación de fuentes de energía renovables.

La presente estrategia se alinea con el marco legal de energía sostenible y los objetivos de descarbonización mencionados anteriormente.

CONCLUSIONES Y RECOMENDACIONES

Hay lecciones y buenas prácticas que se pueden extraer al implementar una estrategia de energía sostenible en las escuelas. Algunas de ellas se enumeran a continuación:

a) La motivación de todo el personal (no solamente el profesorado) que trabaja en la escuela es un factor clave para el éxito de este tipo de proyectos o estrategias. Encontrar una persona o un grupo de personas que estén dispuestas a asumirlo y mantenerlo en marcha es garantía de éxito.
b) Una relación fluida entre las diferentes personas e instituciones que colaboran en la implementación de la estrategia. Involucrar a la autoridad local (ayuntamientos) es crucial.
c) Disponer de la información necesaria sobre los edificios escolares: planos, una auditoría energética reciente y, sobre todo, datos de consumo energético.
d) La implicación del alumnado es un gran avance, porque van a aumentar su capacidad para afrontar y provocar cambios en sus hábitos energéticos cotidianos.
e) En España, las autoridades locales están a cargo del mantenimiento de los edificios de las escuelas primarias y de su suministro de energía. Por lo tanto, su participación es imprescindible para proceder con las inversiones de energía sostenible.
f) La aplicación de consejos simples de ahorro de energía por parte de la comunidad escolar podría generar ahorros de energía anuales de alrededor del 10-15%. Por lo que, este es el primer paso a poner en marcha de la estrategia.
g) Marco normativo de la Unión Europea y España deseosos de ayudar a las entidades y ciudadanos a aplicar energías renovables y soluciones de eficiencia energética (REEE).
h) Ahorro de costes energéticos y reducción de gases de efecto invernadero: implementar programas de ahorro energético basados en el cambio de hábitos insostenibles va a inducir a una reducción de la factura energética escolar, liberando presupuesto para inversiones en energías renovables y/o medidas de eficiencia energética. Del mismo modo, disminuir el uso de energía está produciendo de inmediato una reducción de gases de efecto invernadero y otros beneficios ambientales.

i) Mejora de la calidad del aire interior: las prácticas de eficiencia energética también pueden mejorar la calidad del aire interior al reducir la necesidad de aire acondicionado y calefacción, lo que puede ayudar a reducir la propagación de patógenos en el aire.
j) Salud y confort: los sistemas de iluminación y calefacción y refrigeración eficientes desde el punto de vista energético pueden mejorar el confort y la salud en interiores al reducir la exposición al calor excesivo, el frío y la luz brillante.

CARBON NEUTRAL SCHOOLS' STRATEGY AT MEDITERRANEAN SEA AREA

SPAIN

Output 3.2

Energy Smart Mediterranean Schools Network ESMES project

Date: 24 March 2023

CONTENT

CHARACTERISTICS OF THE DELIVERABLE

Ref. WP: WP3	Partner in charge: Ribera Consortium
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1 INTRODUCTION

ESMES project (acronym of Energy Smart Mediterranean Schools Network) is a project aiming to rehabilitate public buildings by making them more energy efficient and optimizing their renewable energy production. The project will intervene in professional institutes/technical schools within each country in order to rehabilitate them from energy point of view. Professors and students will actively take part to the several Activities outlined below.

The project will intervene at 3 main levels:

1. Installations in public buildings, that will be of two types:
   a. Renewable energy production through intelligent design and implementation of PV systems.
   b. Energy efficiency measures. At the same time, the project will implement energy efficiency measures in selected buildings in order to decrease their energy consumption.
2. Organizing a school contest in order to raise awareness about energy saving issues of school community.
3. The project also holds a strong component of cross-border cooperation among countries, envisaging experience exchanges for improving best practices and knowledge to the benefit of public institutions and of energy policies and studies.

Further information about ESMES project http://www.enicbcmed.eu/projects/esmes

WP3 of ESMES project purpose is to develop knowledge and operational capacities of national/regional/local Energy and Education institutions to plan, implement and evaluate energy rehabilitations that are sustainable, cost-effective and tailored on building types and uses, energy loads and climatic zones.

One of the most relevant WP3 deliverables are the energy mix efficiency strategies in school buildings (project output 3.2) that intends to guide future rehabilitations of buildings, through appropriate combinations of REEE solutions and funding sources and respecting existing legal frameworks on public buildings of each of project partners' countries.

The present document goal is to provide decision-makers with a strategy for decarbonizing Spanish secondary and primary school centres based on raising awareness of schools' community about energy usage, at the same time that providing a repository of sustainable solutions and best practices suitable for schools' energy performance improvement.

2 EXECUTIVE SUMMARY

This document will provide executive decision makers with a strategy on how to ensure that public schools achieve a sustainable energy mix, paving the way for sustainable school development that fosters sustainable growth and education. Various energy efficiency and renewable energy practices and technologies are presented, with key recommendations and conclusions based on the local context.

The present strategy is willing schools to participate in energy transition by reducing greenhouse gases by increasing renewable energy sources global energy mix rate and reducing schools building energy demand. The strategy will follow the track defined by European Union (EU), national and regional authorities' legislation by assuming the referred energy goals.

Furthermore, in the case of Spain where primary schools' buildings maintenance and installations management are under the competences of the local authorities, it is crucial that primary schools form part of the Covenant of Mayors local action plans, helping so their local authorities to achieve the EU climate and energy targets.

3 STRATEGY SPECIFIC OBJECTIVES

The Spanish Integrated National Energy and Climate Strategy (INECP) 2021-2030 sets the following sustainable energy targets to be reached in 2030:

- 23% reduction in greenhouse gas (GHG) emissions compared to 1991;
- 42% share of renewables in energy end-use;
- 39.5% improvement in energy efficiency;
- 74% share of renewable energy in electricity generation.

At local level, 2030 target Covenant of Mayors signatories are committed to the following goals:

- 40 % GHG reduction by 2030 compared with baseline year.
- 27 % improvement of energy efficiency.
- 27 % share of renewable energy sources.

The present strategy sticks with the sustainable energy legal framework and the above decarbonization objectives.

4 LA RIBERA STRATEGY

In this section is added a description about how is possible to increase the energy sustainability of public schools. The activities and activities included are focusing on promoting the rational use of

energy of the school community and in promoting the implementation of energy efficiency and renewable energy sources.

4.1 SETTING THE BASELINE: THE ENERGY AUDIT

The implementation of an energy audit of existing school buildings is a key point to future draw up of a sustainable energy roadmap. The assessment of energy performance of school centres involves looking how energy is used, initially, in educational buildings and, with this information, to identify most priority opportunities to improve energy efficiency in the next future.

Consorci de la Ribera adopted the EN 16247-2 energy Audit for building standard to carry out the energy audit of school centres involved in ESMES project. The content of school buildings audits must consider, at least, the following aspects:

- General description of educational centre. For every single building should be collected information about single floor area and total surface, height of different floors, etc., and information about the current use of this single building (information about type of school, number of pupils, number of other people that work in it, operational time….). The collection of climate and temperature data would let to offer a more detailed analysis if necessary.
- Current building condition analysis. This part of an audit will go deep into materials, constructive features, etc., of envelop, windows, airflow and possible pathologies of existing buildings. Here will be also assessed the existing energy systems such as lighting, HVAC, ICT and others.
- Evaluation of energy consumption systems will be conducted taking into account the different existing and/or used energy carriers: electricity, gas/oil/solid fuel, renewable sources, and others. An analysis of tariffs and energy contracts would be needed. With the collection of technical and economical (energy bills) would be able to list the main performance indicators.
- The previous phases will let man looking at how energy is used in existing school buildings and, in a second step, to identify (investment) priority to improve energy efficiency and energy usage.

The energy and/or sustainability goals set by school community and other stakeholders (such as local authorities in Spain that are in charge of primary school buildings maintenance and energy supply) will feed the energy audit and will facilitate the definition of an action plan that should include energy efficiency and renewable energy portfolio interventions.

On the other hand, to involve from the very beginning the school community in investigating school building patterns is a very interesting way of raising awareness of pupils about energy and climate change challenge. For example, EURONET 50/50 MAX project (funded by EU programmes) provides pedagogical and technical resources http://www.euronet50-50max.eu/en/

4.2 ADMINISTRATIVE ASPECT AND ORGANISATIONAL STRUCTURE

Building users may play an important role in improving energy management in buildings. The combination of users' behaviour change (changing habits by means of raising awareness about climate change struggle) with the organizational changes (such as switching off light of unused rooms or optimizing schedules based on occupancy) can come up to 15-20% of the initial energy consumption.

All this is especially relevant for schools, where there are many "permanent" users, including teachers, pupils and other school staff. Of course, each group has different sources of motivation and capacities to act, which should be taken into consideration when planning communication activities and activation methods.

Pupils: they spend at school significant part of their day, not only raising knowledge of different subjects but also learning proper everyday behaviours, including taking care of surrounding environment and using its resources reasonably. Adding to that pupils' natural curiosity and willingness to engage in interesting activities and initiatives, they can become real leaders of energy saving efforts. However, this will require not only raising their energy awareness but also giving them possibilities and tools to act, e.g. by assigning them roles of energy researchers, authors of energy saving measures, implementers and multipliers.

Teachers: they support the pupils in their energy quest, helping to discover how and where energy is used, where does it come from and how it can be saved with simple measures. They can introduce various energy-related topics and tasks both during regular classes (e.g. natural sciences, mathematics, languages, arts) and during additional meetings with pupils (e.g. meetings of school environmental clubs).

Janitor: has very important role to play in reducing school's energy consumption, although this role is not always adequately appreciated. Since he (or she) knows everything about the school building and its relevant systems, he can help other users involved in the process, e.g. pupils and teachers, to understand better its technical state and energy situation. He can also implement many energies saving measures, e.g. conducting necessary reparations (like fixing leaking taps and toilets), sealing windows, placing silver foil behind the radiators or rearranging the rooms to make better use of natural light.

On the other hand, efficient energy management requires an energy manager or an energy management team that would have adequate skills and capacities to analyse and improve building's energy situation. This is the case in all types of buildings, including schools. However, schools are also unique since one of the main user groups are the pupils, who - despite their young age - should be involved in energy management and optimization processes for the two equally important reasons. Firstly, because they have significant potential to influence school's energy consumption and second, because they are there to learn proper behaviours.

This should be taken into consideration when planning energy management structures at school. Three basic options are possible, with the third one associated with the highest energy saving potential but also most difficult to implement:

- Appointing energy manager
- Establishing energy team
- Appointing energy manager and energy team

The establishment of an 'energy team' is a key point to obtain awareness and energy saving results. Based on EURONET 50/50 MAX project, it is recommended to involve the following members in an energy team:

- Representatives of the building: managers, technical staff, employees, etc.
- Representative/s of the town council department/s managing the facility.
- Others thought appropriate: caretakers, workers, clean service, etc.

In the case of Spain where primary schools' buildings maintenance and installations management are under the competences of the local authorities, it is crucial to have the local authority on board. If project is addressing secondary and/or VET schools, in Spain, authorities in charge of secondary/VET schools are the regional government.

The energy team might have the following main functions:

a. Coordinating the project and taking the necessary decisions to guarantee its correct progress.
b. Detecting the strong and weak points in the energy management of the facility and proposing improvements.
c. Monitoring the energy consumption of the centre, both the control of invoices and the management of the monitoring devices in the building.
d. Disseminating the project among the rest of the users and transmitting messages to encourage savings.

4.3 CREATION OF A RES & RUE ACTION PLAN

Creating a renewable energy sources (RES) and rational use of energy (RUE) action plan is necessary to have a stable and agreed technical framework to ensure that greenhouse gases reduction emission/RES /energy efficiency targets are overcome.

Of course, when monitoring the progress of the referred action plan (in terms of RES contribution, energy consumption or CO2 emissions), shall be necessary to adapt the action plan accordingly if necessary, to accomplish the objectives.

The content of a school sustainable energy action plan should take into account the following aspects:

- Should include actions focusing energy usage and buildings refurbishment (including buildings installations such as lighting systems, heating and cooling, etc) but also listing user behavioural measures (such as switching off classrooms' lights when getting off).
- Should include recommendation and providing information on procedures for reducing energy consumption (procedures on closing windows and operating the heating system for instance).
- Proposing facility repairs and improvements for enhancing the situation of certain systems or machinery.
- When actions require small or large investments, these actions may be listed and sent to local/regional/national authorities and other stakeholders.
- Analyse mobility patterns of school community and propose actions to calm the school surroundings and reducing toxic air pollution.
- To spread surveys (such as a perceptive survey to measure school community comfort) is recommendable.
- Should include a calendar of the actions and implementation & monitoring responsibilities;
- Should highlight and communicate the whole school community about the most energy demanding installations and facilities.
- Might include other topics such as water saving; green procurement actions; nature; food; stationery supplies or wastes.

It is recommended to involve the whole community, and necessarily the energy team, in defining and monitoring the school action plan. On the other hand, the action plan will be a result of school community (energy team) investigation activities and their discoveries in the, the evaluation of school energy status. A proposal of solution or improvements of school will form the action plan.

The action plan should identify clearly objectives, milestones and an execution time schedule.

4.4 ENERGY SYSTEMS DESIGN. TECHNICAL CONSIDERATIONS / TECHNOLOGY SOLUTIONS

i. Renewable energies.

Renewable energy uses natural resources such as sunlight, wind, rain, tides and geothermal heat, which are naturally replenished. In 2021, renewable energy sources made up 37.5 % of gross electricity consumption in the EU, very similar to the previous year (37.4 % in 2020). Wind and hydro power accounted for more than two-thirds of the total electricity generated from renewable sources (37.5 and 32.1 %, respectively)[1].

[1] EUROSTAT.

The technical potential for their use is very large, exceeding all other readily available sources.

Geothermal Energy

Geothermal energy comes from the heat stored in the earth's core and heat from the sun warming the earth. The word geothermal originates from the Greek words geo (earth) and therme (heat).

On a small scale 'ground source heat' may be used to heat a building. A ground source heat pump circulates a mixture of water and antifreeze around a loop of pipe, called a ground loop, which is buried beneath the ground. Heat from the ground is absorbed into the fluid and then passes through a heat exchanger into the heat pump. The ground stays at a fairly constant temperature under the surface, so the heat pump can be used throughout the year.

On a larger scale, pipes carry water to areas where hot magma comes close to the earth's surface. This heats the water producing steam which is used to drive a turbine as in a conventional power station.

Solar photovoltaic

Solar energy is the most abundant energy source available. In fact, every hour, the sun beams enough energy to meet the entire world's energy needs for a year! The tricky part is harnessing the energy effectively to meet those needs.

Solar power systems, once they're up and operational, last for 15-30 years.

Sunlight can be directly used to create electricity photovoltaic (PV) cells. The solar cells are made using silicon, the same thing that makes up sand. The silicon is heated and melted at super high temperatures and then melded into thin wafers. When sunlight strikes the solar cell, electrons are loosened and move toward a treated front surface, making an imbalance between the front and back. Electricity occurs when a connector, such as a wire, joins the negative and positive sides together.

The production of photovoltaic cells, which are used to change sunlight directly into electricity, causes far less pollution than fossil fuel-burning power plants. While manufacturing the cells does require harmful metals such as lead and mercury and also produces some greenhouse gases, the toxic emissions are up to 300 times lower than those created by coal power plants.

Arrays of panels can be small (like those found on solar-powered calculators) or huge, covering large areas of land.

Solar Thermal

Solar thermal energy is a technology for harnessing solar energy for heat. Solar heating harnesses the power of the sun to provide solar thermal energy for solar hot water and solar space heating. A solar heating system saves energy, reduces utility costs, and produces clean energy. For example, solar hot water heating is one of the most cost-effective ways to include renewable technologies into

a building by incorporating solar hot water. A typical residential solar water-heating system reduces the need for conventional water heating by about two-thirds. It minimizes the expense of electricity or fossil fuel to heat the water and reduces the associated environmental impacts.

Solar space heating is another good example of how we can take advantage of warmth from the sun through design features, such as large south-facing windows, and materials in the floors or walls that absorb warmth during the day and release that warmth at night when it is needed most. A sunspace or greenhouse is a good example of a passive system for solar space heating.

Wind Energy

Wind energy is much more than the gentle breeze that causes the trees to sway or the waves to move across a lake. The power in the wind can blow a semi-trailer truck off the road and flatten buildings. And it can be harnessed to be a non-polluting, never-ending source of energy to meet electric power needs around the world.

Wind power is a form of renewable energy – energy that is replenished daily by the sun. It is caused by the uneven heating of the earth's surface by the sun. Since the earth's surface is made of very different types of land and water, it absorbs the sun's heat at different rates. During the day, the air above the land heats up more quickly than the air over water. The warm air over the land expands and rises, and the heavier, cooler air rushes in to take its place, creating winds. At night, the winds are reversed because the air cools more rapidly over land than over water. In the same way, the large atmospheric winds that circle the earth are created because the land near the earth's equator is heated more by the sun than the land near the North and South Poles.

Since ancient times, people have harnessed the winds energy. Over 5,000 years ago, the ancient Egyptians used wind to sail ships on the Nile River. Later, man built windmills to grind wheat and other grains. Centuries later, the people of Holland improved the basic design of the windmill. They gave it propeller-type blades, still made with sails. The oil shortages of the 1970s created an interest in alternative energy sources, paving the way for the re-entry of the windmill to generate electricity.

Like old fashioned windmills, today's wind machines use blades to collect the wind's kinetic energy. Windmills work because they slow down the speed of the wind. The wind flows over the air foil shaped blades causing lift, like the effect on airplane wings, causing them to turn. The blades are connected to a drive shaft that turns an electric generator to produce electricity.

Wood (biomass)

The use of wood (or biomass) as a fuel source for home heat and cooking is as old as civilization itself. Early examples include the use of wood heat in tents. Fires were constructed on the ground, and a smoke hole in the top of the tent allowed the smoke to escape by convection.

Much wood fuel comes from native forests around the world. Plantation wood is rarely used for firewood, as it is more valuable as timber or wood pulp. The collection or harvesting of this wood can

have serious environmental implications for the collection area. The concerns are often specific to the particular area, but can include all the problems that regular logging create. Removing wood from forests can cause habitat destruction. On the other hand, cleaning forests from old timber, trim trees ans shrubs of diseased or dead branches can help forests to be fire resistant.

Wood burning does not release more carbon dioxide than its biodegradation. This is commonly called "carbon neutral", whereby the burning of wood releases the same amount of carbon into the atmosphere as the wood would do if it was left to rot on the ground. This is why the burning of wood does not have the effect of increasing global warming.

Biomass is organic matter, such as agricultural wastes and wood chips and bark left over when lumber is produced. Biomass can be burned in an incinerator to heat water to make steam, which turns a turbine to make electricity. It can also be converted into a gas, which can be burned to do the same thing.

ii. Site design. Location and space management.

For buildings passive heating at northern hemisphere, the ideal orientation for living areas (such as classrooms in schools) or largest façade is within 30° of south. Buildings oriented east of south will benefit from the morning sun. That orientated west of south will catch the late afternoon sun – which can help delay the evening heating period. Standard eave overhangs will allow winter sun to heat the building and exclude summer sun with no effort from the occupants and no additional cost.

Orientate the house east-west to ensure a long side to face the sun. Minimising east and west facing walls and windows reduces excessive summer heat gain.

Concerning buildings form design, buildings should be designed to minimise the building surface to volume area.

Besides the benefit of promoting the conscious importance of the environment by creating natural habitats next to the buildings, or inside, to use tree belts around school site or buildings will reduce heating needs by sheltering. Tree arcs across the north of the site will be particularly useful against cold northerly winds. This sort of barriers will provide an extra thermal buffer. Furthermore, trees are able to create summer shading. Deciduous trees should be planted to optimise shading in the summer while permitting sun to penetrate at low winter angles.

School centre area and buildings design might also favour to bring more natural light into the classrooms. There are a number of benefits to making good use of natural light. Firstly, it is a free source of light and making good use of natural lighting in a classroom can reduce lighting costs by up to 20%. However, this is not the only benefit. Natural light has significant physical and mental health benefits. Think about how you feel on a dark, dank day compared to a bright sunny one. Natural daylight improves mood and alertness and can help with concentration, improving learning.

However, excess natural light can cause problems of glare and sunshine reflecting off computer and projector screens can make viewing difficult. Where this occurs and blinds are closed to prevent it, it is important that the blinds are opened again afterwards to allow best use of natural light.

A really simple activity to encourage teachers to make better use of natural daylight is to ask them to turn their lights off at the start of each lesson and make a decision as to whether the lights are needed. It may be that they will decide the lights aren't needed at all or that only a small number of lights are needed – you will be surprised how much electricity this can save.

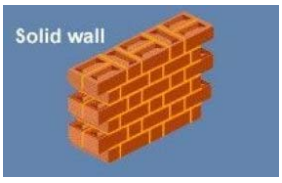
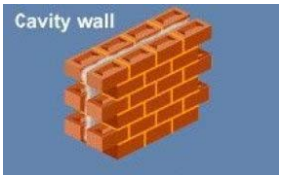
iii. Energy-efficient building shell.

Insulating materials slow down the rate of heat transfer through them, reducing the total heat loss. How well materials are able to do this is measured using a u-value. A u-value is simply a measure of the rate of heat transfer through a material. The higher the u-value, the higher the rate of heat loss, so materials with a lower u-value are more effective insulating materials.

Metals tend to have high u-values. These make poor insulating materials. Gases tend to have low u-values. They make excellent insulating materials. This is why things like cotton wool and animal fur are such good insulators – they trap air which is an effective insulating material.

Another factor to consider is the surface. The larger surface you have, the greater lose of heat through these may be.

That's why most heat is lost through walls. Walls are generally built in two main ways. Buildings built prior to 1932 were mainly constructed with solid walls. However, from 1932 onwards buildings started to be constructed with a cavity; that is a gap between two layers of bricks.

Built before 1932	**Built 1932 - 1982**	**Built after 1982**
Unlikely to have cavity walls (solid walls) 	Likely to have cavity walls (cavity walls unfilled at time of construction)	Will almost certainly have cavity walls but these are likely to already be well insulated (cavity walls filled at time of construction) 

Newer cavity walls will already be insulated. However, older cavity walls may have an empty cavity that can be filled with insulating material. If you are unsure, insulation companies will come out and drill a small test hole to see whether the cavity contains insulation. There are three main insulating materials that may be used:

1. UF (Urea Formaldehyde) Foam
2. Mineral wool
3. Polystyrene beads

The roof is the second larger surface of schools' buildings. A large number of school buildings have flat roofs and these are much more difficult and costly to insulate. This means that it is only likely to be considered when work to the roof structure is already planned. In this case, the insulating material can either be laid above the roof in which case it is called warm deck insulation as the roof itself stays warm or under the roof in which case it is called cold deck insulation as it prevents heat from reaching the roof.

The windows of a school play an important role in preventing heat being lost from the building and, as discussed earlier, many schools have large areas of glazing making this factor even more important.

There are two parts of the window that are important in this respect; 1) The frame and... 2) The glass

Most window frames are made from metal, wood or plastic (uPVC). Because metal is such a good conductor of heat, with metal-framed windows much of the heat is lost through the frame. Wood is a much better insulator. However, wooden frames may warp and the gaps left can allow heat to escape. Therefore, the most effective in terms of reducing heat loss are uPVC framed windows.

In terms of the glass, windows may be single, double or even triple glazed. Double and triple-glazed windows have panes of glass with a layer of air or argon gas between them, both of which are good thermal insulators.

Argon is an even more effective insulator than air. The other factor that makes a difference with double and triple-glazed windows is the size of the gap between panes of glass. The bigger the gap, the thicker the layer of air or gas and the better the thermal insulating properties of the window.

A double-glazed window

The only problem with double glazing, is that it is an expensive measure to install. Therefore, many schools consider secondary glazing as a cheaper alternative.

Secondary glazing involves adding a second layer of glass or plastic to the inside of the window. This may be in the form of a solid pane or a clingfilm type material that comes in rolls. It does the same job as double glazing (although not quite as effectively) and some types can be taken down and stored in summer to prevent overheating. Secondary glazing may also be considered when planning restrictions prevent changes to the external appearance of the building.

iv. Lighting and appliances.

One of the main reasons that schools' energy consumption has risen during recent times is the huge increase in the amount of IT equipment used in schools. There are large potential savings that can be made in this area through a combination of improved controls and user behaviour.

Computers are one of the biggest energy users in schools, partly due to the sheer number of them in each school. In general, laptops use less energy than desktops and also have the additional advantage of the screen turning off at the same time as the computer.

There are a few simple steps that can be taken to reduce energy use from IT:

1. Set computers to 'hibernate' after 5 minutes of inactivity. The exception here may be computers that are connected to projectors and interactive whiteboards as the teacher may need to leave images on display during lessons. Laptops can be set to hibernate when the lid is closed and it tends to be easier to remember to simply shut the lid when not in use.
2. Install automatic shutdown software. There is a wide range of automatic shutdown software available, much of it available for free. This enables you to set a time when all computers automatically shut down. If someone is still using one of these computers, a message will come up giving them the option to continue working.
3. Educate people to switch off screens when not in use. Where computers have a separate screen, it is important that these are switched off and not left on 'standby' when not in use. This needs to be included as part of your energy awareness campaign. Some schools have designed screensavers that tell people to 'switch me off if you're not using me'.
4. Projectors are huge energy consumers in schools and are often left on when not in use. This not only wastes energy, but means that a replacement bulb is required more often. If you have ever had to purchase one of these, you will know that they are extremely expensive. Where possible, projectors should be completely switched off (not left on standby) during evenings and weekends. However, in some instances the master switch is housed within the roof space and cannot be easily accessed. In this instance, it is well worth re-locating this switch to a more accessible location.

Apart from these tips, there are other complementary ways of reducing the energy consumed in school buildings (or houses). Choosing the right energy efficient domestic appliances is one of them.

In many countries, efficiency rating labels are mandatory on most appliances. In the EU, models are labelled A++ for the most efficient, then A+, A, B, C, D for subsequently less efficient models. Look for the A++ or A+ models. The European Energy Star Programme is another voluntary energy labelling programme for office equipment. The Energy Star logo helps consumers identify office equipment products that save them money and help protect the environment by saving energy. Office information and communication technology equipment (computers, monitors, printers, fax machines, copiers, scanners and multifunction devices) is responsible for a growing share of electricity consumption in the EU.

Clearly there will be some times when natural light is not available and artificial light has to be used.

Lighting typically accounts for approximately 10% of a school's total energy use. Therefore, there are substantial savings than can be made by improving the type, control and use of lighting in your school. Artificial light can also have impacts on health and well-being with poor or flickering light leading to headaches and loss of concentration.

Artificial light can be created in different ways:

- Incandescent: light is created by passing an electrical current through a wire so that it glows white hot. (e.g. tungsten / filament). Manufacturing incandescent bulbs are forbidden in EU since 2018.
- Discharge: the generation of light occurs within a gas filled envelope that is driven by an electric circuit. (e.g. fluorescent tube, CFL (energy-saving light bulb), low and high pressure sodium, metal halide)
- Solid state: light is generated at the junction of a semi-conductor (e.g. LED).

Replacement current luminaires with LED technology improves efficiency and reduce the consumption.

With a push-button timer, the light stays on for a short period of time after the button is pressed. These are useful in areas such as cupboards or cloakrooms where people may be entering the area for only a very short period of time. They need to be carefully maintained as if they start to 'stick' lights can remain on unnecessarily for extended periods of time.

Most push-button timers have been replaced with occupancy detectors. These sense movement when someone is present in the room / space and turn on. They then turn off after a set period of inactivity.

If occupancy detectors are installed in classrooms or halls, they should be accompanied by over-ride switches, so that the lights can be kept on if everyone is sat still (for example when sitting a test) and can be turned off if there is plenty of natural daylight (or when watching a film for example). They are most effective in cupboards, corridors and toilets where there is a danger that lights may be left on all day even though they are only required for short periods.

Lux sensors sense how much light there is in the room so that the lights only come on when light levels are low. Ideally, they should be combined with occupancy detectors so that the lights only come on when it is dark and there is someone in the room.

v. Heating, cooling and ventilation systems.

Heating is one of the largest and most expensive use of energy in a school and significant savings can be made through the implementation of even simple, low-cost measures. In fact, it is possible to cut heating costs by up to 30% by simply adjusting time and temperature settings.

The majority of school heating systems rely on water being heated and then piped around the school buildings. For this reason, they are often referred to as 'wet' heating systems. The water may be heated using gas, oil, wood, coal, heat from the ground or the sun's rays.

If the water is heated using a solid or liquid fuel (gas, LPG, wood, coal etc) it is usually heated by a boiler (or set of boilers). In a home, a gas-fired boiler is usually a single small box attached to the wall. However, in a school (or other large building) these are more likely to be much larger freestanding boilers and there may be more than one.

Where the heat is produced by a boiler, the efficiency of the boiler will be a key factor in how much energy is used. The more efficient the boiler, the less energy it will use. To make sure they run as efficiently as possible, boilers should be serviced at least once a year. Even then, the efficiency will reduce with age and after 15 years of use it may be worth considering replacing inefficient boilers.

Furthermore, there are several elements that contribute to improve heating systems energy efficiency such as central control equipment or thermostatic radiator valves.

Generally, in order to improve energy efficiency, we aim to prevent warm air from leaving buildings. We call this insulation. However, if a building was completely sealed the air would soon become stale and stuffy. Therefore, there needs to be a certain amount of air exchanged from outside. We call this ventilation.

Most schools use natural ventilation in the form of air blocks or air vents. Natural ventilation relies on air flow through openings of a room or building, preferably from opposite sides. It also applies to rising hot air being replaced with cooler air sucked in through windows or vents from a lower level. Obviously, the advantage in terms of energy saving is that natural or passive ventilation uses no energy at all.

Where natural ventilation is not sufficient, 'artificial' and mechanical systems can operate to fine tune the desired temperature and environmental conditions.

Concerning school cooling systems, some years ago there were not such kind of systems at school buildings but because of climate change is provoking an increase of temperatures, cooling systems

are being installed increasingly. Air-Source Heat & cooling pumps is nowadays the most efficient system.

vi. Energy supply

To properly manage energy supply, paying attention to procure green energy (renewable energy sources) and improving energy contracts (e.g. tariffs, power, etc.) is a best practice to reduce greenhouse gases contribution of schools but also to reduce energy bills.

Switching to greener energy suppliers, looking for which offer 100% renewable should favour companies' investment in producing it (Law of supply and demand).

On the other hand, improving energy carrier's procurement will benefit school finances. Whether the saving got by reducing energy consumption are reinvest, results will go further.

vii. Other sectors: sustainable mobility

The state of the art in transportation engineering has advanced dramatically over the last decade, and the application of new and more flexible traffic control devices, software systems, computer hardware, communications and surveillance technologies, and analysis methods has become commonplace. Many metropolitan areas have created traffic management centres with closed-circuit television cameras, to monitor and manage traffic flow on streets and freeways. As this information is received at the traffic management centres, travellers are informed of problems via radio, television and the Internet, along the roadways.

In order traffic management to be effective, should consist of actions or tools that come from three different categories. These are managing the supply of the transportation system, managing the demand or travel behaviour of those who use transportation, and managing the land use and/or development patterns that influence when and where travel demand occurs.

To reduce the environmental impact of the whole school community is crucial to promote sustainable mobility means of transport. It might be done by increasing the use of cycling and especially walking. It will not only reduce greenhouse gases emissions but also benefit people's health and health of the local economy.

4.5 ENGAGING THE COMMUNITY: AWARENESS & CAPACITY BUILDING

The implementation of a sustainable energy project in a public-school building shows a double benefit: from one side the result is the reduction of schools' energy bills (besides the reduction of greenhouse gases associated with energy savings) and the change of behaviour of school pupils (and rest of users) provoked by raising awareness about daily activities.

A suitable methodology for conducting capacity building activities in primary and secondary schools, such as the one followed within ESMES project, is shown below:

1. Creation of an Energy Team (ET) as described in section 4.2.
2. Project starting phase: A set of project presentation & Energy Team (ET) training sessions to provide info about project methodology, collection of energy data and energy saving tips. These sessions should serve to train the trainers, in that case the energy team members who will transfer the knowledge to the rest of the school community.
3. During project implementation: Virtual meetings with school's management board to coordinate schools project (e.g. contest) activities and provide assistance and solving problems about project implementation.
4. End of the project: An awarding event to be organized to conclude the project school contest and to award the best schools in terms of energy saved (and/or other criteria agreed previously). This event might be a one-day seminar focused on showing the participating schools project activities, sharing best practices about raising awareness.

Other activities recommended to conduct a rational use of energy project at school level are the following ones:

I. Diagnose of the school initial situation. Collection of school energy consumption data. Conducting an energy survey on energy consumption habits and other topics.
II. Analysis of energy usage and comfort critical surveys and development of good energy practices and other topics to improve the sustainability of the school centre.
III. Implementation of the proposed sustainable measures. Good practices or even an action plan will be implemented in the centre in order to reduce energy consumption and other environmental aspects such as waste and water. Periodically the EE will have to check if the classmates, as well as the rest of school community, comply with good energy practices.
IV. Monitoring and inspection actions of Energy Teams (ET). ET must be attentive to energetic behaviour of the educational community, regularly monitoring the application of good practices.
V. Reviewing the former action plan. With the change of weather seasons, good practices may need to be adapted. The ET may need to review whether the good practices proposed at the beginning of the course are still valid or need to be adapted.
VI. Evaluation of energy savings and actions carried out by the school. Savings analysis, comparing current energy data from previous scholar years. Analysis of the actions and good practices launched at schools.

4.6 MONITORING MEASURES & IMPACT

Monitoring the implementation of a plan and/or the results of energy measures impact is a need to evaluate the progress, if efforts and investment are being applied, and if the plan objectives are reached.

For that reason, a monitoring and evaluation (M&E) plan will be produced. This document should help to track and assess the results of the interventions throughout the life of a program. It should be a living document that should be referred to and updated on a regular basis.

A lot of open tools have been created to assist schools in improving their energy bills. For instance an available tool is the one provided by 50/50 MAX project: http://www.euronet50-50max.eu/en/energy-savings-calculation-tool

Furthermore, schools' energy bills should be collected and energy carriers' meters must be identified. It is recommended to appoint someone in the centre to be responsible for this task.

The appointment of the school Energy Team (or a different committee) such as responsible of monitoring energy plan implementation is a best practice recommended.

5 CURRENT LEGAL & SUPPORTING FRAMEWORK

Aligned with European Union legal framework, the most relevant energy legal and supporting regulation affecting school buildings are shown below:

Document	Description
Spanish Climate Change and Energy Transition Law. Law 7/2021, 20th of May.	Spanish Climate Change Law aims to reach an emissions neutral status in carbon dioxide (CO2) in 2050. This law also establishes that by 2050, the electrical system will be 100% renewable. By 2030, the law sets the next objectives: i. reduction of greenhouse gas emissions (GHG) by at least 23% compared to 1990; ii. To achieve a penetration of renewable energies in final energy demand of at least 42%; iii. an electrical system with at least 74% coming from renewable sources; iv. To improve energy efficiency by reducing primary energy demand by at least 39.5% compared with the baseline year. One of the 6th main pillars of this law is urban planning and transport, where is included the rehabilitation of existing buildings. That is the reason why main measures are concentrated in the field of energy renovation of buildings, another key segment in the economic reactivation plan that, in addition, is a pillar of the fight against energy poverty. According to the law, the

Document	Description
	Government will promote and facilitate the efficient use of energy and the use of renewable sources in buildings, aligning with the long-term Strategy for the renovation of buildings with the objectives of the successive INECP strategies.
Spanish Law 8/2013, 26th June, on urban refurbishment	The aim is to boost the refurbishment of buildings and urban areas as a means of reconverting the traditional construction sector as long as promoting the sustainable development including energy efficiency criteria. The present law set up the so-called "Building Evaluation Report" that will show the level of conservation of the buildings and the energy efficiency (other issues included but not relevant for our project objectives) as mandatory in the European Directives 2002/91/EC and 2010/31/EU. This Spanish new law provides certain deadlines to dispose of the Building Evaluation Report such as: a) Collective residential buildings typology older than 50 years, must have the report prepared in five years (since the date building reaches that age) b) All buildings which are going to be refurbished using public funds/subsidies c) Other kind of buildings depending on regional or local regulations
RD 106/2018 of 9th March, regulating the Spanish National Plan for promoting house rental, rehabilitation of buildings, as well as the urban renewal, 2018-2021.	Royal Decree 106/2018, regulating the National Plan for promoting rents, building refurbishments, urban recovery and renewal 2018-2021, covers a very wide-range of issues such as a new concept of building, more linked to sustainable development, and the recovery of the building sector by means of bringing urban planning in line with social and environmental needs. Accomplishment and adaptation to Technical Building Code (CTE in Spanish) requirements is one of the main objectives. The plan is formed by several sub programs. Paying attention to RES & RUE issues, the interesting sub plans are the followings: 1) Building rehabilitation programme. Focused on financing refurbishment interventions on residential buildings (built before 1981). It includes actions such as improvement of building envelops in order to reduce its energy demand or substitution/upgrade of common building facilities (cooling, heating, ventilation, domestic hot water). Or the installation of RES facilities with the aim or reducing the consumption of conventional energy sources. 2) Urban regeneration and renewal. The aim is to finance neighbourhoods' rehabilitation. The objective is to improve urban areas. Regarding the actions related energy funded: improvement of energy

Document	Description
	efficiency and renewable energies, as well as district heating and cooling, and sustainable mobility.
RDL 17/2019, of 22 November 2019 for urgent measures for the adoption of a remuneration framework for electricity production sector.	The RDL 17/2019 is a modification of the legislation that currently regulates installations that produce energy derived from renewable sources. It provides for urgent measures for the adoption of a remuneration framework that will guarantee, under certain conditions, the remuneration for such installations throughout the next two regulatory periods (2020-2025 and 2026-2031). It is important to distinguish between: • facilities in operation after 14 July 2013, for which the rate of return for the next regulatory period (2020-2025) has been set at 7.09 per cent; and • facilities in operation before 14 July 2013, which may either: i. keep the current rate of return of 7.398 per cent for the next two regulatory periods (2020–2025 and 2026–2031) provided that they drop any arbitration or litigation proceeding against Spain concerning the regulatory changes of the economic regime of renewables approved since 2007; or, ii. application of the 7.09 per cent rate of return for 2020–2025 and of the subsequent rates of returns to be afterwards approved for the following regulatory periods. In addition to economic incentives, other policies that promote the development of renewable energies in Spain are the following rights granted to renewable generators: • the priority of access to the grid. Renewable energy generators have priority over other operators to access and connect to transmission and distribution networks; and • the priority of dispatch of electricity generated in the wholesale market. Under equal market conditions, renewable energy generators have priority over other conventional generators to deliver their electricity in the wholesale market.
Royal Decree 244/2019, of 5 April, regulating administrative, technical and economic types of electricity supply and generation with self-consumption.	This RD seeks to promote the self-consumption of energy, and particularly renewable energy, by regulating the sector. It notably: 1. Updates the framework for the connection and energy supply to the electricity grid, and the economic compensations attached to different schemes; 2. Authorises the self-consumption for a group of people (beyond single owners), and; 3. Ease the regulatory process for small-scale producers. This RD regulates the administrative, technical and economic conditions of self-consumption in Spain. This rule supplements the regulatory framework

Document	Description
	promoted by RDL 15/2018; whose main measure was the repeal of the so-called 'sun tax'. This decree thus represents a new energy scenario that is committed to a model based on distributed generation and renewable energies. It is worth highlighting: • Recognition of the figure of shared self-consumption, which enables to several users the possibility of benefiting from the same generating facility. This is of vital importance for industrial sites, which can take advantage from better locations and reduce the overall investment; • Simplification of bureaucratic procedures and deadlines for the legalization of facilities; • Introduction of a simplified compensation for generation surpluses. It consists of a balance in economic terms of the energy consumed in the billing period; • Self-consumed energy from renewable sources, cogeneration or waste, as well as surplus energy discharged into the transport and distribution network, will be exempt from all types of charges and tolls.
Integrated National Energy and Climate Strategy (INECP) 2021-2030	The INECP 2021-2030 is intended to reflect this commitment and Spain's contribution to the international and European effort. Spain's INECP identifies the challenges and opportunities within the five dimensions of the Energy Union: decarbonisation, including renewable energy; energy efficiency; energy security; the internal energy market; and research, innovation and competitiveness. The Plan also gives the necessary signals to provide certainty and direction to all players while also bringing flexibility and manageability to the energy transition and the decarbonisation of the economy. Spain's INECP 2021-2030 is aimed at making progress with decarbonisation, laying down a firm foundation for consolidating a climate-neutral path for the economy and society by 2050. The measures provided for in the INECP are expecting to allow the following results to be achieved in 2030: • 23% reduction in greenhouse gas (GHG) emissions compared to 1991; • 42% share of renewables in energy end-use; • 39.5% improvement in energy efficiency; • 74% share of renewable energy in electricity generation. These results will enable progress to be made towards the longer-term objective of this Plan, namely to achieve GHG emission neutrality in Spain by 2050, in line with the positions adopted by the European Commission and the majority of Member States. This objective represents a reduction of at least

Document	Description
	90% in total gross greenhouse gas (GHG) emissions by 2050 compared to 1990. In addition, the aim is to achieve a 100% renewable electricity system by the same date.
Spanish long-term decarbonization roadmap 2050.	This roadmap is an outcome of Paris Agreement by which signatory countries should draw a long-term low greenhouse gas emission development strategy to reach EU climate-neutral by 2050. Concerning tertiary sector stock (including public buildings) the roadmap by 2030 foresees renovation actions on the thermal envelope, thermal installations and lighting systems. By 2050, new buildings are built under nZEB criterion. Related to existing building stock, besides energy efficiency measures covered with the Long-term strategy for energy renovation in the building sector, main actions will address the decarbonization of cooling & heating systems and the production of renewable energy in-site and other systems such as vehicle charging infrastructure, energy storage batteries or energy management systems.
Law 6/2022 of December 5 on Climate Change and Ecological Transition of the Valencian Region	The Generalitat Valenciana has approved the Law 6/2022 of December 5 on Climate Change and Ecological Transition of the Valencian Community, which sets the roadmap to achieve a fairer and more sustainable society, economy and environment. The objective is to combat the current challenges, but also the future ones, of the climate emergency. To achieve this, the law is based on the decarbonization of the Valencian economy to promote energy transition, sustainable mobility, reduction of polluting emissions and green taxation.
Climate and Energy Strategy of Valencia Region 2030	The 2030 Strategy for Climate Change and Energy in Valencian Community includes 43 climate change mitigation measures, 28 adaptation measures and 7 common ones. The reduction of greenhouse gas emissions (40% reduction by 2030 comparing with 1990), the increase in renewable energy of at least 32% of the final gross consumption as well as an increase in energy efficiency at least 32.5% are the general objectives. The mitigation measures will be implemented in the public sector, energy, the carbon footprint and sectors such as mobility and transport, agriculture and livestock, waste, scuppers and health. The promotion of organic production,

Document	Description
	as well as local trade are some of the measures taken with the reduction of pesticides and the efficiency of agricultural operations. Sustainable tourism and a rational occupation of soil are among the mitigation points. In the adaptation will also work on health, the area of response to emergencies, biodiversity and forestry, water resources, coastal areas, landscape and social environment. As for the common ones, it will focus on research, development and technological innovation, awareness-raising, training and participation, as well as cooperation and sustainable development. In the Public Administration, the incorporation of environmental criteria that lead to a minimization of emissions will be promoted. CO2 in purchasing and contracting procedures with the development of digital transformation plans, as well as safe and sustainable mobility. At this point, it will influence new models with actions on vehicles, responsible for almost 25% of emissions by the preferential use of petroleum-based fuels that represent more than 90% of total energy consumed in Spain. Concretely, focusing on buildings energy rehabilitation, measure 26 deals with building energy consumption reduction of public and private sectors, at the same time that promoting the RES installation. Measure number 3 is addressing the promotion of energy efficiency measures at educational buildings. Moreover, measure number 86 is dealing with the realization of communication actions about climate change through the educational sector.

6 SCHOOL BUILDINGS ASSESSMENT TOOLS

ESMES project activities embrace the design of 3 tools for assisting local stakeholders in implementing renewable energies and energy efficiency solutions (REEE) and sustainable energy management (SEM) measures in schools' buildings.

An implementation tool to replicate REEE solutions adopted by the project has been designed to determine the photovoltaic system needs for a building. The Photovoltaic (PV) System Design and Monitoring Tool has been developed to support users in estimating their PV system capacity requirements as well as monitoring and evaluating the system's performance over time. The design approach adopted in this tool is based on a data-driven design approach, which utilizes location-

specific, environmental, and energy consumption data. This allows for the design of specifically tailored PV systems in accordance to the unique needs and conditions of the sites where the PV system is to be installed.

The other tools produced are focused on providing support for school rehabilitation planning and facilitate the perform of raising awareness activities at school community.

7 CONCLUSIONS & RECOMMENDATIONS

There are common lessons to be raised when implementing a sustainable energy strategy at schools. Some of them are listed below:

a) High motivation of the project manager, teachers and the staff working in the school. A key factor in the success of this sort of projects or strategies is finding a person or group of people who are keen to take it on and keep it going.
b) A fluent and easy relationship between the different people and institutions collaborating in the strategy implementation. To put on board the local authority is crucial.
c) Having information about the school buildings: maps or plans, a recent energy audit and, above all, energy data consumption.
d) The involvement of school pupils is a breakthrough, because they are going to increase their capacity to face and provoke changes in their daily energy habits.
e) In Spain, local authorities are in charge of primary school buildings maintenance and energy supply. So, their involvement is a must in order to proceed with REEE investments.
f) Application of energy saving simple tips by school community might drive to yearly energy savings around 10-15%. So, this is the first step when implementing the strategy.
g) European Union and Spain regulation and supporting framework eager to help entities and citizens to apply renewable energies and energy efficiency solutions (REEE).
h) Energy cost savings and greenhouse gases cutting: implementing energy saving programmes based on changing unsustainable habits is going to induce a reduction of the school energy bill, freeing up budget for investments in renewable energy and / or energy efficiency measures. In the same way, to decrease energy use is producing immediately a reduction of greenhouse gases and other environmental benefits.
i) Improved indoor air quality: energy-efficient practices can also improve indoor air quality by reducing the need for air conditioning and heating, which can help reduce the spread of airborne pathogens.
j) Health and comfort: energy-efficient lighting and heating and cooling systems can improve indoor comfort and health by reducing exposure to excessive heat, cold, and bright light.

8 ACKNOWLEDGMENTS

The Project wishes to acknowledge the support of the ESMES project Spanish National Hub members, all the schools involve in and the Consorci de la Ribera throughout the various stages of the project.

Finally, it is important to highlight the support provided by the members of ESMES project Thematic Committees, because this strategy is a consequence of the cross-border work.

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JOSE JESUS RIBES FELIU, Secretario del Consorci de la Ribera

CERTIFICO:

Que la Junta General del Consorci, en sesión de fecha 4 de mayo de 2023, aprobó el siguiente acuerdo:

2.7. PROPUESTA DE ACUERDO PARA LA APROBACIÓN DE LA ESTRATEGIA DE ESCUELAS CON CERO EMISIONES DE CARBONO EN EL MARCO DEL PROYECTO ESMES DEL CONSORCI DE LA RIBERA

Atendiendo a las siguientes consideraciones:

El Consorci de la Ribera es una entidad constituida por las Mancomunidades de la Ribera del Xúquer y la Ribera Baixa. El área de Energía del Consorcio de la Ribera tiene como objetivo principal contribuir al desarrollo sostenible de la comarca de la Ribera, potenciando la utilización de recursos energéticos endógenos o energías renovables e implantando una cultura basada en la eficiencia o ahorro energético.

Para contribuir al desarrollo sostenible de la comarca de La Ribera, el área de Energía del Consorcio de la Ribera presentó a finales de 2017 una propuesta de proyecto llamada ESMES (acrónimo de Energy Smart Mediterranean Schools Network) a la Comisión Europea en el marco del programa ENI CBC MED. Dicho proyecto fue aprobado por la UE:

El proyecto ESMES tiene como objetivo la rehabilitación de edificios educativos públicos haciéndolos más eficientes energéticamente y optimizando su producción de energía renovable.

Una de las principales líneas de actuación del proyecto es el desarrollo del conocimiento y las capacidades operativas de las instituciones de energía y educación nacionales/regionales/locales para planificar, implementar y evaluar rehabilitaciones energéticas que sean sostenibles, rentables y adaptadas a los tipos y usos de edificios, cargas de energía y zonas climáticas.

Fruto del trabajo transnacional se ha desarrollado, para cada territorio participante en el proyecto, una estrategia de eficiencia energética para centro educativos que pretende guiar las futuras rehabilitaciones de edificios, a través de combinaciones apropiadas de soluciones de energía sostenible y fuentes de financiación y respetando los marcos legales existentes sobre edificios públicos de cada uno de ellos. países de los socios del proyecto.

El objetivo de la “Estrategia de escuelas con cero emisiones de carbono en el mar Mediterráneo” elaborada por el Consorci de la Ribera es proporcionar a los responsables de la toma de decisiones una estrategia para descarbonizar los centros escolares de secundaria y primaria del mediterráneo español basada en la sensibilización de la comunidad escolar sobre el uso de la energía, al mismo

tiempo que proporciona un repositorio de soluciones sostenibles y mejores prácticas adecuadas para las escuelas.

Siendo uno de los principales objetivos del Consorci de la Ribera la concienciación de la comunidad educativa sobre los retos del cambio climático y la energía sostenible, y teniendo en cuenta según el contrato firmado con el programa ENI CBC MED, que cada estrategia debe ser aprobada por actores relevantes de cada territorio exigiendo un pronunciamiento de carácter general, se considera procedente la aprobación por la Junta General del Consorcio

Sometido a votación la Junta General del Consorci, por unanimidad, aprobó el siguiente **ACUERDO:**

PRIMERO. - APROBAR la "Estrategia de escuelas con cero emisiones de carbono en el mar Mediterráneo", elaborada por el Consorci de la Ribera en el marco del proyecto ESMES, que consta como anexo al acuerdo, para impulsar de ese modo la promoción de la sostenibilidad energética de los centros educativos.

SEGUNDO. Facultar a la presidencia tan ampliamente como sea procedente para cuantas actuaciones o resoluciones sean necesarias para la ejecución del programa y de este acuerdo.

TERCERO. - Notificar dicho acuerdo al organismo gestor del programa de la Unión Europea ENI CBC MED.

Y, para que conste, se emite este certificado, con el Visto Bueno de la presidencia del Consorci de la Ribera, con la salvedad prevista en el artículo 206 del Reglamento de Organización, Funcionamiento y Régimen Jurídico de las Entidades Locales.
Alzira, en fecha al margen
Firmado electrónicamente, conforme figura al margen del documento
El secretario El presidente