How to Handle the Energy Team

An Educational Guidebook for Caretakers

Co-funded by the Intelligent Energy Europe Programme of the European Union

CONTENT:

1. EURONET 50/50 MAX:

The project EURONET 50/50 max is based on the results and experience of the previous project EURONET 50/50 which was also supported by the IEE (Intelligent Energy for Europe) and was implemented between 2009 and 2012 in 50 schools in eight European countries. Its goal was the implementation of the 50/50 methodology in schools, which sees 50 % of the savings returned to users of public buildings through a financial pay-out, with the remaining 50 % representing a net saving for the local authority that is paying the bills.

Between 2009 and 2012, the EURONET 50/50 project united 6,900 pupils, teachers and caretakers, and achieved on average 2,100 euros of savings per school.

The project EURONET 50/50 max is focused on pupils, teachers and other users of public buildings and aims to raise their awareness of the importance of energy efficiency. The 50/50 methodology will be disseminated to at least six new European countries (13 all together) which will further strengthen its role in local, regional and national energy strategies. Between 2013 and 2016 the 50/50 methodology will be implemented in 500 schools and 48 other public buildings across Europe. Through the exchange of good practices and experience, the knowledge will be distributed to new schools and other public buildings. The various activities taking place in schools and other public buildings are expected to achieve savings of approximately 8%.
A further important goal is the set-up of a sustainable network of 50/50 participants, which will contribute to the European climate and energy goals by the year 2020.

An energy team will be set up in each school participating in the Euronet 50/50 max project, which will coordinate the implementation of the 50/50 methodology. Each energy team will consist of: pupils, teachers, caretakers, the headmaster, and the Euronet 50/50 max partner, etc.

EURONET 50/50 max

European countries and partners in the project EURONET 50/50MAX

The main tasks of the energy team are:

- Conducting an energy tour of the school building,
- Reporting on the measures and actions taken to improve the energy situation in the school,
- Running a promotional and awareness campaign on the importance of energy efficiency and encouraging others in the school to implement energy efficiency measures.

2. ABOUT THE EDUCATIONAL GUIDE

This educational guide was prepared by the partners of the EURONET 50/50 max project. The project, which aims to achieve energy savings, will be implementing the 50/50 methodology in 500 schools and 48 other public buildings in 13 European countries. The energy savings will be achieved through raising awareness of the importance of energy efficiency and through changing the habits of the school and public building users: pupils, teachers, caretakers and other users of public buildings.

Reducing the use of energy in schools and other public buildings is vital in aiding the achievement of the energy and climate goals set by the European Union for the year 2020. The 50/50 methodology is a very useful tool for reducing the use of energy and thus reducing CO_2 emissions.

This educational guide will help you with the implementation of the activities planned at your school. The main part of the guidance material sets out advice on how to approach and interact with the school's energy team and how to provide an overview of the energy sources that are necessary for the normal operation of the school.

One of the main goals of the European Union, by the year 2020, is to reduce greenhouse gas emissions by 20 %.

We advise you to adapt the project to your circumstances, but the basic idea must stay focused on pupils and other users of public buildings. The pupils are creative enough to be able to change the environment. The Euronet 50/50 max project represents a very useful tool for reaching this goal. Pupils will be able to use it during school hours, whilst the good habits developed will be further passed onto their families and to other aspects of their life. This is very important for achieving a common sustainable and energy efficient future.

3. ENERGY AND CLIMATE ISSUES

Climate change is a global problem in which we all have the power to make a difference. Even small changes in our daily behaviour may result in a reduction of greenhouse gas emissions. Even though these changes do not significantly affect our quality of life, they can make a notable contribution to the reduction of greenhouse gas emissions as well as result in financial savings.

The weather is an everyday topic of discussion, especially as the weather has a great impact on our mood. However, climate is not the same as weather. The climate is the average weather for a particular area over a long time. The climate can be affected and changed by natural factors, such as major volcanic eruptions whereby solid particles in the atmosphere reflect the sunrays back into space. However, the climate change we have been experiencing in recent years has not been as a result of such natural factors. Most experts agree that increasing concentrations of greenhouse gases in the atmosphere, due to human activities, are the main reason for the drastic climate change observed in recent years. The higher concentrations of carbon dioxide, methane and nitrogen oxides lead to an increase in temperature and consequently to extreme weather phenomena. This increased concentration of greenhouse gases is due to the exploitation of fossil fuels to satisfy the huge energy needs of modern society, including:

- Heating and cooling by fossil fuels (oil, gas, etc.)
- The use of petroleum and other oil based fossil fuels in transport (diesel, gasoline, kerosene, etc.)
- Fossil fuel based electric generators (coal-fired plants)
- Fossil based energy generators for huge energy consumption in the sector of industry (coal, mazut, etc.)

Burning wood releases as much CO_2 as had absorbed it in its life. According that fact, biomass fuel is CO_2 neutral fuel and important alternative fuel to fossil fuels.

Raising awareness of energy efficiency is as important as raising the share of energy produced by renewable energy sources. Technology in the field of renewable energy production has recently evolved rapidly. In combination with the implementation of measures which raise energy efficiency awareness we can further contribute to lowering carbon emissions and thus the preservation of our planet.

4. GUIDEBOOK FOR CARRYING OUT EURONET 50/50 MAX ACTIVITIES

This guidebook is designed to give you – caretakers- basic guidelines in guiding the energy team during the energy tour of the school. With the help of this guidebook you will be able to collect all the energy information related to your school and prepare yourself for possible questions that pupils may ask. Before the energy tour, you should meet the teacher responsible for coordinating the project activities, and discuss the energy tour with them and agree on your role in the project.

During the energy tour you should:

- Describe to the pupils all the different types of energy entering the school building (electric energy, heating, hot water, etc.),
- Show pupils the devices used for measuring energy consumption (electricity meter, heat meter, level of liquid in tank meter, etc.),
- Show the pupils the point through which energy enters the school building,
- Point out the appliances which consume energy in the school (radiators, air conditioners, computers, lighting, etc.),
- Tell the pupils the annual fuel consumption of the school building and the corresponding annual cost,
- Show pupils the eco points where waste is separated and collected and explain the different types of containers and their use (paper, plastic, glass etc.),
- Tell pupils the annual amount of waste generated by the school.

5. START

5.1. STEP 1: CARETAKER

Describe the work and responsibilities of the caretaker at the school.

- How many caretakers does the school have?
- Who is/are the caretaker(s)?
- What are the caretaker's responsibilities?

5.2. STEP 2: DESCRIBE THE DIFFERENT TYPES OF ENERGY SOURCES USED BY THE SCHOOL BUILDING

Describe all the different types of energy sources used by the school that enable its normal operating conditions:

- Electricity,
- fossil fuels (oil, natural gas, etc.),
- biomass (firewood, wood pellets, wood chips, etc.),
- wind energy (wind turbines),
- solar energy (solar panels, photovoltaic),
- nuclear energy (nuclear power plant),
- other.

5.3. STEP 3: POINTS WHERE ENERGY IS ENTERING THE SCHOOL BUILDING

Together with the energy team locate the points through which energy enters the school building (electrical connection, boiler room, etc.).

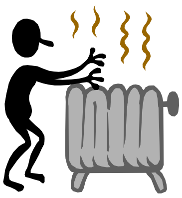
1. ELECTRICAL ENERGY

- Show pupils the electricity meter.
- Introduce the basic units for measuring electricity.
- Explain to the pupils which devices consume electricity at the school.

- Show to the students which devices consume the most and least electricity.
- Tell the students the school's annual electricity consumption and the cost of this consumption.
- Ask pupils to suggest ways in which the school's electricity consumption can be reduced.
- Ask pupils to imagine a day without electricity.

2. THERMAL ENERGY FOR HEATING

- Show students the boiler room.
- Ask pupils to tell you what energy sources are used for heating.



- Describe the sources of energy used for heating by your school.
- Describe the technique used for measuring the energy consumed by heating.
- Describe how the classrooms and other rooms at the school are heated.
- Ask pupils to tell you if they know what the recommended temperatures for different rooms are.
- Demonstrate how the temperature in classrooms and other rooms at the school is regulated.
- Tell pupils the annual energy consumption for heating at the school and the cost of this consumption.
- Ask pupils to make recommendations on how to reduce the energy consumed by heating.

3. ENERGY FOR COOLING

- Show students the air conditioning appliances used by the school.
- Describe which energy source is used by these appliances.
- Tell them when (time of year) air conditioning appliances are used.

- Ask pupils to give you their recommendations on how to reduce the energy consumed for cooling.

HOT WATER

- Describe to the pupils the technique used for measuring the consumption of hot water.
- Tell them the basic units for the measurement of hot water consumption.
- Ask pupils if they know who/what consume hot water at school.
- Tell them who/what consumes hot water at the school.
- Tell them how much energy is consumed annually for hot water and the cost of this energy consumption.
- Ask pupils to make recommendations on how to reduce the consumption of hot water.

4. OTHER ENERGY SOURCES

- Describe all other energy sources used by the school (if there are any).

5.4. STEP 4: ENERGY TOUR

Perform the tour together with the teacher - mentor responsible for coordinating the project's activities at your school and the pupils from the energy team.

During the energy tour, point out the devices or appliances that consume energy in each room and show them to the pupils. Throughout the energy tour, encourage pupils to consider ways through which to achieve energy savings and how to encourage other pupils and school staff at the school to do the same.

5.5. STEP 5: SCHOOL WASTE

Along with the energy team, visit the site of the school building where waste is sorted.

- Ask pupils if they know why several different waste containers are needed.
- Describe the different waste streams arising from the operation of the school (paper, plastic, glass, etc.).
- Inform them when waste is collected and disposed (how often, time of week etc.).
- Tell them who has responsibility for waste collection and disposal.
- Ask them if they know how the waste is disposed of (recycling plant, landfill, incineration plant, etc.).
- Tell them the annual amount of waste generated by the school and the cost of its disposal.
- Ask pupils to give you their suggestions on how the annual amount of waste generated by the school can be reduced.

6. INVESTMENT MEASURES FOR ACHIEVING ENERGY SAVINGS

Within the EURONET 50/50 max project, financial investments, for achieving energy savings in school buildings have not been provided for. The project is based primarily on the implementation of organizational measures and on raising awareness of the importance of energy efficiency in order to achieve energy, and by extension, financial savings. Nevertheless, it is important to know that the European Directive 2012/27/EU, mandates that EU member countries significantly improve the energy efficiency of their existing public buildings. The Directive dictates that all public buildings must be nearly zero energy by the year 2020. Due to the current state of public buildings, financial investments will also be required to meet the Directive's requirements even following the implementation of organizational measures. This chapter will provide an overview of some of the modern technological solutions for energy production and regulation of energy consumption to improve the energy efficiency of buildings. These methods can also be described to your school's energy team. Nevertheless, within the EURONET 50/50 max project, these investments have not been provided for.

6.1. LOW COST ENERGY SAVING INVESTEMENTS AND TIPS

Proper natural ventilation

Use your windows wisely and use natural ventilation to keep air quality in check. In the warmer months, windows should be opened when it gets colder in the evening, and remain open till morning. In the colder months, windows should be only opened in brief periods for ventilation purposes.

Operate your thermostat efficiently

Use your thermostat efficiently and reduce energy consumption. When it is hot outside, set your thermostat as high as possible while maintaining a certain level of comfort. This is not only good for energy savings but it is also far healthier for the building occupants, as the body doesn`t experience so much shock when moving from the colder inside to the warmer outside. When you turn on your air conditioning unit avoid setting it to colder settings than normal, as it will not cool the space any faster but will most certainly consume more energy and provide an unfavourable temperature profile.

Use fans and ventilation strategies to cool your home

A ceiling fan allows you to raise the thermostat setting more than 2°C higher in the warmer months while remaining the overall level of comfort and thus reduce energy requirements and increase cooling efficiency. Turn the ceiling fan off, when not present as they have no in-direct cooling capacity.

Keep your heating and cooling system running efficiently

Be vigilant when it comes to system maintenance and monitoring the system performance. Especially with older systems it is not uncommon for simple sealing elements like washers to wear and tear. Most of the times this is quite noticeable. However there are some situations when this type of malfunction is not so visible and because of this energy consumption raises, fuel efficiency drops and additionally we run the risk of permanent system failure, as the heat is not redistributed as it should be. Monitor your manometers at all times to ensure no pressure drops in the system.

Change appliances and lighting that don`t meet current industry standards

School appliances and lighting systems are not designed for heating but in some cases their overall energy efficiency is so poor, that much of the lost energy is transformed into heat. In fact, only 10 to 15 % of electricity when using regular incandescent bulbs results in light, where the lion`s share of the energy is actually lost. So change the appliances and lighting systems that have the worst energy efficiency characteristics and at the same time minimize the activities on heat generating appliances that are not necessary.

Seal the cracks of the building

Seal the cracks in the building that allow cold/hot air to pass into the interior. There are several low-cost ways to seal the unnecessary openings in the building structure. You can use weather stripping, where we apply a strip of vinyl, felt, tape (even sellotape) between the sash and the frame to provide better sealing of doors and windows. Another method is caulking (like silicone sealing), which is used only for stationery elements.

Install light system sensors

A significant amount of energy can also be saved by installing light system sensors which turn the light on only when there are people in the vicinity. The most suitable rooms for installing these sensors are the lavatories, hallways and wardrobes.

6.2. REGULATION OF HEATING WITH THERMOSTATIC VALVES

Regulation of indoor temperatures through conventional valves is quite difficult. When the valve is closed the radiator is cold, but if the valve is only half open the radiator becomes hot. Conventional valves usually do not have an intermediate stage. As a result, the temperature is regulated by opening the windows while the radiator is on, which is very inefficient.

By installing thermostatic valves you can avoid losing energy through open windows. The difference between conventional valves and thermostatic valves is in the valve head, which in the case of a thermostatic valve has an indicator of the openness of the valve. The head of the valve in the thermostatic valve contains a medium, which expands and contracts in response to ambient temperature. If the temperature goes above a certain setting, the medium in the valve expands and restricts the flow of water through the radiator. This is how the valve controls the flow of hot water in the radiator and thus the temperature of the room.

Investing in thermostatic valves is usually relatively cheap with an estimated saving in energy consumption of between 5 -15%.

6.3. DISTRICT HEATING

District heating is a system for distributing heat generated in a centralized location. The heat is distributed via a network of insulated pipes to residential and commercial buildings for use for their heating requirements, such as space and water heating. The first district heating networks were set up 100 years ago. An advantage of district heating is that it is flexible in terms of the technology used for heat production and it can serve a variety of consumers. District heating can be used in private homes, commercial, production and public buildings. The centralized heat production and pipe line network are usually designed so as to easily connect new consumers to the existing network. District heating can increase the efficiency of the system by approximately 35 percent if combined heat and power technology is used; the thermal energy generated during electricity production can be used instead of being lost. Heating plants produce only heat, while thermal power plants simultaneously produce heat and electricity. The retrieved waste heat is used for district heating purposes increasing the plant's energy efficiency. In the case of a cogeneration system for electric and heat energy production, efficiency is up to 70 to 80 percent. A further advantage of district heating is lower air pollution due to reduced emissions by power plants, a topic which has been gaining importance in the last years.

The cost of the generated heat is relatively low, but the breakdown of costs for users is still quite high. Therefore, a large number of consumers must be connected to the network to lower the cost per consumer.

District heating consists of following four units:

- Thermal power plant or heat plant.
- The district heating network.
- Building Station (= discharge point + indoor station).
- Building pipe system.

Hot water can be supplied directly in a heating system of a building, or it can be used in a heat exchanger.

The use of district heating

The advantages of district heating:

- high reliability of supply,
- safe operation and easy maintenance,
- professional monitoring and management,
- high efficiency,
- increased functional space for the building (no boilers, chillers, gas equipment, chimneys or cooling towers on-site),
- no local emissions by end-users (consumers),
- lower investment costs (heating station is significantly cheaper than a boiler),
- lower cost of energy,
- environmentally friendly, emissions of flue gases are controlled,
- the most comfortable way of heating.

6.4. DISTRICT COOLING

In the modern world, cooling of residential and public buildings is becoming as important as heating – today buildings without cooling in the summer are almost unimaginable. On the other hand, conventional cooling systems consume large quantities of increasingly expensive electricity. An alternative to conventional cooling is district cooling, where the cooling needs of buildings is produced by heat from a district heating system instead of conventional electricity. District cooling system is using a central source to supply cooling to a number of buildings instead of multiple individual systems.

How does it work?

1. In a district cooling solution, cold water is produced in a central chiller plant. A plate heat exchanger can be used either as a condenser or evaporator, offering considerable advantages in terms of space, efficiency and maintenance. A cold-water storage facility can also be used to take advantage of off-peak power rates.
2. Cold water is pumped through the district cooling system to a heat exchanger in a building. The heat exchanger is used to transfer the cold from the high-pressure pipeline to the lower-pressure internal system.
3. After use in air handling units, the warmer water returns to the heat exchanger for cooling again. Higher-temperature return water from the basement heat exchanger is pumped back into the district cooling system and returns to the chiller.

Compared with building-specific energy systems, district cooling systems (http://www.stellar-energy.net):

- Are up to 40 percent more efficient, as larger systems are considerably more energy-efficient than small, individual units.
- Require lower capital costs, as they eliminate the need for chillers, cooling towers, pumps and other individual systems.
- Have lower operating costs, as energy experts manage them around the clock, keeping costs low with fuel and energy diversity.
- Save building space that can be used for more valuable purposes (such as rental income).
- Eliminate noise and vibration caused by cooling or heating equipment.
- Are environmentally friendly, as they use an average of 40 percent less electricity than traditional cooling or heating systems. District cooling systems also capture most of the heat energy generated in electricity production and use it to produce steam and hot and chilled water (cogeneration).
- Provide a higher degree of reliability, as they are built with enough capacity to ensure energy is always available at the central plant. Distribution systems are

generally designed with multiple loops or other backup to provide additional distribution reliability.

- Have fewer surprises-financial requirements are predictable, and you only pay for the energy you use.
- Enable a greater degree of flexibility, as building needs can go up or down without the need to change the central plant's capacity.

6.5. CHP - COMBINED HEAT AND POWER SYSTEM

A CHP unit (also known as a combined heat and power cogeneration unit) is an independent unit for the production of electricity and heat. The electricity produced is sold to electricity companies, while the heat produced is used for heating or for hot water. Cogeneration systems can save up to 25 % of the primary fuel use when compared to the separate production of electricity and heat.

Modern co-generation units have demonstrated huge technological progress as a result of their increased use over the years, primarily reflected through improved energy efficiency. The biggest advantage of a cogeneration system is security of energy supply because of its independence to the public network, and is an excellent investment for heating large areas. A wide range of different co-generation units with different nominal power supplies, allow supply to a wider group of users, including:

- large and small industrial plants,
- medical institutions,
- public educational institutions,
- shopping and sports centres,
- natural parks and mountain huts,
- faraway farms,
- business premises and
- ordinary residential buildings (houses, apartment blocks).

CHP plants are able to operate using any of the following types of fuel:

- natural gas, LPG,
- propane,
- bio gas (water treatment plants, landfills, animal or vegetable waste),
- diesel fuel,

- bio-diesel,
- biomass.

6.6. HEAT PUMPS

The heat pump is a technologically advanced system, adapted to exploit renewable energy sources. Their advantage is their ability to recover heat from the surrounding air, groundwater or soil (heat source) and releasing it to a colder destination (heat sink). A heat pump exploits the fact that heat spontaneously flows from warmer places to colder places.

Heat pumps are actually very similar to household refrigerators in a sense that they contain the same types of components, which basically perform all the same functions, the only difference being, the process is performed in a reverse manner. There are several types of heat pumps available on the commercial markets which substantially differ in price. The most expensive are water-water systems that require a bore hole to access the underground water supply, while air source heat pumps are quite low-cost. It is true however, that air source heat pumps have a significantly lower COP (coefficient of performance - the ratio between heating/cooling provided and energy consumed), which means they are not as energy or cost effective, especially on an annual basis. The ratio between the energy consumed (electricity) and produced (thermal) is usually 1:3 to 1:5. This ratio between the heat produced and the energy consumed is the heating factor or the Coefficient of Performance (COP). Its value depends on the type of heat pump and the heat source. The annual heating factor is on average 3 to 5 or even more.

Any heat generated from the environment is free, but some electricity is required to raise the energy from low temperature level to a higher temperature level. There are three basic designs of heat pumps, which vary according to the environment that is cooled and the medium that is heated. The most common types of heat pumps are:

- air / water,
- water / water,
- ground / water.

6.7. SOLAR COLLECTORS

Solar collectors collect solar energy by warming up a transmission fluid. The sun is a practically inexhaustible source of energy and solar energy can be directly exploited through the installation of solar collector technology. Solar collectors are both economically and environmentally friendly.

Originally used on space stations, they are now used for a wide range of applications due to the positive attributes highlighted above. The use of solar collectors as an alternative to conventional sources of energy (fossil fuels) reduces the amount of greenhouse gases released in the atmosphere.

It should be noted that a solar collector is not equivalent to a solar cell. Solar cells convert solar energy into electrical energy, whilst a solar collector absorbs infrared radiation to warm up a medium inside the solar collector (usually a liquid medium).

An important factor to consider when installing solar collectors is the amount of available solar energy in a given area. The amount of solar energy depends on the weather conditions, location and orientation. In areas of northern latitudes, (south central Europe) the annual solar radiation energy is estimated to be between 1000 and 1500 kWh per square meter, but unfortunately, most of this energy is mostly available from April to October, when heating is not required. In the winter, the estimated solar radiation energy is only about 200 to 250 kWh. For example, the annual average in Slovenia is approx. 1200 kWh/m^2. This corresponds to the energy of about 12 litres of gas oil or 120 m^3 of natural gas.

Solar collectors convert solar energy into heat and deliver it to the medium inside the solar collector panel (usually a mix of water and glycol). The efficiency of a solar collector is the proportion of the radiated solar energy intercepted by the collector area and the energy received by the medium. Depending on the type of collector, up to 75 % of the solar radiation energy received can be converted into useful heat. The lifetime of solar collector is up to 25 years, but the payback period is estimated to be within 12 to 14 years.

Comparison of different types of solar collectors

There are several types of solar collectors, depending on the design and manufacturing technology. Based on the current market supply, solar collectors are divided into three main types:

Level or flat plate solar collectors consist of an absorber, a heat insulating backing and a transparent cover on the upper side that reduces heat losses. The absorber is an essential part of the solar collector. Usually it is a black-painted metal, which absorbs the solar energy and to which fixed pipes with water are connected.

Vacuum tube collectors with direct flow (also known as a "pipe inside pipe" system) which consist of several units. Each unit consists of two concentric glass tubes with their internal surface coated with a highly selective black coating. The pressure between the pipes is considerably lower than normal pressure. In this way heat losses are minimised. Heat losses are so small that heat can be provided even on cloudy days. A coaxial heat exchange tube is fitted inside of the absorber, through which the heat transfer medium flows. Each tube is up to 1.5 m long and the diameter ranges from 50 to 70 mm.

Heat pipe vacuum tube collectors has the absorber integrated inside the vacuum tube, on which a coaxial heat exchange tube is mounted. Liquid (water or methanol), flows in the heat exchange tube which evaporates during heating. In the condenser the liquid releases the heat on to the heat carrier while it condenses. The condensed liquid flows down the pipe, where the process repeats.

The length of each pipe is up to 1.9 m, with an outer diameter of 65 mm and can easily be replaced if it breaks. The effectiveness of a vacuum tube collector is on average higher than the level or flat collectors, however due to complex manufacturing, the price is higher.

This variety of options can be confusing for someone who has decided to install solar collectors, as it difficult to judge which solar collectors will be best - both in terms of technical characteristics and the efficiency - price ratio. Currently, flat collectors have the best ratio between price and performance, although the heat pipe collectors are up to 64 % more efficient.

6.8. PHOTOVOLTAIC

The word photovoltaic is based on the Greek word "phos ", meaning light, and the word "volt". The photovoltaic effect is the mechanism by which solar radiation is directly converted into voltage or an electric current, when a material (semi-conductor) is exposed to solar radiation. Photovoltaic conversion is defined as the direct conversion of solar energy into electricity. It is one of the cleanest renewable energy sources, due to the modular design which can be used in power plants from a few milliwatts up to several megawatts.

Solar photovoltaic systems consist of two parts. The first part consists of a set of solar photovoltaic modules, (the heart of every solar PV system) that convert the electromagnetic radiation of the sun into direct current (DC). The second part consists of a set of electronic elements, designed to use the produced electricity for specific purposes. These electronic elements are: power inverters, casing, patch cords, DC - and AC (alternating current) - junctions, regulators, batteries, switchgear and protective devices, etc.

A photovoltaic module consists of a set of series-connected solar cells, which are on each side coated by a special film of EVA, which has a high gel content and a low yellow index. The film hermetically closes the cell between the back layer film from the rear side of the module (which is used as a protection module against UV light, scratches and any other external influences) and the glass on the front side. The highly permeable tempered glass provides strong resistance to mechanical shock, hail, and high light transmittance, thereby increasing the efficiency of the module. On the back of the module is a mounted box with connections, which enables connection to the electrical wiring and on to the inverter that converts DC voltage into usable AC voltage.

7. ANNEX

7.1. ANNEX 1: REGULATORY ROOM TEMPERATURE (SIST EN ISO 7730:2006)

Room	Regulatory room temperature [°C]
Living rooms and bedrooms	20
Offices, meeting rooms, exhibition halls, stairways	20
Hotel rooms	20
Selling premises	20
Classrooms	20
Theatres and concert halls	20
Bathrooms, showers and all other types of premises where people may be naked	24
Toilets	20
Lobby and corridors	15
Unheated adjacent rooms (basements, staircases)	10

A device for measurement of electricity consumption

Thermometer

Lux meter

7.2. ANNEX 2: REFERENCE VALUES FOR LIGHT IN DIFFERENT ROOMS (SIST EN 12464-1)

Room, visible task or activity	E_{VZ} [lux]	UGR_m	R	Comment
LIBRARY				
Bookshelf	200	19	80	
Reading room (section for reading)	500	19	80	
Rental of books	500	19	80	
EDUCATIONAL PREMISES				
School playroom	300	19	80	
Classes for preschool education (kindergarten)	300	19	80	
Facilities for pre-school activities	300	19	80	
Classrooms for primary and secondary schools	300	19	80	There must be a function for regulating the lights
Classrooms for evening classes and adult education	500	19	80	
Lecture halls	500	19	80	There must be a function for regulating the lights
Whiteboard	500	19	80	Reflection must be prevented
Demonstration table	500	19	80	750 lux in the lecture halls.
Classrooms for fine arts and handicrafts	500	19	80	
Workrooms in art schools	750	19	90	T_{cp} >5000 K
Facilities for technical drawing	750	16	80	
Facilities for practical work and laboratories	500	19	80	
Training workshops	500	19	80	
Music classrooms (tutorials)	300	19	80	
Tutorials for computer training	500	19	80	
Laboratory of foreign languages	300	19	80	
Facilities for the preparation and training workshops	500	22	80	
Student shared premises and halls for meetings	200	22	80	
Staffrooms and staff facilities	300	22	80	
Sports halls, gymnasiums, swimming pools	300	22	80	
Wardrobes	200	25	80	
Entrance halls	200	22	80	
Stairways	150	25	80	
Storage cabinets for educational tools	100	25	80	
School canteens	200	22	80	
Kitchens	500	22	80	

For additional information, please contact your local partner on the project:

PLACE FOR EACH

PARTNERS CONTACT

INFORMATION

Web site of the project: http://www.euronet50-50max.eu/en/

Project coordinator: euronet@diba.cat

Co-funded by the Intelligent Energy Europe
Programme of the European Union