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meetMED
Mitigation Enabling Energy Transition in the MEDiterranean region
Together We Switch to Clean Energy

SOLAR-POWERED SCHOOLS IN THE MEDITERRANEAN: FEEDBACK, CHALLENGES AND OPPORTUNITIES

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MED ENER

RCREEE
Regional Center for Renewable Energy and Energy Efficiency
المركز الإقليمي للطاقة المتجددة وكفاءة الطاقة

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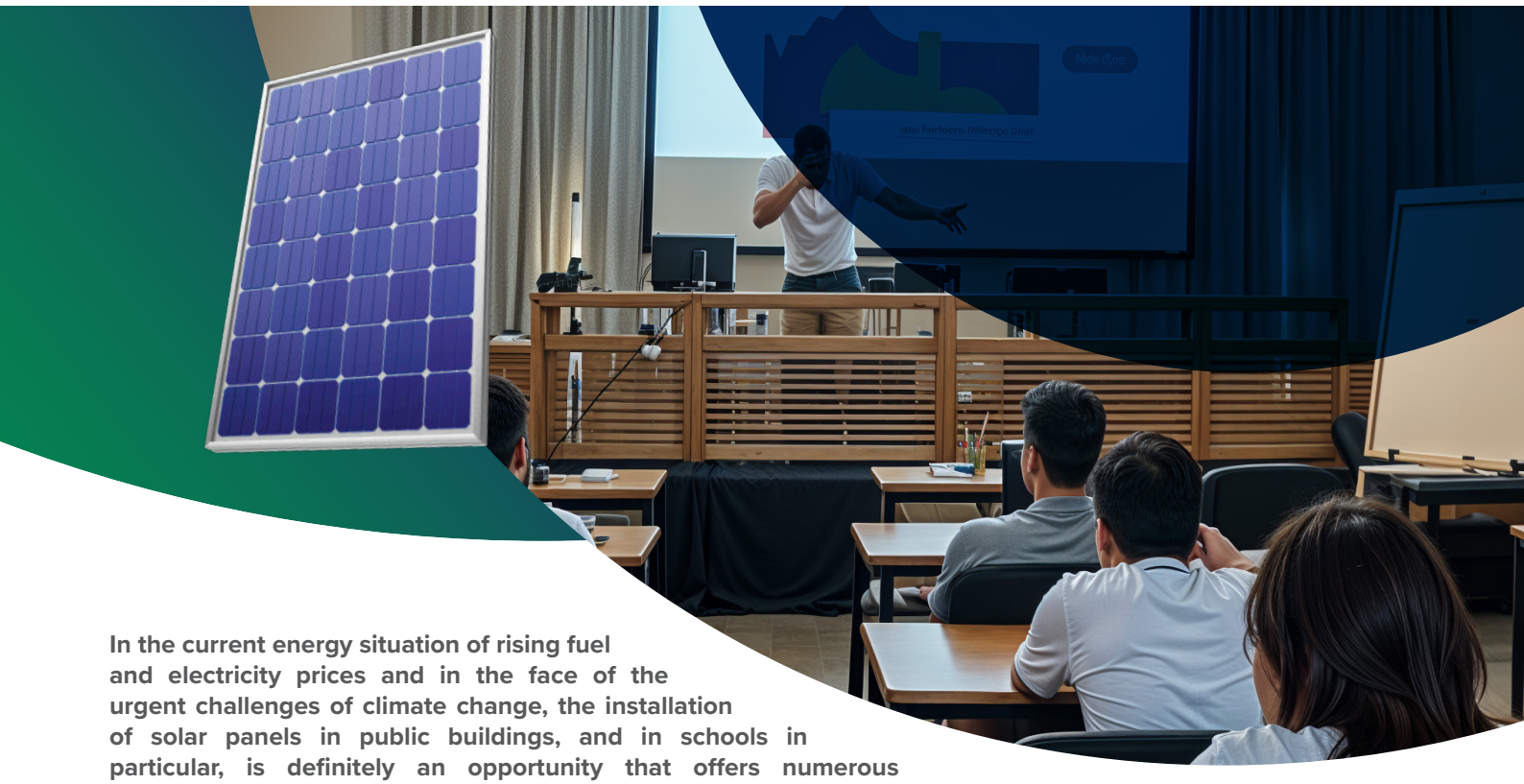
About the project

The Mitigation Enabling Energy Transition in the Mediterranean region “meetMED” is an EU-funded project and developed by the Mediterranean Association of the National Agencies for Energy Management (MEDENER) and the Regional Centre for Renewable Energy and Energy Efficiency (RCREEE).

With the objective of contributing to energy and climate transition Southern Mediterranean Neighbourhood through a multi scale, multi partner inclusive approach, meetMED II activities aim at developing a more stable, efficient, competitive and climate-resilient socioeconomic environments Southern Mediterranean countries, in, by fostering regional cooperation for Energy Efficiency measures and implementing demo actions.



In the current energy situation of rising fuel and electricity prices and in the face of the urgent challenges of climate change, the installation of solar panels in public buildings, and in schools in particular, is definitely an opportunity that offers numerous advantages:

Reducing electricity bills

Increasing energy independence

Raising awareness among the younger generation

with regard to the use of renewable, long-term energy with lower greenhouse gas emissions. Numerous installations have thus been completed in several Mediterranean countries, whether or not involving cooperation projects, with a dynamism that appears to be exponential. What is the feedback after several months or years of operation? What challenges have there been? What are the issues at stake that this gives rise to in terms of economic sectors? New kinds of pollution connected with the recycling of batteries and the dismantling of panels? Financing? What are the new risks (theft, black market, infrastructural risks (broken panels due to conflicts, etc.)?).

On the occasion of the REDEC in Lebanon in July 2023 ADEME and its Lebanese and Mediterranean partners organised a round table with researchers, professionals and experts, which provided the opportunity to present feedback and provide possible answers to these challenges.

This paper aims to **explore feedback from the different contributors and the key messages from this conference** in order to invite decision-makers to take action and promote the energy transition at the local level through renovation and solar electrification of schools.

SUMMARY OF PRESENTATIONS AND DEBATES

Speakers were invited to present feedback from projects and programmes of different sizes. Feedback was thus presented from five different projects: **three in Lebanon, one in Tunisia and one in Algeria.**

Feedback 1 - Solar Electrification of 7 Schools in Beirut

Denis Vigier, an expert from Electriciens sans frontières, presented a project for the installation of solar panels in 6 private schools, completed in Beirut between 2021 and 2023. This project, funded by several different partners, including ADEME, was aimed at sizing and supporting the implementation of these installations in the context of a triple pandemic, economic and energy crisis.

6 photovoltaic power plants with capacities of **50kWp** and **100kWp** were installed in the **6** schools catering for almost **5,300** pupils, more than **1,000** solar panels were installed to supplement the existing generators and connected to the grid. However, the efficiency of the installations varied between **2** and **104%** over the first 6 months, which weakens the profitability of these systems, and is partly explained by the constraints of operation of the generators (which are often too big) due to low availability of the grid.

Feedback 2 – Re-Fit Project for the Renovation of Public Buildings in Lebanon

Jose Antonio Naya, project manager at ICU, an Italian NGO, presented feedback from the RE FIT project, funded by the European Union, for the renovation of public buildings and schools in Lebanon. A certain number of issues, of a technical nature in particular, connected with installations, standards and quality were pointed out, while stressing the importance of combining installations with the pursuit of performance of the buildings themselves (improved insulation, rooves and windows).

Feedback 3 – CLIMAMED Project in Support of Energy and Climate Planning in Lebanese Communities

Oussama Kassamany, Senior Expert Coordinator of the project for the Mashrek region, for his part presented some feedback from the **Clima-MED** project, also funded by the European Union, in support of Climate & Energy planning for Mediterranean communities. For example, within the framework of the SEAP (Sustainable Energy Action Plan) for the Municipality of Baakline (Mount Lebanon, Chouf region, 20,000 inhabitants), the latter built a Solar Micro Station to supply electricity for public lighting in the village. The use of tried and tested technology that meets international standards enabled the reduction of maintenance and operational costs as well as the risk of thefts. Another project for the solar electrification of primary healthcare centres (PHCC) has been put in place, but technical challenges connected with power cuts and load-shedding by Electricité du Liban, which increase needs, prevent solar solutions from being optimised.

Feedback 4 – Projects for the Electrification of Schools by means of Solar Energy in Algeria

Menouer Boughedaoui, senior expert and professor at the University of Blida, for his part presented feedback from Algeria on this issue. Indeed, a pilot programme, managed at the national level, enabled the installation of PV kits for lighting, connected to the grid, and solar water-heaters in 80 primary schools. The lessons learned from this pilot programme are set to fuel the launch of a national programme aimed at reaching all schools by 2030 (19,275 schools). Its significance relates to the issue of mass deployment by means a pilot programme and the mobilisation of funding via the School Fund, the wilayas and the Communal Development Plans. The issue of the existence of trained regional coordinators and technicians at the level of the 48 wilayas was highlighted, as well as the issue of involving and raising awareness among elected members of government and administration and the population in a context of heavy subsidisation of fossil fuels.

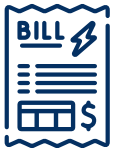
Feedback 5 – ESMES Energy Smart Mediterranean Schools Network Project

Finally, **Houcem Eddine Mechri, university lecturer at ISSAT-Sousse**, presented the recommendations made for ISSAT Sousse, undertaken within the framework of the ESMES (Energy Smart Mediterranean Schools Network) project, funded by the European Union for 5 countries (Italy, Jordan, Lebanon, Tunisia and Spain). The approach was thus intended to be comprehensive: in addition to energy efficiency measures (implementation of a Building Energy Management System, LED lights and renovation of electrical cabinets), a 60kWp PV solar installation was recommended. With a substantial investment cost (almost €500k), this plant will make it possible to cover 40% of needs with a return on investment of 9 years, which may remain prohibitive. It is worthwhile noting that once again the combination of various different measures, both organisational and technical, ultimately enables the improvement of energy performance.

WHY INVEST IN OVERALL RENOVATION OF SCHOOLS AND ENERGY EFFICIENCY OF SCHOOL BUILDINGS?

There is no need to recall that the Construction and Building industry is one of the most energy-intensive and GHG-emitting sectors, and that no reduction in these characteristics is taking place given the phenomena of rapidly-increasing urbanisation in Mediterranean countries. The sector is capable of making a significant contribution to mitigation, from construction to dismantling, since it, in turn, is exposed to the impact of climate change in several different regards. In particular, in towns faced with the increasing intensity of heatwaves, amplified by the so called "urban heat island" effect, energy consumption connected with air conditioning contributes to the increasing burden on municipalities' operating budgets. There are many reasons for this: poorly designed buildings, poor insulation, inefficient facilities and unsuitable uses (opening windows, very low regulation temperatures, etc.).

Within this building stock, schools provide an excellent opportunity for concrete energy transition.
Indeed, beyond the social and health issues to which a particularly vulnerable population such as children is exposed, school buildings come under appreciably clear public project management specifications, both local and national, in property that is entirely at the authorities' disposal, which is subject to regular public investments coming within an approach of an exemplary nature by the State and public authorities.



Reducing bills

Developing markets for renewable energies through massive public demand

Controlling costs

Improving the comfort of schoolchildren and young people

There are numerous arguments for investing in energy efficiency, renewable energies and the renovation of schools from a perspective of both mitigation and adaptation to climate change.

RISING ENERGY COSTS IN FRANCE AND IMPACTS ON LOCAL AND REGIONAL AUTHORITIES

Although the building sector gives rise to **44%** of energy consumption in France, buildings alone represent **75%** of local and regional authorities' energy expenditure. In 2019, schools represented **12%** of public sector energy consumption, and **82%** of the energy consumption of metropolitan municipalities, while their share of real property assets was no greater than **31%**, i.e.

About 135 kWh of final energy per m2, per year.

The "urban heat island" (UHI) effect refers to a "kind of dome of warmer air covering the city", which results in limited night-time cooling compared with the countryside. City temperatures are increased by the urban configuration, architecture, the materials used and the absence of vegetation (Reghezza-Zitt, 2023). The UHI is greater at night, because while the suburbs cool down, buildings and roads release the heat stored during the day.

According to the Assembly of French Departments (Assemblée des départements de France), the observed increases in energy prices have had variable consequences in different French departments with regard to energy expenditure, but they are confirmed, as far as municipalities are concerned, by a survey conducted among its members by the National Federation of local authorities granting concessions for and managing public-sector firms providing public services (FNCCR, Fédération nationale des collectivités concédantes et régies), revealing **an increase in energy expenditure, between 2021 and 2022, of between 30% and 300%.** According to the French association of intermunicipal authorities (Intercommunalités de France), the energy bills of three-quarters of intermunicipal authorities have at least doubled or even quadrupled in the space of a year.

This assessment is corroborated by the Association of Small Towns of France (APVF, Association des petites villes de France) which indicates that this expenditure has **increased by more than 50%** in certain municipalities and in **90% of small towns.** Local and regional authorities have thus been compelled to immediately implement measures to face up to this explosion in energy costs and, consequently, the large and unforeseen increase in their energy expenditure. These measures have for the most part been aimed at reduction of energy consumption:

- **Lowering heating in the winter period**
- **Limitation of lighting**
- **The closing of certain facilities**

such as gymnasiums and swimming pools. **Energy sobriety plans have also been put in place. In October 2022,** the Auvergne-Rhône-Alpes region thus launched an energy sobriety plan for secondary schools, which is divided into thirteen short and medium-term initiatives and concerns all issues: the bringing into general use of contracts with performance clauses, an action plan for sobriety through use, compliance with regulation temperatures, re-equipment with LED lighting, a large-scale plan for massive retrofitting and acceleration of the putting in place of overall public procurement contracts for energy performance.

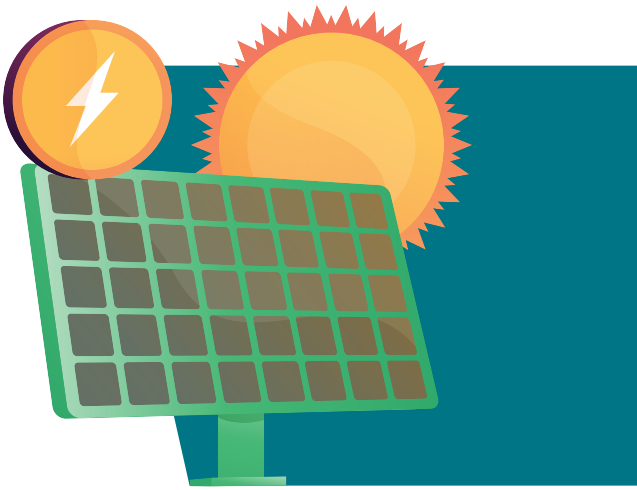
Excerpts – Report to the French Senate on ecological transition with regard to school buildings: https://www.senat.fr/rap/r22-800/r22-8006.html#fn44

Survey every 5 years of the energy expenditure of local and regional authorities in France conducted by ADEME – 2019 summary of 2017 figures - https://librairie.ademe.fr/cadic/495/depenses-energetiques-collectivites_synthese_2019.pdf

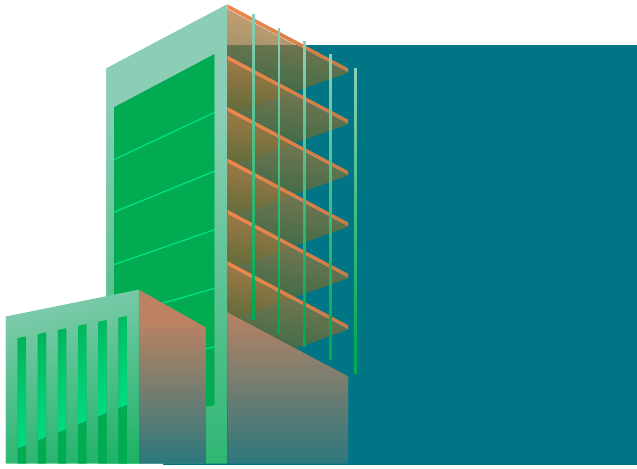
WHAT CHALLENGES ARE WE CONFRONTED WITH?

On the basis of the feedback presented, several challenges appear to be common depending on geographical factors. In the SEMCs (Southern and Eastern Mediterranean countries), **one of the technical and human challenges concerns the quality of the solar panel supply and installation industries.**

Whether with regard to choice of suppliers, available skills, the types of equipment supplied (reliable panels, compliance with standards – for safety in particular, high-quality and correctly configured inverters), or the services provided (installation quality, maintenance and repair services), access to these industries is uneven according to geography and they are organised in various different manners. Apart from problems of supply in a situation of saturation of the world market and shortage of raw materials, the problem of standards of origin and their compatibility in the absence of regulations makes it difficult to put standards in place and above all to implement them effectively. In terms of the use of panels, the challenge of the monitoring of consumption, maintenance and the putting in place of energy management procedures in general appears to be lacking. Finally, the presence of energy managers, renewable energy officers and qualified technicians at the regional level is also one of the challenges posed, in particular with a view to scaling up or deploying large-scale programmes.



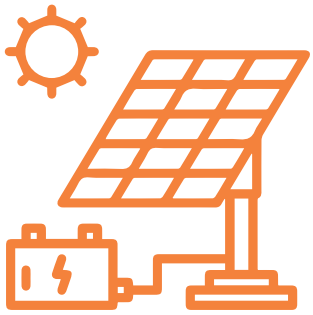
Another challenge lies in the sizing of installations and the technical choices made with regard to whether or not to connect them to the grid. These questions arise in small and medium as well as large towns. In Lebanon, the structural weakness of the grid makes it necessary to operate with generators, in particular in order to maintain the conservation of 20% of rated power, thus reducing the usefulness of the panels in proportion. The use of batteries may be appropriate, but this gives rise to issues of quality, replacement (lifespan of 3 to 5 years) and compatibility (high-quality inverters, etc.), all of which are issues that, in the absence of standards, are liable to have a major impact on the economic relevance of installations of this kind.



This question of the viable economic model, of the profitability of installations of this kind, their costs, the feed-in tariff by the grid, positive and negative externalities such as end-of-life costs of equipment (scrapping campaign, eventual recycling, etc.) is ultimately at the heart of the issues at stake, while only being dealt with in a very marginal manner in the feedback. It may be assumed that the fact that these projects are highly subsidised and have a dimension of exemplarity prevents in-depth reflection on economic models. However, lifecycle assessments could be conducted in order to provide more effective guidance to decision-makers in their technical choices.

Finally, the challenges of **coordination between actors, governance and regulations** are mentioned in the majority of cases. Involvement of the local electricity company upstream, provision of information and eventual consultation with schools, and moreover with pupils' parents, and lastly, it appears essential to adopt procedures at local levels in order to recognise each stakeholder's role and to clarify their responsibilities and obligations.

Although the difficulties connected with the absence of standardisation of equipment are often easily referred to: **stability, safety, compatibility of equipment, higher costs, problems in finding spare parts, repair difficulties, absence of guarantee of end-of-life equipment being taken back, impossibility of upgrades etc.,** it is more difficult to see the consequences of the absence of local procedures and an administrative and regulatory framework. They are nevertheless of equal importance.

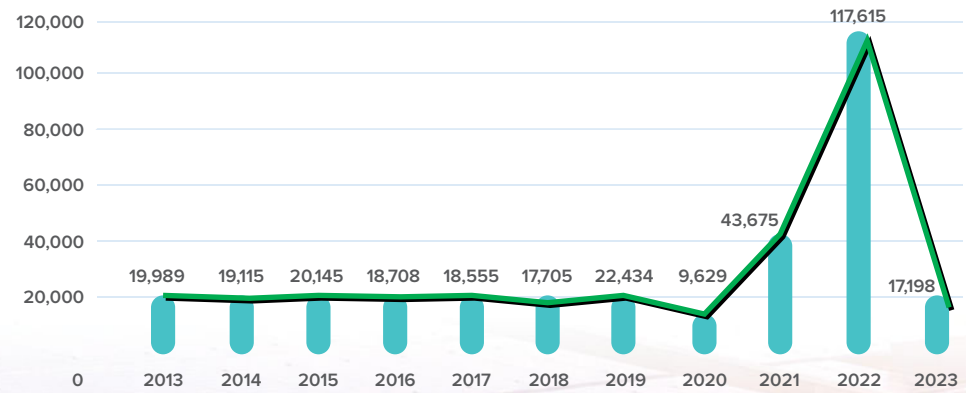


Regulatory changes, the areas of authority and mandates assigned to local and national institutions, whether or not the guidelines for investments provide incentives, the security of these investments (ownership of real estate, obtainment of installation permits, etc.), the procedures for connection to the grid and metering of consumption, not to mention inspections and the awarding of contracts, need to be subject to clear procedures that are known to all, without which it is difficult to deploy the energy transition in an extensive manner.

THE EXPONENTIAL GROWTH OF BATTERIES AND PV PANELS IN LEBANON, WHAT LONG-TERM CONSEQUENCES?

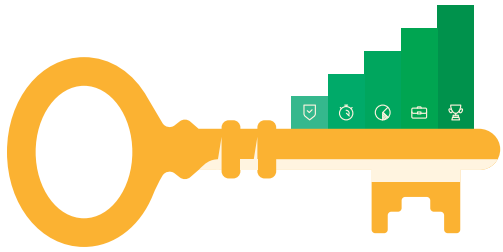
The issue of management of waste electrical and electronic equipment (WEEE) in Lebanon comes within a more general framework of waste management that gives considerable cause for concern in Lebanon, in a situation of urban, demographic (influx of refugees), diplomatic (bombardment in the South) and economic crisis (currency crisis and hyperinflation). After falling sharply due to the pandemic, WEEE imports greatly accelerated in 2022. An exceptional tonnage of more than 82 kT of solar panels were imported in 2022, showing the strength of this growth (as compared with 13 kT in 2021); Batteries are following a similar growth pattern reaching 117 kT in 2022. Although it is more prudent to assess this growth without counting the exceptional year 2022, waste generated in Lebanon is set to reach almost 145 kT of battery-related waste and 30 kT of solar panel waste in 2040.a similar growth reaching 117 kT in 2022. Even if it is more prudent to estimate this growth without counting this exceptional year 2022, battery waste will reach nearly 145 kT and solar panels 30 kT of waste generated in Lebanon in 2040

Batteries Import/Export/POM in Lebanon from 2013 till 2022



Source: Lebanese Customs, 2023

4 KEY MESSAGES



Questioning energy needs through an analysis of relevant energy efficiency measures upstream. The installation of solar equipment requires an energy audit and a needs analysis, which is decisive for the relevance of the technical choices. Beyond the challenges of pure and simple replacement of an energy carrier by renewable energy, it is essential to question one's needs in terms of air conditioning, heating, lighting, water supply, the orientation and envelope of buildings, as well as their uses (IT, technical equipment, etc.) so as to prioritise measures and work in order to optimise energy performance. The massive use of generators, and particularly of sometimes excessively large generators, needs to be called into question before thinking about the installation of solar panels. Investments then need to be prioritised with the adoption of multi-criteria approaches.

Encourage a change in mentality, particularly with regard to "local" and vernacular practices from rural environments and local materials, by adapting them to the requirements of modern urban contexts. To achieve this, it is essential to involve those carrying out research and training of city and building professionals, as well as to strengthen the control of use in households and in public buildings, among other things.

Encourage cross-sectoral thinking and policies (energy, construction, urban planning, education, social affairs, health, etc.) at different levels (buildings, neighbourhoods, cities, policies, behaviour), through dedicated forums for dialogue and consultation involving, in particular, representatives from the professional and private sectors. At sub-national level: support the integration of cooling principles into urban planning (strategic and operational) and strengthen resources (human and financial, as well as regulatory and organisational) of local authorities to steer sustainable urban planning and housing approaches and projects based in particular on community initiatives. Intervention at neighbourhood level requires skills in leadership and social engineering that can be mobilised internally by local authorities or through collaboration in particular with associations.

To finance and support the organisation of a sustainable construction industry by providing appropriate institutional support, access to international financing, an improved regulatory framework, the introduction of incentive tools, the development of public-private partnerships, quality control of equipment and construction, and training for professionals. Setting up local construction channels is a vital link, thereby helping to structure a competitive supply of skills (tradespeople) and materials. Workshops, pilot schemes, professional groups and inter-professional networks are also part of the possible solutions.

YOU HAVE THE INTENTION OF INSTALLING SOLAR PANELS ON YOUR SCHOOLS, ...

1

Ask yourself the right questions

as presented, the technical, economic, regulatory and social challenges depend upon your situation... a proper analysis of these aspects, your needs, consumption, developed sites and climatic conditions will enable you to put a quality project in place...

2

Find support

Contact the Energy Agency in your country or region...they will be able to guide you regarding certified design consultancies, existing regulations, best practices etc.

3

Equip yourself with the proper tools

audits, technical requirements, sizing tools and best practices exist, find out about them. The meetMED project provides a certain number of tools and publications. A few examples:

Financing issues

Discover how to finance work through energy performance contracting

GrassMED Platform

E-learning & Certification process to determine whether you have considered all aspects of your building

PRIORITEE TOOL

measure energy savings to prioritise work

Cooling cities & buildings

Discover solutions for cooling buildings and cities for more resilient schools, passive measures for reducing HVAC needs (Brochure + webinar)

SCHOOLMED TOOL

measure energy savings to prioritise work in your school

Credits

Technical coordination

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