DIDSOLIT-PB: Development and implementation of decentralised solar-energy-related innovative technologies for public buildings in the Mediterranean Basin countries.

Coordinating Institution: BEG-INCERS Research Group – Universitat Autònoma de Barcelona (UAB)

Report 10

SUMMARY of the Project's Main Results

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Partnership:

- UAB, BEG Research Group (Leader), Spain, (Mediterranean Region: Catalonia)

- AEIPLOUS, Greece, (MR: Ditiki-Ellada)

- Egyptian Association for Energy and Environment, EAEE, Egypt (MR: Marsa-Matrouh)

- Balqa Applied University, BAU, Jordan (MR: Al Balqa)

- Alexandria University, AU, Egypt (MR: Alexandria)

- Mediterranean Agronomic Institute of Chania, MAICh, Greece (MR: Crete)

- Eco-System Europa, SL, *EsE*, Spain (MR: Catalonia)

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1. THE PROJECT'S STARTING OVERALL OBJECTIVES

This interdisciplinary development project has been addressed to promote and implement innovative technologies and know-how transfer in the field of decentralised, small scale, solar power systems, that may be integrated in public buildings/premises. All this, to be achieved through cross-border public-private partnerships and in cooperation with organisations from Spain, Greece, Egypt, and Jordan (with special attention to SMEs).

It was designed building upon the general objective stated in the ENPI-CBCMED’s Working Programme 2007-2013, “Definition of policies and promotion of pilot initiatives to support R&D, innovation and technology transfer, with particular attention to SMEs, in the field of Solar energy”, (call for Strategic Projects, 05/05/2011, priority 2, 3rd. topic). A general objective which was developed in the corresponding Programme’s Guidelines as: “Promotion and implementation of innovative technologies and know-how transfer in the field of solar energy, including that stemming from the private sector and especially from SMEs, and that may be implemented in particular in public facilities through public procurement processes”.

As a specific implementation of that, our Project was focussed on solar technologies that:

1) were already available in the market, even though they may be in a pre/first-commercial stage; and

2) for which warm weather conditions (as the usual ones in the Mediterranean Basin countries) is not an inconvenient for the system’s performance (as it happens to some extent regarding standard photovoltaic modules) but even an advantage.

These innovative technologies we focused on –because they show a huge potential in the Mediterranean climate- are:

- Solar thermoelectric generation: Small-scale dish-Stirling systems,
- Solar thermoelectric generation: Small-scale parabolic-trough systems.
- PV glass-substitute, semi-transparent (pergolas, skylights, brise-soleils, façade uses)
- PV thin-layer, flexible sheets (for buildings' curved surfaces)
- Solar-cooling & heating systems, with a cycle starting at higher than usual temperature.

That is, three Concentrated Solar Power (CSP) technologies, and two non-standard photovoltaic technologies, for substituting standard building materials: Building integrated photovoltaics (BIPV).

By promoting the distributed generation in public buildings, the particular needs and constrains involved in the generation of solar power that this project has addressed regarding the countries involved were:

- Energy security supply,
- Foreign trade balance (reducing foreign dependence/ reduction of oil imports), and
- Environment sustainability: reduction of GHG emissions, by reducing the consumption of fossil fuels as energy source.

The main point on these needs/constrains are problems sourcing from the increasing primary energy demand in the Mediterranean basin (forecasted to increase of 70% over the next 15 years), which at least arises concerns on the security of energy supply. The increasing energy use/demand is particularly stemming from final consumption in buildings, more than industry or transport. Thus, over 40% of the EU-25 final energy use is consumed in buildings (residential and commercial), more than by industry or transport. And the proportion in the South Mediterranean countries is even higher.

More specifically, regarding electricity production, Spain and Greece are mostly dependent on fossil-fuel imports. And in the case of Jordan about 96% of the energy consumed also relies on imports. And although Egypt is currently producing a large part of the oil and gas it consumes, the observed trends in electricity consumption points clearly towards an increasing dependence on fuel imports.

Thus, to make contributions in this line, the above overall objective of the project was deployed through the following four specific objectives:

a. To substantially increase the knowledge on the potential, state-of-development, and environment sustainability contribution of the above-mentioned five solar-power technologies, for decentralised, small scale applications in buildings/facilities, in relation to the regions and countries included in the project.

b. To develop an up-dated assessment of these technologies for in-public-buildings applications: models/options mapping and trends; comparative social cost-benefit when applied to the climate conditions of the target countries/regions.

c. To promote, **undertake**, and encourage in the partner target regions the implementation of a given number of solar-energy decentralised systems (specific applications of those of the five innovative technologies selected that appeared as better options from the above assessment) to be integrated in public buildings/premises[1] by private and public stakeholders[2].

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[1]Building roofs, frontages; car parks' shady-covers, and small land plots within those public premises.

[2]The backbone idea in that core point is that these pilot-demonstration installations will be set up with the participation of temporary associations (consortiums) of SMEs (engineering/ consulting firms, installation firms, parts & other components suppliers, etc.) from both EU countries and MPC, working together either in EU locations (Spain and Greece) or MPC locations (Egypt and Jordan). This joint-team approach is, among other things, a clear way for an effective know-how and technology transfer between the two Mediterranean Basin shores.

d. According to the practical and field experiences resulting from the above, and previous studies on the status of the issue in the four countries involved, to make recommendations to Governments and stakeholders regarding:

1) policies, regulatory framework and administrative procedures regarding decentralised solar-power applications, such as the ones carried out within the project, and

2) financing dedicated mechanisms that would facilitate the deployment of such solar-power systems.

Objective ‘c’ was especially made specifically in terms of targets regarding the number of public buildings that would be the purpose of the project’s innovative solar-power installations, as well as of the expected power installed and the annual kWh of electricity resulting from these applications, and the reduction in GHG emissions.

In the following sections of this report you can see from the set of achievements presented that the project has satisfactorily fulfilled the above four planned objectives.

2. ACHIEVEMENTS IN TERMS OF KNOWLEDGE INCREASE & TRANSFER

2.1 On the possibilities, advantages and constraints of CSP technologies for power-generation, in public building applications

The application of the two selected Concentrated Solar Power technologies –***Dish Stirling***, and ***Parabolic trough***- for decentralised, in-building systems have clearly a huge potential for Mediterranean countries' climate conditions. These technologies were already in the market at the start of the project, though in a pre-commercial stage, at least for small-scale applications. Thus, for example, dish-Stirling technology has been on the market for approximately fifteen years, showing promising cost/yield ratios; but just for rather big, power-plant type systems. Most of the systems in operation were, and are, dishes with a diameter of around 9.5 metres. Therefore, the project's aim in this point was to innovate by assessing the possibilities and features of scale-down systems, suitable for in-building/premises applications. Thus, in the case of Dish-Stirling technology, it would require lower-scale versions, in the range of a 2-3.5 mts diameter, either if we think it be to be placed in a building's flat roof or on a small plot of land of the premises. As in the case of Parabolic Trough generators, troughs could be, for example, 10-20 mts. Large, but should not be higher than 2-2.5 mts.

So, the objective undertaken by the Project Technical Team (PTT) in that field of CSP technologies was to assess the technical and economic viability of scale-down models, as well as to develop conceptual designs for then being implemented in specific public buildings.

In order to better achieve that, *the UAB-PP6 Technical Team*, (BTT) reinforced its work by outsourcing studies with European technological centres and high-tech companies with a leading engineering and innovation profile in the electrical & industrial mixed field. For preparing that commitment, previously the BTT elaborated a *State of the Art* and a *market exploratory study* regarding scale-down models for the two referred CSP technologies.

This collaboration with the technological Centres implied the BTT engaging in a fruitful joint work with them; which also derived in a two-way transfer of knowledge. These outsourced high-tech services also included the installation and testing of a prototype with a 3.5 mts. diameter Dish-Stirling (3 $kW_{thermal}$ + 1 $kW_{electrical}$), which allows both for a technical and economic evaluation of the scale-down technology, and for designing a conceptual design to be applied in the actions to be subsequently implemented by the Project's partners.

The corresponding outcomes in terms of knowledge increase & transfer, organised and prepared by the BTT, can be found summarised in the following final reports which are already available:

-**Report 1, "***Technical assessment and Viability Study of scale-down* Dish Stirling (DS) *technology for power generation in the Mediterranean Regions*.

- **Report 2**, "*Technical assessment and viability study of scale-down Parabolic trough (PT) technology for power generation in the Mediterranean Regions"*.

It must be pointed out that one of the conclusions in Report 2 was that there is no market availability for turbines small enough for the size of a PT installation that we were considering in our project (<25 kW). This conclusion leads us to discard the PT technology for power generation in our project. However the study also showed that PT technology could be a very good option for feeding a solar-cooling system.

2.2 On the application of small-scale Parabolic-Trough elements as feeding-unit for Solar-Cooling systems

As stated in the starting project objectives, the deployment of solar-cooling installations appears as especially promising for the highly sunny Mediterranean Regions. And it is a technological option that is clearly promoted (innovation and market deployment) in several lines of European programmes as FP7, now Horizon20, or ENPI –now ENI.

Again, solar-cooling systems (especially those based on 'absorption' machines) have been on the market for approximately 20 years; and in that case especially for in-building applications. However, as our Sate of the Art surveys have also confirmed, it is a fact that this technological option has not got the market spread that could be expected, not only at European but also at an international level. This suggests that there were some technical or/and economic constraints for its full development. So, in that case our project aim consisted in assessing the innovation of using Parabolic Trough units as solar field for feeding the conventional solar-cooling equipments available in the market (mainly *absorption chillers*). More specifically, our objective was to assess the possibilities of getting a higher overall efficiency of the already available 'chillers machines' by making their thermal cycle start at higher than usual temperature (double-effect machines).

Again, in that phase our BTT was supported by outsourced high-tech services from the above-mentioned technological centres; this collaboration implying that the BTT engaged in a joint work with them. These contracted services also included the installation and testing of a prototype Parabolic-Trough-Solar-Cooling-and-Heating system (PT-SCH); which allows both for a technical and economic evaluation and for designing a conceptual design to be applied in the applications to be then carried out by the Project's partners.

Gathering all those material produced, the initial State-of-The Art on solar-cooling included, the BTT summarised the knowledge increase & transfer on the 'Solar cooling by parabolic trough technology' in the following final publication:

- **Report 3**: *"Technical assessment and viability study of applying Parabolic Trough technology to feed a Solar-Cooling-Heating system (PT-SCH) in the Mediterranean Regions".*

2.3 Knowledge updating & transfer on photovoltaic technologies for building integrated applications

Regarding the other two selected innovative technologies,

- PV glass-substitute, semi-transparent (pergolas, skylights, brise-soleils, façade uses)
- PV thin-layer, flexible sheets (for building's curved surfaces)

The relevant issue is, as it is in general with those non-standard photovoltaic options which may be easily used as substitutes of 'passive' building-materials, that the trend of innovations has seen an acceleration throughout the last years; and at present. The changes are mostly in the line of quick improvement in efficiency ratios and reduction in cost per kWp. Thisimpulse is mainly driven by:

a) The decrease of the PV-module production costs.
b) The EE and RE directives that boost the energy autonomy of the buildings, through energy efficiency and renewable energy production.
c) Increasing sensibility and skills of the building designers and engineers on Renewable Energy system-integration into the building envelope.
d) The emergence of new photovoltaic compounds.

Thus, in that case, the assessment workof technologies has involved our BTT carrying out a*State-of-the-Art* (SoA) on the building-integrated photovoltaic technologies and options (BIPV) that are either commercially available at present commercial or in a pre-commercial stage. And then, working on that, to choose three specific BIPV options, and define an overall conceptual design for the BIPV installations to be carried out by project Partners in specific analysed public buildings/premises.

This *SoA* exploratory market study for the three selected BIPV technologies, and the overall conceptual design for specific BIPV installations has been summarised in the final publication,

- **Report 4:***"BIPV (Building-Integrated Photovoltaics): Technical Assessment and overall Conceptual Design for the applications".*

2.4 Survey updating on costs and cost-viability of the selected technologies

Several market studies on costs and respective yields (energy-efficiency ratios) for Dish-Stirling, Solar Cooling based on Parabolic Trough, and three BIPV options have been carried out, producing an important package of economic knowledge to draw conclusions on:

1) comparative economic viability of the respective technologies, and

2) costs forecast for the different solar-systems finally planned to be carried out by Partners.

These studies and conclusions have been summarised in the final publication:

- **Report 5:** "Comparative costs-analysis for the selected innovative solar technologies".

2.5 Knowledge transfer:

The knowledge transfers and the promotion of the Solar systems and the Project activities have been carried out through a wide range of strategies.

- **Expected impact by the end of the project**
  - Solar applications daily operation (O&M involvement, visibility, users' awareness)
  - 20 public buildings with pilot solar applications (initial target 10 buildings)
  - 276 kW of installed solar power
  - More than 435,210 KWh of electric output annually
  - Reduction of about 231 T of CO_2 emissions per year (about 5,147 T end life)
  - 2 M€ of economical savings during the systems' lifespan.

- **Quantified target groups and population involved**
  - About **600 stakeholders involved**
  - Over **50,000 users and visitors** are expected to benefit from this
  - Thanks to **public ownership** of the buildings:
  - Universities and research centres, schools, hospitals, regional governments, administrative buildings…

- **Trainings in BIPV and CSP:**
  - Over 50 attendants
  - Collaboration of research centres and enterprises of the solar sector.

- **7 Technical Team meetings** (Spain, Greece, Jordan and Egypt)

- **Capitalisation events:**
  - Over 700 attendants to12 open conferences held in Spain, Greece, Egypt and Jordan

- **Solar applications daily operation**

- **Synergies with other initiatives or projects**
  - ENPI Solar Cluster (involving all the ENPI CBCMED Strategic Project 2013-2015)
  - "Catalan Strategy for energy renovation of buildings"
    (MARIE-Med Project, Generalitat de Catalunya, 47 institutions)
  - Linked to the selected buildings and their owners' commitment:

- "Green@hospital", (Hospital de Mollet),
-"Energy efficient urban block, Barcelona" (Agència Cat. Habitatge- RELS, MARIE Projects)

- **Local/International Agreements**
  - **6 Consortiums** involving **24 SMEs** from 7 countries.
  - Agreements with the **owners of the public buildings (11)**.
  - Long-term **commitment with the systems' O&M**.
  - **Online monitoring platform.**

- **Transferred good practices**
  - **Technical, economic and administrative reports**
  - More than **13 tender procedures, > 50 SMEs involved**.
  - Synergies and cross-border cooperation > boost future initiatives

3. INNOVATIVE SOLAR-POWER APPLICATIONS CARRIED OUT

In a first step of the project we analysed several public buildings in each of the seven Mediterranean Regions covered by the partnership: Ditiki-Elade (*Patras*) and Crete (Greece), Alexandria and Marsa-Matrouh (Egypt), Al-Salt and Irbid (Jordan) and Catalonia (Spain). And in a second step, some of these buildings were pre-selected by the PTT for being studied as candidates for receiving defined solar-power applications, according to the conceptual designs referred to in the previous section, and more properly gathered in ***Report 6***.

This criterion was used firstly to choose the public buildings to be analysed (finally, 48) and secondly to decide the pre-selected ones (finally, 34), their relevant features, and which type of solar-power installations were pre-planned for each one. This can be found in final ***Report 7***, *"Public buildings analysed and pre-selected in each Partner's Region"*.

In a third step, 18 out of the 34 pre-selected public buildings were proposed by the PTT to actually be selected, and so approved by the Project Management Board. And then, specific conceptual designs for the solar-power systems to be installed in each of these 18 buildings were prepared by the PTT. Thus, the result defined the action plan for the solar-power applications to be carried out by the respective Partners. This action plan, a central piece of our project, has been summarised in the final ***Report 8***, *"Public Buildings selected, and Solar installations to undertake in them (conceptual designs)"*.

As it could be expected for any action plan, several unforeseen events occurred throughout the implementation of this plan and also new issues arose, implying that that the solar-power applications that were actually carried out were not exactly what was previously planned.

After the implementation process, it was decided to include the 2 "CSP Pilot Projects: Dish Stirling and Parabolic Trough". These two pilots, were initially part of the WP4, and were therefore only intended to be tests for the future applications. However, they were finally successfully connected to the buildings and, therefore, considered to increase the number of buildings, from 18 to 20.

However, the overall objectives in terms of number of buildings/applications and power-to-be-generated have been fulfilled, as it can be seen in the following summary:

Number of public buildings involved[#]

Mediterranean Region	Country	Partners	Public buildings Studied		Public buildings Pre-selected		Public buildings Selected for project Actions	
			Internally assigned Target	Achieved	Internally assigned Target	Achieved	Internally assigned Target	Achieved
Ditiki-Ellada	**Greece**	**PP1**	4	4	3	3	1	1
Marsa-Matrouh	**Egypt**	**PP2**	14	14	9	9	3	4
Al-Salt and Irbid	**Jordan**	**PP3**	14	14	9	9	3	5
Alexandria	**Egypt**	**PP4**	8	8	5	5	2	3
Crete	**Greece**	**PP5**	3	3	2	3	1	1
Catalonia	**Spain**	**BEN + PP6**	5	5*	4	5*	2	4+2**
		Total	**48**	**48**	**32**	**34***	**12**	**18+2***

#: The targets were:
- Number of Public buildings involved in project's studies, 40
- Number of pre-selected (pre-defining would-be solar systems to install in them), 30
- Public buildings finally selected, and solar systems to install: target, 10

** One more was added afterwards; ** Two more were added afterwards*

Innovative Solar Power Systems installed

Mediterranean Region	Country	Partners	N. of solar systems		SUA *		POWER CAPACITY (KwP)		
			Final planned Target**	Achieved	Internally assigned Target	Achieved	Internal assigned Target (kWp) initially	Internal assigned Target (kWp) Reviewed (**)	Achieved
Ditiki-Ellada	**Greece**	**PP1**	2	2	1.5	1.59	19.8	21.-	**21.-**
Marsa-Matrouh	**Egypt**	**PP2**	4	4	6	6.00	79.2	79.4	**79.2**
Al-Salt and Irbid	**Jordan**	**PP3**	6	5	6	6.37	79.2	88.7	**84.1**
Alexandria	**Egypt**	**PP4**	4	3	3	2.23	39.6	39.6	**29.5**
Crete	**Greece**	**PP5**	2	3	1	1.05	13.2	13.8	**13.9**
Catalonia	**Spain**	**BEN +PP6**	4	7	2.5	3.65	33.-	33.-	**48.2**
		Total	**22**	**24**	**22**	**24**	**264.-**	**275.4**	**275.9**

#: The targets were:
- Total power to install, in terms of Standard Unit Applications (SUA), 20; (= 264 kWp)
- Solar-power systems (applications) to implement: at least one per building/premise selected: 10
(*) 1 SUA = 13,2 kWp;

(**) Resulting from the conceptual designs elaborated for the 18 finally selected buildings. That is, finally more than one solar-power system was planned for some given buildings/premises

Given the relevance of this point, a description of the innovative solar-power applications actually carried out and in which buildings is summarised as follows in this section. The table numbers (1 to 20) denote the buildings or premises. The total number of solar systems installed are, however, 24, since some buildings host more than one solar-power system. A complete description of the 24 applications, with full technical and economic details, can be also found in **Report 9**, *"Innovative Solar-Power Application carried out".*

Installed power:

24 different systems have been implemented, with a total amount of installed power over 275.9 kW.

Partner	275.4 kWp	24 systems	% kWp	% budget
BIPV	**246.3**	**21**	**89.4%**	**88.7%**
Crystalline	193.4	14	70.1%	
Thin Film	32.2	3	11.7%	
Thin Film flex	25.2	4	9.1%	
Dish Stirling	**8**	**2**	**2.9%**	**6.3%**
Parabolic Trough-SCH	**17.1**	**1**	**6.2%**	**5.1%**

Type of applications:

Depending on the building's interaction, there is a range of type of applications:

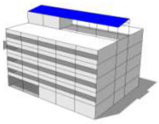
Type of application	Installed power (kWp)	No. systems (24)
BIPV		**21**
Pergola (outdoors)	134.9 kWp	10
Canopy/ brise-soleil (façade)	60.2 kWp	4
Skylight (building interaction)	38.1 kWp	5
Roof integrated (flex TF)	17.6 kWp	3
Dish Stirling		**1**
DS ground mounted	4	1
DS roof mounted	4	1
Parabolic Trough-SCH (roof)	17,1	**1**

(1) Patras Science Park (Ministry of Economics, AEIPLOUS)

Building data

- Location: **Platani, Patras, Greece**
- Ownership: **Ministry of Finance**
- Use: **offices, laboratories**
- Building surface: **4,684 m² (approx.)**
- Electricity consumption: **484,594 kWh (approx.)**

Solar Energy System



- System application: **BIPV integration Car shelter &Skylight**
- PV module technology: **semi-transparent_glass-laminated crystalline modules**
- Installed power: **21 kWp**
- Electricity production: **28,000 kWh/year (approx.)**
- Estimated surface: **200 m²**

Objectives & Opportunities

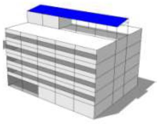
- The building has an excellent public visibility due to the constant flow of visitors: students, scientists and businessmen.
- The roof terrace, already has a public use, that might be stimulated with the new shadowed area. The installation may improve thermal comfort in summer time providing a pleasant level of natural light.
- Solar parking lots are expected to draw enormous attention by the visitors due to the appearance and the utility of the application. It is expected to drive into the implementation of numerous similar applications.
- Local authorities will be familiarized with dealing and licensing similar applications facilitating the expansion of the sector.

(2) Matrouh Governorate Building (Governorate of Matrouh, EAEE)

Building data

• Location:	**El Cornish Street, Matrouh**
• Ownership:	**Matrouh Governorate**
• Use:	**Administrative Services**
• Building surface:	**3,200 m² (approx.)**
• Electricity consumption:	**389,019 kWh (approx.)**

Solar Energy System



• System application:	**BIPV integration, Pergola**
• PV module technology:	**semi-transparent glass-laminated crystalline modules**
• Installed power:	**44.2 kWp**
• Electricity production:	**73,283 kWh/year (approx.)**
• Estimated surface:	**560 m² (1150 m² total roof area)**

Objectives & Opportunities

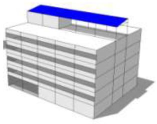
- The BIPV pergola provides a new shaded area in the roof surface.
- A great Visibility and Dissemination expectation, the building is a public building located in the city centre around a big community.
- Great dissemination of the BIPV technology thanks to the integration into the media and local press. operation of the system will give the visitors the opportunity to increase their awareness of the importance of solar energy.
- Local SMEs active in the field of RE will get experience from the operation of these innovative solar technologies and will be able to support them in the future.
- Various local stakeholders will be informed through seminars and newsletters about these innovative solar technologies and their possible future uses.

(3) M.E.I.L.S School Building (Governorate of Matrouh, EAEE)

Building data

- Location: **El Cornish Street, Matrouh**
- Ownership: **Governorate of Matrouh**
- Use: **Offices, labs**
- Building surface: **3,784 m² (approx.)**
- Electricity consumption: **23,623 kWh (approx.)**

Solar Energy System



- System application: **BIPV integration, Pergola**
- PV module technology: **semi-transparent glass-laminated crystalline modules**
- Installed power: **5 kWp**
- Electricity production: **8,290 kWh/year (approx.)**
- Estimated surface: **44 m²**

Objectives & Opportunities

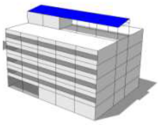
- The BIPV pergola provides a new shaded area in the school play yard.
- The operation of the system will give the opportunity to students to increase their awareness of the importance of solar energy
- The installation and operation of the systems will give the opportunity to post graduate students to do research and write dissertations about these technologies.
- Various local schools and stakeholders will be informed through seminars and newsletters about these innovative solar technologies and their possible future uses.

(4) Matrouh general hospital (Governorate of Matrouh, EAEE)

Building data

- Location: **Alexandria Street, Matrouh**
- Ownership: **Governorate of Matrouh**
- Use: **Health care centre**
- Building surface: **11,520 m² (approx.)**
- Electricity consumption: **978,276 kWh (approx.)**

Solar Energy System



- System application: **BIPV integration, Pergola**
- PV module technology: **semi-transparent glass-laminated a-Si thin film modules**
- Installed power: **20 kWp**
- Electricity production: **33,160 kWh/year (approx.)**
- Estimated surface: **318 m²**

Objectives & Opportunities

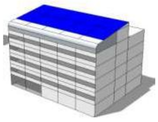
- The roof surface and orientation are suitable and a primary substructure as pergolas.
- The BIPV pergola provides a High public visibility and a new shaded area in the roof surface.
- Great dissemination of the BIPV technology thanks to the exposure in the press and media.
- The operation of the system will give the visitors the opportunity to increase their awareness of the importance of solar energy.

(5) Culture Center (Governorate of Matrouh, EAEE)

Building data

- Location: **El Cornish Street, Matrouh**
- Ownership: **Governorate of Matrouh**
- Use: **Culture center**
- Building surface: **1,300 m² (approx.)**
- Electricity consumption: **The library will be inaugurated 2014**

Solar Energy System

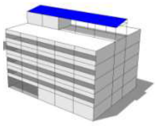


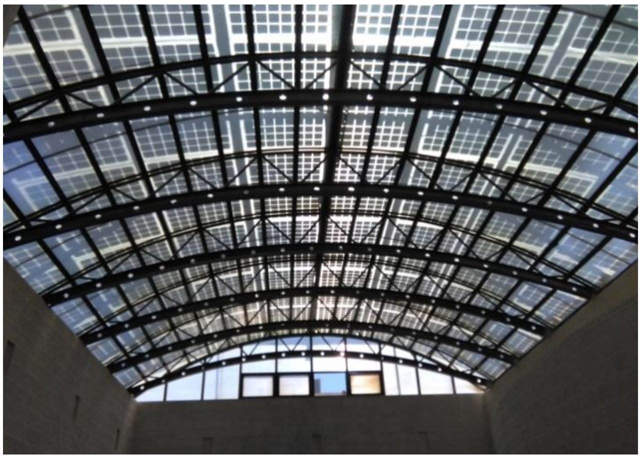
- System application: **BIPV integration, Pergola**
- PV module technology: **ETFE laminated flexible thin film (a-Si) modules**
- Installed power: **10 kWp**
- Electricity production: **16,586 kWh/year (approx.)**
- Estimated surface: **160 m²**

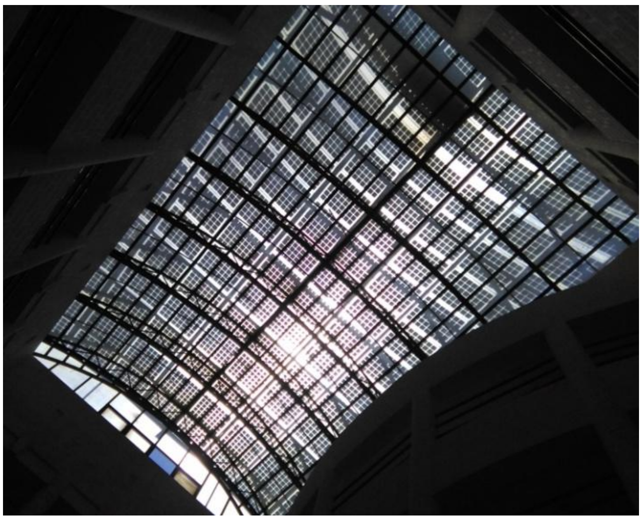
Objectives & Opportunities

- The building permanent loads still not identified as the library will be officially inaugurated on Sept 2014
- The roof surface and orientation are suitable and a primary substructure as steel sheet is required which will be covered by 74 units of flexible thin film modules (5.4 x 0.4m) .
- Local SMEs active in the field of RES will get experience from the operation of these innovative solar technologies and will be able to support them in the future.

(6) Science building and Engineering workshop (Al-Balqa Applied University, BAU)

Building data	• Location:	**BAU campus in Al-Salt, Jordan**	
	• Ownership:	**BAU university**	
	• Use:	**offices, classrooms, laboratories, Workshop**	
	• Building surface:	**6,755 m² (approx.)**	
	• Electricity consumption:	**526,890 kWh (approx.)**	
Solar Energy System 	• System application:	**BIPV integration, Skylight**	
	• PV module technology:	**semi-transparent glass-laminated crystalline modules**	
	• Installed power:	**26,6 kWp**	
	• Electricity production:	**42,040 kWh/year (approx.)**	
	• Estimated surface:	**207.8 m²**	
Objectives & Opportunities	• The building has an excellent visibility in the campus. University community and external visitors will be able to learn from the experience. • The roof presents different orientations and inclinations that can be optimized with a proper design, control and management system. • New semi-transparent PV modules will optimize the solar gains, improving the thermal comfort in summer time, and maintaining a good level of natural light in the building court.		



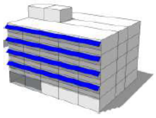


(7) Finance Building (Al-Balqa Applied University, BAU)

Building data

- Location: **BAU campus in Al-Salt, Jordan**
- Ownership: **BAU university**
- Use: **offices,**
- Building surface: **4000 m² (approx.)**
- Electricity consumption: **240,000 kWh (approx.)**

Solar Energy System



- System application: **BIPV integration, façade brise-soleil**
- PV module technology: **semi-transparent glass-laminated crystalline modules**
- Installed power: **24,48 kWp**
- Electricity production: **38,689 kWh/year (approx.)**
- Estimated surface: **191.4 m²**

Objectives & Opportunities

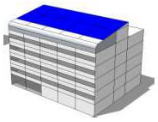
- The building has an excellent visibility in the campus and from outside as it is close to the ring road. University community, external visitors and local community will be able to learn from the experience.
- The building is Grid connected and thus there will be no waste at weekend and holidays
- The owner has local expertise in PV installation and maintenance

(8) Engineering Workshop (Al-Huson University College, HUC)

Building data

- Location: **HUC campus in Irbid, Jordan**
- Ownership: **HUC**
- Use: **offices, classrooms, Workshop**
- Building surface: **1300 m² (approx.)**
- Electricity consumption: **108,000 kWh (approx.)**

Solar Energy System



- System application: **BIPV integration, thin film**
- PV module technology: **ETFE laminated flexible thin film (a-Si)**
- Installed power: **3.5 kWp**
- Electricity production: **5,532 kWh/year (approx.)**
- Estimated surface: **24.25 m²**

Objectives & Opportunities

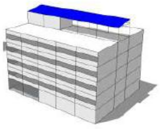
- The building has an excellent visibility in the campus. The technical community college students and external visitors will be able to learn from the experience.
- The college is the only academic institute in Jordan who teaches a Solar Technology program and thus it would be a great opportunity for students to practice and study such a technology.

(9) Bairooni Building (Al-Huson University College, HUC)

Building data

- Location: **HUC campus in Irbid, Jordan**
- Ownership: **HUC**
- Use: **offices, classrooms,** labs, restaurant
- Building surface: **3,300 m² (approx.)**
- Electricity consumption: **202,800 kWh (approx.)**

Solar Energy System



- System application: **BIPV integration, ground pergola**
- PV module technology: **semi-transparent glass-laminated crystalline modules**
- Installed power: **21.1 kWp**
- Electricity production: **33,348 kWh/year (approx.)**
- Estimated surface: **165 m²**

Objectives & Opportunities

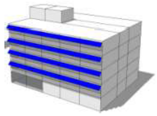
- The building is a new building and the system is located at high student and staff traffic and also it is close to a mosque and thus it has an excellent visibility in the campus. University community and external visitors will be able to learn from the experience.
- The system will have great educational benefit for solar student who are studying at HUC Campus.

(10) Main building (Al-Huson University College, HUC)

Building data

- Location: **HUC campus in Irbid, Jordan**
- Ownership: **HUC**
- Use: **offices, classrooms,** labs
- Building surface: **8,500 m² (approx.)**
- Electricity consumption: **527,000 kWh (approx.)**

Solar Energy System

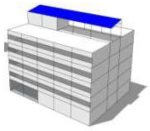


- System application: **BIPV integration, façade brise-soleil**
- PV module technology: **semi-transparent_glass-laminated crystalline modules**
- Installed power: **8.44 kWp**
- Electricity production: **13.339 kWh/year (approx.)**
- Estimated surface: **66 m²**

Objectives & Opportunities

- The building is located infront of the student registration department and so it has an excellent visibility to students, parents and external visitors who will be able to learn from the experience.
- The building is facing south with no obstacles and this it has an excellent orientation and it will be a great example for building integration systems.

(11) Faculty of Science, (Alexandria University, AU)

Building data	• Location:	**Moharam Bek Campus, Alexandria, Egypt**	
	• Ownership:	**Alexandria University**	
	• Use:	**Offices, classrooms, laboratories, playgrounds**	
	• Building surface:	**14,965 m²**	
	• Electricity consumption:	**579,744 kWh (annual approx.)**	
Solar Energy System 	• System application:	**BIPV, garden pergolas**	
	• PV module technology:	**semi-transparent glass-laminated thin film**	
	• Installed power:	**8.1**	
	• Electricity production:	**15,951 kWh/year (approx.)**	
	• Estimated surface:	**130 m² (approx.)**	

Objectives & Opportunities

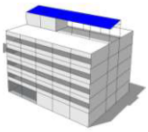
- The pergola to be constructed in a location with excellent visibility inside the campus.
- The pergola will be designed to face south with suitable inclination to maximize the output generated electricity.
- New semi-transparent PV modules will enable a good level of sunlight for a magnificent pergola design to be used as a cafeteria area in summer and winter for students and faculty staff.
- University community and external visitors will be able to learn from the experience.

(12) Administration building, Faculty of Science, (Alexandria University, AU)

Building data

- Location: **Moharam BekCampus, Alexandria, Egypt**
- Ownership: **Alexandria University**
- Use: **Offices, classrooms, laboratories**
- Building surface: **5,850 m²**
- Electricity consumption: **208,494 kWh (annual approx.)**

Solar Energy System



- System application: **BIPV roof pergola**
- Technology: **Flexible thin film**
- Installed power: **4.08 kWp**
- Electricity production: **7,325 kWh/year (approx.)**
- Estimated surface: **66 m² (approx.)**

Objectives & Opportunities

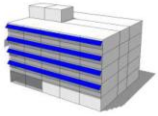
- The pergola is constructed in a location with excellent visibility inside the campus.
- The roof pergola was intended to be used to shade the chiller of SHC system (finally not executed in the framework of the Project, due to logistic and administrative issues)
- The flexible thin film BIPV installation is new to Egypt.
- University community and external visitors will be able to learn from the experience.

(13) Building "A", Faculty of Science, (Alexandria University, AU)

Building data

- Location: **El-Shatby Campus, Alexandria, Egypt**
- Ownership: **Alexandria University**
- Use: **Offices, classrooms, laboratories**
- Building surface: **8,190m²**
- Electricity consumption: **342,833 kWh (annual approx.)**

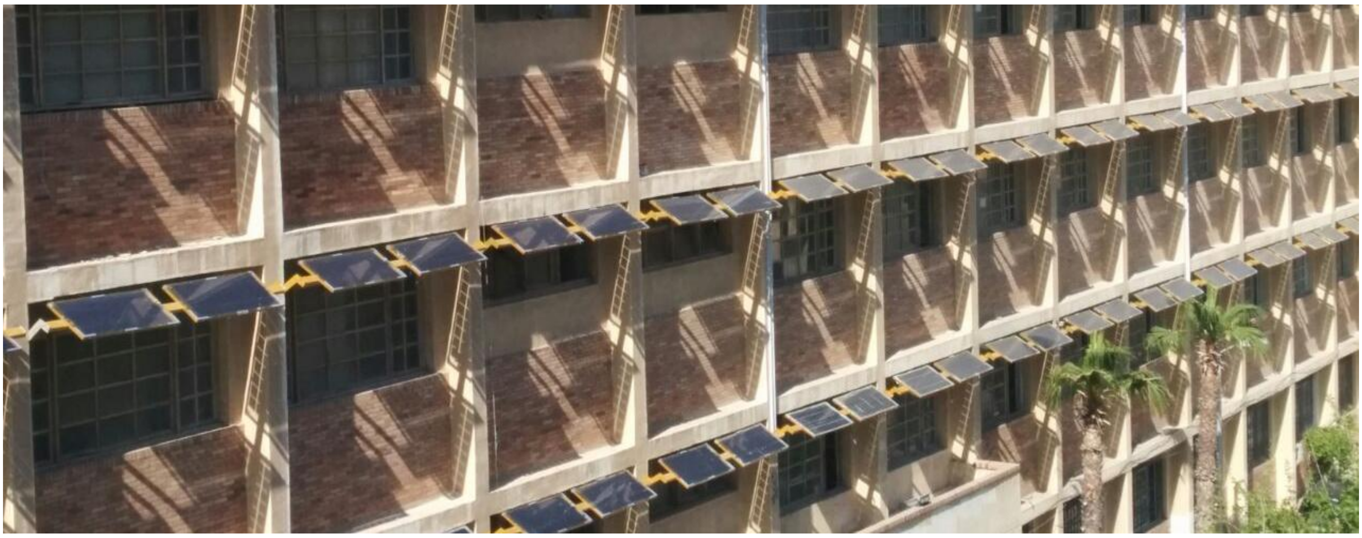
Solar Energy System



- System application: **BIPV façade brise-soleil**
- Technology: **semi-transparent glass-laminated crystalline modules**
- Installed power: **17.28 kWp**
- Electricity production: **26,858 kWh/year (approx.)**
- Estimated surface: **150 m² (approx.)**

Objectives & Opportunities

- The façade brise-soleil modules will be visible almost from any location inside the campus.
- The facade brise-soleil BIPV installation is new to Egypt.
- The modules will face SE direction at inclination of 30°which will allow high efficiency of electricity production.
- New semi-transparent PV modules will shade building windows from direct sunlight while maintaining a good level of natural light inside the building.
- University community and external visitors will be able to learn from the experience.

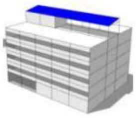


(14) MAICh campus, Conference Centre (MAICh, Chania)

Building data

- Location: **MAICH campus in CHANIA, GR**
- Ownership: **GREEK MINISTRY OF RURAL DEVELOPMENT AND FOOD**
- Use: **CONFERENCE CENTRE**
- Building surface: **11,200 m² (approx.)**
- Electricity consumption: **965,200 kWh (approx.)**

Solar Energy System



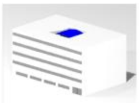
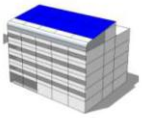
- System application: **BIPV integration, Skylight**
- PV module technology: **Glass laminated, Thin Film, a-Si**
- Installed power: **4.1 KWp**
- Electricity production: **6,000 kWh/y (approx.)**
- Estimated surface **86.4 m²**

- System application **BIPV integration, Pergolas (2)**
- PV module technology **Glass-laminated monocrystalline**
- Installed power: **5 kWp + 4.9 kWp**
- Electricity production: **7,500 + 7,200 kWh/y(approx.)**
- Estimated surface: **41 m² + 44 m²**

Objectives & Opportunities

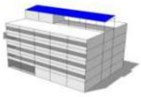
- The building has an excellent visibility in the campus. University community and external visitors will be able to learn from the experience.
- The roof presents different orientations and inclinations that can be optimized with a proper design, control and management system.
- New semi-transparent PV modules will optimize the solar gains, improving the thermal comfort in summer time, and maintaining a good level of natural light in the building court.

(15) Housing Agency of Catalonia(Government of Catalonia, EsE-UAB)

Building data	• Location:	**Barcelona, Spain**	
	• Ownership:	**Government of Catalonia**	
	• Use:	**Offices**	
	• Building surface:	**5,328 m² (approx.)**	
	• Electricity consumption:	**680,549 kWh/y (approx.)**	
Solar Energy System 	• System application:	**BIPV integration, Skylight**	
	• PV module technology:	**Semi-transparent Glass Crystalline**	
	• Installed power:	**1.91 kWp**	
	• Electricity production:	**1,884 kWh/year (approx.)**	
	• Estimated surface:	**19.3 m²**	
	• System application:	**BIPV integration, Roof Top**	
	• PV module technology:	**Flexible Thin Film**	
	• Installed power:	**7.62 kWp**	
	• Electricity production:	**9,626 kWh/year (approx.)**	
	• Estimated surface:	**121 m²**	
Objectives & Opportunities	• The Housing Agency of Catalonia is part of the European MED project “MARIE”. Here’s another great opportunity to generate positive synergies and to multiply the impact of our work. • By substituting the previous skylight, the building decreases the energy loses through the roof, improves the solar radiation control and the users comfort. • The energy production of the two different solar fields will contribute to minimize the electricity demand of the building.		

(16) Mollet Hospital(Mollet Health Foundation, EsE-UAB)

Building data	• Location:	**Mollet del Vallés, Spain**
	• Ownership:	**Mollet Health Foundation**
	• Use:	**Hospital and Offices**
	• Building surface:	**22,182 m² (approx.)**
	• Electricity consumption:	**7,604,161 kWh/y (approx.)**
Solar Energy System	• System application:	**BIPV integration, Canopy**
	• PV module technology:	**Semi-transparent Glass Crystalline**
	• Installed power:	**10.05 kWp**
	• Electricity production:	**11,885 kWh/year (approx.)**
	• Estimated surface:	**104 m²**



Objectives & Opportunities

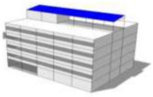
- Mollet Hospital is a center run by the Health Foundation Mollet, an activity that began on July 31st , 2010. Based on efficient and sustainable design, the building is currently using geothermal heat pumps and interested on installing more photovoltaic power.
- Mollet Hospital is part of an international network "GREEN HOSPITAL". There's a great opportunity to generate positive synergies with this initiative.
- The BIPV is based a canopy placed on the cafeteria roof along the south facade of the building. It was conceived to increase the shading of the glazed façade in the summer period, reducing the cooling needs.

(17) Primary School Catalunya (Sant Cugat Council, EsE-UAB)

Building data

- Location: **Sant Cugat, Spain**
- Ownership: **Sant Cugat Council**
- Use: **Primary and Secondary School**
- Building surface: **10,758.12 m² (approx.)**
- Electricity consumption: **191,268 kWh/y (approx.)**

Solar Energy System



- System application: **BIPV integration, Pergola**
- PV module technology: **Semi-transparent Glass Crystalline**
- Installed power: **3.57 kWp**
- Electricity production: **4,190 kWh/year (approx.)**
- Estimated surface: **33.3 m²**

Objectives & Opportunities

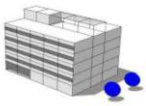
- The BIPV pergola provides a new shaded area in the playground.
- A great Visibility and Dissemination expectation, the building is a public school located around a big community.
- Great dissemination of the BIPV technology thanks to the integration into the schools environmental education protocol.
- The operation of the system will give the students the opportunity to increase their awareness of the importance of solar energy.

(18) Eco Park 2 (ECO2) (Metropolitan Area of Barcelona, EsE-UAB)

Building data

- Location: **Montcada i Reixac, Spain**
- Ownership: **Area Metropolitana of Barcelona**
- Use: **Plant treatment of urban waste**
- Building surface: **110,000 m² (approx.)**
- Electricity consumption: **17,503,661 kWh/y (approx.)**

Solar Energy System



- System application: **Dish Stirling - Cogeneration**
- Module technology: **Dish Parabolic**
- Installed power: **1 kW electric**
3 kW thermal
- Electricity production: **1,800.0 kWeh/year (approx.)**
6,861.9 kWth/year (approx.)
- Estimated surface: **11 m²**

Objectives & Opportunities

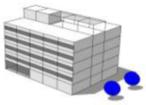
- The Eco park facilities, owned by Metropolitan Area of Barcelona (AMB), are responsible of the managing, process and recycling of part of the waste of the Metropolitan Area of Barcelona.
- They represent an extraordinary pole of attraction amongst a number of visitors (mainly schools and community managers), for environmental purposes.
- The Dish Sirling pilot will have a great visibility, and will contribute to reduce the electricity and hot water needs of the administration building.
- This building has other renewable facilities, such as biogas, photovoltaic and a boasts a solid track record of performance and maintenance over these systems.

(19-P1) Politechnic University of Catalonia (UPC) (Barcelona, UAB)

Building data

Location:	**Barcelona, Spain**
Ownership:	**Politechnic University of Catalonia**
Use:	**Offices, classrooms, laboratories, workshop**
Building surface:	**47,000 m² (approx.)**
Electricity consumption:	**2,528,038 kWh/y (approx.)**

Solar Energy System



System application:	**Dish Stirling - Cogeneration**
Module technology:	**Dish Parabolic**
Installed power:	**1 kW electric** **3 kW thermal**
Electricity production:	**1,800.0 kWeh/year (approx.)** **6,861.9 kWth/year (approx.)**
Estimated surface:	**11 m²**

Objectives & Opportunities

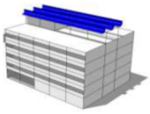
- The faculty of Engineering of the UPC offers a great opportunity in terms of visibility and capitalization of the Dish Stirling Pilot. Thousands of students, professors, researchers and visitors will be able to visit the installation.
- The institution (UPC) will guaranty the Operation and Maintenance of the system.
- The pilot is connected to the building electrical and thermal loads (gymnasium), contributing to its energy savings .
- The easy and controlled access to the DS roof top installation facilitates the visibility and safety.

(20-P2) Public Office Building (Sant Cugat del Vallés, UAB)

Building data

- Location: **Sant Cugat del Vallés, Spain**
- Ownership: **Sant Cugat Council**
- Use: **Office and Residential**
- Building surface: **8,000 m² (approx.)**
- Electricity consumption: **1,205,660 kWh/y (approx.)**

Solar Energy System



- System application: **Parabolic Trough – Solar Cooling/Heating**
- Module technology: **Parabolic trough**
- Installed power: **17.1 kW cold**
- Electricity production: **24,640.25 kWc/year (approx.)**
- Estimated surface: **41 m²**

Objectives & Opportunities

- The existing Solar Heating and Cooling system offered a great opportunity to test its performance, combined with CSP Parabolic Trough system, investing only in the CSP system.
- The public office building, owned by the municipality of Sant Cugat del Vallès, it's part of a recently new developed area, focused on energy efficiency and renewable energy technologies.
- The municipality is committed with the Project objectives and will give visibility to the installation.
- There's an Energy Service Enterprise Operating and Maintaining the building, which facilitates its proper function.

4. PROMOTING REPLICATION: PRELIMINARY STUDIES OFFERED TO LOCAL STAKEHOLDERS

Regarding solar-power applications as the ones carried out within the Project

Throughout the first two years of the project activities the Technical Team (PTT) analysed and pre-selected a total of 34 public buildings or premises, and specific areas in them, for hosting the innovative solar-power applications planned to carry out in each target Mediterranean Region. And for each of these buildings/areas, the PTT defined the type of innovative solar system that could be more convenient or fitted, both according to the building/area features and the institution (public entity proprietor of the building) needs and possibilities. The results of this preliminary analysis have previously been summarised in **Report 7** (www.didsolit.eu/*Reports and Project's outputs*).

In a further step, 18 out of the above 34 pre-selected buildings/planned applications were finally selected by the Technical Team and then approved by the Project Management Board (PMB), as the base-programme for implementing our committed solar applications (see **Report 8** in the project web).

Thus, for the rest (16) of the pre-selected actions (public building areas & pre-planned solar system for each one) we had their corresponding preliminary studies on the table.

Public buildings/ Solar systems

Mediterranean Region	Country	Partners	Pre-selected		Finally selected		rest
			Internally assigned Target	Achieved	Internally assigned Target	Achieved	
Ditiki-Ellada	Greece	PP1	3	3	1	1	2
Marsa-Matrouh	Egypt	PP2	9	9	3	4	5
Al-Salt and Irbid	Jordan	PP3	9	9	3	5	4
Alexandria	Egypt	PP4	5	5	2	3	2
Crete	Greece	PP5	2	3	1	1	2
Catalonia	Spain	BEN + PP6	4	5*	2	4	2*
Total			32	34	12	18	16+1*

* *Afterwards, one more public building/area–application was identified, studied and pre-selected; so, the 'rest' is in fact equal to 2*

Afterwards, at the end of the implementation period, these preliminary studies were completed using our experience in the buildings-applications-systems actually carried out. As a result, we have obtained a useful basis as conceptual designs for the referred 16 buildings-applications-systems, to be offered to the public institutions that are the owners of the respective buildings. And so it has been done. First through the final open conferences and then by direct contact, in order to promote their interest and subsequent conduction of the proposed pre-planned innovative solar-power applications on their own. In that sense, it is noteworthy to point out that 3 of the partners (Alexandria University, Balqa Applied University, and MAICh) are at the same time the owners of the corresponding public buildings, both for the installations actually carried out and for the ones described here as pre-planned for promotion.

To sum up, Project partners have engaged in actions to promote additional solar-power installations so that they could be carried out in future by the institutions that own of the above referred buildings, on their own, or by other local stakeholders, who could also benefit from the experience of the solar systems actually implemented by our project in their Region

The following table summarise the referred 17 pre-planned innovative solar-power applications whose conceptual designs and data have been offered to stakeholders, plus 3 more: we have added three applications that had been selected to be carried out, but that the respective partner was not able to carry out in the end (for internal reasons explained in our **Report 9**): one from partner 3 (Al-Balqa Applied University) and two from partner 4 (Alexandria University). Thus, a total of 20 pre-planned applications (public building, building specific area, and pre-planned innovative solar systems) are described as follows.

Public building / Proprietor Institution	Planned Solar Renewable Energy system (RE)	Planned power (kW)	Estimated cost (€)
Partner 1. AEIPLOUS – Mediterranean Region: Ditiki-Ellade (Greece)			
University of Patras building in Agrino / University of Patras	A) BIPV: glass laminated crystalline. Roof pergola	6	104,580 €
	B) BIPV: glass laminated crystalline. Car shelter	15	
Town hall building in Amfilochia / Amfilochia Town Council	A) BIPV: glass laminated crystalline. SW façade	11,30	99,600 €
	B) BIPV: glass laminated crystalline. Roof	8,70	
Partner 2. EAEE– Mediterranean Region: Marsa-Matrouh (Egypt)			
Local Assembly / Governorate of Matrouh	BIPV – glass laminated semi-transparent a-Si thin film	24,2	163,600
Children Hospital, in Matrouh / Ministry of Health	BIPV – glass laminated semi-transparent a-Si thin film	10	42,500
Faculty of Education / Alexandria University, Branch in Matrouh	BIPV – glass laminated semi-transparent crystalline	5	23,750
El-Negila Hospital /	BIPV – glass laminated semi-transparent a-Si thin film	10	42,500
SidiBaraniHospital /	BIPV – glass laminated semi-transparent a-Si thin film	10	42,500

Partner 3. BAU – Mediterranean Regions: Al-Salt &Irbid (Jordan)			
Engineering Building/ Balqa Applied University (BAU)	BIPV-glass laminated semi-transparent crystalline	4	19,000 €
Scientific Research Deanship / (BAU)	BIPV-glass laminated semi-transparent crystalline-Façade	3	14,000€
Main Library / (BAU)	PT-SCH	17	140,000 €
Engineering Workshop (BAU)	Stirling Dish	4	45,000 €
Engineering Workshop (HUC) / (BAU)	Stirling Dish	4	45,000 €

Note: The one shadowed in light-blue was in fact finally selected and scheduled for being carried out. But due to the Partner's several difficulties, they have not been able to implement this application. Therefore, it remains as a pre-planned application that is offered to the building owner.

Partner 4. AU – Mediterranean Region: Alexandria (Egypt)			
Faculty of Science, AU. MoharamBek "MB" campus Alexandria University	Dish Stirling	1 kWe +3 kWt	40,110 € (10.03 €/W)
Administration building, AU, MB campus/ Alexandria University	PTSC	17 .1	131,313 €
Faculty of Engineering "FoE", AU. / Alexandria University	BIPV-flexible thin film	10	35,000 (3.5 €/W)
SIDPEC administration building / Alexandria University	BIPV-glass laminated semi-transparent thin film	10	42,500 (4.25€/W)

Note: The two ones shadowed in light blue were in fact finally selected and scheduled for being carried out. But due to the Partner's several difficulties (in short, cash shortage and customs problems), they have not been able to implement these two applications. Therefore, they remain as pre-planned applications, that are offered to the building owner.

Partner 5. MAICh – Mediterranean Region: Crete (Greece)			
Kolymbari School / Municipality of Kolimbary	BIPV	13.2	26,000 €
Nea Chora School / Municipality of Nea Chora	BIPV	13.2	26,400 €

Partners 6, EsE and BEN – Mediterranean Region: Catalonia (Spain)			
Centre Mediterrani d'Investigacions Marines I Ambientals (CMIMA) / Consejo Superior de Investigaciones Científicas (CSIC)	**BIPV - Pergola** Glass laminated semi-transparent - Crystalline	9.54 kWp	46,078 €
Area Metropolitana de Barcelona, Headquarters Offices/ AMB	**BIPV - Facade** Glass laminated semi-transparent - Crystalline	9.87 kWp	47,686 €

5. OTHER OVERALL CONCLUSIONS AND LEARNING FROM THE PROJECT

The following conclusions were drawn in the framework of the DIDSOLIT-PB Project and of the collaboration with other European funded projects, in the Energy Efficiency and Renewable energy fields.

The closest cooperation has been developed among the other ENPI CBCMED Strategic Projects related to Renewable Energies.

A "Solar Cluster" was created, sharing some of the public presentations and co-organising the "MedaSolar Forums I and II" in Barcelona, 2014 and 2015 (Mediterranean Week of Economic Leaders, organised by ASCAME).

SHAAMS, ENPI CBCMED Project, http://www.shaams.org/
MED SOLAR, ENPI CBCMED Project, http://www.medsolarproject.com/
FOSTER IN MED, ENPI CBCMED Project, http://www.fosterinmed.eu/
STS-MED, ENPI CBCMED Project, http://www.stsmed.eu/
MED-DESIRE, ENPI CBCMED Project, http://www.med-desire.eu/

UAB, as Project coordinator has also been in close contact with other projects coordinated in Catalonia, that started before. They offered good opportunities to share the network and conclusions of their previous research. Thanks to the cooperation with theMARIE Project (Energy renovation strategy around Mediterranean regions), DIDSOLIT-PB has had the opportunity to present its activities in the Capitalisation Conference EE in Med building (Malta March 2014), Word Sustainable Building Congress (Barcelona October 2014) and participate in the Renewable Energies chapters of the policy paper promoted in the EU (Ljubljana declaration).

MARIE, MED Project, http://www.**marie**-medstrategic.eu
RELS, ENPI CBCMED Project, http://www.enpicbcmed.eu/

A chart of "Advantages" and "Threats and challenges" have been produced (6.1. and 6.2.)

On the other hand, the DIDSOLIT-PB technical and coordination teams (Project Technical Team and Management Boards) have produced a SWOT analysis summary taking into consideration not only the aspects related to the Solar Technologies, but also the challenges related to the Project Implementation (6.3.)

DIDSOLIT-PB Project approached Innovative Solar technologies from the technological research and market availability, but also considering 6 main pillars:

-Energy Performance

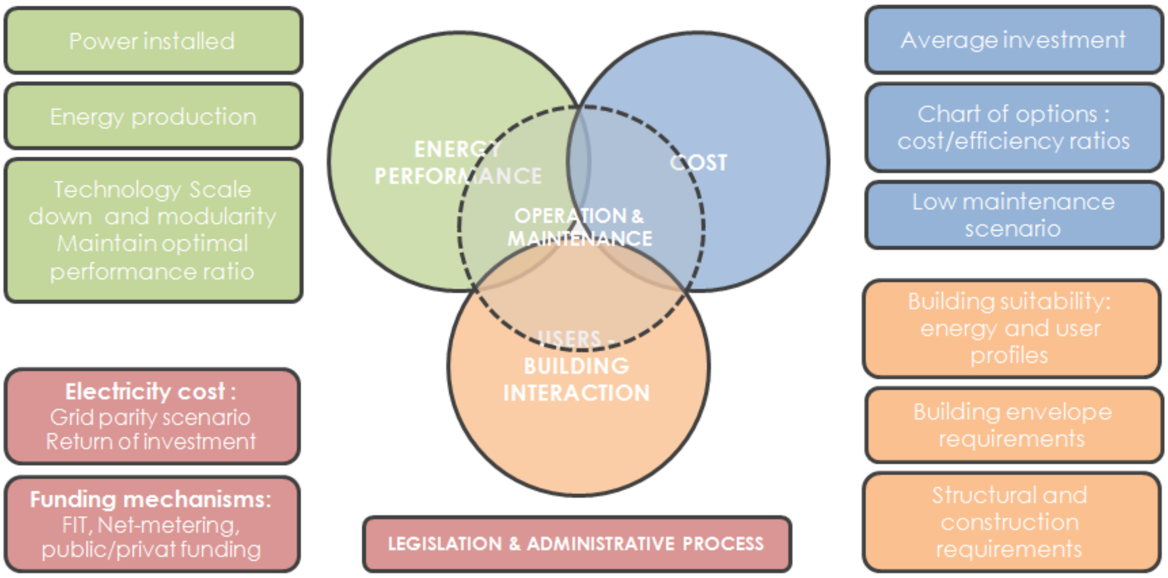
-Cost

-Users-Building interaction

-Operation & Maintenance

-Financial

-Legislative and administrative process



5.1 Main advantages of decentralised solar systems

Besides its renewable, free and clean source, building-integrated photovoltaic systems have a number of additional advantages. DIDSOLIT-PB has analysed, promoted and taken advantage of them, using the Solar applications undertaken in the Project framework.

1) **Decentralisation:** The capacity to be produced near the consumer.

Minimising distribution loses which are typical in centralised generation systems.

Minimising infrastructure requirements

Increasing energy autonomy and contribution to solve social and energy emergencies due to energy supply interruptions.

PV systems are easily compatible with existing or current electricity backup systems.

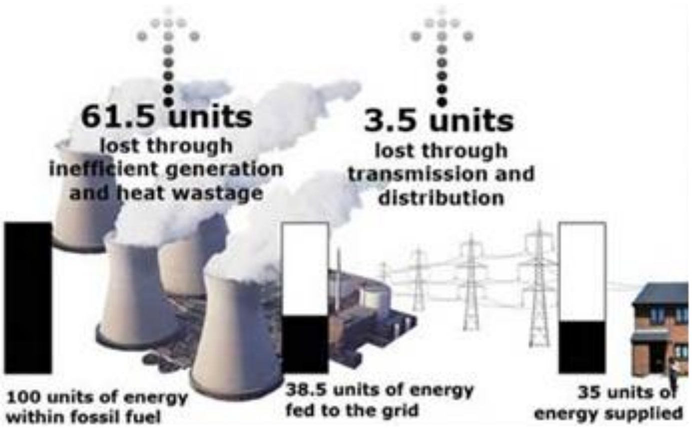


Figure 1 Distribution loses typical of centralised generation systems. Source: http://www.greenpeace.org.uk/blog/climate/

2) **Adaptability** to the building energy demands and local grids, in order to prevent energy waste and maximise its performance.

Compatible with both self-consumption and local or regional electric grids (net-metering).

In public buildings with tertiary uses, consumption and production match.

The energy required to run office buildings, schools, hospitals during daylight.

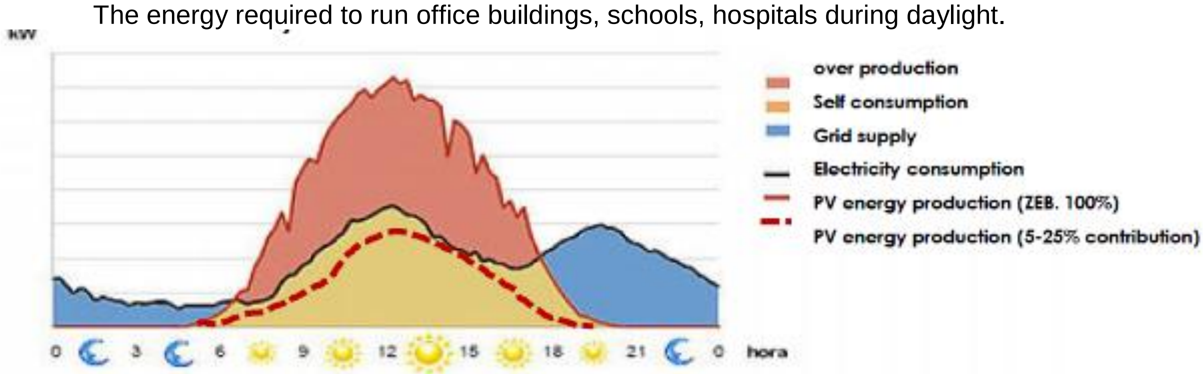


Figure 2 Adaptation of a typical energy balance of a tertiary building, including RE self-consumption and grid-connection scenarios.

3) Building integration: energy savings contribution, user comfort and new social areas

Traditionally, Mediterranean architecture has adopted bioclimatic strategies to deal with the Sun: either protecting from it or taking advantage of it.

Passive behaviour: PV elements might provide sun protection, which is absolutely necessary in the Mediterranean countries with high insolation.

Building integration: the substitution of construction elements (façade, roof, etc.) can optimise other construction costs associated with these functionalities.

4) Competitive cost of electricity:

Grid parity with standard PV technologies is already a reality in most Mediterranean countries, with electricity costs over:

- 0.22 €/kWh Jordan; 0.15-17 €/kWh Spain and Greece; 0.05-0.08 €/kWh Egypt
- LCOE: 0.10-0.25 € depending on irradiation, type of integration and costs of PV-BIPV.

On-site production might ensure controlled energy costs throughout the next 25 years.

Grid electricity supply has experienced an inflation of over 5 and 10% per year throughout the last decade.

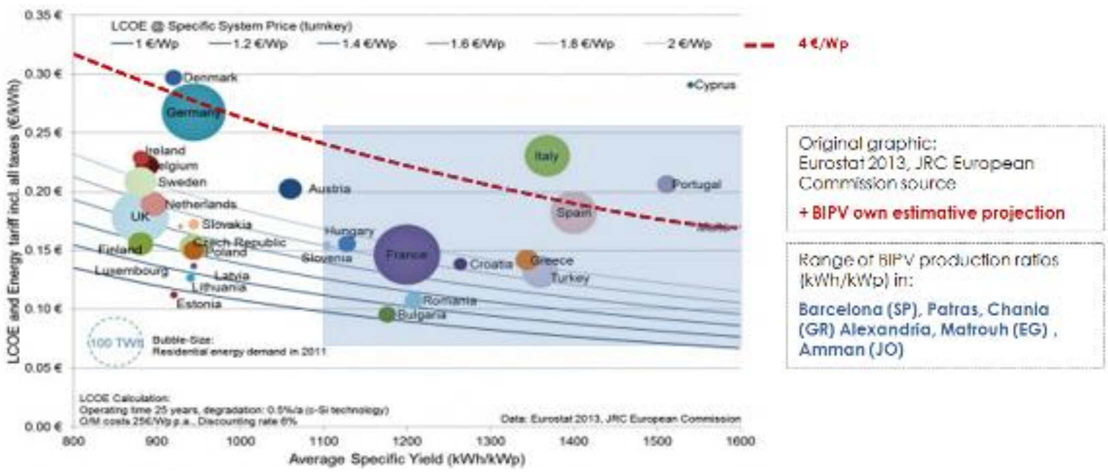


Figure 3 BIPV own estimate projection

5) Development of an industrial and service market:

The installation, operation and maintenance of small and medium-sized installations requires qualified and local labour force. It boosts the creation of cross-border partnerships between producers, suppliers, installers and O&M companies.

6) Environmental regulations on CO_2 emissions reduction:

For the European countries, it contributes to achieve the targets of **nearly Zero Energy Buildings** defined by the European directive **EPBD 2010/31/UE.** Public buildings should lead the process (2018).

5.2 Main threats and challenges for solar RE in EU and MENA countries

Despite the maturity of some of the Solar technologies, there are still some important challenges and barriers to overcome. Some of them are related to the technical-economic viability and climatic conditions, but most of them are mainly related to the local socio-political framework.

1) Energy performance

- Small-scale system maturity: BIPV is highly scalable due to its modularity. However, small-scale CSP need further development to be competitive.
- In some countries, the lack of local suppliers of materials and components makes the installation and Operation & Maintenance of the Renewable Energy systems difficult.
- Lack of experience in RE installation and Operation & Maintenance.
- Local climate characteristics, despite excellent levels of solar radiation, involve some O&M issues (sand, dust…etc.) regarding cleaning.

2) Building selection and integration

- Selecting buildings in good construction conditions, counting on existing O&M.
- Selecting buildings with a good level of passive energy performance in order to minimise the temptation of "greening" low performance buildings with renewable energy gadgets.
- Energy monitoring and control, with the possibility of previous energy audit and the commitment to future data collection is essential.

2) Costs and local availability

- When local alternatives are not available, import procedures and taxes might be challenging.
- Logistics: The creation of commercial and technical networks for innovative technologies, dealing with technical, logistics and administrative issues.
- O&M costs have to be taken into consideration, according to local availability.
- The LCOE of small scale innovative decentralised solar applications might be significantly higher than the one for standard RE solutions (standard PV modules, big scale CSP or SCH plants).

4) Economical (electricity cost)

- Electricity costs vary depending on the country and building type.
- Subsidised electricity might condition the perception of economic viability of investors and users.
  e.g.: Some governments, like the Egyptian one, have been covering the difference between the energy production real costs and users' electricity bills.
- Cost-efficiency analysis should be based on real production costs (not always available). Last year's energy inflation scenarios might be considered
  e.g.: approx. energy cost inflation: Jordan approx. 60% from 2010, Egypt 7% annual over the last 10 years.
- Most of the countries present different tariffs according to the kind of consumption
  e.g.: Jordan (NAMA) elect. cost ordinary consumers 7th block (> 1000 kWh/month) 0,22 €/kWh. Solar FIT: 0,12 €/kWh
  e.g.: Egypt (NREA): electricity cost: 0.03 – 0.07 €/kWh. No FIT.

5) Economical (funding mechanisms)

- There isn't a clear policy coordination in Energy Efficiency and Renewable Energy in the Mediterranean area. Consequently, there is a similar lack of coordination at funding instruments' level.

6) Policies and administrative aspects

- According to IRENA 2013, report 18 of the 21 MENA countries have some type of policy to promote RE power generation (especially NOIC (oil importers) countries)
  In practice, implementation faces challenges calling for case by case solutions.
- Absence of FIT policy in most of the MENA countries (except Jordan))
- Lack of regulation for RE grid connection> OFF-grid as the only option in some countries.
  e.g.: Jordan: possibility of grid connection and Net Balance.

  e.g.: Egypt: Theoretically, Net Balance is available since 2013.

- Uncertainty about distributed Renewable Energy legal framework in most of the countries.
  Nowadays, not only MENA countries are facing RE policy uncertainties.

  Spain and Greece RE policies, and specifically the decentralised and

  self-consumption ones, are blocking its deployment.

  e.g.: The Spanish Government has been blocking the deployment of self-consumption and small-medium-scale distributed RE systems. A combination of complex administrative procedures, specific taxes associated with the production and lack of net-metering system has been drowning a sector with a tremendous potential.

7) Social awareness

- Changing people’s behaviour. Difficulty to introduce EE+RE measures because there's still a lack of environmental conscience and confidence into new technologies.
- The scale of priorities is a bit different from North to South: in the North it is mainly a matter of budget, electricity cost and environmental regulation and conscience. In the MENA countries the energy supply quality enters into the equation.

5.3 SWOT analysis of DIDSOLIT-PB Project

DIDSOLIT-PB technical and coordination teams (Project Technical Team and Management Boards), have produced a summary SWOT analysis, taking into consideration not only the aspects related to the Solar Technologies, but also some of the challenges related to the Project Implementation.

	STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
Procedures / Administrative			Egypt and Jordan: -Net-metering is being regulated (boosts self-consumption)	Spain & Greece: -Net-metering has been semi-blocked
Regulations / Legal / Political		-Conflict of interests		
Tendering	-Transparency -Cost decrease -Unified standard		-Boosts international cooperation	-Time consuming -Burocracy -Quality/Price balance
Logistics / Cross-border cooperation / Consortiums	-Consortium-cooperation		-Initiate cooperation	
Know-how (local?): **-Installation** **-Suppliers** **-O&M**	-Boosts research and networking -Experience based on real applications		-Stakeholders network. New links, partnerships: Suppliers-installers -Cost decreases	
Cost/Performance	-Electricity fix price (25 y)	-Autonomy, not so cost effective.	-Cost/performance	
Technology performance	-Great radiation conditions in Med area		-High solar radiation -Possibilities for building integration	
Bioclimatic benefits	-Improve energy. performance -Reduce cooling demand -Increase comfort			
Social benefits	-Visibility of the Solar applications, helps improve social awareness		-Increase local employability (install and O&M) -Reduction energy dependency -Cross border conflicts reduction (security)	
Environmental	-CO2 emission reduction -Strong sustainability message	-Cleaning requirements (water)		
Political commitment				-RE Distributed / self-consumption impacts on big Energy Corporations traditional core model -Lack of commitment of some governments (conflict of interests)
Financial		-Public funding burocracy (doesn't fit with tight execution timings)	-Public funds -ESCO funding -Might boost private-public cooperation	

6. PROMOTING THE DEPLOYMENT OF SOLAR-POWER APPLICATIONS IN THE MEDITERRANEAN REGIONS:

Recommendations to Governments on:

i) Policies and regulatory framework, and

ii)Financial viability and dedicated funding mechanisms

6.1 Greece (from contributions by AEIPLOUS and MAICH)

6.1.1 Policies and regulatory framework

Emissions savings & Renewable Energy policy in the European Union.

In 2009 the European Union defined new Policies to reduce the emissions of carbon oxide and to incrase renewable energies.

The European framework is based on the following Laws:

Directive 2009/28/EC - Renewable Energy Sources
Directive 2009/29/EC - Emissions Trading Scheme
Directive 2009/30/EC - Fuel Quality Directive
Directive 2009/31/EC - Carbon Capture and Storage
Decision 406/2009/EC - Greenhouse Gas Emissions
Regulation 443/2009 - Reduct. of CO_2 Emissions from Light-Duty Vehicles

This package is designed to achieve the EU's overall environmental targets by 2020:

- 20 % reduction in greenhouse gases emissions
- 20 % share of renewable energy in the EU's total energy consumption

In Greece there some specific initiatives:

An independent RES service has been established (Law 3851/2010 «Accelerating the development of Renewable Energy Sources to deal with climate change and other regulations addressing issues under the authority of the Ministry of Environment, Energy and Climate Change”).

“ΦΕΚ Β 1630/11.10.2010”: “Decision to target ratio of installed capacity and the allocation of time among the various renewable energy technologies”.

Financing viability and dedicated financing mechanisms

Various financial tools currently exist in Greece to support investments made in innovative solar energy technologies including photovoltaics in buildings. These tools include either bank loans or direct and indirect subsidies of solar energy technologies used as described below:

Bank loans are offered to various energy investments in commercial and household buildings including solar energy investments. They are offered with ordinary banking criteria but in general, banks support energy refurbishment of household buildings combined with an energy inspection thereof and the improvement of their energy behaviour and efficiency. Since the energy renewal of buildings are also supported by European structural funds. Bank loans with low interest rates are easily offered in these cases. Eligibility criteria for capital subsidies and bank loans supporting energy renovation of flats and houses are presented below.

Three criteria are used for subsidising energy investments in households:

1. The energy category of the house must be low
2. The value of the house must not be high
3. The income of the owner of the house must not be high

More specifically:

- Energy category of the house should be smaller or equal to D
- Value of the house should be below 2,100 €/m^2
- Family income of the home owner should be between 20,000-80,000 €/year
- Individual income of the home owner should be between 12,000-60,000 €/ year
- Capital Subsidies offered should be between 15-70% of the energy investments
- Bank loans at zero interest rate are offered corresponding to 30-85% of the energy investment
- Duration of the bank loan is 4-6 years
- Maximum amount of the energy investment in each flat or house should not exceed 15,000 €

Capital Investment Subsidies. -Governmental subsidies of the initial capital invested in solar energy technologies in commercial or industrial buildings are offered in Greece. These investments are oriented to enterprises rather than to households, like hotels, commercial or industrial buildings and depending on the case, the invested capital subsidy ranges between 15-50 %. Therefore, with the support of EU structural funds, investments of innovative solar energy technologies can be promoted in commercial and industrial buildings.

Feed-in tariffs offered for electricity generated from solar energy systems. -Electricity generated from solar energy systems installed in buildings must be sold into the grid. Twenty-five years contracts are offered from the grid owner to the electricity producers with guaranteed feed-in tariffs. The electricity grid is currently owned by the government but it will soon be partly privatised. However, only various photovoltaic systems generating electricity are eligible for feed-in tariffs but not dish-Stirling or parabolic trough systems. Current feed-in tariffs offered are equal to 0.115 € per KWh but they are reduced in future installations. A few years ago when this initiative was initially offered, the feed-in tariffs offered were very high (0.55 €/KWh) and a large number applications were submitted. Later due to the decrease of the cost of photovoltaic cells the price of the feed-in tariffs offered was reduced. Feed-in tariffs for new photovoltaics placed on building roofs in Greece are presented in the following table.

Current and future values of feed-in tariffs in Greece for photovoltaic installations in building roofs

PERIOD	PRICE €/KWh
1/2/2015-31/1/2016	0.115
1/2/2016-31/1/2017	0.110
1/2/2017-31/8/2017	0.105
1/9/2017-31/8/2018	0.100
1/2/2018-31/8/2018	0.095
1/9/2018-31/1/2019	0.090
1/2/2019-31/8/2019	0.085
1/9/2019-31/1/2020	0.080

The Net-metering initiative was launched recently in Greece, allowing the installation of Photovoltaic systems in houses and various enterprises in order to generate electricity and offset the grid power consumed per year. The owner of the PV system must send the PV generated electricity into the grid which will be deducted on an annual basis from its electricity consumption. In the event that the annual PV generated electricity were higher than that consumed from the grid, the owner will not have any benefit or compensation due to the excess electricity sent to the grid on an annual basis. The Net-metering initiative was launched in December 2014 in Greece and it is considered as an effective energy-saving tool that is particularly profitable for SMEs operating seasonally during the summer such as hotels. Payback period for PV installations under this initiative is estimated to 5-10 years depending on the case. Mono, polycrystalline and thin film PV cells are eligible for feed-in tariffs (including semi-transparent PV cells) placed either on the roofs of buildings or on the fields.

6.2 Jordan (from contributions by BAU)

6.2.1 Policies and regulatory framework

In the Master Strategy of the Energy Sector in Jordan for the period (2007-2020) (the **Energy Strategy**), the Jordanian government set a target to obtain 1,800 MWs, or 10 per cent of the country's energy supply, from renewable sources by 2020.

Of this, about 1,200 MWs will come from wind energy, 600 megawatts from solar power, and between 30 and 50 MWs from waste-to-energy facilities, according to the Energy Strategy.

Further matters to note include the following:

- Priority will be given to photovoltaic projects from 5 to 10 MWs and solar thermal projects from 25 to 50 MWs "in order to meet the interest of a large number of investors and to comply with the commercial applications of such projects and the similar experience required by the Law".
- Larger projects will be considered but they "will need to prove their clear superiority in terms of technical and financial aspects in order to be accepted" in addition to compliance with the Law.[2]
- Projects generating energy for domestic consumption will have priority over export projects. Projects based on exports will be considered on a case-by-case basis and priority will be given to export projects based on regional / international initiatives.

Key Drivers

- The Energy Strategy aims to reduce Jordan's dependence on imported products from 96 per cent (in 2010) with renewables meeting 10 per cent of energy demand by 2020 and nuclear energy meeting 60 per cent of energy needs by 2035. Since the Iraq invasion of 2003, Jordan's main source of imported oil has been Saudi Arabia, followed by Kuwait and the United Arab Emirates.
- By seeking to increase the share of renewable energy projects contributing to primary energy supply in Jordan, the government hopes to "decrease the Kingdom's dependence on international fuel prices, to enhance security of supply and to shift patterns of energy supply and demand into a more sustainable direction."[3]
- Annual electricity demand growth for the period of 2008 to 2020 is projected to reach 5.5 per cent.
- Experts have warned that the Kingdom will be facing severe water shortages in the coming years. Desalination projects intended to meet Jordan's water supply needs will increase the energy demand.
- The Jordanian government has signed contracts with a number of companies to undertake feasibility studies to produce oil from oil shale deposits. Projections indicate that oil shale may contribute with 14 per cent of Jordan's energy requirements by 2020 and it will also be used to produce crude oil.
- Jordan has potential to utilise biogas from solid waste. A successful pilot biogas plant has been built at the country's largest landfill is located in Russaifah. The original project rated capacity as 1 MW. Due to the successful operation this was expanded to 3.5 MWs.
- Jordan benefits from rich wind energy resources. Studies show that there is a potential for several hundreds of megawatts of wind power installations around the Kingdom.
- Jordan lies in the earth-sun belt area and has vast solar energy potential. At present, solar energy is used primarily for domestic solar water heating.

- Studies performed by Jordan's Natural Resources Authorities have found medium and low geothermal waters along the Dead Sea rift valley. Small geothermal resources are also utilised in aquaculture.

Policy and Regulatory Framework

Jordan has introduced a number of regulatory measures that form part of its Nationally Appropriate Mitigation Action (**NAMA**) plan. The NAMA is the plan that sets out the policies and actions adopted by developing countries to reduce GHGs emissions. NAMA is a voluntary mechanism, and the relevant developing country will report its NAMA directly to the United Nations Framework Convention on Climate Change. It is expected that the NAMA will be the primary means by which emerging economies will introduce carbon emission reduction actions. The NAMA concept recognises that different countries may take differing nationally appropriate actions to reduce GHGs emissions.

Energy Strategy

The Energy Strategy underlined the Jordanian government's commitment to the large scale development of renewable energy projects by:

- launching the Law;
- committing to the development of specific wind projects; and
- the announcement of the creation of a renewable energy fund.

In addition, the Energy Strategy committed Jordan to the development of other types of clean energy projects by announcing plans to build further nuclear plants.

http://www.nortonrosefulbright.com/knowledge/publications/62385/renewable-energy-in-jordan - pg_hdr

The Law sets out a number of measures for the use of renewable energy in Jordan including the following:

- The establishment of a regime whereby private companies with renewable energy projects can bypass the competitive government bidding process and negotiate directly with the Ministry of Energy. The Law permits an unsolicited or direct proposal submission, where investors can identify and develop renewable grid-connected electricity projects using renewable energy sources (such as solar or wind) and propose these to the Ministry of Energy.
- A requirement that developers of renewable energy projects must set out in their proposals fixed electricity tariffs before being approved.
- A requirement that the National Electric Power Company purchases all electricity produced by renewable energy sources and to cover the cost of grid connection for developers.

6.2.2 Financing viability and dedicated financing mechanisms

Tariffs

- The Law provides that the tariff that the project developer sets out in its proposal shall be (amongst other things) "within an acceptable range according to the Reference Price list. The Reference Price list is prepared by Jordan's Electricity Regulatory Commission together with relevant bodies, and specifies the mechanism of pricing the purchase of electricity from renewable energy sources. The lack of a tariff regime, may act as a disincentive to the development of renewables in Jordan, as project developers may be discouraged by the lack of transparency and limits on investment return.
- However, the lack of a tariff regime may not necessarily be a barrier to the successful deployment of renewable energy projects on a wider basis. There is precedent in the MENA region, for bankable projects, by the negotiation of a green tariff individually between the project developer and the government. This approach was demonstrated by Abu Dhabi's Shams 1 Solar project, which introduced a "green payment" by which the Abu Dhabi Ministry of Finance will compensate the Abu Dhabi Water and Electricity Company for the shortfall in revenue stemming from subsidised electricity supply and the cost of production.

Jordan Renewable Energy and Efficiency Fund

The aim of this fund is to support energy-saving and renewable energy initiatives. The fund will be financed by the Jordanian government and international donor agencies such as the French Development Agency and the World Bank. Private investors, both domestic and international can apply for the fund.

The feed-in tariff in Jordan until the end of 2013according the Renewable Energy law is shown in the following table

Renewable Energy Source	Tariff sale of electrical energy (Fils/kWh)
Solar Energy	120
Hybrid Energy	95
Other	85

Net Metering

Reasoning and Description of Net-metering

As mentioned above, electricity prices can reach up to JD 0.294 per kWh for certain consumer categories.20 The levelised costs of PV electricity over 20 years are well below this rate – depending on site, system price and operation and maintenance costs, the cost can be as low as JD 0.10 per kWh. From a rational economic point of view, all of those consumers would prefer to cover part of their electricity demand with PV-generated electricity instead of buying all their electricity from the utility if it is cheaper to directly produce and consume it, with all costs for the PV system, maintenance and operations, financing etc. included.21 As the difference between the price of PV electricity and grid electricity widens, more electricity consumers will opt for PV self-consumption if they can.

Net-metering as model to facilitate PV production

To enable large-scale PV electricity production, the Renewable Energy and Efficiency Law (REEL) (13) of 2012 allows electricity consumers who operate PV systems for self-consumption ("self-consumers") to receive energy credits for any PV electricity their systems generate in excess of the amount of electricity consumed within a billing period.

Table 8: Simulations chosen

Case	Consumption / month	Electricity tariffs JD / kWh 2014	Electricity price increase 2014 – 2017 in % per year	Size PV system	IRR in simulation in %*	Amortization in years
Small residential rooftop	600 kWh	0.033 – 0.14	0	2 kWp	1.53%	17.53
Large residential rooftop	2,000 kWh	0.033 -0.259	5	8 kWp	31.41%	4.53
Small ordinary (public) consumer rooftop	4,000 kWh	0.04 – 0.259	5	15 kWp	54.63%	1.97
Midsized commercial rooftop	15,000 kWh	0.12 – 0.168	5	60 kWp	38.91%	3.19
Midsized industrial	25,000 kWh	0.063 (daytime tariff)	5	150 kWp	13.48%	10.51
Large industrial wheeling (other industries)		0.124	5	2 MWp	27.38%	5.83

* *Please take assumptions into account*

(Source: "Enabling PV in the MENA Region. The Emerging PV Market in Jordan".www.giz.de)

6.3 Egypt (from contributions by EAEE and AU)

6.3.1 Policies and regulatory framework

Emission savings &Renewable Energy policy in Egypt

The vision

Economic and social sustainable development is directly linked with the availability of adequate sources of energy, which ensure suitable living conditions. This requires the provision of a balanced mix of conventional and renewable energy resources, and reducing the impacts of energy production and consumption on the surrounding environment and human health.

The Egyptian electrical system planning takes into account in its major steps the improvements concerning environmental protection. It can be noticed in the decrease in demand (demand side management, reduction of losses, etc.) and the environmental-friendly supply options. An important programme is carried out to implement new & renewable sources of energy as well as thermal generation emitting lower quantities of GHG.

The strategy

The strategy, which was approved in February 2008, aims to:

- The contribution of renewable energies with 20% of the total electricity generation by the year2020.
- The share contribution of the grid-connected wind power will be 12% of the total electricity generation, i.e. reaching more than 7200 MW grid-connected wind farms while the remaining will be from mainly hydro (8%) and solar energy (2%).
- In July 2012, an Egyptian Solar Plan has been approved by the Cabinet which targets to install about 3500 MW by 2027 (2800 MW CSP+ 700 MW PV) with a private investment share of67% including an enhancement of the relevant local industry.

Besides the main role of renewable energy sources in preserving the environment and reducing its negative effects on climate change, its role in securing energy sustainability cannot be overlooked. Also, research and development efforts in using available natural resources leads to increasing the feasibility of these technologies and adding more prospects to the applications of renewable energy. From this standpoint, the national approach aims to work on expanding the use of renewable energy and increasing rates of investment to meet the energy growing demand.

Policies

One third of the targeted capacity of renewable energy (approx. 2400 MW) will be implemented by the government in cooperation with different international financing institutions. The remaining two thirds(approx. 4800 MW) will be implemented by the private sector.

Five policies have been approved to foster the increasing RE energy contribution as follows:

- **Public Competitive Bidding:** Issuing tenders internationally requesting the private sector to supply power from RE energy projects.
- **Third party access (TPA):** Investors are allowed to build & operate RE power plants to satisfy their electricity needs or to sell electricity to other consumers though the national grid.
- **Feed-in Tariff (FIT):** In September 2014, the Ministry of electricity approved to apply an FIT with attractive prices to encourage the private sector to invest. Also, the land will be giving just 2% of the total power generated revenue from the plant. Additionally, the customs will be 2% of the total items cost.

- **Net Metering:** In January 2013, Egypt ERA adopted a net-metering policy that allows small-scale renewable energy projects to feed-in electricity to the grid. The electricity surplus generated will come from heavy industries' consumption and will be obliged to use a percentage of their electricity consumption from RE sources.

6.3.2 Financing viability and dedicated financing mechanisms

Establishing Renewable Energy Fund:

- In 6/6/2012 the cabinet approved to establish a Renewable Energy Fund to cover the difference between the production cost of energy generated from renewable resources and the selling price to the grid.
A Technical Committee was formed under Ministerial Decree No. 418/2012 in order to:

(i) Review Public and Private RE projects planned for implementation.
(ii) Determine annual funding requirements for the plan through the resources of the Fund that have already been granted.
(iii) Study other and additional options of fund resource streams.
(iv) Develop and propose an organisation structure

In February 2008 the Supreme Council of Energy set the target to have 20% of the electrical energy mix from renewable sources including hydro by the year 2020.

The current hydro installed capacity represents about 11% of the total generation. This percentage shall be reduced to 6% by the year 2020. Therefore, the contribution from renewable sources other than hydro shall be 14% by 2020.

The renewable energy strategy priority goes to wind to represent 12% of the targeted 14% of the renewable energy mix by the year 2020.

Electricity generation plants using renewable energies shall be established according to the following mechanisms and in line with the plants and the programmes approved by the cabinet of ministers:

- State owned Wind Farms through NREA
- Competitive Bidding through the private sector
- Feed-in Tariff through the private sector

Financing mechanisms

The Egyptian Government has promoted several initiatives since 2013.

Feed-in Tariff through the private sector

The goal is to reach 2500 MW through medium and small developers. Tariffs will be set for 15 years taking into consideration the wind speed and capacity. Feed-in Tariff will work hand in hand with the competitive bid mechanism. But in order to prevent the two mechanisms from clashing, the competitive bids will be for the large size installations (250 MW wind farm), while the feed-in tariff will be restricted for the small capacities (less than 50 MW installations) as the international experience has shown that feed-in tariffs are more attractive for smaller investors like farmers, cooperatives, and private investors.

In addition to the previously mentioned mechanisms, Egypt ERA developed a proposal for the commercial power plants where the producer has the right to use the grid and sell electricity directly to consumers without any burdens on the EETC. The investor seeks to encourage consumers to conclude contracts with them to buy the renewable energy through this mechanism. This mechanism suits consumers who must use a higher percentage of renewable energy.

Currently, a 120 MW wind project is under development through this mechanism in co-operation with the "Italgen" Company.

There are some future projects in NREA's 5- year plan (2012 - 2017) which includes:

A proposed Concentrator Solar Power (CSP) project with a capacity of 100 MW in KomOmbo city to be a model for governmental projects. It will take advantage of finance available in order to produce electricity to feed the national grid and meet the increasing demand for electricity

Photovoltaic plants with a total capacity of 20 MW.

Feed-in Tariffs, Egypt, 2014

Duration for contracting	Home Roof top mounted	Rooftop or Ground mounted			
		up to 200 kW_p	up to 500 kW_p	up to 20 MW_p	up to 50 MW_p
25 Year	84.8 Cent EGP With bank loan by 4% interest	90.1 Cent EGP With bank loan by 8% interest	97.3 Cent EGP	97.3 Cent EGP With money exchange guarantee (13.6 Cent $)	102.5 Cent EGP With money exchange guarantee for (14.34 Cent $)

(Source: Ministry of electricity conference, FIT, Sep. 2014)

Net Metering

On January 2013, the Electric Regulatory Agency approved a set of regulatory rules to encourage the exchange and usage of electrical power produced from solar energy. The rules include the possibility of net metering on a monthly basis and payments will be based on the consumption of the purchased net power. The electricity metering systems will be supplied by the relevant electricity distribution company; however, the subscriber should bear its cost.

Other initiatives promoted by the Egyptian Government in 2014

1- Land Availability: More than 7600 square kilometres of desert lands have been allocated for implementing future projects. All permits for land allocation have already been obtained by NREA. Environmental Impact Assessment (EIA) including Bird migration studies have been prepared by NREA in cooperation with international consultants. Signing land use agreement with the investor against payment equivalent to 2% of the annual energy generated from the project or its value.
2- Custom Duties: All renewable energy equipment and spare parts have a 2% customs duties.
3- Power Purchase Agreement: Signing a long term Power Purchase Agreement (PPA), 25 years for solar and 20 years for wind. The Central Bank of Egypt will guarantee all financial obligations of EETC under the PPA.
4- Renewable Energy Fund: Establishing renewable energy funds for household owners by a loan from banks at an interest of 4% for systems up to 10kW and for commercial buildings by a loan at an interest of 8% for systems up to 200kw.

6.4 Spain (from contributions by EsE and BEN/BEG Research Group)

6.4.1 Policies and regulatory framework

Renewable Energy Policy in Spain

The specific regulations of the Spanish electric framework has become really complex in the last years due to the different changes occurred in the fixed support schemes to renewable energies. The incentive scheme is currently suspended by RD-L/1/2012, and therefore, new installations cannot access a support schemes, and in addition, the re-operating date of the scheme has not yet been set.

Spain should have complied the minimum target of 20% set in the Renewable Energy Directive (2009/28/EC) and also the expected initial target of 22.7% in the National Action Plan for Renewable Energy (PANER) and of 20.8% set by the Spanish Government in its own Renewable Energy Plan (PER) 2011-2020.

The framework and regulations to achieve these targets have resulted in several new legislations that have decreased support schemes of renewable facilities, which may have contributed to not complying with the target set up.

We can find a summary of the evolution of Spain's regulations for the last 10 years:

RD 436/2004 modifies the legal and economic framework for electricity generation under the Special System, making it more stable and predictable, and establishes a system to support electricity generation based on the free choice of the producer, who can decide between two options:

- ✓ Option 1: Sale to the distributor at the regulated tariff, which is the same for all scheduling periods, calculated as a % of the yearly average tariff as defined in R.D. 1432/2002, which approved the methodology for determining this tariff.
- ✓ Option 2: Free market sale, through the bidding system managed by the market operator (OMEL), the bilateral contracting system or forward contracting system (or both). The price is set by the market or negotiated by the parties in the case of a bilateral contract, plus an incentive and a premium for the power guarantee, like other producers under the Ordinary System.

RD 661/2007 regulated the electricity production activity within the Special Regime. Therefore, it determined the rate/tariffs for each kind of facilities in the special regime. Also, it fixed a target for each technology: the maximum capacity that can be installed.

In our case, Solar Energy is type b.1

- ➢ b.1.1. Photovoltaic technology
  The capacity maximum that can be installed is 371 MW and FiT is 44.03 c€/kWh
- ➢ b.1.2. Thermoelectric technology
  The capacity maximum that can be installed is 500 MW and Fit is 26.9375 c€/kWh

RD 1578/2008 regulated the remuneration for electricity production by photovoltaic technology systems. This affects subsequent facilities to the deadline for remuneration within of the RD 661/2007 for this technology. The Solar Systems saw that its Tariffs were decreasing. In addition, it defined rates that renewable facilities should pay in relation to its location and its power generated for previous registration at the Administration.

These rates or guarantees to be paid previously are the following:

- Facilities Type I.1 are 50 €/kW
- Facilities Type I.2 are 500 €/kW

RD 1614/2010 regulated and modified certain aspects of the electric activity production by wind and solar technologies. Also, it established a limit of equivalents working hours for wind power and thermoelectric power to receive tariffs. In addition, the wind power tariffs suffered a great decrease.

RD 1699/2011 regulated the new rules for network connection of low power facilities. In the case of facilities lower than 100 kW of capacity and these are connected to a low voltage line (lower than 1 kV) that should pay only 20 €/kW in concept of rates/guarantees for the connection. Also, it created an abbreviated procedure for facilities with a capacity lower than 10 kW. This abbreviated procedure is the same that for other bigger capacities. However, the waiting time-frames for its legalisation and connection are smaller.

RD 1/2012.- This Royal Decree-Law determined the suspension of pre-allocation procedures and the removal of economic incentives for the production of new electricity facilities from cogeneration, renewable resources and waste energy.

RD 900/2015 intends to regulate the terms and conditions of self-consumption Renewable Energy Systems. In practice, it obstructs the deployment of self-consumption of small-medium and large scale systems, increasing the costs (technical requirements) and the complexity of the administrative process.

Administrative legalisation processes for self-consumption

This subsection is devoted to summarise the expected processes in the legalisation of renewable energy facilities with a capacity between 5 and 100 kW, to focus on photovoltaic and thermoelectric facilities. Nowadays in Spain, there are no small capacity solar thermoelectric facilities installed. Therefore, it will be assumed that the processes will be the same as for photovoltaic facilities.

The main body responsible for managing the facilities of renewable energies systems (RES) is the Ministry of Energy, Industry and Tourism, and all RES must be registered in the RIPRE (Registration in Special Regime Production Facilities). In the event of renewable facilities with a capacity under 50 MW, the Autonomous Region will be the competent body to authorise and register these facilities in the Special Regime.

As for the eligible area of Catalonia, the responsible bodies are:

- Direcció General d’Energies, Mines i Seguretat Industrial
- Departament d’Empresa i Ocupació
- Oficina de Gestió Empresarial (OGE)

In the legalisation process were required, an engineer and a qualified installer shall sign the technical documents.

The final person responsible for the good operation and maintenance of the facilities is the owner.

When the renewable energy facility is to be registered in the RIPRE, the minimum documentation required is the following:

- Communication of facility, template provided by the administration (OGE)
- Application of start-up, template provided by the administration (OGE)
- Contract with supply electric company
- Low voltage electric installation Certificate, template provided by the administration. Original signed by a specialised and authorised installer with the seal of the registered specialist installation company, stating that the installation has been completed in accordance with the current REBT, its MI-BT Instructions and Regulations of the electric supply company
- Executive Project, signed by an engineer
- Certificate of management and end of work, signed by an engineer
- Certificate of commissioning
- Report from the grid's management, to be made by the distribution company
- Report on the fulfilment of measuring points, to be made by the distribution company
- The environmental studies, required by the administration depending on several aspects, such as location, size and kind of facilities and the Autonomous Region where they are located

Two copies of all of these documents should be submitted to the Administration in paper format and in digital format (PDF).

The administrative procedure can be different depending on the kind of connection to the grid to be made. On one hand, it should explain the kind of facilities that will send the energy generated to the grid and therefore receiving money for that. This kind of facilities comply with Royal Decree 661/2007 and 1578/2008. On the other hand,self-consumption facilities will be explained pursuant to RD 842/2002 (ITC-BT-40) and RD 1699/2011. Nowadays there are few differences between both kinds of connections in relation to their administrative procedures.

Procedure for facilities selling energy:

- ✓ Getting the Grid Connection Permit
- ✓ Getting the Condition of facility included in the Special Regime
- ✓ Getting the previous Administrative Authorisation
- ✓ Getting the Planning Permission and Municipal Authorisations
- ✓ Approval of the Executive Project
- ✓ Getting the final Authorisation Commissioning
- ✓ Getting the final Registry in RIPRE

Procedure for self-consumption facilities:

- ✓ Getting the Planning Permission and Municipal Authorisations
- ✓ Getting the Grid Connection Permit. *For facilities with a capacity under 20 kW within developable areas, electric grid connection infrastructures' taxes are substituted by the duty connection economic regime as if it were a supply connection*
- ✓ Getting the Low Voltage Electric Installation Certificate
- ✓ Approval of the Executive Project
- ✓ Getting the final Authorisation Commissioning
- ✓ Getting the final Registration in RIPRE

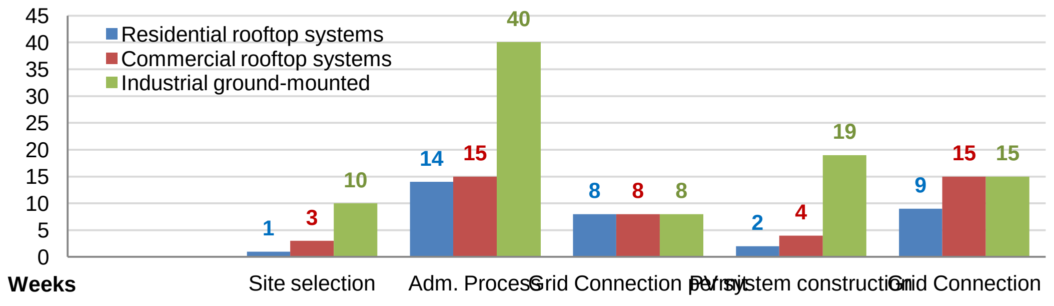
RD1699/2011 establishes the economic guarantees that renewable facilities should pay at the beginning of the administrative process, although for facilities with a capacity under 10 kW this is not required. In addition, there is an abbreviated procedure to connect facilities with a capacity under 10 kW.

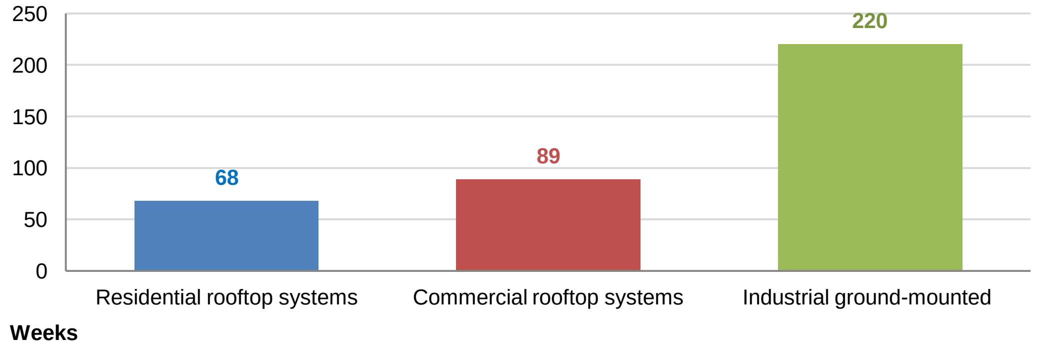
The Final PV Legal Report of February 2012 shows a study on the reduction of Bureaucratic barriers for successful PV deployments in Europe. This report includes all the information explaining the time-frames and costs needed for undertaking these kinds of facilities.

The time-frame required for undertaking a renewable energy facility could be that used in the following breakdown of the life cycle of a project.

Both figures below show the average time required for three different kinds of PV facilities, depending on where they are located and their capacity once installed. In this case, for Didsolit Project, the Residential Rooftop System is the reference system, due to the fact that its capacity is under 20 kW once installed and it is located on the rooftop.

The administrative process and grid connection (permit and operation) are both parts of the project that require most time due to the excessive bureaucracy in Spain. The average time required for the administrative process could be around 14 weeks and for all the grid connection process with the electric supply company over 4 months. Therefore, the overall time needed for undertaking every part involved in a renewable energy project is around 68 weeks, depending on process times and waiting times.





Graphic 1 Overall Project Development Duration. Source: Final Report of PV legal by EPEA

The figure below explains the share of administrative costs within total development costs excluding system equipment. The administrative costs for Residential Rooftop Systems represent about 36% of the total costs of the project, which represents a very significant part of global costs.

Graphic 2 Share of Administrative Costs in total development costs
Source: Final Report of PV legal by EPEA

Specific recommendation to the Spanish government:

The new regulation for self-consumption in Spain is extremely damaging to the development of the decentralised photovoltaic energy. There are no advantages or easiness for private and small public institutions to install small-medium size Solar systems. Extra taxes on self-consumption, complexity and uncertainty of the administrative process and extra costs (difficult to accept for small systems), among other inconvenients.

No clear protocol has been established until now. In fact, DIDSOLIT-PB solar applications will be the first ones to be legalised under the new regulation, which has seriously affected the timing of the legalisation process.

Taking into account the maturity of the PV sector, and the ambitious goals raised by the EU and accepted by Spain, the Spanish government should simplify and facilitate (at least, not obstruct), the deployment of self-consumption and net-metering models.

German and French regulations could be a good example to optimise the national strategy.

6.4.2 Financing viability and dedicated financing mechanisms

Institutional support to renewable energies in Spain lasted over one decade (1998-2011). It was mainly implemented trough Feed-in Tariff policies, that reached their peak in 2007-2008, fostering a great boost of the sector (80% of the installed PV was completed in less than one year).

The dramatic reduction of the FIT, combined with the economic crisis led to a huge fall in the sector.

However, the important cost reduction of the PV systems and the inflation of the electricity costs (approximately 5% per year) brought a “Grid parity” scenario and opened a wide range of possibilities for Self-Consumption PV systems.

In order to minimise the mismatch between the energy production and energy consumption curves, a “Net metering” system has been developed throughout the world. It allows consumers who generate some or all of their own electricity to use that electricity anytime, instead of when it is generated. The RE kWh that is not directly consumed is deducted of the monthly electricity metering, so that, the prices of both are equal (Grid-parity).

Although this initiative has been widespread in most European countries, the Spanish government has been blocking its implementation.

6.4.2.1. FIT in Spain

Spain has had a decreasing evolution in its tariffs paid to the renewable energy facilities. In 2004 it defined a fixed tariff for each renewable resource system. In this manner, promoters and investors could ensure fixed incomes for every kW generated and invest with a stable economic projection. The figures below show the evolution of tariffs for the solar energy systems from 2004 onwards.

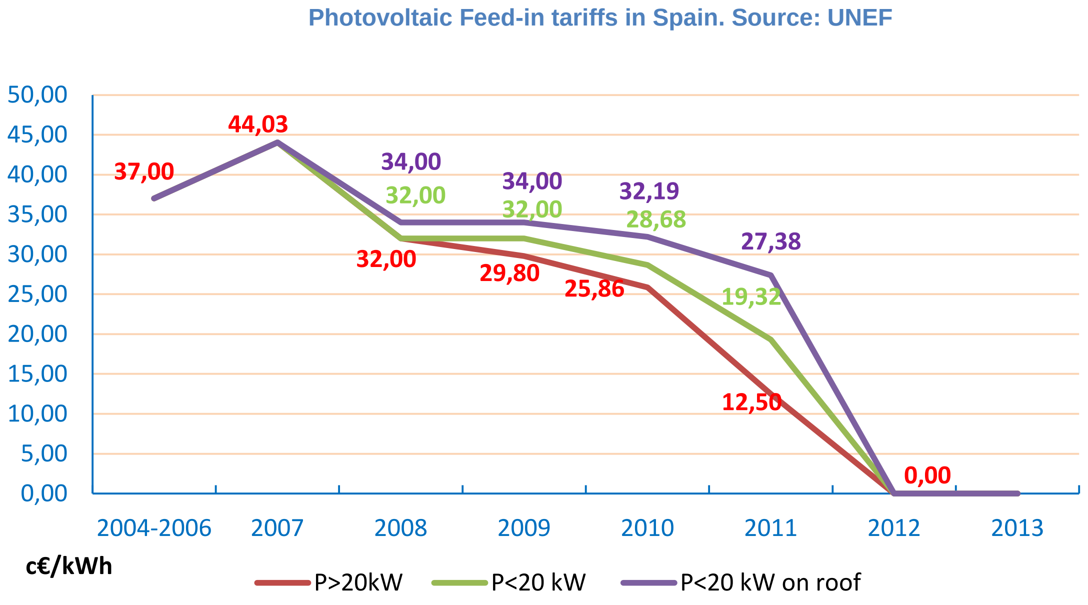
In the case of Photovoltaic systems, on the graph you can see how in 2007 with the issue of the RD 661/2007, the tariffs were increased 7 c€/kWh and the installed capacity increased significantly in Spain. For this reason, the set targets for installed capacity were quickly achieved. From 2007 onwards, tariffs started moving downwards until now, which they are nil.

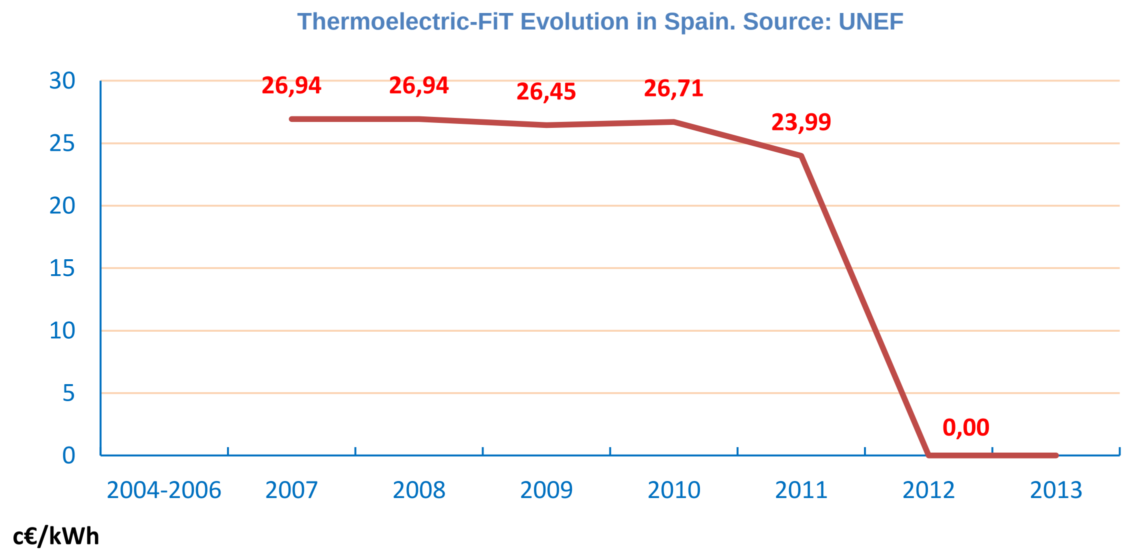
In the case of Solar Thermoelectric, from 2004 to 2011 tariffs did not move considerably, but today they are nil as well.

FIT evolution in Spain, 1998-2011:

From 0.44 €/kWh (2008) to 0.125 €/kWh (2012)
Dropped by 71.5% in 3 years.

TARIFAS REGULADAS								
RD2818/1998				RD 436/2004			RD 661/2007	
1998		2004		2007/2008				
pta/Kwh		pta/Kwh		€/Kwh				
36		22		0,440381				
RD1578								
2009			2010			2011		
Tipo 1.1	Tipo.1.2	Tipo 2	Tipo 1.1	Tipo.1.2	Tipo 2	Tipo 1.1	Tipo.1.2	Tipo 2
c€/Kwh			c€/Kwh			c€/Kwh		
0,356572	0,335597	0,335597	0,330773	0,294689	0,265676	0,27374	0,193116	0,124935





6.4.2.2. Net Metering

Spain's RE Self-Consumption is intended to be regulated by the last RD 900/2015, but it doesn't include the possibility of Net-metering.

On the contrary, the new regulation system for small and medium renewable energy producers includes a tax to be paid for every kWh/h produced, for both self-consumption and grid-connection.

6.4.2.3. External financing (public/private):

State level: IDAE

The more clearly specific financial mechanisms at State level are the ones established by the specialised public Agency IDAE (Instituto para la Diversificación y el Ahorro de la Energía).

Investment activity is in fact one of IDAE's strategic action lines. The aim is to promote projects which have a clear technological innovation component and have potential for replication.

The way in which the Institute takes part in projects depends on each specific case, the sector concerned, the technology involved and the turnover. Thus, the different formulas are:

- Fondo JESSICA-F.I.D.A.E.:*"Fondo de Inversión para financiar proyectos de eficiencia energética y energías renovables*".

- Third-Party Finance (TPF): this is one of the most suitable mechanisms available to undertake investment projects in energy saving and efficiency and energy generation using various sources, including renewable energy ones. The IDAE, the main promoter of this financing mechanism in Spain, has been using it successfully since 1987.

- Project Finance and Provision of Services: a financing mechanism applicable to projects investing in energy saving, energy efficiency and renewable energy sources, which have undergone a prior economic/technical feasibility analysis. It is a new model of financial collaboration which entails drawing up and signing two contracts: a framework collaboration and service provision contract and a project finance contract (i.e. a business loan).

Other participation forms by IDAE in energy projects:Joint Ventures; Economic Interest Groupings (IEA); Shares in corporations; Share accounts; Technology development agreements.

The IDAE's Third-Party Finance mechanism (TPF)

The majority of the IDAE's direct investments are made using the *Third-Party Finance* (TPF) approach. Its basic features are:

TPF represents an integrated technical and financial solution for energy investment projects: the IDAE takes part in the definition of the project, providing the most appropriate technical solution for each case and financing all or part of the project investment. For the enterprise or final recipient this formula is a more attractive alternative to conventional finance.

The IDAE makes the investment directly, so payments are not normally required by the enterprise or final recipient of the investment: it does not, therefore, constitute a loan to the industrialist by the IDAE, as the equipment is owned by the IDAE until the investment is recovered. Thus, with this mechanism, the industrialist's debt capacity is unaffected, and the resources he can devote to other company objectives are not reduced.

The IDAE recoups its investment, with a profit, from the energy savings produced or the energy generated. This means that depreciation of the investment is not an increased cost for the enterprise, as it is paid out of the energy savings produced or the energy generated as of the time the plant in which the investment is made is brought into operation. Thus, the user of the installation enjoys a reduction in energy costs right from day one.

Once the IDAE has recouped its investment the installed equipment becomes the property of the customer: as of this time the final user benefits from all the energy savings or energy generated by the plant, and will also have improved its competitive position as it will have a more technologically advanced, and more energy efficient, plant.

Versatility of TPF to adapt to the different types of projects: TPF allows for various different contractual forms, all retaining the underlying philosophy, which are suited to different types of projects.

Regarding TPF implementation. While maintaining the inherent features of TPF described above (technical/financial definition of the project, purchase of equipment, recouping the investment from savings, final transfer to industrialist), different contractual forms may be used to implement it, these being:

Loan of equipment*:* A contract for the loan of equipment is established between the customer and the IDAE, whereby the IDAE, as the owner of the equipment, grants the customer the right to use it for a fixed or variable length period. During this time the user is obliged to pay the IDAE a series of periodic instalments depending on the energy saving obtained or the energy produced by the new equipment. This mode is normally applied when drawing up projects whose aim is the implementation of equipment and installations in industry and in the services sector, which result in energy savings or energy replacement. It is also applicable to energy generating technology projects (electricity or heat), provided that the energy produced is wholly or partly consumed by the user, in which case the unconsumed surplus is sold directly to a third party. This is the form most commonly used by the IDAE and covers almost 50% of its investment projects. The size of investments that can be made using this mechanism are normally set in the range of 300,000 to 3,000,000 euros and the period over which the IDAE recoups its investment is normally 4 to 8 years.

Purchasing on deferred payment terms:

This formula is available as an alternative to the preceding one in which use of the equipment is granted. It is used in cases where the user, for reasons not inherent to the project, asks for this formula to be used (this is often because a purchase invoice for the equipment is required in order to obtain a subsidy).

Direct operation by the IDAE:

In this formula the IDAE retains ownership of the equipment and invoices the user directly for the energy produced. This formula can be used in the case of projects using renewables to generate electricity: mini-hydroelectric plants, small scale wind farms, biomass power stations, and photovoltaic plants. The legal formula used in these cases normally involves the signing of two contracts: one between the IDAE and the electricity company and another between the IDAE and the end user of the equipment. In order to allow the end user to have a share of the energy profits of the project, the parties sign an operation and maintenance contract for the equipment, under which the user receives a share of the income from the sale of the energy produced.

The IDAE's involvement in the financed projects

The process followed by a typical TPF project, and the IDAE's involvement in each of the phases could be summarised as follows:

Technical/economic analysis *:*Once a project has been identified, the relevant technical department of the IDAE conducts an initial analysis to determine the technical feasibility of the project and the energy produced. In this phase, depending on the technical nature of the projects and the envisaged economic scope of the investment, the feasibility study or taking of measurements may sometimes be contracted out, and an agreement signed between the industrialist or project developer and the IDAE. Under this contract the parties agree to implement the project if the results of the analysis are favourable. If the results of the first approach to the project are favourable, the IDAE will proceed with a more in-depth technical and economic analysis. This will assess the energy component, its profitability, technological nature, sector, possibilities for replication, the nature of the customer (SMEs, large companies, institutions, or individuals), the value of the investment, the form of contract, and the technical and economic risk (IDAE Risk Committee). In short, the project is designed, in technical and financial terms, according to its energy component.

Technical/financial proposal*:* Thus, once the most appropriate technical solution has been identified and the financial and legal definition of the project determined, the relevant proposal is drafted so it can be negotiated with the customer. Once accepted the relevant contractual documents are drawn up by the IDAE. The technical departments concerned are responsible for this process, with support from the "horizontal" departments: Procurement, Legal Advice, Budgets and Financial Management.

Signing of the contract*:* Once the contract has been signed with the customer, project implementation can start.

Project implementation:

The IDAE is responsible for the technical supervision of the project, handling the procurement and financing of the operation, and purchasing the equipment agreed with the customer. This process is handled by the technical departments and the Procurement, Purchasing and Services Department.

Project operation: Once the investment in the equipment has been completed it can be brought into operation. At this point, the IDAE, depending on the type of project, may operate the equipment directly or hand it over to the industrialist. In either case the IDAE always provides technical support and supervision. In this phase, logically, the tasks carried out by the administration departments regarding invoicing, collections, incidents, budgetary supervision, etc. are particularly important.

***End of the IDAE's involvement**:*

Once the IDAE has recovered its investment, it hands over the ownership of the equipment to the industrialist and withdraws from the project.

EU level:

The EEEF

The EU Agency *European Energy Efficiency Fund* (EEEF) aims to support the goals of the European Union to promote a sustainable energy market and climate protection. One of its institutional objectives is to offer funding for energy efficiency and small-scale renewable energy projects. The Fund observes the principles of sustainability and viability, combining environmental considerations and market orientation. It does so by financing economically sound projects, allowing for a sustainable and revolving use of its means.

EEEF targets

The final beneficiaries of EEEF are municipal, local and regional authorities as well as public and private entities acting on behalf of those authorities such as utilities, public transportation suppliers, social housing associations, energy service companies etc. Investments can be made in Euro, or local currencies, however the latter is restricted to a certain percentage. To reach its targets, EEEF can pursue two types of investments: *Direct Investments*, i.e. to action'final beneficiaries; and *Investments into financial institutions* for funding programmes to the referred kind of beneficiaries.

Direct Investments:

These comprise projects from project developers, energy service companies (ESCOs), small scale renewable energy and energy efficiency service and supply companies that serve energy efficiency and renewable energy markets in the target countries.

- Investments in energy efficiency and renewable energy projects in the range of €5m to €25m
- Investment instruments include senior debt, mezzanine instruments, leasing structures and forfeiting loans (in cooperation with industry partners)
- Ere equity (co-)investments are also a possibility for renewable energy over the lifetime of projects or equity participation in special purpose vehicles, both in direct cooperation with municipalities, or with public and private entities acting on behalf of those authorities.
- Debt investments can have a maturity of up to 15 years, equity investments can be adapted to the needs of various project phases
- The Fund can (co-)invest as part of a consortium and participate through risk sharing with a local bank.

Investments into Financial Institutions

These include investments in local commercial banks, leasing companies and other selected financial institutions that either finance or are committed to financing projects of the Final Beneficiaries meeting the eligibility criteria of EEEF.

- Selected partner financial institutions will receive debt instruments with a maturity of up to 15 years
- These instruments include:
  - senior debt
  - subordinated debt
  - guarantees
- No equity investments in financial institutions
- Financial institutions lend to the beneficiaries of the Fund meeting the eligibility criteria to finance energy efficiency and/or renewable energy projects

The EEEF process for Direct Investments

Step 1: Initial screening. Direct investments embrace projects in energy efficiency, renewable energy and clean urban transport sectors. The Investment Manager will source projects actively from various sources, e.g. global and local ESCOs, manufacturers of equipment or project developers. At the same time potential project partners can also contact the Investment Manager to suggest their project for funding. The Investment Manager will conduct a first assessment on the eligibility of the project, and the overall portfolio fit. If the outcome of the first screening is positive the Investment Manager will start the due diligence process.

Step 2: Due Diligence. For the due diligence process further project information such as a financial model, comprehensive project description and technical details are required. Project evaluation will first focus on the portfolio fit with regards to applicable risk ratios and risk-return considerations. The Investment Manager will also analyse whether the Fund's environmental and developmental objectives are met prior to assessing the project's legal, financial and technical specifications. If necessary, the Investment Manager might collaborate with the counterparty to identify more feasible financing structures.

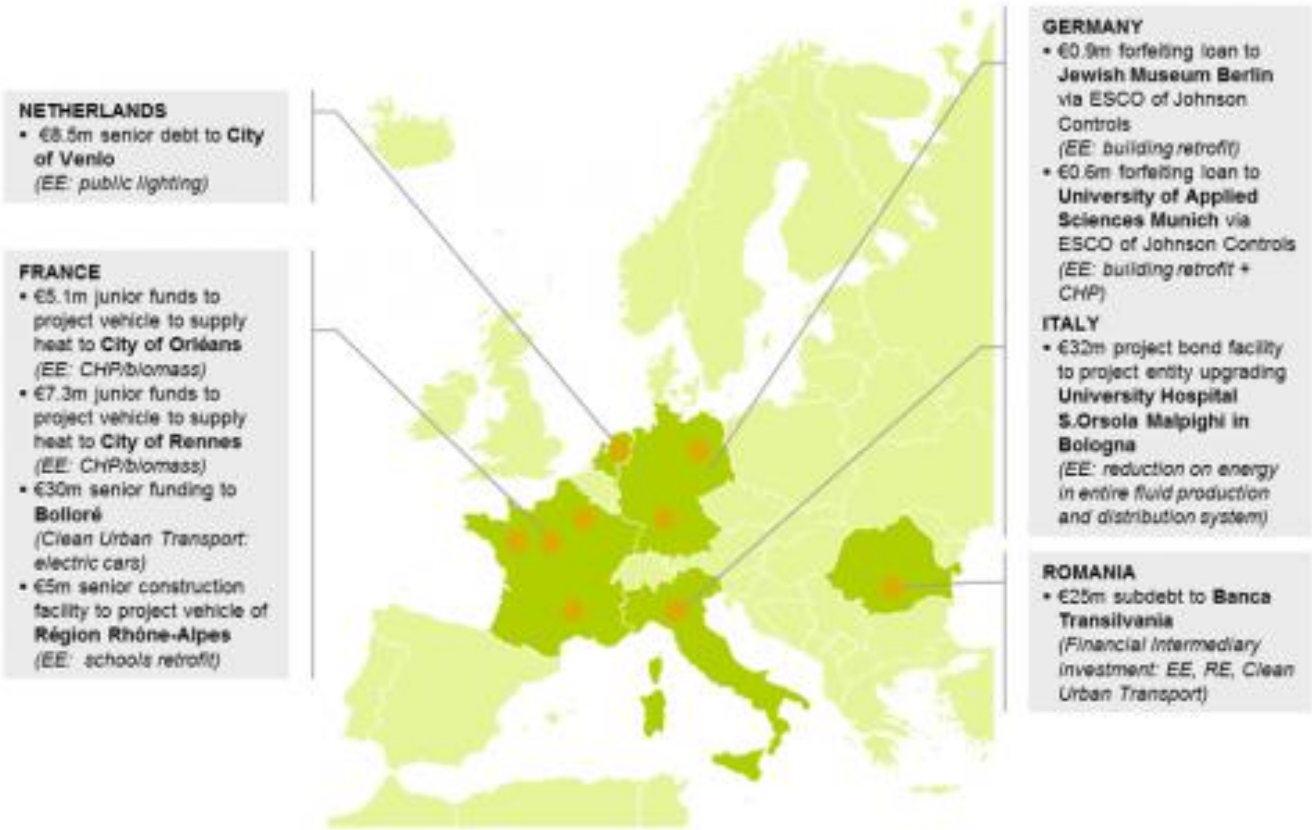
Step 3 - Preparation of Financial closing. Subject to a successful outcome of this analysis, the Investment Manager will prepare an Investment Proposal and the project will be presented to the Investment Committee. Upon approval by the Investment Committee, the Investment Manager will prepare the financial closing.

Step 4 - Monitoring and reporting. The Investment Manager will ensure that all projects comply with the terms and conditions agreed upon prior to the investment. This includes regular (quarterly and annual) review of its financial, social and environmental performance. Potential work-out scenarios, restructurings, terminations and any other potential follow-up issues will be performed by the Investment Manager.

Important remark on the use of EEEF financing instruments

Taking into account that our DIDSOLIT-PB Project focuses on Mediterranean Regions – and as far as the European Union ones- it is worth underlining that most of the EU Mediterranean Regions do not have a Project funded by the EEEF, as it is illustrated into the following figure:

"The EEEF has achieved financial closings for following investments:" *



(*) EEEF web site page: http://eeef.lu/current-investments.html, as of 27/02/2016.

EIB - ELENA

The *European Investment Bank* (EIB) –through the *Intelligent Energy Europe* (IEE) programme- has been funding Local Authorities energy efficiency in public and private buildings, including social housing, and street and traffic lighting; applications of Renewable Energy Sources (RES) in buildings; district heating/cooling; decentralised Cooling and Heating Power (CHP) systems; urban transport; freight logistics in urban areas; local infrastructure, including smart grid and Information and Communication Technologies (ICT) for energy efficiency, energy-efficient urban equipment as well as intermodal transport facilities and refuelling infrastructures for alternative fuel vehicles.

That funding has been implemented through the IEE's protocol ELENA(*European Local Energy Assistance*). So, for instance, the *Diputació de Barcelona,* a Council gathering all the municipalities of the province, was the beneficiary of a line of funding aids for development-assistance projects presented by the specific municipalities.

However, in 2014 the IEE programme with its ELENA line ended being subsumed into the new EU platform ***Horizon 2020***. Though no clear alternative similar to ELENA can be found in the *Horizon 2020* calls so far.

Bank sector level:

The only one public bank in Spain, *Instituto de Crédito Oficial*", ICO, has no specific credit line for renewable energy investments. It only has general-purpose credit lines for SMEs, its loans being only for companies, not private individuals (which are processed through the Spanish commercial banks).

The only private Spanish bank which offers a specific loan line both for companies and individuals for renewable energies investments is *Triodos Bank*. Although this is quite a small financial institution.

Big Spanish banks, such as Caixa bank for example (which talks in its press releases about having a 'renewables line'), publically declare how important the loans they have given for renewable energy projects are. But they refer basically to loans for financing large power plants, usually to also big energy companies. That is, they actually underline that of those usual big loans to corporations, be it in Spain or in any other country, are related to renewable energy projects of such corporations. In any case, in the bulk of the Spanish bank system specific loan lines do not exist with specific conditions and easy procedures for distributed solar power applications (basically self-consumption) which can be addressed to buildings owners, either private individuals, private associations, municipalities, local agencies, industries or any type of companies.

General statement on the European Union

Project funded by the
EUROPEAN UNION

The European Union is made up of 27 Member States who have decided to gradually link together their know-how, resources and destinies. Together, during a period of enlargement of 50 years, they have built a zone of stability, democracy and sustainable development whilst maintaining cultural diversity, tolerance and individual freedoms. The European Union is committed to sharing its achievements and its values with countries and peoples beyond its borders.

بيان عام عن الاتحاد الأوروبي
يتكوّن الإتحاد الاوروبي من ال 27 الدول الأعضاء الذين قرروا معاً ربط خبراتهم والموارد ومصائرها. معاً، وخلال فترة 50 عاماً من التوسع، تم بناء منطقة من الإستقرار، الديمقراطية والتنمية المستدامة مع الحفاظ على التنوع الثقافي، التسامح والحريات الفردية. يلتزم الإتحاد الأوروبي في تقاسم إنجازاته وقيمه مع الدول والشعوب خارج حدوده.

General statement on the European Union (Greek)

Η Ευρωπαϊκή Ένωση αποτελείται από 27 Κράτη Μέλη που έχουν αποφασίσει να συνδέσουν σταδιακά την τεχνογνωσία, τους πόρους και το μέλλον τους. Κατά τη διάρκεια μιας περιόδου διεύρυνσης 50 ετών, έχουν δημιουργήσει μαζί μια ζώνη σταθερότητας, δημοκρατίας και αειφόρου ανάπτυξης διατηρώντας παράλληλα την πολιτιστική πολυμορφία, τη διαφορετικότητα και τις ατομικές τους ελευθερίες. Η Ευρωπαϊκή Ένωση έχει δεσμευθεί να μοιράζεται τα επιτεύγματα και τις αξίες της με χώρες και λαούς που βρίσκονται εκτός των συνόρων της.

Statement about the Programme

ENPI CBCMED
CROSS-BORDER COOPERATION IN THE MEDITERRANEAN

The 2007-2013 ENPI CBC Mediterranean Sea Basin Programme is a multilateral Cross-Border Cooperation initiative funded by the European Neighbourhood and Partnership Instrument (ENPI). The Programme objective is to promote the sustainable and harmonious cooperation process at the Mediterranean Basin level by dealing with the common challenges and enhancing its endogenous potential. It finances cooperation projects as a contribution to the economic, social, environmental and cultural development of the Mediterranean region. The following 14 countries participate in the Programme: Cyprus, Egypt, France, Greece, Israel, Italy, Jordan, Lebanon, Malta, Palestinian Authority, Portugal, Spain, Syria, Tunisia. The Joint Managing Authority (JMA) is the Autonomous Region of Sardinia (Italy). Official Programme languages are Arabic, English and French.

بيان حول البرنامج
إن برنامج NPI CBC MedE 2007 – 2013 هو برنامج للتعاون المشترك عبر الحدود لحوض البحر الأبيض المتوسط، هو جزء من سياسة الجوار والشراكة الأوروبية ومن آلياتها التمويلية. يهدف هذا البرنامج إلى تعزيز ودعم عملية التعاون المستدام والمنسجم على مستوى حوض البحر الأبيض المتوسط وذلك من خلال معالجة التحديات المشتركة وتعزيز الإمكانات الذاتية. يموّل البرنامج مشاريع التعاون كمساهمة في التنمية الإقتصادية، الإجتماعية، البيئية والثقافية لمنطقة البحر الأبيض المتوسط. إن قبرص، مصر، فرنسا، اليونان، إسرائيل، إيطاليا، الأردن، لبنان، مالطا، السلطة الفلسطينية، البرتغال، إسبانيا، سوريّا، الدول ال 14 التالية هي الدول المشاركة في البرنامج: تونس. إن سلطة الإدارة المشتركة JMA هي منطقة الحكم الذاتي لمقاطعة سردينيا (إيطاليا). إن اللغات الرسمية للبرنامج هي : العربية ، الإنجليزية والفرنسية.

Statement about the Programme

Το Πρόγραμμα Διασυνοριακής Συνεργασίας Μεσογειακής Λεκάνης (ENPICBCMediterranean SeaBasin) 2007-2013 είναι μια πολυμερής πρωτοβουλία Διασυνοριακής Συνεργασίας η οποία χρηματοδοτείται από το Ευρωπαϊκό Μέσο Γειτονίας και Εταιρικής Σχέσης (ENPI). Το Πρόγραμμα έχει σαν στόχο να συμβάλει στην προώθηση της βιώσιμης και αρμονικής συνεργασίας στην περιοχή της Μεσογειακής Λεκάνης αξιοποιώντας πλήρως τις ενδογενείς δυνατότητες της περιοχής και αντιμετωπίζοντας τις κοινές προκλήσεις. Χρηματοδοτεί έργα συνεργασίας τα οποία συμβάλλουν στην οικονομική, κοινωνική, περιβαλλοντική και πολιτιστική ανάπτυξης της Μεσογείου. Στο Πρόγραμμα συμμετέχουν οι ακόλουθες 14 χώρες: Κύπρος, Αίγυπτος, Γαλλία, Ελλάδα, Ισραήλ, Ιταλία, Ιορδανία, Λίβανος, Μάλτα, Παλαιστινιακή Αρχή, Πορτογαλία, Ισπανία, Συρία, Τυνησία. Η Κοινή Διαχειριστική Αρχή (ΚΔΑ) του Προγράμματος, είναι η Αυτόνομη Περιφέρεια της Σαρδηνίας (Ιταλία). Επίσημες γλώσσες του Προγράμματος είναι τα Αραβικά, Αγγλικά και Γαλλικά.

Disclaimer

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تنبيه
"لقد تم إعداد هذه النشرة بمساعدة مالية من الإتحاد الأوروبي في إطار برنامج التعاون المشترك عبر الحدود لحوض البحر الأبيض المتوسط ENPI CBC Med. إن محتويات هذه الوثيقة من مسؤولية ولا تعكس تحت أي ظرف من الظروف رأي الإتحاد الأوروبي أو الهياكل الداخلية للبرنامج. "

Disclaimer

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European Union web links
http://ec.europa.eu/world/.
Europe Aid Development and Cooperation Office http://ec.europa.eu/europeaid/index_en.htm
ENPI CBC Med Programme http://www.enpicbcmed.eu

The project DIDSOLIT-PB is implemented under the ENPI CBC Mediterranean Sea Basin Programme (www.enpicbcmed.eu). Its total budget is 4,3 million Euro, and it is financed, for an amount of 4,1 million Euro, by the European Union through the European Neighbourhood and Partnership Instrument. The ENPI CBC Med Programme aims at reinforcing cooperation between the European Union and partner countries regions placed along the shores of the Mediterranean Sea."

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