FOSTErinMED

Context Analysis Report

Project
funded by the
EUROPEAN UNION

ENPI
CBCMED
CROSS-BORDER COOPERATION
IN THE MEDITERRANEAN

This report has been produced thanks
to the financial support of the European Union
under the ENPI CBC Mediterranean Sea Basin Programme

Project
funded by the
EUROPEAN UNION

ENPI
CBCMED
CROSS-BORDER COOPERATION
IN THE MEDITERRANEAN

Index

Executive Summary WP4 –Context Analysis

FOSTEr in MED (*FOstering Solar TEchnology in the MEDiterranean area*) is aimed at promoting the adoption of Photovotaic (PV) and Building Integrated PV (BIPV) technologies in the cities of the project partner countries: **Egypt, Italy, Jordan, Lebanon, Spain, Tunisia**. As a preliminary step, a Context Analysis has been performed within the WP4, aimed at understanding drivers and hinders to the diffusion of these technologies in the partner countries urban environment.

The **Context Analysis** has been structured in three steps:

1. Desk Analysis
2. In-Depth Interviews to local stakeholders (10 in-depth interviews in each partner region)
3. Survey (administration of questionnaires to 100 citizens in each partner region)

with the aim to assess: i) Market conditions; ii) Normative settings and local regulation standards; iii) Knowledge, diffusion and public interest in solar energy, and in particular PV and BIPV technologies.

Qualified pollsters have been recruited in each partner country to perform the research activities entailed by the WP. The research group in Cagliari had the role of coordinating the activities, collecting and analyzing the information, and reporting.

1. In the **Desk Analysis** phase, each pollster provided an analysis of energy consumption and production in each partner country, and their relation to socio-economic and demographic trends; a review of the instruments available in the partner countries for the promotion of social acceptability of renewable energy, in particular PV technologies, and the adoption of energy efficient technologies and energy saving measures. In addition, the pollsters reviewed the studies carried out in each partner country on PV energy, to account for previous findings on PV diffusion, barriers and social acceptability.
The main results indicate that in all partner countries there is:

- an increase in residential electricity consumption
- an increase in the air conditioning and heat pumps diffusion, mainly to cool buildings in the summer period
- economic and management problems due to the fossil fuel dependence
- an increasing cost of electricity
- some critical issues in the promotion field (information, knowledge, awareness, etc.)

Some relevant issues are different in **EU and in MENA countries**. **Italy and Spain** are subject to the UE climate change policy that leads to a high pressure towards Renewable Energies and Energy Efficiency. Both countries have witnessed an important diffusion of PV systems due to the high level of incentives (national feed-in tariff); however, recently, such subsidies have been reduced or terminated (as in other EU member states). Nevertheless, in our literature review, we have found that in these countries there is an increased awareness of PV benefits, mainly due to EE building regulations. In the EU area, the cost of initial investment is decreasing (either for traditional and innovative modules costs and for installation costs). In this context, PV integration could be seen as a solution to solve some critical issues (urban landscape preservation, lack of space, etc.). As regards **Egypt, Jordan, Lebanon and Tunisia**, we have found a low diffusion of

PV technologies, which are considered an expensive technology, mainly recommended for areas that are not grid connected. It seems that there is little awareness of the potential benefits generated by the PV diffusion. In these countries, Governments keep a high level of subsidies to sustain fossil fuel consumption. This situation leads to an excess of demand of fossil fuels, and to difficulties in matching national electricity needs in Jordan, Egypt and Lebanon. As a consequence, also in these countries there is a growing necessity to increase the share of renewables in order to relax the dependence from fossil fuels. Different policies and strategies, and different subsidy programs have been designed to promote the transition to renewables. However, the implementation of the policies has often been unsatisfactory; moreover, the communication has also been defective. In general, the highest interest has been placed on energy efficiency and on the solar thermal technology, since it is deemed cheaper, easier to use, and more suitable to urban areas that are grid connected than the PV technology.

2. The **In-depth interviews phase** aims to add qualitative knowledge on drivers and barriers for PV and BIPV diffusion in the partner countries. Through the elements of the desk analysis, the researchers established the themes to be analyzed and then designed the interviews. The questions focused on the following areas: Perception; Innovation; Public Policies; Development of specific topics; Drivers/Barriers.

Each partner provided a list of the key actors to be interviewed, basing their choice on the criteria proposed for the identification.

The in-depth interviews were semi-structured: a trace for the interview was common for all countries in order to provide a comparative analysis, but some space was left to account for the peculiarities of each country.

Some common elements emerged. While environmental issues are perceived as a “political” problem, the adoption of PV technologies is seen as an “economic” choice: an investment, which is associated with the concept of innovation, that finds a certain resistance in relation with the perception of risk (economic, technological and social) and trust. A common element in the discussion is the centrality of the role of public institutions: due to their regulatory function, the power to grant subsides, the desirable role to raise awareness through specific policies and programs; and to the recognized necessity to ease the bureaucratic process. In fact, bureaucracy and public decision making are mentioned among the main barriers in the majority of the countries. In Spain specifically, the uncertainty related to the changes in PV legislation and the retroactive policies applied were indicated by the privileged interlocutors as prejudicial for a development of PV in the next future.

PV and BIPV aesthetic acceptability represents a discretional variable that was defined throughout the discourse of the interviewees. All interlocutors expressed the opinion that the application of photovoltaic technologies involves a change in the aesthetics of architectural structures and, consequently, of the urban landscape. Interestingly, though, the change is not always perceived negatively: some interviewees were attracted by the idea that it can “modernize” the city, and in some cases (especially Beirut) the PV and BIPV technologies are seen as an opportunity to ameliorate the disordered aspect of the urban space. In other cases (primarily Tunis and Cagliari) PV and BIPV are seen as threats to the urban identity, especially when applied in the historical city center.

In Egypt, Jordan, Lebanon and Tunisia, PV covers a different function in urban areas and in rural area: in the latter it is considered a fundamental and concrete solution to the problem of supplying electricity to area that are not connected to the grid. Electricity price, access and outages are confirmed as elements that are contributing to a transition toward renewable energy.

On the other hand, speculation and corruption related to renewable energy investment projects are elements that in some countries, especially in Italy and Lebanon, are perceived as threats. Another element of risk is seen in the possibility that the PV market in MENA countries will be filled by low quality products (several interlocutors expressly make the example of some Chinese solar thermal panels), whose main function is to comply to building regulations rather than to produce energy. In Italy the issue of quality signaling is more related to the installing firms rather than to PV panels (because in the boom period of high feed-in tariffs many new firms entered the market); moreover, the interviews highlighted some lack of knowledge (even among experts) regarding innovative BIPV applications/technologies.

The importance of quality controls and enhancement of general information on the benefits and costs of the PV technologies has been emphasized by interlocutors in all countries.

3. The last part of the work package activities entailed a **survey**, aimed at providing information on the level of awareness that residents in different cities/countries have with respect to innovative PV technologies, and on the social acceptance of BIPV applications in these different urban environments.

Given the exploratory purpose of the study, a convenience sampling method was employed: 100 individuals were sampled in each partner country, for a total amount of 600 respondents. The survey was administered in the period June – August 2014, in the cities of Tunis (Tunisia), Alexandria (Egypt), Haddath (Lebanon), Barcelona (Spain), Cagliari (Italy). The resulting sample precludes a generalization of the results to the population of the cities where the interviews have been taken. Notwithstanding this, we believe that the present analysis is useful to shed some light on awareness, attitudes, and preferences regarding the photovoltaic technology, among a class of people who can be a potential PV market target in our partner countries.

Drawing from previous studies and from the qualitative previous stage of the research (in-depth interviews and a deliberative group), the questionnaire was constructed so as to verify some specific hypotheses on the role of awareness and information on the social acceptance of the PV technology in the dwellings and in the urban environment; how space and economic constraints influence the decision to invest; how the individual's feelings of attachment and identification with the urban context and the community can influence her/his acceptance of a change in the built environment generated by the application of PV and BIPV.

The results of the econometric models show that potential "adopters" (i.e. those individuals who affirmed to be certain to install a PV system in their house in the near future) are well informed of the existing subsidies to promote these technologies, and would be further pushed toward the investment if they could see PV systems at work in friends/relatives/neighbors households, or in public buildings.

As expected, space constraints may be a hinder to the decision to install a PV system: innovative PV modules that do not require permissions (by authorities or by other tenants in the condominium), such as windows glazing, would enhance the probability of adoption.

Another relevant issue is how the information is conveyed. Our results show that those who are seriously interested in the investment would require expert information, that should be perceived as “neutral”, i.e. not coming from professionals or organizations (including public institutions) that hold a private interest in the investment. Finally, it is interesting to note that the potential “adopters” are characterized by a positive attitude and attachment toward the city where they live.

Similar results are found when we examine the social acceptability of different PV applications on residential buildings in the urban context. The respondents had to rank in order of preference 4 technological options (including the status quo) for BIPV applications in two different buildings of their city (a large and a small building). In the first exercise the respondents did not have any information on the cost effectiveness of each application; in the second exercise this information was provided and the interviewees were required to rank again the technological options.

Individuals characterized by appreciation of the environmental qualities of their neighborhood are especially keen on the BIPV applications, which are strongly preferred to the status quo solution (with no PV modules installed). This is an interesting result, since it is often claimed that a higher identification and attachment to a place generates higher opposition toward changes in the landscape produced by the installation of renewable energy technologies. Awareness of the benefits of the PV technology and of governmental subsidies is positively associated to preferences for BIPV applications; this is also confirmed by the fact that after providing cost effectiveness information the preferences for the most beneficial technologies increase significantly.

Finally a comparative analysis across partner countries reveals that Italian, Tunisian and Jordanian respondents seem the most interested in PV technologies, either when considering a possible investment for their household, and when evaluating PV applications in the buildings presented in the experimental scenarios. The Spanish respondents are those who especially see the problems and risks associated with a PV investment (here the recent problems related to the termination of the feed in tariff system, and the retroactivity of some effects may have played a role); and would be more interested in other types of energy efficiency investments. Also in the experimental scenarios they propend for the status quo, and switch preferences only in front of clear economic advantages. Lebanese and Egyptian respondents are in between the two positions: the results of our survey suggest that much more work should be required to raise awareness of the benefits of PV applications in the residential sector especially in the latter three countries.

WP4 – Context Analysis Report

Phase 1: Desk Analysis

Coordinator: University of Cagliari (UNICA) – Department of Social Science and Institutions (DiSSI) Italy

Authors:

Vania Statzu (UNICA- DiSSI, Italy)

Covadonga Pérez Pérez (ASCAME, Spain)

Salma El-Sahhar (CEEBA, Egypt)

Marion Schnorf (IRI, Lebanon)

Laith Basha (RSS, Jordan)

Hedi Essid (CCI-T, Tunisia)

Editor: Vania Statzu

WP4 Coordinator: Elisabetta Strazzera (UNICA-DiSSI, Italy)

Index

Introduction

FOSTEr in MED (*FOstering Solar TEchnology in the MEDiterranean area*) is an ENPI CBC MED project focused to the **promotion of opportunities created by the diffusion of PV** technologies in the partner countries. In particular, the aim is to overcome the different kind of barriers that hinder the adoption of PV technologies. In order to achieve this objective the WP4 is devoted to conduct a **Context Analysis**.

Barriers could be very different, such as climatic, political, economic and financial, market related, technical, cultural.

In order to have a detailed analysis of all the factors affecting the current level of diffusion of PV in the buildings of cities of the regions involved in the project and having information about the factors that could help to promote the diffusion of PV, the Context Analysis concerns:

- A desk analysis phase
- An in-depth interviews phase
- A survey administration phase.

The present report sums up the data and information collected during the desk analysis phase. The **desk analysis phase** is devoted to collect information about:

- **Law and regulation** concerning **energy strategies**, with particular attention on laws referring to renewable energies, mainly PV technologies, and **incentives** adopted to promote it;
- Law and regulation concerning **energy efficiency** in appliances and in buildings;
- A wide range of data on **demographics, socioeconomic and dwelling characteristics** with particular attention on the stock of electric appliances and the heating/cooling systems;
- A detailed analysis of the **energy sector**: data on production and consumption of energy and electricity, focused on solar and PV technologies diffusion and, data over the adoption of energy efficiency technologies and energy saving measures;
- A description of the **main facts concerning energy sector management** and **energy market** characteristics focusing on PV markets;
- A review of previous studies concerning **social acceptability of PV,** or similar technologies; analysis of **barriers and drivers** to the PV diffusion

The purpose of our desk analysis activity is to collect and analyse the information listed above in order to:

- **map stakeholders** and provide a **list of topics** that would be debated during in-depth interviews with selected stakeholders
- **construct the questionnaire,** insertingimportant questions addressed to all partners countries
- Obtaining information required to **organize the survey and to draw the sample**

The document is structured as follows:

- In the first chapter, we will provide a short country description, with an analysis of demographics, socioeconomics and dwelling characteristics, and a description of the main energy facts, with particular attention to those facts that provide useful information for our research;

- The second chapter contains a review of energy and energy efficiency legislation, with a focus on renewable energies -;
- The third chapter is devoted to the analysis of barriers to the diffusion of PV technologies;
- The fourth chapter analyses the main drivers that could promote the diffusion of PV system in the partner countries;
- The fifth chapter contains a description of examples of project developed in the partner countries in previous years and devoted to the promotion of solar technologies, mainly PV.

In the Appendix, four tables are inserted in order to summarise the information collecting about:

1. Energy legislation;
2. Energy efficiency legislation;
3. Barriers;
4. Drivers.

Chapter 1.

Country description and energy facts

Generally, in all **MENA countries** analysed, there is a **scarce diffusion and low knowledge of PV technologies** and associated benefits and opportunities. Most of these countries would be largely benefitted by the diffusion of renewables and PV in particular: reduction of dependence from fossil fuels from foreign countries; reduction of incertitude in electricity provision; reduction of pollution.

Italian and Spanish energy policies are mainly driven by **European Commission Climate Action Policy**. This policy strongly promotes the development and diffusion of renewable energies and energy efficiency in buildings and appliances. Under the pressure of EU, the two countries **set a system of incentives** to promote PV systems. The incentives permit to achieve the objectives. However, **recently** in these two countries (and in some other) Governments cut **incentives (feed-in tariffs)**.

Egypt

The current population of Egypt is 83,661,000 with an increase of 32% in the period 2000-2013. 52% of inhabitants are males. Concerning age, Egypt has a young population (68.25% of population are from 0 to 30 years). The population density is 79 inhabitants per square kilometre.
56.3% are rural population and the urbanization rate is 2.04%.
In Egypt, there are nearly 21,560 household with an average size of 3.78 components.

30% are residential buildings; 82% of them was built from 1970 to now (24% from 2000 to now). 52.12% are detached houses. Condominiums are the 23% of residential buildings in urban areas. 99% of Egyptian houses do not have a heating system, while 22.6% uses gas fired boilers or electric heaters to heat water (solar thermal are mainly adopted in hotels or resorts). 6.50% of houses are equipped with air conditioner systems (it was 5.2% in 2008), while most houses have a fan system (ceiling or portable).
Residential consumption is 37% of total electricity consumption.
In the city of Alexandria there are 4,509,000 inhabitants. 85% of buildings are residential buildings; 47% of them have been built from 1970 to now (23% since 2000 to now). 72.4% are detached houses.

Egypt is an oil and gas producer. It exports a part of inner production in other MENA countries, such as Lebanon and Jordan. The only relevant renewable source is hydropower (nearly 10%). Wind power is 1% and **solar energy is 0.1%**. So far **5.2 MW of photovoltaic energy plants** have been installed in Egypt. According to NREA, two settlements in Matrouh Governorate have been

electrified with photovoltaic technology as energy resource, specifically, 50 houses, 2 medical clinic units, a school, 3 mosques and 40 street lighting units. Egypt's energy market is currently characterized as **a single-buyer captive market**, where the Ministry of Electricity and Energy, via its affiliated companies and authorities, essentially holds a monopoly over the distribution, transmission, and generation of electricity. The EEHC distribution company is responsible for distributing and selling to customers on medium and low voltage. The Ministry of Electricity and Energy determines electricity prices for all sectors. The **residential tariff is organised as an increasing block structure.** Residential consumers benefit from a high level of subsidy, but subsidies are provided to all sectors in varying degrees (with subsidies per kWh declining as consumption rises). The peak month of consumption is July.

Lebanon

The last Lebanese National Census survey was made in 1932. The Lebanese population is now estimated over 4,000,000 people, but foreigners (migrant workers from Pakistan, Sri Lanka, Ethiopia, Eritrea, Egypt, Philippines) are underestimated and Palestinian refugees are not counted in the total. Recent Syrian refugees are nearly one million.

In order to update national data on population, the National Institute for Statistics organises periodically surveys based on a population sample. The last national survey dated back to 2007. This source provided an estimate of 3,800,000 of people (Lebanese and non-Lebanese) with about 4 persons on average in each household. This produced a population density of approximately 362 inhabitants per square kilometre. In 2007, the population was approximately made up of equal numbers of women and men. Children under the age of 15 constituted 25% of the total population and elders (those aged over 65) represented around 10% of the population. The population density is of approximately 362 inhabitants per square kilometre.

The Census of Buildings, Dwellings and Establishments (CBDE), conducted in 2004-2005, indicates that there were approximately 408,515 buildings in Lebanon. Only half of the buildings in Lebanon had a sewage system but 84% were connected to a water network.

In 2009, a survey estimated about 930,500 dwellings occupied by households as a primary residence. 71% of households owned their own dwellings. The majority of households live in apartments (67%) or independent houses (31%) and very few live in other types of dwellings such as villas or improvised dwellings. One noticeable characteristic of dwellings in Lebanon is the relatively high number of living spaces (excluding kitchens and bathrooms). The majority of dwellings had at least four rooms while very few were composed of only one room (3%).

In a 2004, 21% of the dwellings was built after 1990. Around 57% were built during the period 1955-1989 and some 22% before 1955. Only 3% were built in the last 5 years.

361,000 inhabitants (9,5% of the total Lebanese population) reside in Beirut. Concerning the age of buildings, we noticed that in the city of Beirut, 45% have more than 19 years and 6% only less than 10 years.

Lebanon is completely dependent on energy imported from foreign countries, such as Egypt and Syria. The recent political instability in these countries has worsened the energy situation in Lebanon due to the drop of the exports. During the 2006 war, main power plants were destroy. The national electric grid is quite obsolete. All these factor lead to recurring electricity shortages. **In the rural areas,electricity is supplied only for five-six hours per day; in the main cities, electricity is supplied for 21 hours over 24**. Households face this situation producing electricity with **domestic diesel generators** settled in the rooftops of their houses. Households pay an "illegal bill" to have the availability of a generator and the provision of fuel. Diesel is quite cheap but the price is increasing. In addition, diesel generators produce noise and pollution. Only nearly 4% of electricity is produced using local resources, mainly hydropower. The **total PV installed capacity in 2011 was about 85 kWp**. Energy sector is managed by a **state owner company, Electricité du Lebanon** (EdL). EDL has a monopoly on production, distribution and transmission of electricity. A reform of the energy sector is required in order to solve the existing management problems. Several factors cause a serious gap between the annual supply (1,500 MW) and demand (about 2450 MW), accumulating structural deficits, such as 40% of non-technical losses (grid failure, uncollected bills (5%) and theft); old and inefficient power plants; no maintenance; overloading problems.

The **residential tariff is organised as an increasing block structure**. The peak month of consumption is August.

Jordan

The Jordan population was 6,388,000 in 2012 with an increase of 32% from 2000 to 2012. 51.55% of inhabitants are males. Nearly 70% of population are from 0 to 30 years.

The density is 70,4 inhabitants per square kilometre. 17.4% of population is living in a rural area; the urbanization rate is 83%. 1,157,200 households live in Jordan with an average size of 5.4 components (it was 5.8 in 2000).

In the region of Aqaba there are 139,200 inhabitants (78% lives in the main city, Aqaba). 54.3% of inhabitants are male (56% in the city of Aqaba). Nearly 70% of population ages from 0 to 30 years. The population density is 20 inhabitants per squared kilometre. 14.3% is rural population. 24,224 households live in this region (81% lives in the city of Aqaba). In the region there are14,788 residential buildings (68% in Aqaba).

The domestic electricity consumption in the district was 157,729,380 kWh in 2012 (it means 2,903.99 kWh per inhabitant). 30% is consumed during winter and 70% in summers, due to the high diffusion of air conditioner appliances.

Jordan does not produce fossil fuels. It is completely dependent from Syrian and Egyptian imports but the situation changed after the drop of exports due to political instability in these countries. Only nearly 2% of electricity is produced using renewable sources, mainly wind. Currently there are more than 172 PV installed in urban areas. Overall, there are 2,07 MW of PV system installed in the country. 31 PV (63 kWp) systems are in the district of Aqaba, one (17 kWp) in the main city.

The electricity sector in Jordan experienced extensive reorganisation over the last decades; the sector was traditionally run by the Jordan Electricity Authority (JEA) and two distributing companies operating under concessions. In 1994 a reorganisation plan was initiated: the Electricity Sector Regulatory Commission (ESRC) was established; JEA was divided into three separate companies, namely for generation, distribution and transmission; the generation and distribution companies were privatized and the transmission company kept under government ownership to act as a single buyer for generated electricity. Two other Independent Power Producers were licensed and currently operating a total of 743 MW combined cycle plants, firing imported natural gas. **The residential tariff is an increasing block structure**. The peak month of consumption is August.

Tunisia

The population of Tunisia amounts at 10,777,500 in 2012 (it was 9,545,200 in 2000). 49.8% are males. 40% of inhabitants are from 0 to 30 years. The population density is nearly 70 inhabitants per square kilometer. 34% of population lives in rural areas and the urbanization rate is 66.1%. In Tunisia 2,734.5 households live with an average size of 4.09 components. There are 2,886,755 residential buildings, 70% are located in urban areas.

Tunisia is a gas producer and 97% of electricity is produced with this cheap fuel. The electricity produced by solar energy technologiesis nearly 0% of the inner production of electricity. The use of PV for residential electricity demand has mainly addressed to **rural electrification**. In 2010, a total of **13,000 households have electricity due to a PV system** (7,600 households before 2000 and 5,400 after). This sector, with an estimated average integration rate of over 50%, made possible to attract importers, local components/spare parts suppliers, installers and small maintenance businesses. Tunisian electricity market is **fully regulated by a state monopoly** where the dominant operator is the **Tunisian Company of Electricity and Gas (STEG)** which is responsible for the transportation and distribution of electricity and gas throughout the country. In the production side, the legislation allows the participation of some **Independent Power Producer** that operates thanks to a production concession from the Government after a tender. There are two companies**:** the ***Carthage Power Company (CPC)***, for the exclusive sale of electric energy to STEG, and ***Electricity Company of El Bibane (SEEB)*** in charge for the

production of the electricity using gas from hydrocarbon exploitation concessions and for the exclusive sale of it to STEG. In Tunisia, some **self-producers or co-generators** operate and they are allowed to produce electricity for their own consumption and can sell part of their production to the industrial STEG. **The residential tariff is an increasing block structure**, with only two blocks**.**The peak month of consumption is July.

Italy

The region of Italy involved in the project is Sardinia. Sardinia is the second largest island in the Mediterranean sea with an area of 24,090 square kilometers. In 2013, 1,641,047 inhabitants live in Sardinia. The region has a density of 68 inhabitant per squared kilometer. Population could be considered constant in the period 2000-2013 (+0.01%). 49% of inhabitants are males. 29,3% of inhabitants are from 0 to 30 years. 710,828 households live in Sardinia (+21% from 2000) with an average size of 2.3 components.84.47% of building are residential. 72% of buildings are built before 1981. 76.09% are detached houses, while the 23.91% are semi-detached or condominiums. The average surface is 97 square meters. After National Incentives (tax allowance) more than 20,500 residential houses was renovated in the period 2007-2010 in order to improve their energy efficiency. 10,070 was equipped with a solar thermal water heating system. 51% of houses are equipped with electric boilers and 31% with gas boilers.

Concerning the heating system, 30% of houses are equipped with a biomass system (traditional fireplaces and wood stove but also pellet stoves) and 28% with gas fired heaters; 23.4% use an electric heater and 18% an oil heater. Electric heaters are mainly heat pumps: latest data from a National survey indicate that nearly 45% of households live in a house equipped with an air conditioner or heat pump system, more than the national average (nearly 32%); data indicate an increase from 2005 (where the percentage was nearly 39%).

Total domestic electricity consumption increases 18% in the period 2000-2011, while the average consumption per household (nearly 2,914.03 kWh in 2011) decreases 5% in the same period.

In 2013, the city of Cagliari has 149,575 inhabitants, nearly 9% of regional population. 25% of population is in the range 0-30 years. 73,540 households live in Cagliari (average size: 2 components). In the city, 63% of 66,030 residential buildings are block of flats. 84% of buildings are built before 1981. 1,54% of building in Cagliari was equipped with solar thermal water heating in the period 2007-2010. Average domestic electricity consumption per household was 3,387.62 kWh in 2011.

TERNA (the National Grid Manager) 2012 data indicate that **82.2% of electricity is produced in Sardinia using traditional fossil fuels**, mainly oil and coal imported from abroad. In Sardinia, there is not availability of natural gas (not produced and not imported). Gas boilers use LPG or propane gas. **Renewable energies are17.8%** of total electricity produced in Sardinia. **4.77% is produced by PV plants**. In Sardinia, **26,678 PV** plants have been installed from 2006 to October 2013 and **11,068 plants (41%) have a power less than or equal to 4 kWp**: due to the size, we refer to these plants as residential PV plants. Indeed, 3 kWp was the PV plant size for a standard Italian household consumption. 11,691 (44%) plants are from 4 and 10 kWp size and 2,647 (10%) are from 10 and 20 kWp. Only 1,147 (4%) plants have a dimension superior to 20 kWp. 370 plants have a dimension superior to 100 kWp.

759 PV plants have been installed in the city of Cagliari. The total power installed is 8,686.223 kWp and the average size is 11.44 kWp. 52% of PV plants installed in the city of Cagliari have a size inferior or equal to 4 kWp. 37% of PV plants have a size from 4 kWp to 10 kWp. Only 9 PV plants installed in Cagliari are larger than 100 kWp.

In 2007, following the EU Directives, the Italian residential electricity market was liberalized. In the liberalized market, two different systems operate: a regulated market called “Mercato di Maggior Tutela” and, a not regulates market, called “Mercato Libero” (Free Market). In 2012, **80% of customers was in the regulated market**. In the regulated market is adopted an **increasing block tariff system**; **93%** of customers have a **tariff with a daily peak and off-peak price**. Peak months of consumption are January and February.

Spain

The region of Spain involved in the project is Catalonia. Catalonia has a population of nearly 7,465,619 inhabitants. The population increased in the period 2001-2013 (+18%). 49% of inhabitants are male. 31% of inhabitants are from 0 to 30 years. The population density is 232,64 inhabitants per square kilometer.

3,863,381 households live in Catalonia.

99% of building are residential buildings. 30% are built after 1990. 71.30% have two or more floors. Concerning heaters, boilers and HVAC systems, Catalonia has some differences with respect the rest of the Peninsula. In regard to heating, electricity is the preferred energy source in the region (68.4%), being reversible heat pumps and electric heaters the most commonly appliances used in heating. Concerning hot water systems, electricity is also the main energy source in the region, being the electric heater the most common system (64%). Catalonia is the most air conditioner equipped region in the country. 67% of households have some kind of air conditioning system and, among them, 83% are equipped with reversible heat pump. Due to these reasons, residential average electrical consumption in the region is above the national average.

Catalonia has a strong dependence on foreign primary energy. The dependence rate has been increasing year after year and it seems that this tendency will not change in the near future.

83.3% of electricity is produced from natural gas or nuclear energy; natural gas are imported mainly from Algeria and uranium from France.
Some of **electrical infrastructures of transport and distribution** in Catalonia have become **obsolete and undersized according to current demand** which is much higher than some decades ago, when these infrastructures were designed. The lack of investments in maintenance and update of the grid have **become critical** in some areas that have **experienced several shortages** in the last few years, especially in the North of Barcelona (Costa Brava), due to unexpected meteorological phenomena (snow, severe wind, etc.) or simply due to seasonal peak demand during summers.
16.6% of electricity comes from renewable sources: 8.8% hydro, 4.3% wind, 2.7% biomasses, **0.8% solar energy**. In Catalonia, 266,121 kWp of PV system have been installed in the past years: 94% of the power comes from plant larger than 20 kWp. Most of the plants are grid connected.

Until July 2009 electric tariffs in Spain were determined by the government depending on voltage level and annual electricity consumption. Tariffs were updated monthly or every three months according to primary energy cost variations. After the liberalization, **small consumers** (small business and residential) have two possibilities: to buy electricity in the power spot market through **one of the commercialization companies** or to pay the electricity according to the only tariff that is still applicable in Spain, the **Final Regulated Tariff** (TUR according to its Spanish name). This tariff is intended to provide a reasonable cost of electricity for those consumers that do not want or are not able to sign any contract with a commercialization company in the electricity free market and have a contract with less than 10 kW power (Low Voltage customers): this tariff is mainly applicable at (and chosen by) almost all domestic consumers. In 2011, 27% of Spanish customers (domestic and not domestic users) bought electricity in the free market. The peak months of consumption are January/February.

Chapter 2.

Review of legislation on Renewable Energy and Efficiency

Analysis of energy legislation and strategies and renewable energy policies

Only some of the Governments in the partners' countries have set an energy strategy or an energy law concerning the diffusion of renewable energies.

Egypt. In light of increasing energy demand, dwindling natural gas resources, electricity blackouts and population growth, the Egyptian Government puts renewable energy on its agenda. In 2008, the Ministry of Electricity and Energy set the **2020 target of 20 %of electricity generation from renewable energy**. In order to reach this target, several technologies are being considered, with concerns about costs and resource availability and favouring some technologies over others. Wind energy has been prioritized over solar energy because of its lower cost. **Egypt's plans for solar energy** are less ambitious than those for wind energy, with a 2017 target for the installed capacity of 100 MW of CSP and 40 MW of PV. Considering that Egypt has one of the highest levels of direct solar irradiance, these figures for installed capacity is negligible. More ambitious targets must be set for solar energy deployment in order to capitalize not only on the potential for energy generation, but also on the potential for jobs creation.

Lebanon. In Lebanon there are neither a national energy strategy nor a legislation about renewable energy and energy efficiency. At the beginning of 2000, some legislation were issued by the Lebanese Parliament (Privatization Law No. 228/2000 and the Law no. 462/2002 organizing the electricity sector) in order to promote private sector participation in the energy sector, in line with the international trend. However, only in 2012, EDL delegates some of their tasks but no action was undertaken to move towards a liberalized market. Moreover, recently the Government in order to achieve "[…] The reduction in energy demand through the use of energy conservation measures and renewable energy applications" and "[…] The setup of a national road map built on environmental concepts to reach **12% of renewable energy by the year 2020"** throughthe Ministry of Energy and Water, set some plans of action and tools to achieve a "[…] demand growth control in order **to save a minimum of 5% of the total demand**" and "commits to **launching, supporting and reinforcing all initiatives [...]to reach 12% of renewable energy**". Under this framework, LCEC launched **National Energy Efficiency Action Plan (NEEAP)**that includes 14 initiatives in the energy efficiency and renewable energy sectors between 2011-2015. However, NEEAP is a consultative document not a law with obligations. The NEEAP for the period 2011-2015 was developed by LCEC during September 2010 and officially adopted by the Ministry of Energy and Water on December 21th 2010. The NEEAP was developed in accordance with the requirements of the League of Arab States thanks to the support of the MED-ENEC project. 5 NEEAP initiatives concern renewable energies: **1. Promotion of decentralized power generation by PV and wind applications in residential and commercial sectors (target: 50-100 MW of installed capacity)**; 2. Electricity generation from wind power (60-100 MW); 3. Electricity generation from solar energy (100-200 MW); 4. hydro power for electricity generation (100 MW); 5. Geothermal, waste to energy, and other technologies (15-25 MW).

Jordan. The government of Jordan has adopted an updated strategy for the energy sector for the period (2007-2020) in order to tackle the future energy challenges that limit development in various sector. In this comprehensive strategy, Jordan has cleared the vision and some more

ambitious targets than it had in the original strategy which was issued in 2004.The **2007-2020 Energy Strategy of the Jordanian Government** includes targets to increase the contribution of renewable energy sources to the national energy supply. The share of renewable energy in the total energy mix shall reach 7% by 2015 and 10% by 2020, including 600 MW of wind energy projects and 300-600 MW of solar energy projects. The **Renewable Energy and Energy Efficiency Law** was issued as a permanent law under No. 13/2012 of April 16th 2012 after being issued as a temporary law in 2010. The law provides legal, regulatory and legislative framework for investments in renewable energy field; it allows the Ministry of Energy to deal with direct proposals submitted to it and regarding investment in renewable energy projects without entering long-term tender processes; and it obliges electricity companies to buy all electricity generated from these projects regardless of priorities of generation from electrical stations and economics. All instructions governing the investment process have been finalized, including the preparation of a list of indicative prices of electricity from renewable energy projects, and **allowing energy consumers to produce all their needs of electricity from renewable energy resources** with the possibility of linking to the electrical grid to sell surplus to the concerned electricity company through incentive prices determined by Electricity Regulatory Commission (ERC). After the issuance of this law and the preparation of regulations and instructions issued therewith that provided legal, legislative and regulatory framework and gave many financial incentives, Jordan become ready to collect foreign investment in renewable energy projects.

Tunisia. Since the early 1980s, Tunisia has progressively put in place the institutional and regulatory instruments for the promotion of renewable energies. The **Agence Nationale de la Maîtrise de l'Energie**(ANME) is now the main tool for the design and implementation of renewable energy and energy efficiency policy. The Agency is under the Ministry of Industry and Technology. The implementation of the regulatory framework on renewable energy in Tunisia was covered by two regulatory texts:

- **Law No. 7/2009 of February 9th 2009** amending and completing Law No. 72/2004 of August 2th 2004 **authorizing the independent power production by renewable energy** to any institution or group of establishments engaged in the **industrial, agricultural or tertiary sector** for their own use. This law allows power auto-production from renewable energies with a right to sell to STEG up to 30% of power generated. The price is fixed according to the highest voltage prices. Auto-producers are allowed to use the national grid to transport power to point of consumption, paying a transport fee, currently set at 0,005 Tunisian Dinars/kWh. The new electricity transport contract allows the group of self-producers to use sub-contracting tool in order to ensure electricity production.
- **Decree No. 2773/2009 of September 28th 2009** fixing the conditions for the transport of the surplus of energy produced in order to be sell to STEG and upper limits of this surplus. The prices are set by the Minister of Energy.

Concerning solar energy, the **Tunisian Solar Plan** is in line with similar international projects, in particular, the Mediterranean Solar Plan. It reflects Tunisia's ambition to become an international hub in the field of industrial and energy production, enabling the country to play e role in the exportation of the Solar Energy. The plan has structured in two phases:

- **the first phase**: **16%** of total energy generated by renewables by **2016**
- **the second phase**: **40%** of total energy generated by renewables by **2030**

Between 2010-2016, the Tunisian Solar Plan includes 40 additional projects covering :

- Solar energy, wind energy, energy efficiency, manufacture of photovoltaic panels and so on, for a total investment of 2,300,000 Euros (70% for private sector).

- Now only 2 MW of energy comes from solar (PV and CSP): the objective has been established in 253 MW by 2016 and in 1,700 MW by 2030.

Italy. Currently, the most important national law about energy is the **National Energy Strategy: for a more competitive and sustainable energy (2013)** that aims promoting a sustainable growth through enhancing competitiveness and environmental sustainability in the energy sector. National Energy Strategy focuses on four main goals:

1. Significantly reduction of energy cost gap for consumers and businesses, by bringing prices and costs in line with European levels. Now, differential prices of over 25% for electricity have a decisive impact on Italian businesses' competitiveness and on households' budgets.
2. Achieve and exceed the environmental targets established by the European Union's 2020 Climate and Energy Package (known as the "20-20-20" package) through the improvement of national environmental and decarbonisation standards, which are already among the world's highest.
3. Continue to improve the security of supply, especially in the gas sector, and reduce dependency on imports. Italian system needs to improve the ability to respond to critical events (i.e. the February 2012 gas crisis) and reduce the overall energy imports, which currently amount at about 62 billion of Euros annually.
4. Foster sustainable economic growth by developing the energy sector. The development of the energy supply chain is a goal in itself in Italian National Energy Strategy. Energy sector is experiencing continuous growth (an estimated 38,000 billion of US Dollars in global investment by 2035).

As regards photovoltaic technologies, the strategy states that: 1. In the electricity sector, the **20-20-20 targets has already almost been achieved, nearly 8 years ahead** (nearly 92 TWh of generating potential from installed capacity at the end of 2011, compared to the 2020 target of 100 TWh). This can be explained by the strong installations increase in recent years, most notably photovoltaic plants. In 2011, Italy accounted for 33% of the photovoltaic capacity installed worldwide, with a total of around 12.5 GW of installed capacity (second only to Germany). The main reason for this rapid growth is the very generous incentive system in force in the last years. This has not correctly taken into account the rapid fall in technology costs (photovoltaic technology costs have fallen by about 70% since 2005), which has translated into very high profitability and incentives exceeding those of the other European countries. 2. The incentives have produced **environmental benefits** (e.g. a reduction of 18,000,000 of tonnes of CO2), as well as **employment, energy security and economic benefits** (including a reduction in fossil fuel imports of 2.5 billion of Euros per year and a flattening of the demand curve on the wholesale market, for an estimated 400,000,000 Euros per year). 3. In the medium - long term, it is expected that the **PV incentives will gradually cease**, with the aim of reach a full integration with the electricity market and the grid. Attaining grid parity does not entail giving up support policies, but will involve a change of direction towards instruments that do not increase charges to electricity consumers. Thanks to the incentives provided and the expected achievement of grid parity for photovoltaic energy, an aggregate 50 - 60 billion of Euros is forecast to be invested for renewables by 2020, including new installations and renovation. The reduction of the highest incentives in Europe for production from renewable will reduce energy production costs (about 20% of the Italian electricity bill (taxes excluded) goes to cover incentives for the production from renewable energies). 4. **Photovoltaic solar energyattains grid parity** in various parts of the country in just a few years (although parity with wholesale prices is still distant). An acceleration in this trend would determine a higher proportion of renewable sources than today, feasible to enter rapidly the

system. Some measures to help attain grid parity will need to be put in place in the coming years. For example: a further simplification of authorization procedures for grid connections and plant activation, so that indirect costs, as well as technology costs, can be reduced; tax advantages deriving from the provisions governing works implemented to achieve energy savings, including those following from the installation of renewables plants (decree law 201/2011); a possible review of the net metering service with the aim to extend its scope of Application.

The specialised press provides a large amount of articles concerning the opposition to the NES. Indeed, NES will not clarify how to reach the goals on energy efficiency and promote a gradual reduction of incentives for renewables, while promotes the exploitation of national reserves of oil and gas. Nextville (a magazine devoted to renewable energies and energy efficiency) outlines that representatives of renewable energy firms and companies have given a negative opinion about NES (Qualenergia). Nextville in his analyses stated that the NES is addressed more to finance oil and gas sector than to promote renewables. A "100% renewable" revolution is clearly far from the adoption in Italy due to an old attitude of policy makers and lobbies activities. In March 2013, the NES has been officially adopted, with not relevant changes concerning PV technologies. In the meanwhile, Government has decided not to support more PV and incentives (feed-in tariff) for PV power plant was ceased in June 2013. Only small PV plant for household could benefit for a tax allowance concerning energy efficiency in buildings (Qualenergia). The NES have strong interest in enhancing energy efficiency but there are not a clear definition of tools and strategy in order to achieve it (Nextville). At the moment, analysts do not consider that grid parity (if it will be definitively reached) will have the same impact on consumers of monetary incentives (Qualenergia).

Current Government and National Authority for Electricity and Gas are trying to impose **taxes over self-production/self-consumption.**

At regional level, the most important act is the **Resolution of the Regional Council No. 12/21 of March 20th 2012.** With this resolution, the Regional Council approved the Policy Document that contains the energy scenarios necessary to achieve the specific objective of 17.8% coverage of the gross final consumption of energy from renewable sources in the electrical and thermal, as was assigned to Sardinia by Decree of the Ministry of Economic Development of March 15th 2012. It was based on the previous document, the **Regional Action Plan for Renewable Energies** (January 2012). The Regional Government intends to achieve the objective assigned by promoting energy saving and energy efficiency, increasing the share of energy produced through the use of renewable sources within a diversified and balanced system, according to the actual needs of consumption, environmental sustainability and the development of new technologies. Regional incentives are introduced to promote the diffusion of **building integrated photovoltaic systems**.

Spain. Spain has been one of the most "renewable" European countries. In the last recent years, it invests a lot in developing the renewable energy industrial sector and in the adoption by all kind of consumers. Spain sets a system of incentive to improve the adoption of PV systems but, after the economic crisis, the Government decided to cease incentives. **The Royal Decree - Law 9/2013 approves energy reform measures eliminating the regulated tariffs for renewable energy, and creates the Register of Self Consumption** of Electrical Power. According to the new and **retroactive** Royal Decree, the Government will have to approve a royal decree regulating the legal and economic framework for the production of electricity from renewable energy sources,

cogeneration and waste. This decree will change the remuneration model of existing facilities. This framework will articulate a fee that will allow renewable, cogeneration and waste installations to cover the costs required to compete in the market on the same footing with other technologies and obtain a "reasonable return", completely different to what was promised before making the investment. Before **the January 1st 2013, Law 15/2012** introduces a tax measures for energy sustainability. A **single rate of 7% will be applied on earnings obtained from all energy generators**, regardless of the technology that is being used, without discriminating between managed and unmanaged renewable technologies. The impact of this measure is not the same for all energy producers, since conventional energy producers can transfer this increase to final consumers through electricity bills, renewable energy producers cannot do the same. In the final provision of this Act, measures are also established to tax the use of natural gas and other fossil fuels in electricity production or cogeneration of electricity and heat. This provision directly affects producers of solar thermal energy, to which the Royal Decree 661/2007 allowed the sale of power generated by natural gas at a regulated tariff price or at market price. Previous law concerning PV was the **Royal Decree 1699/2011** that regulates the **conditions for application, connection procedures and technical characteristics for small power electricity production facilities (auto-consumption)**. It legalizes consumption facilities that were previously in a legal vacuum and allows the installation of parallel meters to compute auto-consumed energy and to transfer the power generated to others but doesn't specify how they should be doing this; the Decree**says nothing about net metering** which already exists in many countries but not in Spain. The great contribution of this measure is that it passes the current centralized generation model and enables households, small businesses and industries to install a power plants and to become energy producers, through distributing power generation, enabling the installation of small wind energy facilities, and other self-production facilities (solar, biomass, etc.) that were previously unregulated.

Analysis of energy efficiency strategies and legislation

Partners countries have adopted a legislation concerning the promotion of the diffusion of energy efficiency requirements in buildings.

Egypt. The 2003 Egyptian Energy Efficient Building Codes affect: 1. New buildings; 2. New parts in existing buildings (commercial, governmental and residential). Building Codesare very innovative, for its specific minimum building requirement that are addressed at improving both thermal and visual comfort in non-conditioned buildings as well as minimum energy efficiency requirements in conditioned buildings. However, does not provide any requirementconcerning the installation of PV systems (neither traditional PV panel nor innovative PV technologies). At the moment, there are not incentives for Energy Efficiency and the energy code requirements have not been achieved but the government announced the introduction of some incentive for Solar Thermal (for example, since 2013 new compounds in Sheikh Zayed have to install Solar Water Heaters in order to obtain a license. If the enforcement proves to be successful, Sheikh Zayed will serve as a model to be applied in all new compounds).

Lebanon. With regard to this country, no legislation or strategy has been implemented concerning the energy efficiency in buildings. NEEAP initiative concerns a set of measures to bridge the gap through the adoption of the Energy Conservation Law and Institutionalization of the Lebanese Centre for Energy Conservation (LCEC) as the National Energy Agency for Lebanon. Related measures to these initiatives are based on increasing the awareness and capacity building and paving the way for energy audit and ESCO business. More directly initiatives

concerning energy efficiency are: 1. Banning the import of incandescent lamps (160 MW or 1,401 GWh); 2. Solar water heaters for buildings and institutions (337 GWh/year); 3. Design and implementation of a national strategy for efficient and economic public street lighting (18.6 GWh over 3 years); 4. Promote a building code (16,282 GWh/20 years); 5. Promotion of energy efficient equipment (16 MW).

Jordan. The **2007-2020 Energy Strategy of the Jordanian Government** includes a strategy to reduce energy consumption via energy efficiency measures, mainly addressed to industrial and commercial customers. In execution of the provisions of Renewable Energy and Energy Efficiency Law (Article 11), a **Renewable Energy and Energy Efficiency Fund** had been established as one of the directorates of the Ministry of Energy and Mineral Resources. The Fund has been activated and provides support to renewable energy projects and studies; energy efficiency programs and activities; raise renewable energy consumption in various sectors by providing necessary finance and capacity building; raising awareness to increase the use of renewable energy resources and promoting programs of energy efficiency to reach the desired goal in the comprehensive national strategy of energy sector. The **Fund is currently supporting three projects**:

1. Promotion of the use of energy-saving lamps in Government buildings by 600,000 lamps, and it is expected to replace old lamps on the short and medium terms at a cost of 1,800,000 Jordan Dollars.
2. Distribution of 1,500,000 energy-saving lamps to residential buildings of consumption less than 600 kWh at a cost of 5,000,000 Jordan Dollars.
3. "Toward local communities contributing in energy consumption efficiency" initiative to install 5,162 solar heaters in houses in coordination with Jordan River Foundation at a cost of 1,360,000 Jordan Dollars.

Tunisia. The **Tunisian Solar Plan** is addressed to energy saving and has been structured in two phases. The **first phase target is** 24% of energy saving by **2016,** whilethe **second phase target will be** 40% of energy saving by **2030.** The **Energy Efficiency Programme** for buildings aims to improve the **thermal performance of residential** and tertiary sector buildings, by developing thermal regulations suited to the climate conditions in the country. The purpose of these regulations is to **define the minimal standards to be applied for the design and construction of residential** and tertiary sector **buildings** through: the development of a minimum technical energy-saving specifications for projects to construct or extend office buildings and multi-family residential buildings; the establishment of a blueprint auditing for new and extension projects in the construction sector; in order to define conditions and methods for carrying out blueprint energy audits in the residential and tertiary sectors, according the specifications approved by ministerial order.

Italy. The first law concerning energy efficiency is the **Legislative Decree August 19th 2005, no. 192.** According this Legislative Decree, new energy efficiency requirement for new building, such as insulation, heating system, solar water heating, have been made compulsory as well as building energy qualification (on the base of the so called Energy Performance of Buildings Directive - EPBD 2). Then, the **Legislative Decree 115/2008**implemented the Directive 2006/32/EC focuses on regulate end-use efficiency and energy services. The Decreeaddresses a broad range of different aspects concerning the energy sector and assigns an important role to the public sector, designateto adopt the best technical tools and the economic and financial resources

in order to implement measures to improve efficiency and fostering actions at the local level. Two other important laws are: the **Ministerial Decree of 26 June 2009**thatcontains the National Guidelines for the Certification of Buildings and makes operating a key element of the **Directive 2002/91/EC of the European Parliament concerning the energy certification of buildings**, and the **Legislative Decree of 3 March 2011 n. 28**thatimplemented the Directive 2009/28/EC for the renewable energy sources promotion. The Decree contains provisions on energy efficiency measures relating to the use of renewables, and in the Annex 2 shows the minimum performance of plant and equipment supplied from renewable sources, such as electrical heat pumps and air conditioning.

The**Italian Action Plan for Energy Efficiency Energy (PAEE) 2011**has introduced strong novelties, compared to the existing legislative framework, the design methodology, the minimum requirements and inspection. In the residential sector, energy efficiency improvement measures refer to two intervention categories:**energy performance of buildings (wraps and plants) and consumption of appliances (appliances and light sources).**In the first case the measures (upgrading the energy efficiency of existing buildings, adopting efficient heating system, thermal fireplaces and wood-fired boilers, low flow water regulators) meet the expectations introduced by the buildings energy certification (Directive 2002/91/EC of Legislative Decree 192/ 05). On the second case actions (substituting: incandescent light bulbs with fluorescent light bulbs; less efficient dishwasher with A level ones; less efficient fridges and chest freezers with A+ and A++ level ones; less efficient washer machine with upper grade A level ones) are inspired by the current European legislative framework and national energy labelling (Directive 2005/32/EC Energy Using Products, EUP).Other measures concern: the installation of solar thermal panels to heat water; adopting more efficient air conditioning systems; electricity recovery through natural gas decompression and**photovoltaic power plants**adoption.The extension of these**measures until 2020 determines approximately 1.4 Mtoe of additional savings** compared to the expected value in 2016. Over 18% of this amount could be allocated tointerventions related to the demand for heating and domestic hot water.Major reductions are also expected from the adoption of high efficiency version of the main appliances (about 15% of the additional savings is indeed attributable to it).Based on sharing agreement reached by the Member States with the Climate Energy Policy approval, Italy should achieve the following objectives by 2020:

- A share of renewable energy of 17% of gross final consumption (10% from renewable sources in the transport sector)
- A reduction of 21% of the emissions related to the sectors involved in the Emissions Trading Scheme (ETS) measure
- A reduction of 13% of the emissions related to the non-ETS sectors (compared to 2005).

At the moment, a Regional Plan for Energy Efficiency has not been adopted by **Sardinia Regional Government**yet, howevera draft is in the pipeline.

Spain. The **National Building Code** aims to achieve a rational use of energy in buildings by setting several design, construction, use and maintenance requirements to reduce the energy consumption and to increase the part of this consumption generated by renewable energies.

The basic **Energy Saving requirements (HE) are**:

- HE 1 – Reducing the energy demand to achieve the thermal comfort depending on the weather conditions, the use of the building, the isolation characteristics, the permeability, etc., to minimize the heat/cold loss
- HE 2 – Thermal performance: buildings must have suitable characteristics and installations to provide the thermal comfort for users

- HE 3 – Energy efficiency in lighting installations: lighting installations must be adapted to the user needs while guarantying the energy efficiency (i.e.: a regulation system to optimize natural light…)
- HE 4 – Minimum solar contribution to sanitary heat water: a part of the sanitary heat water or the heating pool demand must be covered by solar energy (only applicable for certain types of buildings specified in the Building Code)
- HE 5 – **Minimum photovoltaic contribution to electricity**: buildings must have photovoltaic and transformation systems for either self-consumption or grid supply (it is not mandatory for residential buildings, only for certain type of buildings specified in the Building Code).

The above energy efficiency requirements are **mandatory for new constructions and large rehabilitations** (as of November 2007); **selling and renting buildings** (as of June 2013); and **public buildings** (as of June 2013 depending on the surface).

At regional level, the Royal Decree 21/2006 sets the eco-efficiency requirements related to water, materials, wastes and energy (double glazing, thermic transmittance coefficients, solar factor and sanitary heat water contribution).

At local level, each municipality can have their own city ordinances as far as national and regional regulations are respected.

The Royal Decree 235/2013 establishes the basic procedure for the building energy efficiency certification, which came into force in June 2013. Its main characteristics are:

- The management of energy certification for residential buildings is decentralized: for Catalonia, it is up to the Institut Català d'Energia (ICAEN)
- The energy efficiency classification has 7 levels (A-G, where A is the best score), and it depends on the energy consumption and CO2 emissions in comparison with a similar typology of building, located in a similar area
- The energy efficiency certification have a maximum validation of 10 years (then, it must be renewed).

According to the ICAEN, 65,534 requests for the certification of residential buildings have been received:

- **Only 5% of the certifications received a qualification from level C or upward**. This is mainly due to the age of the existing buildings and to the drastic reduction of new constructions
- 1 out of 4 certifications achieve the worst score (G), and **only 0,1% the best one** (A)
- The **vast majority** (50%) of the certifications (1 out of 2) **got an E.**

Concerning the reason of the energy certification request for residential buildings, in most of case requests are related to market and economic drivers (56.3% due to rental, 42.2% buying/selling).

Only 0,6% have requested a certificate to increase, voluntary, the building energy efficiency level. 0,7% requested a certificate because of the expiring terms of the energy label.

Chapter 3.

Analysis of Barriers to Diffusion of Photovoltaic Technology

The analysis concerns some different aspects that could hinder the diffusion of PV technologies in the partner countries.
Policy barriers are related to strategies, legislation and other technologies that are promoted by Governments and that could become an obstacle to the diffusion of PV systems. Administrative barriers concern the bureaucracy necessary to install a PV system. Economic and financial barriers are related to all the factors that are linked to the cost of investing in a PV technology and refers also to the existence of various form of incentives.
Market barriers refer to the existence of a demand and mainly of an offer that provides the PV technologies and the other services related. Technical barriers concerns the obstacles linked to the technologies: PV systems, national grids, building characteristics; etc.
Finally, social and information barriers refer to the awareness of cost and benefit linked to the diffusion of PV technologies and to the strategies adopted to improve it so far.

Policy Barriers.

Egypt, Lebanon and Jordan have adopted high subsidies to fossil fuels and energy generated from themselves. Subsidies represent a substantial drain on **Egypt**'s budget in addition to being one of the main obstacles to the growth of renewables in the energy mix. More than half of energy subsidies are allocated for petroleum products, while one-third is accounted for electricity and about 15% by natural gas. Energy subsidies represent nearly 73% of all subsidies and approximately 21% of the country's budget. There is no law, regulation or effective policies to promote the use of solar energy. There is no clear and comprehensive strategy and/or program for promoting and disseminating information and knowledge about renewable energy.

Lebanon and Jordan need to promote national production due to the severe reduction of imports from Syria and Egypt. Currently, in both countries the cost of production is quite higher than electricity prices and there are governmental subsidies for electricity produced by fossil fuels. In **Lebanon,** in addition, the energy sector management is very complex and subject to more and ambiguous interests of lobbies that govern the country. At the moment, there are more interest for the diffusion of solar thermal facilities than for PV systems. In **Jordan**, there are no coordination among agencies that are involved in renewable agencies development and management and there is more interest for new fossil fuel resources, such as oil shale or gas shale, and for nuclear energy that do not suffer of intermittence.

In **Tunisia**, the legislation in force only allows major electricity consumers to produce renewable electricity for their self-consumption, preventing the expansion of the industry. Independent private operators cannot produce electricity from renewables for the local market, although authorizations can be extended for exports. Third party access is only allowed for self-producers.

In **Italy**, main policy barriers comes from the incertitude about the lifetime of incentives and recurring changes in policies. At the moment, tax allowance has been extended until the end of 2014. Ministry of Economic Development and Authority for Electricity and Gas is thinking to impose taxes over self-consumption.

In **Spain**, the situation is similar: after ceasing the feed-in tariffs, there are not incentives and the new governmental strategies are not clearly set. As well as in Italy, in Spain, government is evaluating to tax self-consumption.

Administrative Barriers

In **all MENA partner countries** do not exist administrative barriers to installation. No City Council or other public institutions are involved in the procedure. Net metering procedure involves only households and local distributor or national energy monopolist. In **European partner countries**, other administration permissions and city council approval are one of the most important barriers. In **Italy**, city council approval is compulsory to install a PV system. The collected information has not clarified whether the same rules concerns innovative installations such as thin films in glasses, windows, solar facade, etc. In historic buildings or innercity areas or near natural or historicmonuments, the Superintendence approval is compulsory. Customers complainregarding the amount of time spent to conclude compulsory procedures.

In **Spain**, in order to obtain the approval to install a PV system an household needs to acquire a high number of permissions, several of them very complex to be obtained; there are not certainty about permissions to obtain. Administrative procedures are still long and complex even though have been recently simplified. Very complex is the situation in condominiums where the approval of all neighbors is required to install a PV system.

Economic and Financial Barriers

In all MENA partner countries, the highest initial cost of the technology and the highest cost of the electricity produced by PV are one of the main obstacles. In **Egypt, Lebanon and Jordan**, this results from the existence of high level of subsidies to enhance fossil fuels. In all these countries, energy prices are well below costs and do not encourage energy savings or the adoption of technologies devoted to the self -production. The same situation is in **Tunisia**, but the higher costs of electricity from renewable (and in particular from PV) than from conventional sources is due to the large use of national gas sources. In **all these partner countries,** there are some incentives that provide a reduction of customs taxes or VAT in order to reduce costs of PV installations.

In **Egypt and Jordan** there are no dedicated funds or other financial mechanisms and incentives to support energy efficiency activities. Moreover, the Egyptian government is deciding to introduce a feed-in system. In **Lebanon** has been introduced a financial mechanism to incentive the adoption of PV technologies. It consists in a loan with a low interest rate (see NEEREA in the next chapter). In **Tunisia**, a National Government fund provides a monetary incentive to reduce the installation cost (see FNME in the next chapter).

In **Italy and Spain**, the cost of PV facilities is decreasing progressively,however the cut of feed-in tariffs reduces the demand of installation. In some other European countries, other strategies have been setting to promote PV without feed-in tariffs: for example, in Germany a 30% monetary incentive to buy storage facilities has been established. In Italy and Spain, customers have demonstrated interest for storage facilities and off-grid PV systems but national legislation does

not provide any insight about it yet. In both countries, there are not national monetary incentives for reducing the installation costs nor financial incentives. In Italy there is only a tax allowance related to energy efficiency investments in buildings. In **Sardinia**, Regional Government has provided incentives equal to 30% of the capital investment cost borne to install PV systems. In **Italy**, some financial institutes and banks provide special loans line, addressed to PV investments, with specific interest rate. In **Spain**, regional subsidies are often not steady enough to be considered reliable; currently, only one bank provides loans with specific interest rate for PV investments.

Market Barriers.

In all MENA partner countries, main obstacles are due to the absence of local manufactures: panels and other main PV components comes from foreign producers; so, imports are subject to the customs costs that are quite high in these countries. Moreover, markets appears dynamic even if not well organized. In **Egypt, Jordan and Tunisia** is based at least one PV panel assembler, in each country. In **Egypt** there are two module assemblers, who must turn to photocell manufacturers for knowledge requirements. In all countries, there are many installers and in Lebanon are present some ESCOs. In **Egypt and Tunisia** there are local manufactures of small components and spare parts for PV facilities.

In Italy, there are some assemblers but not manufactures of PV panels (we do not have information with regards to the innovative PV facilities).In **Sardinia there are only installers and ESCOs**.

Spain is one of the global leaders in PV panel production: it wasthe first global PV market in 2008 when more than 2700 MW were installed in only one year. In 2008, more than 50 companies, among national and international, were manufacturing in Spain when there was a vertical integrated market. After the cease of feed-in-tariff, 90% of firms in the market ceased its activities or left the country. As a result, some activities have been completely lost in Spain such as thin film manufacturing or wafer manufacturing. Only activities related with inverters manufacturing and power electronics in general seems to be resisting the crisis by selling almost all the production to international markets.

Technical Barriers.

Main technical barrier in **Egypt** concerns the low quality of PV components and spare parts made by local manufactures. In **Lebanon**, main problems are the obsolescence of the national grids and recurring shortages; another important problem is the lack of space in rooftops due to the presence of water tanks and diesel electricity generators. In **Jordan** the main problems are linked to lack of standards and controls and the absence of technical experts; as in Lebanon, even in Jordan there is a lack of space due to water tanks in rooftops. In **Tunisia**, main problems is the absence of storage systems in order to avoid the intermittence of renewable energy production.

Main technical barriers,in **Italy**, are linked to the low knowledge of innovative application, such as PV thin films, that could avoid problems caused by lack of space (such as in condominiums) or integration in historic buildings or inner cities areas where citizens are not allowed to install PV

systems in rooftops. In some country areas, as in **Sardinia**, there are problems due to the obsolescence of national grids.

In **Spain,** technical barriers come from the early obsolescence of the technology due to its fast evolution and in the lack of maintenance. Furthermore, technical difficulties are also due to the lack of space in condominiums.

Social/Information Barriers.

Inthe **MENA partner countries,** insufficient information about benefits and opportunities deriving from the diffusion of renewable energies and the adoption of small PV systems in buildings, have been provided. Activities of dissemination are generally not included in governmental programs: specific activities were organisedby some UN or UE program or project. In most of these countries, the small number of experts is a further obstacle. Moreover, information provided does not permit to completely extend this analysis to Tunisia.

In the **European partner countries**, the main lack is related to the little information about new technologies and storage systems and their related costs. In **Sardinia**, more information about benefits of tax allowance and innovative PV technologies are needed in order to overcome some technical barriers. In **Catalonia**, populationis not completely aware of the possibilities and advantages of installing renewable energy devices in residential buildings.

Chapter 4.

Analysis of Drivers to Diffusion of Photovoltaic Technology

Data and information collected provide a useful insight about the existing elements that should be enhanced in order to build policies and strategies to promote PV technologiesdiffusion.
Policy drivers are related to strategies, legislation and technologies promoted by Governments in order to foster the diffusion of PV systems. Economic and financial drivers are related to the existing or planned tools directed to reduce the PV technology investment cost such as the existence of state or regional incentives (feed-in tariffs, grants for sustain capital costs; etc.), the possibility to access to a specific bank credit lines, etc.
Market drivers refers to the analysis of the potential demand and the characteristics of the offer that could have a positive role to bear the adoption of PV technologies. Technical drivers concerns the aspects linked to the technologies characteristics (i.e. PV systems, national grids, building characteristics, etc.) that could foster the PV technologies adoption.

Policy Drivers

In **Egypt**, the political instability has determined difficulties in oil and gas distribution and in the electricity production. The new Electricity Law introduces a number of changes toopen the commercial sector to private investment and competition. The draft law is designed to gradually reduce the investment burden on the government. Action planned are directedto create a competitive market and encourage the private sector to step in and invest in renewable energy.The draft also eliminates the governmental monopoly over the sector and allows third party to access to the infrastructure owned by the Ministry of Electricity. While the electricity transmission company will continue to be state-owned, the law provides a legal framework encouraging private sector investment for energy generation and distribution. Competition is encouraged in the first phase, allowing a limited number of large consumers to contract directly with electricity producers. In January 2012, the new Egyptian government announced the33%increase of the electricity pricefor industries with intensive power consumption. In October 2012, the Egyptian government announced a cut in subsidies on fossil fuels from April 2013.

In order to reduce shortages,**Lebanon and Jordan**need to reduce the dependence from imported fossil fuels, increasing the electricity produced using national sources. Moreover, the unavailability of fossil fuels in the two countries (specially in Lebanon) lead to a diffusion of renewable energies. As the imported fuels becomes scarce and expensive, the subsidies have been reducing and the tariff will increase, also for residential customers.

In **Tunisia**, Governmentsshows interest to find alternative fuels to local natural gas and to become an important solar energy production pole.

Italy and Sardinia, have the need to reduce the production from imported fossil fuels such as coal, oil and natural gas. In addition, the“20-20-20” EU targets related to the EU Climate Action strategy have to be achieved. Promoting renewable energies could enhance local economy and create new jobs.

Spainis a EU member country and it presents a similar policy context. The country is facing a non-favourable scenario with regard to policies applying to RE and PV. Moreover,Spain has still a

strong energy dependency on foreign energy sources, much higher than European average.The Spanish PV sector is still very strong and relevant despite the recent unfavourable legislation.

Economic and financial drivers

The **Egyptian Government** has implemented a **number of measures** to develop the use of solar and wind energy and provided specific incentives for the electricity generation from renewable energy sources. The key provision of the draft law defines an opening of electricity production from renewable energy sources to the private sector.The grid operator is obliged to allow connection of renewable energy plants to the grid; a competitive bidding procedure allows private investors to award a concessions for the construction and operation of renewable energy plants; the grid operator may set a feed-in tariff,afterthe Cabinet of Minister's approval. **The feed-in tariff is set to be planned as soon as the competitive bidding process is clear on the pricing level**. The prices are expected to be "near commercial" level, so that renewable energies - after decreasing energy subsidies – will soon become a commercially viable alternative to fossil fuels, also for the Government. The feed-in tariff will be targeted specially for smaller plants with a capacity of up to 50 MW. An interim period was set in order to allow state administered projects to complement private sector projects. **At the current time, it is still not clear if the draft law will be legislated**. According to the information collected until 2011, the **National Energy Strategy** has not entered the second phase yet and **no feed-in tariff was placed accordingly.** However, the Egyptian Electric Utility & Consumer Protection Regulatory Authority (EGYPTERA) has developed a feed-in tariff for small wind parks (<40-50 MW) and small PV installations (<30 kWp), that is being examined in the Ministry of Electricity and Energy. The feed-in tariff takes into account the prices achieved in the projects that have been commissioned under the tendering system.

There are also some tax reductions available for renewable energy equipment and spare parts from customs duties and sales taxes, as well as grants and loans for renewable energy projects. In August 2011, the cabinet decided to implement a fund for renewable energy. The **Existing Direct Incentives for Renewable Energy Equipment include: a Reduced Import Tariffs** (Under Article 5 of Presidential Decree 39/2007 concerning customs tariffs, "equipment and components as well as spare parts of new and renewable energies (wind and solar energy) are subject to 2% customs tax of value"); and, a**Technical Assistance and Information Dissemination** that is one of the few specific renewable energy support schemes available in Egypt. One of the objectives of the programme is to **provide technical assistance**. This service reduces transaction costs by providing facilities and projectregarding the technical feasibility of different renewable energy options and their relation to organizational capacity. It also provides direct support licensing potential new system integrators (service providers). The programme also disseminates information about the current and prospective status of renewable energy in Egypt, and initiates a dialogue about the existing and proposed logistics of renewable energy production. On the regional level, RCREEE provides technical and regulatory recommendations taking into account the specific characteristics of the regional renewable energy market characteristics and evaluating member states specific needs. Leading experts from the Arab countries and the international community collaborate to provide **latest technologies and best practices** to build institutional capabilities and skills to plan and implement sustainable energy projects. This helps lowering implementation costs, increasing the region attractiveness to potential funders, and the economies of scale. It also helps creating jobs, facilitating trade barriers, and engaging private sector in decision making.

The role of the **Board of Directors of Egyptian Electric Utility and Consumer Protection Regulatory Agency**, also consists in regulating all electricity activities (generation, transmission, distribution and consumption) to guarantee electricity quality, and sustainability. Also has to guaranteethe satisfaction of all consumption requirements at affordable prices as stated in the Presidential Decree No. 339 of 2000. The Board has decided the following governing rules for promoting the use and the exchange of electricity produced from solar energy:

- The distribution company in charge shall install the required meter for the customers; however, customers shall bear the costs of the meter; the calculation of monthly invoice will be based on the net electricity purchased (by using net meter).

- When the energy produced by the customer exceeds the energy purchased from the distribution company, a settlement shall be made according to the highest tariff block purchased within the month.The exceeded amount of energy produced shall be added to the customer's account to be consumed in the next months.

- When at the end of the year,an exceeded amount is registered in the customer's account, settlement shall be made on the basis of the last month whole consumption.In case of an additional exceeded amount existed, it will not be transferred to the account of the next year.

- The Agency shall issue a certificate to the customer, to guarantee the source for each MWh, and demonstrating that, each month, the energy generated by the customerusing solar energy technologies is not less than 1 MWh.

The **Lebanon's National Energy Efficiency and Renewable Energy Action (NEEREA)** has been set in 2010. NEEREA is a national financing mechanism built on the Circular of the Central Bank of Lebanon (BDL). It is dedicated to support the financing of energy efficiency and renewable energy projects all over Lebanon. NEEREA aims at the effective implementation of renewable energy and energy efficiency projects through the technical and the financial support offered by Lebanese commercial banks.

How NEEREA works:

- Ministry of Energy and Water sets the strategic guidance and priority in energy efficiency and renewable energy
- As the national financing institution, Bank of Lebanon sets the framework of operation and offers benefits to banks
- Ministry of Finance defines the subsidies on interest rates for the different sectors of the economy
- EU has offered Bank of Lebanon a grant of 12,000,000 Euros to encourage SMEs in applying for NEEREA
- UNDP partnered with Bank of Lebanon offers technical support, training, marketing, and awareness raising activities
- LCEC is the technical consultant of the Bank of Lebanon, reviewing loan applications, and setting quality control criteria.

It allows private sector entities (individuals, SME's, or corporate bodies) to apply to obtain subsidized loans for any type of renewable energies and/or energy efficiency projects. **NEEREA covers loans with 0.6% interest rate and a repayment period of up to 14 years, in addition to a grant amount released after the project is implemented**.

A household that wants to install a PV system contacts a supplier (from the list of 26 that are available in the LCEC web site). The supplier provides financial and technical aspects (design, production capacity, price etc…). Once the document is concluded and approved by LCEC, the customer contacts the selected bank (among those who are part of NEEREA, such as IBL - Investment Bank of Lebanon, Banque du Libano French, Fransabank or BLC). If the total amount is less than 20,000 US Dollars, the bank contacts directly to LCEC, and the loan is evaluated. If the loan is greater than 20,000 US Dollars, the partner bank must apply to the Central Bank of Lebanon.

The procedure is very accessible, according to the LCEC. Until now, 98% of applicants have obtained the loan. At the end of October 2013, 100 loans were granted for a total of 90,000,000 US Dollars and 50% was addressed to residential systems. No marketing was done for NEEREA. The LCEC receives a high number ofrequests for loans even though no advertising campaign was launched (worked through word-of-mouth).LCEChas planned an advertising campaign that is starting in 2014.

The amount of loans differs on the basis of the investment: loans concerning PV installation in residential houses ranging from 5,000 to 24,000 US Dollars.
In January 2013, Bank of Lebanon has dedicated 90,000,000 of US Dollars to the NEEREA and in March 2013, the amount was increased from 90,000,000 to 150,000,000 US Dollars. A new credit line implemented by European Investment Bank and the Agence Française de Développement will be initiated in 2014 with a total of 65,000,000 Euros.

Net Metering is a billing mechanism that involves Electricité du Liban and the residential, commercial, and industrial customers that generate electricity through their own renewable energy facilities (solar, wind, waste,...). It consists on the deduction of any energy outflows from metered energy inflows. Households are allows to produce renewable electricity and totransfer the electricity surplus to the grid through the digital devices (meters). At the end of the month, EDL calculateshow much electricity the household takes from the grid and how much electricity transfer: the household pays the bill based on net amount of electricity consumed. LCEC bought 200 meters to be distribute for free to households who have already installed a PV system. According to the latest information provided, 50 meters were distributed. Net metering encourages people to install PV systems. Households obtain two benefits: the reduction of the electricity bill and the electricity demand for thermal purposes. With this measure, Government aims at reducing the gap between supply and demand (a huge problem in Lebanon). LCEC awaits to produce 100 MW of electricity through PV via net metering, within the next 3 years. This is a very recent initiative and the Lebanese consumer are still not completely informed of this new option; LCEC and the Ministry of Energy and Water have launched a wide consumer advertising campaign (TV, billboards).

In **Jordan,** there is a **lack of dedicated financing schemes or special incentives** provided for renewable energy technologies initiatives. The high prices of the equipment on the local market, and the relatively low cost of the electricity determine a high payback time. These barriers are mainly due to the high capital investment costs: indeed, some interventions require the installation of some specialized equipment. With insufficient financial incentives, the local market for energy efficient measures and equipment is relatively weak in the country. In April 2008, the Government approved the exemption of imported solar technologies both from a 16% national sales tax and 23% customs duties. The 2012 Renewable Energy and Energy Efficiency Law promotes the

adoption of the following incentives: grant tax and customs exemption for renewable energy systems and equipment; investment incentives for infrastructures related to renewable energy projects, such as the exemption for the investors from the incurring cost of linking renewable energy installations with electrical grid.

In **Tunisia**, the **National Fund for Energy Conservation (FNME - Fonds National pour la Conservation de l'Energie)** was created in 2005 to provide financial measures to support energy consumption rationalization, promoting renewable energies and energy substitution. The Agence Nationale de la Maîtrise de l'Energie (ANME) is in charge to administer this fund. The FNME is mainly financed by the taxation due to the first registration of cars and the taxation over imports or local production of equipments for air conditioning. FNME provides subsidies for the transactions targeted by Article 1 of Law No. 82 of August 15th 2005 on the establishment of an energy management system. Direct aids granted by the FNME are guaranteed by specific tax benefits for energy conservation:

- Reduction of customs duties to the minimum rate of 10% (from a general rate of 18%) and exemption from VAT for imported equipment used for the electricity production from renewable sources and for energy efficiency (valid for those equipment that are not similar to equipment is produced locally);
- Reduction of customs duties and exemption from VAT for imported raw materials and semi-finished products entering into the production of equipment used for the production of energy from renewables and energy efficiency;
- Exemption from VAT for locally manufactured raw materials and semi-finished products entering into the production of equipment for renewable energies and energy efficiency;
- Exemption from VAT for equipment manufactured locally and used for energy conservation or for the production of energy from renewables.

These benefits are to be added to the general system regulated by the investment code, which provides a number of advantages and investment incentives depending on sectors and zones.

In Tunisia, there is a system of **incentives**, concerning:

Measures	**Rate**	**Cap**
Solar lighting and wind pumping in the farms	40%	20,000 TND (8,817.75 €)
Production of electricity from biogas	40%	100,000 TND (44,088.74 €)
Households production of electricity from PV systems connected to the grid	30%	3,000 TND/kWp (1,322.66 €) with a cap of 15,000 TND (6,613.31 €)/household

In **Italy**, at the moment, the only direct incentive to PV is net metering. There also a tax allowance of 65% linked to the energy efficiency incentives. Sardinian Regional Government provides monetary incentives to reduce the initial costs (capital and installation costs).

Until June 2013 in Italy there was a feed-in system incentive system, called "Conto Energia".

The "Conto Energia" incentive was introduced in Italy after the EU Directive for renewable sources (Directive 2001/77/EC), implemented with the approval of the Legislative Decree 387/2003.
This mechanism, which was a feed-in tariff system, rewards all the electricity produced by photovoltaic systems for 20 years. It became operational with the entry into force of the

implementing decrees of July 28th 2005 and February 6th 2006. The First Conto Energia introduced a system based on financing the electricity generation plant operating, replacing the previous government grants for the commissioning of the plant.
The Ministry of Economic Development, with the Ministerial Decree of the 19th February 2007, has set new criteria to subsidize electricity production of photovoltaic systems; it has been in effect until 31 December 2010. The main changes introduced by the Second Conto Energia are: the application of the incentive rate of all the energy produced (and not only on that produced and consumed on-site); streamlining of bureaucratic procedures to obtain tariffs and differentiation of the rates based on the type of architectural integration, and the plant size (smaller plants receives larger grant per kWh produced).
It was also introduced a premium for photovoltaic systems coupled with efficient energy use.
In 2010 the third Conto Energia (Ministerial Decree August 6th 2010) entered into force. It was referred to plants that began operating between January 1st 2011 and May 31st 2011 that could be inserted in the following categories of facilities: photovoltaic system (divided into "systems on buildings" or "other PVs"); integrated photovoltaic systems with innovative features; concentrated photovoltaic plants; photovoltaic systems with technological innovation.
The law of August 13th 2010, n. 129 determined that the incentive rates for 2010 by the Second Conto Energia could be recognized to all people who have completed the installation of the PV system by December 31th, 2010 and come into operation by June 30th, 2011. The Second Conto Energia was the most generous, with the higher incentives. All the following waves of Conto Energia were less generous, with lower incentives. The publication of the Law 129/10 has been effectively extended until June 30th 2011 (the period of operation of the Second Conto Energia), that, at the beginning, intended to run out at the end of 2010 due to the entry into force of the Third Conto Energia.
The fourth Conto Energia was published on May 12th, 2011in the Ministerial Decree May 5th 2011; it defined the mechanism of incentives for the production of electricity from photovoltaic systems on plants coming into operation after May 31th 2011.
The Ministerial Decree of July 5th 2012, the so-called Fifth Conto Energia, redefined the way of incentives for the production of electricity from photovoltaic sources.
The Fifth Conto Energia ceased to apply after 30 calendar days from the date on which the a cumulative approximate cost of the incentives of € 6.7 billion per year was reached. This happened on June 6th 2013.
“Conto Energia” was a very successful tool to promote the diffusion of PV, due to the high amount of incentives and the availability also for small PV plants installed by households to cover their own consumptions. Totally, 549,920 PV plants was installed in Italy, with a total power of 17,441 GW installed.
Moreover, there was a strong opposition to this incentive. GSE financed the Conto Energia through the electricity bills. Some politicians and ASSOELETTRICA (the national association of producers of electricity through large power plants, mainly with oil, coal and natural gas) accused Conto Energia to be the main reason of the increase in the households average electricity expenses. This situation leads to the decision to cease the feed-in system, even if PV operators claimed that the renewable energy sector was able to create a large number of jobs during the economic crisis.
Now, there is not information to understand how the PV market is changing after dropping out feed-in tariff: Qualenergia and other specialized magazines expect that, the PV demand will start to increase, after a short period of difficulties.

Currently, in **Spain**, the Government is not introducing other incentives, after cutting the feed-in tariff system. There are currently in Spain some drafts of regulations that are intended, once definitely approved by the Ministry, to set the economic conditions that must rule the self-consumption in Spain. Unfortunately, those drafts, still under discussion, are not favourable to the use of PV in buildings as they are suggesting the introduction of some taxes that could make PV installations economically unfeasible. Other proposals are relating to the promotion of a better access to credit (loans, rate interest, etc.).As in Italy, the price of PV panels is decreasing.

Market Drivers

In the **MENA countries** involved in the project, **population** is quite young and **increasing**, this could lead to a further increase in the electricity demand in the near future. Currently, **consumption are increasing** in all the countries due to the diffusion of **air conditioning** for cooling houses during summers. In Lebanon and Jordan, the increasing cost of providing fuels from other countries is becoming to be an unsustainable cost. Currently, market demand for PV is not existing, but in rural off-grid areas.

In **Sardinia**, **population is constant, but consumption is increasing**. The main reasons are: a) the diffusion of high efficiency appliances that is compensated by the increasing number of electric appliances in houses; b) the **high diffusion of air conditioner/electric pump heaters,** and c) the high number of not energy efficient houses. Moreover, the price of PV panels is decreasing and it is close to the grid parity; ESCOs are providing very interesting offers that comprises the PV panels and storage facilities. The price of innovative PV facilities, such as thin films for glasses, is very competitive.

In **Catalonia**, the **population is increasing**. The **high diffusion of electric heating system** and **air conditioning** will increase the electricity consumption**.** PV systems are competitive in the electricity market, due to the **parity prices,** in relation to conventional energy sources.

Technical Drivers

In summer, due to the high summer heat, the electricity demand in **Egypt** reached 23,500 MW, which is almost the entire country's installed capacity of 25,000 MW. The consequences are frequent electricity cuts which affected not only the residential population, but the industrial sectors and especially the energy intensive industries like cement, ceramic and steel industries.

In **Lebanon**, shortages happen quite often and households try to avoid the related problems producing electricity with diesel generators; recently diesel price starting to increase. Even in **Jordan**, the reduction of Syrian and Egyptian fuel exports leads to electricity shortages that create problems for water provision due to high presence of desalinisation facilities.

In **Tunisia**, there are not shortages but, as in other countries, there is a peak period in summer due to the increase in the diffusion of air conditioners. PV systems could be a solution: indeed, it seems that building characteristics are not an obstacle to the installation of PV panels. Moreover, more detailed information should be collected about the Tunisian situation.

In **Sardinia**, there are several opportunities for the adoption and diffusion of innovative building integrated PV technologies, because PV panel could not be installed everywhere. Indeed, these new technologies could solve the problem of lack of space in condominiums and provide a

solution for the installation in historical buildings where PV panels are not allowed.

Despite the recent policies, the experience and know how accumulated by the **Spanish** companies and research institutions in the last years are one of the most valuable profit for the Spanish PV sector that is currently trying to export this expertise abroad.As a result of this expertise (and due to lack of domestic market) Spanish PV companies are doing business in more than 80 countries spread over the five continents.So, although all this international activity is not currently turning into increasing the installed PV power in Spain, it is at least maintaining the latent activity of the Spanish PV sector (including manufacturing and services) at a minimum level that could be enough to keep the privileged position gained after years of successful progression in the country.

Chapter 5.

Overview of Pilot Projects for promoting Photovoltaic Technology

Egypt

Egypt is involved in a large number of international projects concerning solar energy (solar heaters, CSP, PV). A project involved also Italian Government: indeed, the **Egyptian Government and the Italian Ministry of Environment** try to install PV technologies **in rural areas** and in leaved places far from the common electricity network. There are other projects that are close to FOSTEr in MED such as:

1) **MED-ENEC I – Energy efficiency in the construction sector in the Mediterranean**

Energy Efficiency in the Construction Sector in the Mediterranean (MED-ENEC) supports national MEDA partners in their efforts to put in place a more enabling environment for energy efficiency and the use of renewable energies in buildings. It also embraces further training, pilot projects and the promotion of company joint ventures and technology transfers. MED-ENEC supports demand-driven energy efficiency measures and the use of solar energy in the construction sector with a view to making energy supplies more secure and reducing the negative impacts on the environment and climate of the dramatic increase in energy consumption.

Partnership: **European Commission;** Energy ministries and energy agencies of the nine partner countries

Specific objective: on behalf of the European Union, the MED-ENEC project promotes energy efficiency measures and renewable energies in the buildings sector in countries of Mediterranean region. Energy supply is to become more secure and the negative impacts of the dramatic increase in energy consumption on the environment and climate should be reduced.

Main activities: active promotion, especially among state institutions , of the introduction of new technologies and services concerning all aspects of energy efficiency in buildings ('ESCO business'); political dialogue and policy advising on planning, regulatory development and the implementation of low-energy building standards in target countries; institution building services for ministries, energy agencies and network organizations in the form of advisory and training services; knowledge transfer, including workshops, presentations, seminars and brochures; implementation and promotion of conference events; preparation of studies with the aim of reducing dependence on fossil fuels; organization of public relation work, including the update of an internet-supported database of companies, organization of trade fair presentations, events and press conferences.

Target groups: 9 among administrations, institutions and agencies dealing with energy and environment in the participating countries.

2) **MED-ENEC II– Energy efficiency in the construction sector in the Mediterranean**

The project encourages energy efficiency and the use of solar energy in the building sector, playing a major role in the design and implementation of cooperation efforts between the EU and its Mediterranean Partners and among the Partners themselves.
The Energy Efficiency in the Construction Sector II (MED-ENEC) project, which follows on MED-ENEC I, carried out between 2005-2009, also focused to raise public awareness and involve civil society in climate-oriented building techniques, energy efficiency and renewable energy use in buildings.

Partnership: **European Commission;** Energy ministries and energy agencies of the nine partner countries.

Specific objective: encourages energy efficiency and the use of solar energy in the construction sector, through capacity building, fiscal and economic instruments and pilot projects.

Main activities: raising awareness of the potentials, the benefits and the feasibility of energy efficiency measures; disseminates information on best practices, while highlighting the need to adopt an integrated perspective covering aspects like tariff-setting, standards and regulations, economic incentives and disincentives, adequate financing schemes etc.; negotiates agreements with public bodies (including ministries), business associations, consumers associations, local banks and municipalities, with the aim of developing energy efficiency schemes; building auditing, accreditation or installation capacities to support these undertakings.
Target groups: 9 among administrations, institutions and agencies dealing with energy and environment in the participating countries.

The Egyptian pilot project concerns a demonstration of solar cooling technologies.

3) **PWMSP– Paving the Way for the Mediterranean Solar Plan**

Paving the Way for the Mediterranean Solar Plan (PWMSP) is a project funded under the European Neighborhood and Partnership Instrument (ENPI). It assists the Mediterranean Partner Countries (MPC) to create conditions that are conducive to greater use of sustainable energy based on solar, wind and other renewable energy sources, combined with energy efficiency and savings in the region. This includes results and activities which contribute to the development and implementation of the Mediterranean Solar Plan (MSP).

Partnership: **European Commission;** MVV decon Consulting (Germany); **TERNA (Italy);** RTE (France); **ENEA (Italy);** Sonelgaz (Algeria); **Florence School of Regulation (Italy); GSE (Italy)**

Specific objective: PWMSP assesses MED partners of the EU and assists them in valorising the results that have been achieved so and bundle them for the creation of a framework and climate that is conducive for the MSP. It provides the European Union and the Mediterranean Partner Countries a platform for dialogue and for the preparation of joint activity. The project performs the necessary analytical work on the key issues involved and feeds the results into the dialogue in order to facilitate progress through a well-informed debate.

Main activities: harmonization of legal and regulatory framework; support to investment; transfer of knowledge and capacity building; sustainable energy policy; infrastructure requirements for the MSP

Target groups: 9 among administrations, institutions and agencies dealing with energy and environment in the MED countries

Lebanon

In Lebanon, one of the largest PV installations (400 square meters) was established at the **Lebanese University Campus Hadath, on the roof of the Industrial Research Institute** building, with a capacity of 50 kWp. Another important PV installation (12 kWp) was set up in 2008 at the **Monastery of Saints Sarkis and Bakhos** under the RAMseS (Renewable Energy Agriculture Multi-purpose System for Farmers) project supported by the **European Commission's Framework 6th Program**. The main use of photovoltaic system arises when the national electricity grid does not reach rural areas.

The **UNDP-CEDRO project** is a unique initiative in Lebanon that is moving and strengthening the Renewable Energy and Energy Efficiency market in Lebanon by installing small-scale renewable energy systems (solar water heaters, mainly) and promoting energy efficiency measures in various public institutions in Lebanon. One of the aim is spreading awareness on Renewable Energies and Energy Efficiency measures through **artistic means targeting the young generation** and assisting in bridging the knowledge/research gap in these sectors through various national studies. UNDP-CEDRO project is working closely with government and other stakeholders to **remove barriers that impede Renewable Energies and Energy Efficiencypenetration in Lebanon.** The project was enabled through a grant from the Government of Spain in 2007 to the Lebanon Recovery Fund (LRF), which transferred the funds to the UNDP. CEDRO has installed large-scale solar hot water systems on 13 public hospitals, 2 army barracks, and 1 large prison in Lebanon; totally it concerns 126,000 litres of solar hot water capacity. The total number of Solar Water Heaters users within these systems is saving almost 250,000 USD per annum in terms of diesel use reduction and a consequent total reduction of 600,000 kilograms of CO2 equivalent per annum***.*** CEDRO invests also in geothermal pilot projects (Beji pilot project) and microwind systems (all installed in public buildings such as schools) and it is involved in study the adoption of Concentrated Solar Power in the North of the country. Under the UNDP-CEDRO Project was **developed a Sustainability Week**. Informative meeting was made with stakeholders and general population. In particular, CEDRO, LCEC, the newly established Water Centre and other UNDP projects, prepared documents for ALL Lebanese school children on issues of climate change, water scarcity, and renewable energies. **Concerning PV there are two investments**: the first concern 40 kWp of PV capacity completed and 56 kWp of additional PV capacity expected in 2011 in the Hosh El Harime Intermediate School (Bekaa), and a smaller application in the Hosh El-Oumara Community Center (Bekaa).

MED – ENEC II (Energy Efficiency in the Construction Sector in the Mediterranean) is a regional project funded by the European Union. It aims to increase the use of Energy Efficiency measures and Renewable Energy systems in buildings in southern and eastern Mediterranean countries. Apart from policy advice and business development, special emphasis is placed on **the support of large building programs as multipliers of climate friendly and cost-saving technologies and measures**. During the first phase (2006 – 2009), the MED-ENEC project

supported 10 low-energy-buildings as pilot projects in all Mediterranean partner countries: Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Occupied Palestinian Territories, Syria, Tunisia and Turkey. Six pilot projects received the prestigious “National Energy Globe Award”. In the second phase, which started its activities in January 2010 and is planned for a period of four years, the MED-ENEC project will focus its support on large building projects. **Ten pilot projects** were established to demonstrate best practices and new technologies as well as integrative approaches for the efficient use of energy and the use of renewable energies in the building sector in the MEDA countries.

Pilot Project Lebanon: Renovation of the Centre Hospitalier du Nord, a block of the hospital building, built in 1986, with 110 capacity, 6000 square meters floor space, located in Zgharta - North Lebanon. The aim of the pilot project is the implementation of energy efficiency measures based on the results of an energy audit of the existing building. As 75% of the electrical energy used in the hospital is produced by expensive diesel generators, the main focus of the adopted strategy is twofold: optimizing the cost per kWh and reducing energy waste. With the MED-ENEC pilot project, annual energy cost **savings of almost 40,000 Euros could be realized**. As only relatively low investments were required, the payback period remained very short with only 1-2 years. These measures can therefore be implemented in any other comparable building without subsidies or substantial investments.

Jordan

Photovoltaic (PV) applications have a high importance in Jordan**, especially in remote areas suffering from the lack of water and electricity networks**. The National Energy Research Center (NERC) gave the photovoltaic (PV) technology and its applications a high priority in these remote areas. So, many PV systems for different applications were installed in Jordan since 1985. The main purpose of these projects was to demonstrate the feasibility of PV electricity generation under the Jordanian weather conditions. NERC has designed and installed **about 100 off-grid PV systems in Jordan for different applications, namely, water pumping, water desalination, rural electrification and telecommunications.**

Existing PV systems are installed thanks to the international cooperation or programs devoted to disseminate the knowledge of this technology:

- **El Hassan Science City and Dead Sea Panorama Complex PV systems, El Hassan Science City in Amman:** The PV Project in the El-Hassan Science City is supported by the Program Grant Aid for Environment and Climate Change established by **the Japanese government in 2008**. This program grant aid originates from “Cool Earth Partnership” announced by the Japanese government in January 2008, and aiming at supporting developing countries’ efforts to reduce greenhouse gas emissions and tackling climate change issues. On February 28th 2010, the Governments of Jordan and Japan made an agreement, and the Japanese government pledged to extend a grant of 5 million US Dollars for the purpose of promoting Jordan’s effort to heighten the self-efficiency of energy supply and preserve energy. Under the project, the **280kWp PV system in the El-Hassan Science City and the 100kWp PV system are installed in the Dead Sea Panoramic Complex.**
- **Tafilah pioneering project- Let Jordan Shine**: The Royal Scientific Society (RSS) of Jordan, Jordan Enterprise Development Corporation (JEDCO), and Petra Solar, Inc., have partnered to mobilize the first phase of a national smart solar energy plan called “Let Jordan Shine”. It will help Jordan diversify its energy generation sources in order to reduce its

dependence on imported sources for power generation. In phase one of this program Petra Solar's Sun Wave™ smart solar systems will be installed on **1,000 homes in the Governorate of Tafila**. The residents of Tafila who participate in the program will receive **a reduced electric bill**, because each smart solar system installed on a rooftop will feed electricity directly into that home. In addition, it will be build a **wireless smart grid communication network** throughout Tafila. This innovation promotes both solar power and the smart grid to the region.

- **Applied Science University in Amman: 500 kWp– This PV plant has been installed in March 2013** in Applied Science University in Amman to **reduce the electricity bill of the University**. This project is considered as the biggest installed PV project in Jordan till the date of this report.
- **Petra Development and Tourism Region Authority**: this 250 kWp PV System is the third biggest on-grid PV System in Jordan. The system was designed to cover all of the electrical consumption of the Petra Development and Tourism Region Authority.
- **PV plant Project in Azraq**: the project is being implemented by a grant through the debt swap with the **Spanish Government** by a value of 5,000,000 US Dollars. The PV plant will have a capacity of about 2 MW. The tender has been proposed to international companies on December 11th 2012 and it provided that the only equipment of Spanish origin was allowed. The project will be implemented in Azraq area near Azraq power plant. It is expected the project will be working in the first quarter of 2014.
- **Other PV Projects**: along with the mentioned projects and the direct proposals investments, many private and public entities request for proposals or tendering for various PV projects with a capacity ranging between 50kWp to 1MWp.

Two main programs are fostering by USA Government. **USAID- Jordan "Clean And Efficient Energy"**, it is a central part of USAID's development assistance agenda in Jordan. The program aims at ensuring a steady and affordable supply of energy for Jordan's economic growth. Since 2008, USAID's helped in establishing **incentives to promote better use of national energy resources**; encourage Jordanian energy producers, utilities and **consumers to adopt best practices for energy efficiency**; and develop alternative and/or renewable energy sources. USAIDs newest programs focus on demand management through **education. Pilot projects will support community energy initiatives** and help determine the most effective tools in order to promote a change in people and institutions electricity consumption habits. USAID's proposals in this sector include:

- Conducting a social marketing campaign to identify and promote actions to be undertaken in order to promote changes in behaviours. The aim is to have a better management of the demand and the use of energy among young people, households and large energy consumers; and improve public awareness through the distribution of information documents on energy efficient practices and technologies.
- Establishing a professional association for Jordanian energy engineers, and make a training course to create 50 certified energy managers, and another to create a core team of individuals that will become trainers for improving energy efficiency at most important institutions.
- Creating a clean technology innovation cluster industry, with an incubator, a capital network, and a research and development centre.
- Improving access to credit for energy efficiency efforts.

The **"Clean tech innovative cluster"** is the second measure. USAID Jordan Economic Development Program (SABEQ) launched in March 22th 2011 "The Integration of Public Policy Dialogue and Policy Development into Innovation Clusters". The innovation clusters are excellent

platforms where set a dialogue with private operators on issues that affect economy as a whole as well as on specific issues that impact the energy and energy efficiency sectors. The aim is to made the clusters able to promote public policy position. Strategic Objectives of the project are:

1. Promoting business development to promote the growth of **local clean technology enterprises**.
2. Promoting research and development to encourage commercialization of new technologies.
3. Facilitating the access to capital to improve business expansion and development.
4. Providing a platform for business development and investment.
5. Facilitating investment to made Jordan a hub for EWE/clean technology enterprises.

Initial opportunities will be pursued within selected measures and options that offer the most direct path to economic growth, namely solar energy, water conservation, and energy efficiency. Focusing on these measures and options, the cluster will focus on the following goals:

- Identify and promote **innovative pilot demonstration projects** for implementation by private sector and other involved stakeholders, and for obtain a local gain. A review on existing / ongoing demonstration projects (and research and development projects) will be made.
- Implement a market–driven, focus on (local and international) investment, knowledge-exchange, trade and incentive plan devoted to promotion strategies.
- Develop a brand to be applied in these areas and/or indicate a specific city or location(s) as a “Clean Tech center of excellence”.

Tunisia

PROSOL is a joint initiative of the AgenceNationale de la Maîtrise de l’Energie (ANME), the state utility SociéteTunisienne de l'Electricite et de Gaz (STEG), the United Nations Environment Program (UNEP) and the **Italian Ministry for the Environment, Land and Sea**. PROSOL Residential started in 2005. includes a loan mechanism for domestic customers to purchase Solar Water Heaters (SWHs) and a capital cost subsidy equal to the 20% of initial costs, provided by the Tunisian government. The program aims to promote the development of the solar thermal market through financial and fiscal support. **In 2010, the PROSOL-Elec programme was launched in order to promote grid-connected PV systems**.

Italy

Sardinia Regional Government fosters the development of PV joining the **EU initiative “Pact of Island”** (http://www.islepact.eu/html/index.aspx) and therefore has undertaken to draw up an Action Plan for Sustainable Energy in Islands (Island Sustainable Energy Action Plan, ISEAP). Main aim of this initiative is to reduce CO2 emission through the promotion of the diffusion of renewable energies and energy efficiency in European islands through the participation at the “Covenant of Majors” EU initiative.

The “Covenant of Majors” has, as main goal, to help cities to become more sustainable through the reduction of greenhouses emissions, mainly CO2 (http://www.pattodeisindaci.eu/index_en.html). In order to achieve this objective, the cities have to sign the “Covenant of Majors Agreement” and adopt an Action Plan for the Sustainable Energy.

The Action Plan has to contain a detailed estimation of CO2 emissions and a list of targeted actions to undertake in order to achieve the objectives.
In order to promote the adoption of the “Covenant of Majors” by the towns of Sardinia, the Regional Government launched the “Sardinia CO2.0” Initiatives. The first action undertaken was “Smart Cities – Comuni in Classe A” (“Smart Cities – A label Town”; the name refers to the Energy Efficiency standard for buildings and electric appliances; A level is the most efficient level).
A selection was made among the towns and villages of Sardinia (that could participate as a single municipality or as an aggregation of municipalities).
20 municipalities or aggregation was selected to participate. Overall, 68 municipalities was interested to the initiative. All municipalities have signed the “Covenant of Majors” Agreement and produced the Action Plan for Sustainable Energy. At the moment, actions have been undertaking. Regional Government gave a financial contribution to the municipalities in order to realize the actions proposed.
In the meanwhile, Regional Government provided an agreement to the European Bank for Investments – called “JESSICA Initiative” – in order to provide other economic resources.
Totally, **285 Sardinian municipalities over 377 signed the “Covenant of Majors Agreements”.**
Cagliari Municipality joined the Initiative the 6th November 2012 (http://www.pattodeisindaci.eu/about/signatories_it.html?city_id=5050).
Previously, some of the Sardinian provinces have participated at the EU Intelligent Energy Initiative to create the local Energy Agency with the aim to promote the diffusion of renewable energies and energy savings.

Spain

The Spanish partner did not collect any information on previous Pilot Projects.

Conclusions

The desk analysis phase provided a wide range of useful information.

All the areas involved in the FOSTEr in MED project are characterised by the growth of electricity consumption. A peak in summer is linked to the increasing diffusion of air conditioning systems.

In all partner countries, the increasing price of electricity causes the need to evaluate the diversification of sources used to produce electricity.

The analysis showed that PV technologies are not diffused in MENA countries. These technologies are considered expensive in relation to the price of electricity provided by national grids; generally, the low price of electricity is due to the high level of subsidies related to the use of fossil fuels. Population and administrations are not aware of benefits coming from PV technologies diffusion. Currently, PV systems are considered a useful tool only for rural areas not connected to the national grid. Furthermore, Furthermore, PV technologies diffusion could be supported by different factors: population growth; increasing consumption; increasing fuels and electricity price (mainly due to the difficulties in the provision of fuels due to the political instability in the area). Additional important drivers consist in the increasing interest of Gulf countries to invest in renewable energy technologies and the development of commercial agreements with PV technologies producers such as Spain, Germany, Japan, USA.

The context in Italy and Spain is considerably different. The European Union policies against climate change forced countries to invest for promoting the renewable energy diffusion. Both countries introduced a generous system of incentives (feed-in tariffs) to foster the diffusion of PV technologies. The incentives permitted to achieve the EU targets required. However, in the last two years, Italian and Spanish Governments decided to cut the feed-in tariffs. Furthermore, two factors that could drive PV demand, without incentives, consist in the increasing awareness regarding PV system adoption benefits and PV system decreasing prices.

Indeed, two additional factors able to support PV technologies investments in Italy and Spain are the increase of electricity cost and demand.

Innovative technologies could help to overcome the problems caused by lack of space in condominiums and aesthetic concerns for historic buildings and inner city areas.

Appendix

	LEGISLATION ON RENEWABLE ENERGIES
Egypt	There is no law concerning energy strategy or renewable energy strategy. However, in 2008, the Ministry of Electricity and Energy (MoEE) set the **2020 target of 20 percent** electricity generation from renewable energy. The target to be achieved is 40 MW of PV.
Lebanon	There is no law concerning energy strategy or renewable energy strategy but eh Government has approved a **National Energy Efficiency Action Plan (NEEAP).** A NEEAP measure sets the 2020 target of 12% of energy from renewable energy to be achieved even through the installation of 50/100MW of PV and wind in residential buildings.
Jordan	The **2007-2020 energy strategy of the Jordanian government** includes ambitious targets: the share of renewable energy in the total energy mix shall reach 7% by 2015 and 10% by 2020, including 600 MW of wind energy projects and 300-600 MW of solar energy projects. Among others technologies, even PV systems are considered.
Tunisia	A coordinated strategy for develop renewable energy production was set in the recent past years. The strategy comprises, among others, a Law for the self-production in non-residential sectors and the **Tunisian Solar Plan.** It set the following targets: 16% of renewables by the 2016; 40% of renewables by 2030. PV system are one of the technologies selected.
Italy	National government have to achieve **EU climate action targets**. They impose to promote the diffusion of renewable but **National Energy Strategy aims at reducing incentives and suggested to cease incentives for PV** (but it promotes hydrocarbons exploitation). Government cut incentives in June 2013. Government and National Authority for Electricity and Gas are trying to impose **taxes over self-production/self-consumption**. Sardinia Regional Government produces an official document, the Regional Plan for Energy and Environment, that gives guide lines about local energy policies.
Spain	National government have to achieve **EU climate action targets**. They impose to promote the diffusion of renewable. Spain was one of the larger developers of renewable in Europe: it invests in both diffusion of manufactures for production and diffusion among consumers. Actually, renewable energies incentives ceased and has been create a Register of Auto Consumption. The more recent National Energy Strategy seems to be addressed towards the promotion of small off-grids PV plants but the phase of transition is still in progress.

	LEGISLATION ON ENERGY EFFICIENCY
Egypt	The 2003's Egyptian Energy Efficient Building Codes has no specific requirement on PV, but there are some on solar thermal and thermal insulation adoption.
Lebanon	Currently, **there are neither a national strategy for energy efficiency nor a building code**. NEEAP promote the adoption of legislative and administrative measures to bridge the gap and some specific measures. Only a measure to promote the diffusion of solar water heaters.
Jordan	The of Renewable Energy and Energy Efficiency Law (Article 11) has set a **Renewable Energy and Energy Efficiency Fund** that provides measure to promote energy efficiency measures. No measures are devoted to PV or innovative PV systems. A measure is the installation of solar heaters in houses.
Tunisia	The **Tunisian Solar Plan** has two phases: in the **first phase** the target is 24% of energy saving by **2016,** whilein the **second phase** 40% of energy saving by **2030.** The **Energy Efficiency Programme** for buildings aims to improve the **thermal performance of residential** and tertiary sector buildings, by developing thermal regulations suited to the climate context in Tunisia.
Italy	**Italian Action Plan for Energy Efficiency Energy (PAEE) 2011** stimulate the promotion of energy efficiency in buildings and appliances. In particular, measures concern the installation of solar thermal water heating panels to heat water; adopting more efficient air conditioner; recovery of electricity from natural gas decompression and adopting **photovoltaic power plants. A tax allowance** of 50% (in ten years) is devoted to the promotion of building renovation and a **tax allowance of** 65% to the energy efficiency, comprises the adoption of PV systems. Tax allowance will decrease in next years: it will be 36% in 2016. Sardinia Regional Government has not adopted a Regional Plan for Energy Efficiency yet but it is in the pipeline.
Spain	The **National Building Code** provides some requirements in terms of reducing energy demand to achieve the required thermal comfort, improving the thermal installation performance, having more efficiency in lighting and a minimum percentage of solar thermal energy to heat water. Furthermore, a **minimum photovoltaic contribution** to electricity is required: buildings must have photovoltaic catchment and transformation systems for either own use or grid supply (it is **not mandatory for residential buildings**, only for certain type of buildings specified in the Building Code). At **regional level, the Royal Decree 21/2006** sets the **eco-efficiency requirements** related to water, materials, wastes and energy (double glazing, thermic transmittance coefficients, solar factor and sanitary heat water contribution). At local level, each municipality can have their own city ordinances as far as national and regional regulations are respected. Only 0,1% of buildings have obtained the best score (A) in the national energy efficiency scale.50% have a E score over an A-G scale.

	BARRIERS					
	Policy Strategies	**Policy Failures**	**Administrative**	**Economic and financial**	**Market Supply**	**Technical**
Egypt	Subsidies to fossil fuels – more interest for less expensive wind energy; more interest for solar thermal	No clear and unambitious strategy	No formal procedure requirement from City council or other to install PV	High technology costs Absence /difficulties to access to credit High customs costs	There are some assemblers and manufactures of smaller parts of PV systems; a high number of installers – many representatives of foreign firms	Low quality for PV components made by local manufactures
Lebanon	Very low electricity price (subsidized) – lobbies not interested – more interest for the solar thermal	The energy sector management is very complex and subject to more and ambiguous interests	No formal procedure requirement from City council or other to install PV	High technology costs High customs costs	There are installers and some ESCO's but no assemblers and manufactures	Lack of space due to oil generators and water tanks in rooftops; national grid management problem
Jordan	Very low electricity price (subsidized) - Preferences for new fossil fuels (oil shale) and nuclear energies in order to avoid RE intermittency	No coordination among agencies that are involved in RE development and management	No formal procedure requirement from City Council or other to install PV	High technology costs Absence /difficulties to access to credit High customs costs	Not well organised market. One assembler and many installers that use only foreign products	Lack of standards and control; absence of technical experts; Lack of space due to water tanks in rooftops

Tunisia	Only major electricity consumers allowed to produce RE electricity for their own use	Exclusive sales of electricity from RE to STEG must not exceed 30% of the total RE; the limit can only be exceeded if electricity comes from biomass	No formal procedure requirement from City council or other to install PV	High technology costs High customs costs	There are one assembler manufactures of smaller part of PV system; many installers – some commercial agreement with EU countries and Japan	Renewable energy production linked to the climate conditions, intermittency considered a problem due to the absence of storage systems
Italy	Reduction of incentives and uncertainty due to changes in legislation	Support of hydrocarbons; incentives on fossil fuels; uncertainty on the lifetime of incentives and proposal of tax self-consumption	Approval of City Council and Superintendence for historical buildings/areas	Absence /difficulties for access to credit (only a few banks have specific loans)	In Sardinia, only installers and ESCOs; marginalproduction of PV panels in Italy	Low knowledge of innovative technologies; lack of space in condominium; obsolescence of national grids
Spain	Reduction of incentives and uncertainty due to changes in legislation	No clear strategy; negative impact of taxes on PV diffusion	Although recently simplified, administrative procedures are still long and complex (high number of permissions and approvals required)	High initial cost and pay-back period; Absence /difficulties to access to credit; regional subsidies are often not steady enough	Spain is one of the main PV panel manufactures in the world	Early obsolescence of the technologies due to its fast evolution; the lack of interest for the maintenance; lack of space and approval from neighbors in condominiums

	DRIVERS		
	Policy	**Economic/financial (incentives)**	**Market**
Egypt	Reduction of fossil fuels subsidies/increase of electricity tariff	Customs taxes reduction and technical assistance; feed-in tariff proposed	Population Growth – Increase in consumption (+ diffusion of air conditioning)
Lebanon	Dependence from fuel imports – difficulties in provision of fossil fuels – increase of electricity and fuel prices	Loan at very low interest rate and net metering	Population Growth – Increase in consumption (+ diffusion of air conditioning)
Jordan	Dependence from fuel imports – difficulties in provision of fossil fuels – increase of electricity and fuel prices	Customs and other tax reduction	Population Growth – Increase in consumption (+ diffusion of air conditioning)
Tunisia	Large interest for the deployment of solar energy	Customs and other tax reduction – Grant to install grid connected PV systems grid in buildings	Population Growth – Increase in consumption (+ diffusion of air conditioning)
Italy	Dependence from fuel imports - achievement of compulsory EU targets	Net metering - Tax allowance for building renovation and energy efficiency	High level of consumption (but constant trends) due to the high number of electric appliances and the high diffusion of air conditioning/heat pumps- Decreasing PV panel cost (grid parity) and competitive price of innovative PV technologies – Increasing price of energy
Spain		No incentives: a proposal to promote a better access to credit (loans, rate interest,…); other incentives are not clear nor are they definitely regulated by the Government	Population Growth – High diffusion of air conditioning and electric heaters - Decreasing PV cost; PV competitive compared to traditional sources

WP4 – Context Analysis

Phase 2: In-Depth Interviews Phase

Social Acceptability

An analysis based on the FOSTEr in MED experience

Coordinator: University of Cagliari (UNICA)– Department of Social Science and Institutions (DiSSI) Italy

Authors: Norma Baldino, Silvia Doneddu (UNICA – DiSSI, Italy)

Interviewers: Norma Baldino (UNICA- DiSSI, Italy)

Silvia Doneddu (UNICA- DiSSI, Italy)

David Pifarre (ASCAME, Spain)

Salma El-Sahhar (CEEBA, Egypt)

Marion Schnorf (IRI, Lebanon)

Laith Basha (RSS, Jordan)

Hedi Essid (CCI-T, Tunis)

Supervisors: Aide Esu – Marina Mura (UNICA – DiSSI)

WP4 Coordinator: Elisabetta Strazzera (UNICA – DiSSI)

Index

Executive Summary

What is social acceptability?

The aim of the present work is to provide an overview of the context of **social acceptability** in the FOSTEr in MED partner countries.

Social Acceptability does not have currently a unique definition even though several qualitative studies have been conducted. The concept of social acceptability emerged when private and public sectors started to understand the importance of public opinion in relation to project and process implementation. This concept has been treated in the research context linked specifically to the renewable energy sector and new technologies.

Social, since public acceptance is recognised as an important issue in relation to the diffusion of renewable energy technologies and the achievement of international energy objectives. In this context 'public attitudes' have to be evaluated and addressed to accompany the process.

Relevant studies have been published with regards to social acceptability for renewable energy technologies specifically in northern European countries, as well as in North America. Most of them had a quantitative analysis approach. Existing social research on the social acceptability of renewable energy technologies provides a novel classification of personal, psychological and contextual factors that combine to shape public acceptance.

The WP4 objective was to increase the knowledge on social acceptability in the analysed Mediterranean countries. Following a defined social acceptability theoretical frame, three main variables have been analysed: socio-political acceptability, community acceptability and market acceptability. Each of these categories contains different elements and variables able to explain the context of renewable energy, PV sector, technologies, and innovation in relation to individual opinion, public debate and political discourse.

How we frame social acceptability?

The WP4 investigation group applied a multidisciplinary approach to the research and adopted social science tools and analysis methodology to frame the private and public sphere of key actors interviewed.

A verification of social acceptability literature has been conducted to verify the state of the art and a classification of the existing investigations realized to define the context frame.

The research aim to add qualitative knowledge to the quantitative data emerged from the desk analysis results. Through the elements of the desk analysis, the researchers established the themes to be analysed and then designed the interviews: a principal structure common to all the partner countries and some specific questions that focused on countries peculiarities and key actors specific knowledge (e.g. questions regarding finance, credit, technical information on PV, methods of electricity bill payment…). The questions defined, reflected the following areas: Perception; Innovation; Public Policies; Development of specific topics; Drivers/Barrier.

Each country provided a list of the key actors to be interviewed, basing their choice on the criteria proposed for the identification.

The WP4 researchers analysed and represented the information obtained through in-depth interviews by the pollsters in each partner countries. The identification, categorization and analysis of the interviews contributed to identify the elements of the social theoretical analysis trough the empirical results.

Partner countries: peculiarities and compared analysis.

The research considered the peculiarities of each country taking into consideration the political context, the social and cultural factors, the market sector and the financial and economic

elements. However the investigation built a common methodology to provide common variables that facilitate a compared analysis.
Drivers and Barriers, represent the main macro areas that emerged constantly in the interview discourses and the “crisis” (political, economic, environmental) results as a constant variable among the interviewees.
The socio economic factors reflect the peculiarity of each country and in this context WP4 focused on elements that the partner countries have in common, as well as some specific topics that are more characterized in a few of them.
The common elements identified in the interview content, in all countries, are for example the polarization between economy and environment. PV sector can support change in individual behaviour and direct this to a sustainable energy policy where the PV choice will be considered an economic advantage. Thus PV technologies result firstly as an economic choice, while environment is a “political” issue.
The PV technologies are easily associated with the concept of innovation that still finds a certain resistance linked to the perception of risk (economy, technology and social) and trust. The fact that in certain cases PV is considered a “new” technology that constitutes a barrier to PV diffusion.
A common element in the discussion is the centrality of the role of public institutions: because of its regulative function, for its power to establish subsides, for the desirable role to support awareness policies and programs and for the recognized need to apply changes in the bureaucratic process.
PV’s aesthetic acceptability represents a discretional variable that was defined throughout the document trough the discourse of the interviewees.

In Egypt, Jordan, Lebanon and Tunisia PV covers a different function in urban areas and in rural areas, where it’s considered a priority and a concrete solution to supply electricity.
Electricity access, price and cuts represent elements that are contributing to the transition to renewable energy.

Speculation and corruption linked to renewable energy are elements that emerged in some countries especially in Italy and Lebanon.
In Italy difficulties were experienced to identify PV companies and the interviews highlighted a poor general knowledge regarding innovative PV applications/technologies.
Bureaucracy has been defined one of the main barriers in the majority of the countries In Spain specifically, the uncertainty related to the changes in PV legislation and the retroactive policies applied are prejudicing, according to the key actors interviewed in the PV sector.

1. A focus on Social Acceptability

Social acceptability of innovative PV technologies has to be evaluated taking into account the influence of social economic variables that become, in the qualitative research analysis, subjective elements for each country. Therefore, results are strictly linked to the local context: policies and legislations implemented, according to the financial measures (e.g. Feed tariff, subsides) adopted, energy access, energy cost and energy cut, monopoly in the energy sector. Economic factors as population incomes, the willing to pay, credit access and the social cultural elements as information communication and education can influence the acceptability level. Specific elements such as corruption and speculation are able to influence the trust in PV technology, increasing the risk perception. The concept of "risk" explores different topics, showing that it is not only related to the perception of innovation, new technologies as "unknown" technologies, but also highlighted in the context of uncertain and mutable legislation and normative frames.

The political context and political changes, the geopolitical dynamics, as well as the global crisis, are relevant variables that characterize the approach of each country towards the PV sector support and implementation, as well as the citizen acceptability on renewable energy and solar energy. Therefore, contexts that are not only influencing choice at policy level, but affect also citizen behaviours.

Political decisions appear directly linked to "monopolies" and solar energy is perceived, according to some interviewees, as a direct competitor of energy lobbies, able to jeopardise conventional energies sources.

Topics such as the use of solar energy as a democratic energy source, its application not only linked to individual choice but also to a community perspective, brings the attention to a new concept on energy access, use and distribution: self-production, small scale system, battery, smart grid, net metering.

Environmental protection, European policies and international environmental negotiations, objectives to be achieved for local government by 2020, are elements that intervene on privileged interlocutors topics.

WP4 has performed a focus on identification, evaluation and analysis of a social variable on PV and BIPV citizen perception and acceptability. Citizen acceptability performs an important role on implementation of renewable energies technologies and still represents a research field that's worth investigative attention and in depth analysis.

Currently a unique definition of *social acceptability* in relation to the technology sector does not exist, despite the several qualitative studies that have been conducted (Wustenhagen R, Wolsink M, Burer MJ, Sovacool BK, 2007).

The focus on this research field started in the eighties, as before companies, authorities and private local investors did not believe that implementation represented a social issue (Carlman 1982). Academic confrontation on this topic started analysing variables that characterized the limits of social acceptability. However the public debate started only ten years after, because of the general public support on renewable energies technologies.

In this social acceptability analysis, we will refer to one of the most shared definitions of social *acceptability* related to small-scale energy system. The theoretical frame has been presented by Wustenhagen, Wolsink, Burer[a](2007), who postulate that social acceptability has composed by three dimensions: 1) socio-political acceptability 2) community acceptability 3) market acceptability.

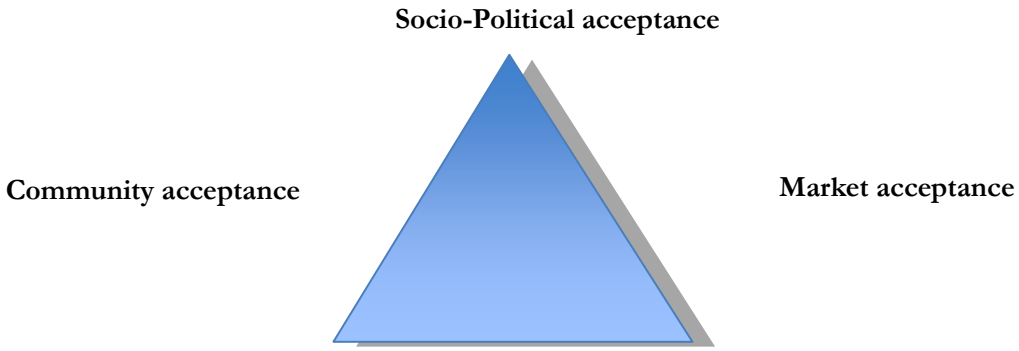


Fig.1 Triangle of social acceptability of renewable energy innovation (Wustenhagen, Wolsink, Burera (2007)

The **socio - political dimension** of social acceptability is aimed at a more general level and extended concerning people and organizations. Both policies and technologies can be subject of societal acceptability. The role of public policies on the widespread of renewable energy, the normative intervention, the fiscal support, various governance level, bureaucracy and coordination between market, citizen and decision-making, can define the socio-political acceptability. The central role of the public sector will be examined taking into consideration as well such context where public intervention offer a little support on renewable energy.

The social acceptability for installations for the production of energy from renewable sources can be interpreted also as **market acceptability**, namely as a process of "adoption and implementation" of an innovation by the market itself. According to this perspective, it is possible to analyse the social acceptability using the analysis presented in the literature on the processes of introduction, development and diffusion of an innovation. This is possible because unlike the majority of innovative products (for which there are numerous studies in the literature), renewable technologies are closely linked to infrastructure, territory and have a size of some significance. The documented strategies can be applied to small systems such as domestic installations for the production of energy, taking into consideration local and sensitive variables for citizen-consumers.

Community acceptability refers to the acceptability of the choice of sites for the installation of the facilities by the local community or citizens residing in the immediate vicinity of the project and local institutions. In this dimension of social acceptability expresses the NIMBY phenomenon for which a person supports the development of renewable energy as long as the project does not threaten the interests of local and personal. A special feature of the acceptability of the community is the fact of being variable over time. The community approach theoretical frame will be reviewed adapting the small-scale RE implementation, confronting cases studies on community acceptability as well verifying empirically trough the results of interviews realised.

2. Methodology

The research tools adopted to identify and design the social variables are based on qualitative methodology and directly linked to the previous desk analysis phase that offered the knowledge to elaborate and develop the following research phase objective: the investigation of social acceptability in the partners countries regarding integrated and innovative PV technologies.
Local key actors were selected based on specific criteria, in order to provide additional and complementary information to the quantitative desk data analysis and to make information useful for the design of the questionnaire administrated on the flowing phase to the population.
All interviews were conducted in different cities of the regions of each partner countries:

- Italy, Sardinia: in Cagliari, Loceri and Carbonia
- Spain, Catalonia: in Barcelona and Madrid
- Jordan: in Aqaba and Amman
- Lebanon: in Beirut, Mansourieh, Hazmieh, Haddath and New Jdeideh (6km from Beirut)
- Egypt: Cairo, Down Town Cairo, Maadi, Mohandseen (Cairo), Nasr City (Cairo), and Giza
- Tunisia: Tunis

Subsequently, we will refer generically to the partner country where the interview was conducted.
The qualitative phase has been characterize by the following steps:

- Selection of the themed topics for further analysis based on desk analysis information
- Selection of key actors
- Interviews design
- In-depth interviews conduction (10 interviews for each country)
- Focus group and Deliberative group (conducted only in Italy)
- Interviews transcription
- Selection, categorization and analysis of the qualitative information collected

Main objective

The mainobjectiveistoobtain qualitative data able to add information and knowledge to the desk analysis results and complete the missed information. At the same time identify specific topics related to PV and BIPV social acceptability and understand potential drivers and barriers to PV development and diffusion.

Variables and themed selection

Based on theanalysis data of each country and according to the emerged topics, a selection of the relevant areas of study has been made with two aims:
1) Identify key actors able to provide information in relation to the specific topics;
2) Use the topics to design the guidelines/questions for the in-depth interviews, which were characterized by common blocks of questions for all the actors and a specific block of questions for the specific area of interest of each respondent. The areas identified for the blocks of questions developed in the interviews were:

- Perception (Environmental/ Renewable energy context / PV)
- Innovation/technologies/integrated application/storage
- Public Policies
- Development of specific topics (e.g. technical, financial, political…)
- Drivers/Barrier (PV sector/ access/ implementation/ diffusion)

Key actors selection

A privileged interlocutor is any individual who is part of a group, organization, corporate entity or

institution of public, social, private, NGO or international agency having direct or indirect relationship with the subject of the project.
Some of the characteristics shown by key actors were:
-They had duties and responsibilities directly related to the subject of the project;
-They had skills, abilities, knowledge, infrastructure and resources to propose, address and solve scientific and technical problems related to the subject of the project;
-They had relevant social and professional networks directly related to the project environment;
-They were recognized as main local actors (linked to the subject of the project) by the local community where the project will be developed
-They had capability to influence, act, elaborate or propose policies related to the project subject;
-They had a direct interest on the subject of the project;

The selection of respondents has taken place according to their significance for the FOSTEr in MED aim and they were able to provide relevant information to the objectives of the research due to their strategic position in their given context.
The number of interviews performed, were 10 for each country (Spain conducted 7 interviews)

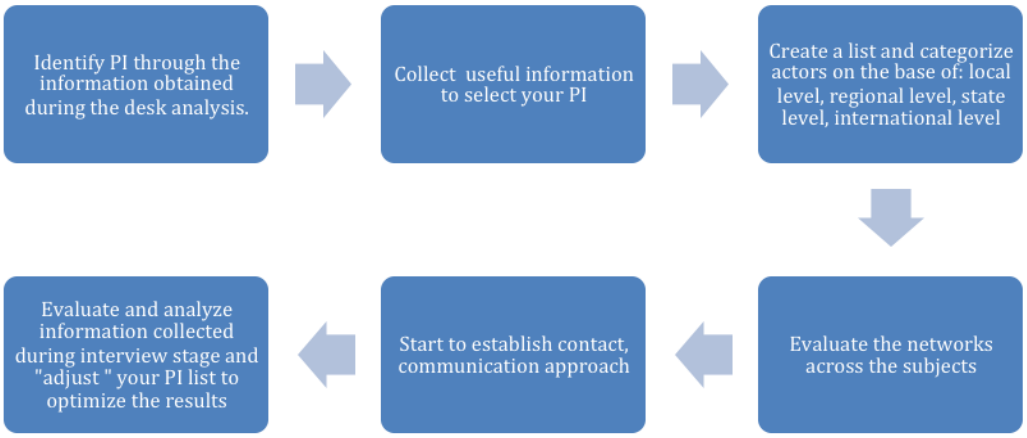


Figure 2: Chart of the privileged interlocutors (IP)

The process has been built up through scheduling and organizing meetings developed during 7 months and a constant check on the information gathered in the interviews in order to avoid duplication of information, as well as analysis of the networks between actors. Relevant work has been developed on the transcription phase and the inclusion of notes/observation at the end of each interview conducted.

Additional methods for qualitative research: Italy.
WP4 decided to use two additional qualitative tools behind the in-depth interviews, common to all partner countries. The WP4 performed in-depth interviews (11), focus groups (3) and the deliberative group (1), for a total of 30 people interviewed.

Qualitative methods for social investigation
The “interview” is a managed verbal exchange (Ritchie & Lewis, 2003 and Gillham, 2000) and as such its effectiveness heavily depends on the communication skills of the interviewer (Clough & Nutbrown, 2007). These include the ability to clearly structure questions (Cohen et al., 2007); listen attentively (Clough & Nutbrown, 2007); pause, probe or prompt appropriately (Ritchie & Lewis, p.141); and encourage the interviewee to talk freely. What is common to the majority of the differences in approach is the extent to which one interview can be compared with another.

The decision to interview implies a value on personal language as data. Face-to-face interviewing may be appropriate where depth of meaning is important and the research is primarily focused in gaining insight and understanding (Gillham 2000, page 11; Ritchie & Lewis 2003, p.138).
Interviewing was chosen for the current project for the following reasons:
-It provides the opportunity to generate rich data;
-Language use by participants was considered essential in gaining insight into their perceptions and values;
-Contextual and relational aspects were seen as significant to understanding of "others" perceptions;

Interviews have been performed face to face by the pollsters and their majority have been recorded and transcribed. Data generated has been analysed and compared considering countries peculiarity, as well taking into account the common guideline and topics.

Focus Group
A focus group or group discussion consists of a group of people brought together in a neutral location, to discuss a topic.
A facilitator moderates the group that use a topic guide as support to manage the conversation. People are consider in their complexity as a group and the size of the group varies between six and ten participants, although mini-groups with three to six participants can be useful for complex or sensitive subject matters. Each discussion group tends to be fairly homogenous in terms of demographics or attitudes towards a topic; this way, differences between the groups can be analysed. Duration of focus is variable depending on topic (an average of 90 minutes up to more than 3 hours).
The topic of the focus group realized involved: technicians, renewable energy experts and citizen who already installed PV system in their residence.

Deliberative Group
Deliberative research is a tool that enables the public to be involved in decision-making and to provide citizen perspective and opinion on a specific topic. Can be a useful methodology for policy consultations. It has many of the characteristics of qualitative group discussions or workshops but the focus is on participants' points of view. They can express their position discussing as individual in a group and evaluating all the information made accessible by expert who respond to doubt and questions regarding a specific matter. The deliberative phase is the last expression of the group.
Deliberative research tends to involve:
-Extended time period for participants to make considered decision
-Information provided over the course of the process to allow participants to make informed decisions
-Information provided from multiple points of view
-Heterogeneous groups of participants to debate issues with different perspectives.

The deliberative group has been conducting involving citizen who did not install PV technologies in their residence.

Software application support: NVivo to analyse the interviews
NVivo is a comprehensive qualitative data analysis software package. The software has been used to organize and analyse the interviews, focus and deliberative.

Bibliographic research

- Bibliography, documents, paper research, related to the RE, Social acceptability and its declination.
- Analysis on publications related to the focus areas identified on the interviews analysis and established as frame of interviews guideline.

Themed emerged from qualitative research.

Topics identified during the analysis and categorized as common to all interviews were:

- Perception (Environmental/ Renewable energy context / PV)
- Acceptability aesthetic
- Innovation/technologies/integrated application/storage
- PV Market (price, product installer, technician, skills, market, vendor, consumer)
- Financial Economic factors (credit access, feed-in tariff, subvention, bank, investment)
- Information Communication Trust Risk
- Public Policies - Governance - Bureaucracy - PP auspicable- PP criticism
- Development of specific topics (e.g. technical, financial, political…)
- Drivers/Barrier (PV sector/ access/ implementation/ diffusion)
- Speculation, Corruption

3. Community acceptability

The object of our study focuses in this interpretation related to the Community dimension; the aim was to analyse the role of citizens and of all the social actors involved in the process of building social acceptability of the implementation of photovoltaic systems for domestic use. The main purpose was to observe how - in this process - the aesthetic point of view, and communication related to the perception of trust in innovation were determining factors.
Indeed, the changes of the landscape, the perception of the planning process and economic impacts are only examples of influencing factors to the acceptability of photovoltaic technology: others might be risk and trust perception, environmental consciousness and information about PV innovation.

3.1 Aesthetical acceptability

Several studies related to social perception have shown that the aesthetic of photovoltaic panels is one of the fundamental variables that influence the attitude of the citizens, in addition to costs and the availability of funding and grants for installation.[1]One of the theories used to explore the complexity of social perception related to this issue is the "Cultural Theory" (Douglas, 1970; Thompson and Rayner, 1998; Verweij and Thompson, 2006; Hulme, 2009).
The theory postulates that these cultural dimensions provide the basis for the four schemes in which the world can be perceived: individualistic, hierarchical, egalitarian and fatalist. Individualistic discourses promote competitive markets and believe that the environment is tolerant to anthropogenic impacts.
For many of the interviewees of all country partners, PV is the type of renewable energy most appropriate in public and private buildings; but it is important to emphasize that the process of construction of perception of PV installations is active, personal and transforming (Ittelson et al., 1977). This process of perception often depends - as noted by the interviewees - from previous experience, direct or not, and from knowledge. Furthermore, it is embedded in processes of social construction: it is influenced by circulation of stereotyped information that shapes and forms a common perception related more to economic profit, than the environment and modernization topics.
Several experts interviewed in all the country partners explained that there are now - in addition to the traditional panel known by most consumers - advanced technologies in the photovoltaic market to be used as architectural elements; this choice, however, provides a lower efficiency and an increase in costs. The discussion about the aspect of the city with PV installations has particularly animated all our research work; the debate often focused on the aesthetics and energy production of new integrated technologies applied in certain areas of the city, with - specifically in **Italy** - a clear distinction between suburbs and inner city. In the interviews conducted in Italy appears that the acceptability of photovoltaic applications in public and private buildings is linked to different social identity of the social actor and, therefore, its perception of space. The level of environmental awareness, attachment to the city and urban spaces and the technical and scientific knowledge are fundamental variables in the creation of an idea related to the acceptability of PV in the city. The citizens, with a strong sense of belonging to the city, are very critical and watchful for the aesthetic change; indeed, all the people interviewed believe that the application of photovoltaic technologies involves a change of aesthetic and architectural structures and, consequently, of landscape: not always, however, the change is perceived negatively; some interviewees are curious and share the choice to "modernize" the city with innovative and

[1] Zhai, P., & Williams, E. D. (2012). Analyzing consumer acceptance of photovoltaics (PV) using fuzzy logic model. *Renewable Energy*, *41*, 350–357.

integrated applications. In Sardinia, advanced planning could have a beneficial impact on the perception of the citizens, who would appreciate the city in which they live more and would develop a greater sensitivity to environmental problems. This could be facilitated by an increased flexibility of the constraints present in Cagliari (Italy), where, in addition to the restrictions in the inner city, the sea represents, in contrast to what other studies in Europe show[2], one of the main limitations in the development of photovoltaic systems in Cagliari.

In **Spain** social identity, or the sense of community, are not considered important for the acceptability of aesthetic changes in city districts, contrary to what we found in Italy. Barcelona is a city of art and architecture; its architectural characteristics have been developed especially in recent decades, so, for this reason, the debate on PV acceptability does not relate to the negative impact that PV installations may be causing, but to the importance of architectural change. Indeed, according to people interviewed, integrated technologies are developed in the Spanish PV market, and their use represent an important and authentic solution to the visual impact.

On the contrary, in **Lebanon**, Beirut is considered a disordered city, without any design. For this reason, PV is accepted by all the people interviewed as an option to give a decorative addition to the city and to the landscape, not only as a source of energy, which the country has strongly needed. Installation of photovoltaic technologies would give a more orderly and modern aspect to the city, and, on the other hand, more planning could be the best strategy for PV in urban spaces: more regulation would favour the increase of PV on the roofs, and, as a result, would create a public perception to use the roof for producing energy through photovoltaic panels and, at the same time, improve the aesthetic of their houses.

In **Jordan**, space is a central point of the discussion about the aspect of the city with PV installation; politicians and experts interviewed especially reflect on the need to solve the problem of the disorder on the roofs of Aqaba. So, photovoltaic on the roof is a solution especially in existing buildings, but the interviewees don't exclude the use of integrated technologies on new constructions: some technicians, in fact, think that PV applications on facade are important elements for modernization of cities, and prefer this option to the classic panel on the roofs.

In contrast to **Jordan and Egypt, Spain**, in the study conducted in **Tunisia** come to light that more knowledge on the technologies would promote a greater acceptability of the aesthetic impact and, therefore, would support an increase in PV installations. However, there are contrasting opinions about the aesthetic impact: PV would have a negative visual impact on the city for half of the interviewees; for the remaining part, integrated technologies could become a resource of aesthetic improvement for the city.

Instead, the qualitative interviews conducted in **Egypt** do not provide information on the issue of social acceptability of Photovoltaic systems.

3.2 Perception, Trust and Communication

The diffusion of the innovations framework has received more attention in academic literature across various disciplines concerning the factors that influence the innovation-decision process. One prominent theme emerging from our research was the differences in how information about PV is interpreted by different stakeholders. Social research on environmental perceptions has long recognized the problems of having trust in information provision about RE to stimulate concern and action (Barr, 2008; Blake, 1999; McKenzie- Mohr, 2000; Owens and Driffill, 2008).

The argument is not that information provision is without impact but that combinations of how information is interpreted, the concern it generates, and social and situational factors impede a causal relationship between information receipt and action: so, in according to this approach,

[2] West, J., Bailey, I., & Winter, M. (2010). Renewable energy policy and public perceptions of renewable energy: A cultural theory approach. Energy Policy, 38(10), 5739–5748.

government policy on RE could consider, alongside social and situational factors, the cultural lenses through which individuals assess information (O'Riordan and Jordan, 1999).
Many studies are linked to the work of Everett Rogers (1962), who highlighted how consumers can absorb external information and how it can influence them on innovation decisions. Trust is related to knowledge and external information: according to Rogers, the collection of external information, in combination with characteristics unique to the individual (social and personality characteristics), informs the individual's perception of the technology's characteristics.
The qualitative data collected in all country partners shows a strong connection between information and trust. Trust in the PV market - from the choice of the technology to the final sale - is compromised without adequate information about innovation. Inadequate information generates a poor perception and awareness of environmental issues and, especially, a lack of trust in technological innovation offered by PV local installers.

In **Italy** public opinion, through stereotypical information, has built the idea that PV technologies are linked to economical profits and, thereby, to a speculation tied to incentives, rather than environmental issues. Awareness towards environmental issues appears to be greater in small communities engaged in the promotion of renewable energy: in these communities human relationships with institutions are more direct than other cities, so there is a better degree of trust in institutions and innovation. In Italy the degree of knowledge and, therefore, trust in the new technologies is different among the interviewees, depending on their social and personal characteristics: citizens in fact, are although particularly interested and intrigued by technological innovation and alternative choices of photovoltaic application are unaware of new technologies, their costs, solutions and innovation. Many of the interviewees in Italy denounce the lack of specialists in the PV market: this is the main cause of distrust. For this reason, in fact, very few people ask information to PV experts or request an expert advice; a photovoltaic system installer able to support the customer in selecting and installing the PV system does not exist. So, there are two important factors related to trust in innovation in Italy: citizens aren't receiving information from skilled dealers, and technicians of PV market complain about the poor communication with citizens and entrepreneurs.
In **Spain** the perception about environmental issues and RE technologies has changed in the last years: technicians, experts and activists believe that the decline in interest and trust in renewable energy, and specifically in PV, is caused by a distorted information campaign developed by the government. Circulation of incorrect information about the high costs of PV systems, in fact, has created a public perception that this source of energy is not important and favourable for the country.
The lack of information, knowledge, and laws aimed at development of renewables cause a strong distrust in innovation and are the main barriers to the development of the PV market.

In **Lebanon**, the rising energy costs and frequent blackouts influence the sensitivity of citizens who begin to inquire about renewable energy; but, as observed in the other countries, trust in innovation is strongly linked to information and knowledge. The interviewees show that there is a lack of correct information: there are no particular specialized scientific magazines, and the media – that has a large role to form perception in Lebanon - do not transmit correct information; there is also no information coming from the government. For these two reasons mainly, citizens do not invest in PV systems: high costs also increase mistrust due to the lack of experts in the PV market.

On the contrary, a peculiar aspect of **Jordan** is trust in the institutions: indeed, citizens ask information directly national institutions. For this reason, many interviewees hope for more communication between government and media (where people find information about RE). Lack

of knowledge, in fact, is an important aspect linked to trust in PV in Jordan: citizens do not know the PV systems and technologies well, so PV represents something new in the cities, where there are no applications on buildings. Nevertheless, politicians and expertsinterviewed in Jordan speak about a recent and increasing environmental awareness among the population. This sensibility to energy use is mainly liked to economic issues: the rising costs of the energy bill, in addition to issues concerning oil resources, is pushing people to seek alternative energy solutions to reduce costs.

In **Egypt** the qualitative interviews show us how personal and social determinants, in addition of course to knowledge and culture, influence Egyptian people in their environmental awareness. Most Egyptians, in recent years, have more awareness about the importance of RE and, especially, PV systems, and they wish to adopt these solution but - as observed for the others country partners - lack of information, and lack of technical knowledge (qualified technicians) are two main barriers to trust in PV and innovation. To solve this issue, experts believe that it is necessary to have regulation and more control on the PV market and installers.

4. Market acceptability

Instead of mere consent to an infrastructure project, private building and domestic generation requires active acceptability by homeowners, where by individual households become part of the electricity supply infrastructure. Acceptability may therefore be expressed in various forms as well as the attitude to evaluate the sector in relation to an investment. In this context the citizen is also an investor who has to reflect and made his evaluation in relation to the PV completive market.
Presenting an individual contest of evaluation and choice, we focused on the elements that are able to influence citizen choices, perception and acceptability also from the market perspective.
Taking in to consideration the PV sector on the complexity of its market elements, has been highlighted the need to analyse certain factors such the influence of product, technologies, brand, the role of installer, their validated competences, the product certification and warranty, the PV factories and the brands, product traceability and its country origin. Analysing the interviews emerged the central role of installer as one the most closure contact to citizen, able to communicate and to inform about PV system. At the same time this role may have good and bad effect on citizen trust, depending on the installer competences and skills.

In **Italy** interviews showed the key role of installer in relation to market and consumers. With the growing of the PV market due to the feed in tariff system, Italy experienced as well a growth in the number of installers. Installers assumed according to certain interviewees a contradictory role, due to the lack of skills, the fact that the installer often managed not only the implementation phase but all the project phase including the commercial part that become just the need to “sell”, and not to provide the client with the best solution.
PV market in **Spain** developed an important set of competences in the labour market, and the issue it’s experiencing is more related to the changes in the normative frame and not directly linked to the structure of PV market system
In **Jordan** details related to the PV market analysis are few in the interviewees discourses that confirmed on one side the high potential of PV market but still lack of trust.
Lebanon PV market system, it’s set behind to its potential and according to some interviewees, PV represent an option to solve of the basic need of having electricity and to avoid the cuts. As Lebanon has to plan a regional project for the PV system, the diffusion can be effective through certificated products supported by professional operators that build their skills and the technical knowledge. In this context public sector will absolve a central role in the control.
With regard to **Tunisian** people interviewed the lack of skilled operators affects the competitiveness of PV market**,** however some interviewees recognize as well that in Tunisia there is a limited interested in renewable energy and topics related to climate change because it prevails an evaluation about energy consumption related more to the cost then to sustainability.
As well in Egypt interviews the topic of certification quality products, certificated skills and training, appears central to widespread to the PV diffusion as well to support the trust of the consumers in the PV market sector.
Private sector has a central role according to the interviewees to communicate and provide information about the importance of PV and Renewable energy.
The PV market in the partner countries appears fragmented and the entire cycle in normally not produced locally (this discourse exclude Spain where the market is strongly developed). Interviewees manifested the need to improve PV supply chain locally supporting the market to create new and quality jobs and offer a good and quality product. In all the countries, the interviewees highlighted the paradox of been able to develop a market that will be beneficed by the climate context.

5. Socio Political Acceptability

As presented in the introduction chapter, socio-political acceptability has been defined as a dimension where policies and technologies can be subject to societal acceptability. Several indicators, as well as qualitative studies and the discourses emerged during the interviews conducted in the present research, demonstrate that public acceptability for renewable energy technologies and policies, has an high level of consensus and support even in countries where the government has little dedicated legislation and policy, and where the policy is not structured or still does not exist. This position in public opinion should positively push policy makers to understand that evaluation of social acceptability represents a driver and an opportunity, not a barrier.

The shift from government to ***governance*** concept highlights the need to answer to new social dynamics and management of nation states divided between processes of globalization and regionalization.

The idea of local governance is the set of formal and informal rules, structures and processes through which local actors collectively solve conflicts and share the social, in which the maintenance of trust and commitment is one of the most critical elements. A lack of inclusion of citizen in the policy-planning phase and in the building process, results across the interviewees in partner countries.

In **Italy** elements of top down policies and limited participation of the population on policy elaboration and implementation represent a transversal and constant discourse that has emerged in the interviews.

The perception that the processes of policy-making and decision-making are not including citizen in the planning, constructing and implementing policies shows criticism not only on the first stage of social acceptability, but also in the next phases of the processes, where policies need to find stable consensus and practice from community perspective.

In **Tunisia** interviews discourse showed the need to intensify the interaction and the communication between State and citizens.

With regard to**Spain** the political changes in PV legislation have generated instability, a decreasing confidence in renewable energies and a lack of clarity perceived not only by citizens, but also by the renewable energy market according to the key actors interviewed. A diffuse sense of lack of support and interest in the widespread PV sector appears in the discourse of all interviewees.

Egypt interviewees provide small elements in relation to public policies, citizen and governance. The discussion is mainly based on the criticism, desirable public policies and on market perspective.

Jordan interviewees highlighted the important role of policies to address the need to increase the sensitivity of people towards renewable energies and photovoltaic. However the dialogue and coordination between citizen and government it's necessary to overcome criticism and make the transition happen.

In **Lebanon** overall analysis about public policies, governance and role of government and citizen contain important element of barrier, criticism and needs that report a complex context where the PV sector have an important role for improvement and the possibility to create a stable strategy.

As highlighted in different countries the opinion regarding the role of citizen, their capacity to build relationship between them, the public sector being able to influence policy process show conflicting ideas.

A number of studies suggest that the rate of PV *diffusion is a function of both high upfront costs and non-monetary costs such as a lack of easily accessible, credible information.* A work of Noll, Dawes and Rai (2013), tried to focus on the role of community and non-profit organizations in

catalysing *peer effects* and other forms of information dissemination in the residential PV sector. The definition of a “peer effect” in literature does not include a unique definition, but is depending on the subject of study that can consider neighbours, friends, family or even firms. These studies demonstrated in the social field the importance of peer effects and social network interactions, on socioeconomic outcomes. Peer effects operate with other variables that affect individual decision-making, and hence the diffusion of technologies. Noil, Dawes and Rai reviewed the diagram of Roger (1962) and highlighted in red the phase of the innovation- decision framework when external information can be absorbed, and as a result, a peer effect can be experienced. Especially during the knowledge and persuasion stages, an individual often seeks to gather a large amount of information about the technology in question. Positive *peer effects* for PV can also increase the likelihood of adoption and decrease the length of decision time.

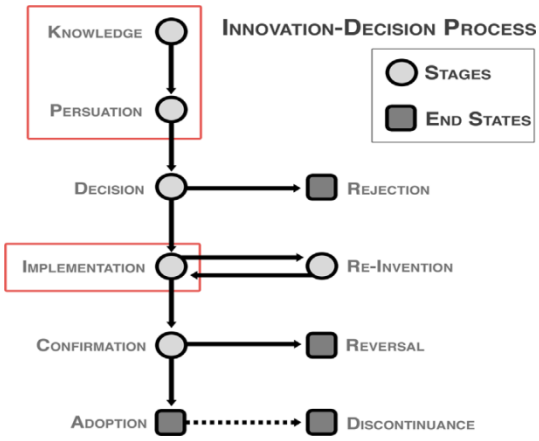


Fig. 3. Diagram of Rogers .The boxes around "Knowledge", "Persuasion" and "Implementation" indicate the stages at which peer effects can influence consumer decision-making.

Peer to peer effect as well as frequently define in the discourse as “emulation” effect and “the word of mouth”, represent informal channel to canalize information and awareness regarding PV technologies.

In **Italy** a focal point with regard to the peer effect and the role of networks, has represented, according to some interviewees, by the SCOs networks that are being implemented in different parts of Italy: social use of PV systems, social networks and progressive social changes in the use of renewable energy source, correspond with the process of solar energy democratization.
In relation to the issue of self-consumption emerged a topic among the **Spanish** interviewees that highlighted some difficulties related mainly to the administrative sphere. Existing SCOs provide an answer to alternative consumption and support citizen that want invest in solar and renewable energiesAlso, in this context, the idea of solar energy as a democratic source, push groups of people to reflect on its use and try to overcome the barriers.
In **Egypt** with regards to no governmental group organized, interviews show the need of put pressure on the government to promote PV effective policies and highlight the importance of creating the condition to be able to influence government strategies.
In **Jordan**, according to the interviewees, peer effect will be certainly generated between citizen who will take example from those who want install or already have installed.

6. A Reflection on Drivers and Barriers

Drivers and Barriers, represent the main macro areas that emerged constantly in the interview discourses. Analysing these elements can be useful for the qualitative analysis, as well as to provide elements to support recommendation for public policies.

The need for enacting policies to support renewable energy is often attribute to a variety of barriers or conditions that prevent the diffusion of technologies. The complexity of the barriers presents several variables that depend directly on different socio economic factors. As mentioned in the analysis, the socio economic factors reflect the peculiarity of each country. In this context we can focus on elements that the partner countries have in common, as well as some specific topics that are more characterized in few of them. The aim of this final reflection is to presents the overview in all partner countries and try to compare different experiences.

*In a policy context, "**barriers"** are factors or attributes of factors that operate in between actual and potential renewable energy development or use* (Verbruggen, 2010).They can be both intentional and unintentional. Barriers prevent action; impede progress or achievement in realizing *potentials* and objectives. The International Panel for Climate Change (2007) defines barrier as ‘‘any obstacle to reaching a goal, adaptation or mitigation potential that can be overcome or attenuated by a policy, program, or measure".

They can be changeable and depending on the objective that has to be achieved, ‘‘barriers'' may refer as well to facts and conditions that should be maintained or strengthened to avoid the realization of perverse goals.

The "**drivers**", represent in this analysis a set of factors or areas of improvement that can be considered and addressed to achieve PV acceptability and diffusion.

The following figure presented by Verbruggen refers to the IPCC representation that introduces an interesting concept, in this case applied to the context of climate change.

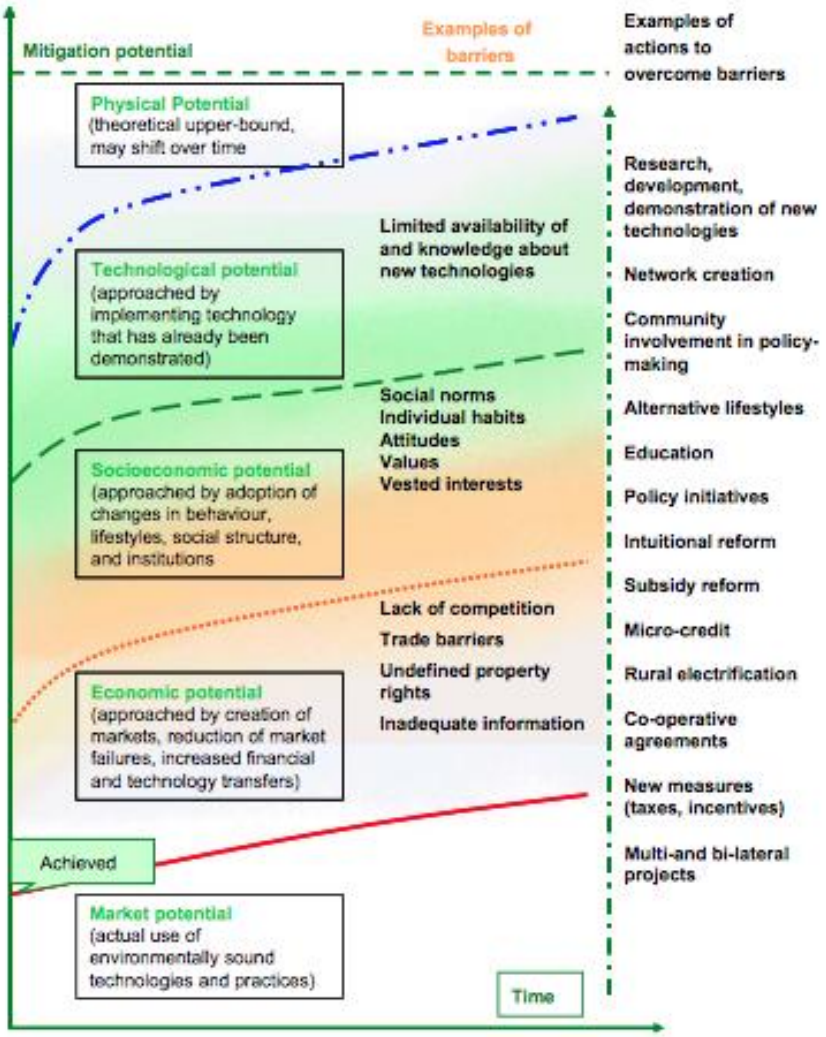


Fig.5 IPCC mitigation potential (2001)

Potential constitutes an amount of adaptation that could be, but it's not yet realized over time.
In this context, it can be interesting to reflect on this model with regards to what has been realized and can constitute a driver and which is the potential context. Also, the scheme can be used to represent some contact points with drivers or to construct further analysis on PV.

Some elements that have characterized the context of analysis

Some elements that emerged from the interviews represent a driver or a barrier at the same time, factors that present a common element in different partner countries.
The element of "**crisis**" represents a transversal factor in all partner countries that affect economies, including citizens, private and public sector. This element can be considered in the complexity of the analysis as a driver or a barrier depending on the function that will cover in the public policy planning and in relation to the way in which will influence energy consumption and citizen opinion about solar energy. On one side, the interviews present some elements that refer to the difficulties experienced by different actors in relation to the financial capacity, credit access and willingness to invest in PV technologies. In a situation of crisis, the *priority* of the citizens doesn't include, according to certain respondents, the capacity to make a relevant investment such a PV system. On the other side, the element of crisis becomes a driver: the limitation of fossil sources, the current price of oil, the increasing energy bill price in countries where electric energy is not

subsidized, bring the attention on the importance and the need to move to other types of energy sources. PV represents in some discourses the concrete alternative to reduce the energy bill and to provide affordable access to electricity. Thus, PV panels represent a practicable solution and not only for the rural areas of those countries where, at the moment, PV solar energy is the only strategy to get electricity.

Referring to another important element that emerged in the interviews; **the political changes** experienced by Tunisia and Egypt constitute in the privilege interlocutors a driver, as well a barrier for the diffusion of renewable energy and the PV sector. In this context, PV represents a big opportunity, according to some actors, to develop a local market and create new jobs; they provide a stable energy access and price to citizens. In some interviews the political changes affect the decision making process and policy makers, move the priority to manage the internal political changes, setting the objective more in short term action then long term planning.

According to some interviewees Jordan experiences that influence of the geopolitical situation on the area and energy access represents an important driver to reflect on energy planning.

Some elements influence *instability* and reduce the diffusion of PV technologies. Attention is brought to relevant barriers that influence internal political, economic, social, and ecological context, as well the energy sector. ***Mafia, corruption*** **and** ***speculation*** represent three elements that emerged in different countries. In Lebanon, some interviews mentioned the presence of illegal organizations, defined by some interviewees as "*mafia"* that manages part of the electricity infrastructure.

"Score" (http://www.euscore.eu), a project realized by Banca Etica Foundation and the European Commission present an investigation about illegal infiltration on renewable energy sector. The social perception about the presence of illegal infiltration in the renewable energy sector is very low because of the publicities and the message diffused and associated with "green energy". According to some respondent, people consider the concept of "green", a positive concept anyway and have difficulties in diving deep into the analysis of criticism.

Some Lebanese and Egyptian interviewees define corruption as a part of the political system, reducing the capacity of PV to be diffused and limiting the possibility to the citizen to benefit from it.

Speculation emerged in Italian and Spanish interviews. In the case of Spain, the concept of speculation is linked to the past PV incentives scheme, used by certain investors as a form of direct profit. In Italy the discourse of speculation is associated to two elements. Firstly, the use of the past incentive scheme "Conto Energia", that provided relevant profit to big investors, to private citizens (that installed more kw than the energy capacity required to get paid for the surplus produced), as well as to the PV market and specially to the installers that adopted, according to some interviewees, an aggressive commercial approach, basing their job more on quantity then on quality.

Secondly: big PV plants, PV plants built on agricultural land and not linked to rural diversification and farming multi-functionality, as well as thermodynamic plants in rural areas, are identified as speculative project that provide a distortional image of what PV system has to represent for citizens and communities. However, an increasing attention on this matter is revealed due to the information diffused by environmental movements, citizen committees, as well as media coverage. This attention is progressively changing the general perception that "green is good" and people are becoming more and more conscious about the existing differences in the complex scenario of renewable energy projects and plants that, according to some civil servant and politician, are starting to represent a relevant issue both at administration and political level.

Bureaucracyisone of the main barriers to the development of PV installation in cities**;** the biggest problem is the progression of practices. Bureaucracy is not a braking element when citizens decide to install, but over time appears demotivating for citizens in Italy: bureaucratic delays are

capillaries throughout the installation phase, from the choice to invest in PV system, to final stage. Citizens constantly denounce the lack of communication and coordination between the different departments that are in charge of PV management; frequently the information received in the various offices are mutually contradictory and lead to a situation of uncertainty that can slow the development of the photovoltaic market: in Sardinia, ***municipality***, in particular, is the node where the process stops. The simplification of bureaucratic procedures is an objective in the planning of administrative management, due to the difficulties found in our study in Italy: the need to develop planning policies that support and facilitate the development of the PV sector, and the priority of streamlining the bureaucratic practices through the reorganization of the offices in charge of the analysis of them.

Bureaucracy is a barrier in Spain, Egypt and Lebanon as well. In Lebanon, as in Italy, the main problem linked to bureaucracy is the lack of coordination between departments in charge of PV management; people also denounce bureaucratic delays to get financial supports for small projects. In Spain interviewees believe that processes are slow and confusing; especially the different opinions between co-owners on installation makes it impossible and limits the freedom of the individual owners to install PV. On the other hand Egyptian interviews showed the difficulty to get an approval and ***permits from government*** to install PV systems.

6.1 Barriers

The study found that there is a strong disconnection between how photovoltaic technologies are produced and how these are socially perceived; indeed, the study shows how social acceptability of Renewable Energy and, specifically, PV technologies, is related to different elements such as social characteristics and culture, economic and financial issues, knowledge and trust in innovation, and control on PV market. Barriers to increase PV installations are often quite situation specific in all partner countries; nevertheless, different main categories of barriers are discussed in this section.

Acceptability of photovoltaic applications in public and private buildings is linked to different ***cultural characteristics.*** The level of environmental awareness, attachment to the city and urban spaces and the technical and scientific knowledge are fundamental variables in the creation of an idea related to the acceptability of PV in the city. Social and personal characteristics of the people is key to confidence in innovation: in fact, in some partner countries such as Spain and Italy, although citizens are unaware of new technologies, their costs, solutions and innovation, they are particularly interested and intrigued by technological innovation and alternative choices of photovoltaic application. On the contrary, in other partner countries as Lebanon, people aren't concerned with investing in PV installations, also in Egypt; the development of PV systems appears to be more a political than a public decision.

The importance of landscape evaluation (i.e., ***visual aesthetic impact***) and a strong connection between procedural justice criteria (including transparency, early and accurate information as well as the possibility of participating during the planning and installation process), appear to us, relevant elements linked to public acceptability of PV installations in cities, first of all in Italy. Qualitative data shows that some people believe that the application of photovoltaic technologies involves a change of aesthetic and architectural structures and, consequently, of landscape: especially in Italy and Tunisia, PV on the roof has less impact than the applications on the building facade. Not always, however, the change is perceived negatively: PV innovative technologies might be installed as an element of modernizing the city, but their uses could be facilitated by an increased flexibility of the constraints present in Cagliari, where at the moment, in addition to the

restrictions in the inner city, the ***sea*** represents one of the main limitations in the development of photovoltaic systems in Cagliari. On the contrary, in Spain, where Barcelona is a city of art and architecture, PV is considered an added value for the city; in Jordan, Tunisia and Lebanon ***the lack of s****pace* to install PV on the roofs might be solved through integrated PV technologies on buildings facades, but the absence of quality and expert installers on the market does not easily allow this solution.

Technical barriers, in fact,do not favour the development of PV installations in the partner countries we have investigated. PV installation in cities could not increase without the requisite skills. In specific PV markets, a large number of skilled technicians who can install, operate, and maintain PV technologies don't exist. Qualitative interviews conducted in every country, denounce the lack of sufficient technical and business development skills; consumers, engineers, experts, technician and politicians don't have a lot of information about the characteristics of PV technology, costs and benefits, operating experience, maintenance requirements and installation service. The lack of skills and information may increase perceived uncertainties and decisions to install PV systems for domestic use. Lack of space in buildings, due to the presence of water tanks and TV antennas on the roofs, prevents the development of PV installations in Jordan and Lebanon; in addition in Lebanon, Tunisia and Egypt there are no specialized technicians and qualified installers, or PV models that are developed as a good example for new installations. Innovative technologies may still be perceived as risky if there is little experience with them in a new application in some region. The lack of visible installations and familiarity with PV technologies can lead to perceptions of greater technical risk than for conventional energy sources.

In Italy the lack of specialists in the PV market appears one of the main cause of distrust in innovation: citizens who have already installed a PV system in their homes report experiences with unreliable dealers, that are unprofessional from a technical standpoint (for example there are installers who are simple electricians) and unstable/unreliable on the PV market. Another relevant element in Italy is the lack of knowledge of innovative technologies.

So the process of perception of PV systems in urban spaces often depends on previous experience, direct or not, and from knowledge. Furthermore, it is embedded in processes of social construction: it is influenced by circulation of stereotyped information that shapes and forms a common perception related more to economic profit, than the environment and modernization topics. Residents are not willing to install PV systems until they receive more ***information*** (e.g. how they work, how they reduce electricity costs, other users' experience): indeed, lack of correct information and communication does not permit increasing the level of confidence in innovation by consumers and skilled technicians.

Inadequate information generates a poor perception and awareness of environmental issues and, especially, a lack of ***trust in technological innovation*** offered by local PV installers. In fact, public opinion, through stereotypical information, has formed the idea that PV technologies are linked to economical profits and, therefore, to speculation tied to incentives, rather than environmental issues. This is particularly relevant in Spain where circulation of incorrect information about the high costs of PV systems, and a substantial change of public policy, has created a public perception that this source of energy is not important and favourable for the country. In Italy, Lebanon and Egypt, too, Media - that is the main source of information for citizen about PV - does not transmit sufficient information about RE and PV technologies; on the contrary, in Jordan consumers ask information directly to the institutions, in which people trust.

Lack of trust in institutions, instead, is a barrier in Lebanon, Spain and Italy to increase PV market. In Lebanon – where there are financial issues, economic crisis, problems of other priorities – they don't believe anymore in State and in long-term actions. In Italy people think that politicians don't know PV technologies and, therefore, are not able to plan actions concerning

renewable energy and photovoltaic; the consequence of a lack of proper counselling is a discrepancy between policies aimed to the use of renewable energies and knowledge of technological innovations. In Spain, in recent years, the perception about environmental issues and RE technologies has changed: interviewees believe that the decline in interest and trust in renewable energy, and specifically in PV, is caused by a distorted information campaign developed by the government. The constant changes in ***legislation and regulation***, are creating difficulties for the sector, from the point of view of production, and regarding the trust of consumers. ***Uncertainty about legislation***, as well as implementation of rules with a retroactive function, such as cuts to agreed incentives, also influences the choices on investments. Regulatory problems influence the PV sector, first of all, in Egypt and Lebanon: in Lebanon there isn't a clear and simple regulation, so the PV sector is not controlled and guaranteed; at administration and political level in Egypt, the lack of regulation, laws, and state aid as the main barriers, such as barriers of public policies is relevant. Also in Tunisia – where the building code and regulation concerning the auto-production of electricity is not clear – setting up clear ***fiscal and financial incentives*** in order to encourage people to use these technologies is very important as well, and this may contribute to enhancing the energy efficiency in Tunisia.

Indeed, ***high initial capital cost,*** represents an important barrier for all the countries analysed, except for Spain which is one of the main PV panel manufactures in the world; many argue that renewable energy costs are higher than other energy sources. Consumers or project developers may lack ***access to credit*** to purchase or invest in PV systems because of lack of collateral, poor creditworthiness, or distorted capital markets. Available loan terms may be too short relative to the equipment or investment lifetime. In some countries (Egypt, Spain and Italy) energy project developers have difficulty to obtain bank financing due to the context of uncertainness.

In all the countries large public ***subsidies*** are channelled to conventional forms of energy, which can distort investment cost decisions. Especially in Lebanon, electricity is inexpensive, but they pay two bills. Most customers are unlikely to choose an alternative product even if it might help them to save money. In Egypt the feed in tariff plan is still not been applied.

6.2 Drivers

In the analysis of the elements identified in the interviews that could support PV acceptability and diffusion, we can identify three driving macro areas: **Political drivers, Economic/financial drivers and Social drivers.**

Some of the elements are common in all partner countries, in certain cases specific for some of them.

With regard to the **political drivers**, according to the majority of the interviewees, the central role of the public administration and the government to create policies, as well as their capacity to plan and build a strategy able to diffuse PV acceptability, is recognized in all the partner countries. Governments, through the public policies, are able to cover a relevant role starting with the education of young citizen, providing the tools to spread communication and awareness on climate change and to transmit a message regarding the importance of renewable energy for environmental protection. The European 2020 strategy, as well as the Smart Cities program, specifically in Italy, has been considered an important measure that besides the direct results obtained, contributed to improve the opinion on the importance of PV solar technologies and renewable energies among local communities and local administration.

Political decisions made on different governance level, can weigh on the decision of the citizen. Streamlining bureaucratic processes, for example, represents an important element to support PV

acceptability highlighted by the majority of respondents. The need of a clear regulation to support the PV sector is central to coordinate actions with public, private and individual actors.

Analysing the **economic and financial drivers,** policies directed to support the PV sector financially, can represent a real support especially in countries where the electricity bill is very cheap and PV does not represent an interesting alternative. The matter of financial intervention is desirable, not only regarding the subsidy scheme, but as well to think from a political perspective, the way to support self-consumption. In the Italian interviews the element of financial cuts regarding local administration emerged. The cuts are linked to the national governments constraints of the "Patto di Stabilità" (stability pact), a strategy to control local spending. The financial cuts imposed an austerity regime that is characteristic in the majority of the European countries, however many of the interviews, especially public actors recognized the possibility that PV can represent, in this context, a valid alternative to reduce energy cost not only for the citizens but for the public administration as well.

The increasing cost of energy, offers a concrete driver to reflect on the use of PV systems to reduce the energy cost not only for private citizen, but as well for the private sector that are facing the need to reduce expensive costs in energy production. The case of Egypt where projects are starting to be realized by the private sector represents a good condition for PV implementation, especially in the tourism sector. PV also represents, according various interviewees, a driver to improve the energy access in those countries subjected to electricity cuts or areas where it's difficult to get access to the electricity grid. In the case of Lebanon, citizens will also be able, for example, to overcome the issue of paying two electricity bills, one for the illegal generation of electricity through private diesel generators and one for the legally acquired electricity.

Access to credit trough projects and loans represents, according to Lebanese interviewees, a central point to support the PV sector. According to Jordan stakeholders, tax reduction can support the solar systems diffusion. Apart from the subsidies, the decreasing price of PV panels for Spanish and Italian interviewees represents an important driver that can support the installation of PV in private buildings.

Cultural drivers, can support a cultural change on PV systems: the increasing consumption of electricity, the seasonal climate peak depending on the regional area (e.g. some countries are experiencing more consumption in the summer season for *cooling*), brings the attention to the need to change the energy supply strategy, representing a social driver to move to PV implementation. Considering the aesthetic of the panels appropriate for cities centres is an important driver for social acceptability. It's been manifested in several interviews that PV panels can be considered as an architectonical element able to embellish public and private buildings. Especially the roof of buildings used as "storage" and in the majority of partner countries where urban shape is suffering from the absence of an aesthetic regulation, for example antennas and air conditioning boxes. With regards to the social factors, previously defined as *peer-to-peer* effect: word of mouth and the diffusion of PV for "emulation" dynamics represents a cultural and social element that cannot be ignored in the driver elements.

7 Swot Analysis

	Strength	Weakness
INTERNAL	Innovation Technologies Decreasing price of product Policies PV sector Subvention Projects Changeable Peer to peer effect Technology Adaptability Word of mouth	Market (consumer awareness) Market (PV sector weak and fragmented) Product Certification Job Skills Credit access Bureaucracy Cultural awareness Lack of information/communication Lack of space Participatory planning Lack of clear and stable policies Governance
	Opportunities	**Threats**
EXTERNAL	Crisis Geopolitical changes Energy cost Energy access Energy cuts 2020 Strategy International strategies on RE Climate change Unpleasant buildings and cities shape Landscape protection Aesthetic Public funds cuts	Speculation Corruption Mafia Lack of trust on new technologies Subvention to other sources Energy Lobby

Appendix

a) Community acceptability

1.1.1 Aesthetical Acceptability

Italy

An approach related to cultural theory provides a useful heuristic device to identify, and better understand the reasoning on the different individual responses to the implementation of renewable energy and specifically of solar panels; therefore, a useful supplement to traditional logical decision making based on the socio-economic status or localization.
Many interviewees consider Cagliari a particular city, "*different from other*"[3] for the typicality of its inner city, that could be protected absolutely in their authenticity - as claimed by A. Associate Professor, Department of Electrical and Electronic Engineering: *"[…] however... is a technology that isn't good, however... to the inner city. No. The urban context was born to be nice without the photovoltaic panel. In the inner city of Cagliari I cannot see PV"*[4].Others, however, accept modernization, even of the most characteristic areas of the city. During the focus groups and in particular the deliberative group conducted to specifically investigate the issue of visual impact and aesthetic photovoltaic technologies in the city, in line with the Cultural Theory, individualistic discourses have emerged in this context.
As observed by a commercial agent during a focus group attended by people who have already installed PV in their home: *"Today the word photovoltaic is on everyone's lips. Maybe everyone doesn't know exactly what it is, but PV is much better known now than 5 to 10 years ago"*[5].
Another participant said that the decision to install has been influenced by *"a bit 'from the internet, a little through looking around on who sells and brochures, to clear my thoughts [...]*[6]; according to several interviewees, a strong environmental awareness among the citizens does not exist, but *"consciousness is linked to the fact that there is an incentive, which saves on the cost of energy. If it were not for this, in most cases, there would not be this tendency to the development of PV plants*"[7] - as R. observes during the focus group.
For many of the interviewees, there is no doubt that PV is the type of renewable energy most appropriate in public and private buildings:
"PV is definitely the element that you can clearly see, if done properly, it is what has increased production in our system, and it is what allows us to have electricity directly linked to our needs, when we need it"[8]observes an expert of the Department of Electrical Engineering and Electronics – but it is necessary to make specific assessments on technologies to be applied, on efficiency and on visual impact at the same time.
Individualist discourses show that knowledge on the technologies would promote a greater acceptability of the aesthetic impact and, therefore, would support an increase in installations. During the Deliberative Group conducted with citizens of Cagliari, we showed to participants' four

---

3 *diversa dalle altre*
4 *però è una tecnologia che non va bene comunque per il centro storico. no. Quel contesto urbano nasceva per essere bello senza pannello fotovoltaico. Nel centro storico a Cagliari non ce lo vedo proprio*
5 *oggi, di fatto, la parola fotovoltaico è nella bocca di tutti. Non tutti magari sanno esattamente di cosa si tratta, però diciamo che è un qualcosa che è molto più conosciuto rispetto a 5 /10 anni fa, che se vogliamo non sono nemmeno poi tanti*
6 *un po' da internet, un po' andando a curiosare da chi vende, opuscoli, per chiarirmi le idee [...]*
7 *la coscienza è legata al fatto che c'è un incentivo che permette di mettere da parte il costo dell'energia. Se non ci fosse stato questo, nella maggior parte dei casi, senza questo non ci sarebbe stata questa propensione allo sviluppo degli impianti*
8 *il fotovoltaico è sicuramente l'elemento che si vede bene, se fatto decentemente, è quello che ha maggiore produzione nel nostro sistema, ed è quello che consente di avere energia elettrica direttamente per i bisogni, quando serve*

images of 4 different buildings in many neighbourhoods of the city of Cagliari; photos portrayed the original building and other 3 options with integrated applications in the facade and balconies. All participants, curious about the novelty, reacted positively to the view, interacting with each other and asking interesting questions on technology, costs, materials of composition and colours available in the market. None of them knew these possibilities. All participants accept the installation of panels integrated into the facades of city buildings, but are more cautious in choosing this option in the inner city. Integrated Technologies on the balconies and in the facade are considered by all participants' aesthetic elements of improvement and enrichment; the choice of colour is crucial to the acceptability of a system: it is necessary to install a colour that does not conflict with the aesthetics of the building.

There is no doubt that the application of integrated technologies can be improved in areas where, over the years, man has built in a disorderly manner: citizens cite the district of Sant'Avendrace as an example "*which may be a positive change*"[9], and, in particular, value the proposed changes to a building in Viale Trento, that "*compared to the abominations that there are ... it's much better!*"[10] - says a citizen. The debate, however, becomes more complicated when they speak about the inner city: "*In my building, the roof was not enough, and I did not like to cross the roof, and I thought, there will be someone to evaluate if it is okay or not? Thinking about Villanova you could say: I put this colour on the yellow house and I'll put another colour on the green one, perhaps it is not feasible... but it is already a reasoning*"[11] - specifies a citizen during the Deliberative Group - and again, always in relation to the neighbourhood of Villanova, another participant says *"in this case the choice of colour makes the difference; here if they had put charcoal I'd say no! This colour doesn't give me any negative impact. Aesthetically this colour is ok.*"[12]Despite the curiosity, and a positive and confident attitude towards the new proposals, fundamental fact is clear: all citizens interviewed prefer traditional panels installed on the roof; PV on the roof has - for all those interviewed- less impact than the applications on the facade. The moderator of the deliberative group asked participants what specifically would they take into consideration to not ruin the aesthetics of the buildings and landscape: all people believe that harmony and the respect of the structure of the building is essential for the acceptability; they are "perplexed *on the existing, because it's difficult to find a situation in which aesthetic impact can be compatible with environment. The situation is different for new buildings, because... during the project they can find elements to make it more harmonic."*[13] *(*Refers to the picture presented by the moderator of the deliberative group*) an image seen like this ...! Is not important, because that can be a sort of flowery balcony*[14] *(*refers to applications on the balcony*) but if I see all of this on a road, I'm going to think that this could be a "mirror way"*[15].

Again, on the basis of the Cultural Theory, *hierarchical discourses* are highlighted in relation to the inner city - specifically to some old neighbourhoods called Stampace, Villanova and Castello – where people think that the need of control over the planning and the choice of buildings for installations is important; citizens, politicians and public servants, underline the need for more planning on the renewable energy sector as a key of growth of the acceptability. All the people interviewed wish to plan a "joint action" that submit the choice of installation to regulation: the

---

9 che può essere un cambiamento positivo

10 confrontato agli obbrobri che ci sono...così è molto meglio!

11 Nel mio palazzo il tetto non era sufficiente, e a me non piaceva sconfinare nel tetto, e ho pensato: ci sarà qualcuno per valutare se va bene o no? Pensando a Villanova bisognerebbe dire: allora nella casa gialla metto questo colore, in una verde ne metto un altro, magari non è fattibile, ma è già il ragionamento a monte è una cosa fattibile

12 in questo caso è la scelta del colore che fa la differenza; qui se lo avessero messo antracite avrei detto di no, di questo colore non mi dà nessun impatto negativo. Da un punto di vista estetico questo colore lo noto meno

13 perplessi sull'esistente, perché è difficile trovare una situazione di impatto che possa essere compatibile con l'ambiente. Diverso è il discorso per le nuove costruzioni, in fase di progetto di possono trovare tutte le situazioni per rendere armonico lo stabile. Sull'esistente noi stiamo vedendo

14 un'immagine che vista così...! non è impattante, perché quello può essere una sorta di balcone fiorito

15 ma se tutto questo io lo vedo su una strada, niente mi toglie dalla testa che questa sia una strada "degli specchi

main constraints must relate to the use of colour and the type of application in the inner city, so buildings follow a common logic in the landscape.
On the other hand, in according to politicians and technicians, control and more strategies appear to be fundamental variables in the discussion on the acceptability.
As said by a technician of "Servizio Pianificazione Territoriale" in Cagliari:
"In the inner city, respect for the system as a whole, I think, mustn't come to an extremist vision of complete prohibition. Because when it comes to that, in systems where the culture of conservation are poorly developed, like ours, you get the opposite reaction; If everything around here is rubbish, why do I have to respect something? It's quite simple to understand: if you go to Portofino and approach it from the sea, if you do not pay attention or do not understand why it is so beautiful, but if you pay attention to Portofino and discover that there is a repetition: that every building has no blinds or shutters, but only green shutters. Buildings have only specific colours; the shape is always the same; the roofs are oriented in the same way: this creates harmony in everything. Today, if we go in our inner cities, unfortunately, also turning into Marina for example, maybe we can see both well-preserved buildings, and right next to it buildings from the seventies. And then, what type of consciousness can be developed? If you say, oh no, you cannot touch a single roof tile..."[16].

A greater acceptability depends on a greater degree of aesthetic sensitivity rather than economic – as shows a politician – because "*PV installations build up to now are bad. (…) Because it is only done to maximize the power in the old logic of profit. So it's bad, it was done without any type of architectural analysis or impact assessment. It's just ugly, and instead there are solutions more aesthetically pleasing. If I have to install PV in a modern building, it can be easy to contextualize with modernity".* In the interviews conducted in Italy, indeed, an egalitarian discourses emerges; these are more accommodating to atrophic changes. Public servants, technicians and experts interviewed are opposed to the extremist vision that prohibits all interventions in the inner city and close to the sea: they also prefer photovoltaic on the roof but do not exclude integrated actions, that should be evaluated in each individual case. The reflection is particularly intense with respect to these areas because - as noted by a politician - "*everyone agrees to go in that direction, however, on the other hand, there is the need to have a lot of attention to the question of landscape. Cagliari is built on hills, and there are many views from above; for example from Castello towards Villanova, or Stampace. What characterizes Stampace are the roofs, but we found it a bit short 'complicated to imagine that the roofs of our inner city could be invaded by reflective surfaces"*[17].
Similar constraints are strong elements of reflection for the technicians of the regional market and for the Sovraintendenza Regionale, that consider Cagliari linked too much to landscape protection, despite the recognized potential in integrated technologies that would be suitable to overcome this limitation:

"*in Gallura and Sassari we are more elastic. We really value on a case by case basis, for example, if in the inner city the intervention is not visible objectively, and not all the inner cities are the same:*

16nel centro storico, il rispetto del sistema nel suo complesso, non necessariamente, secondo me, e questa è una mia opinione personale, deve arrivare alla visione estremista del tutto vietato. Perché quando si arriva a quello, in sistemi dove la cultura della conservazione è poco sviluppata, come da noi, si arriva alla reazione opposta; ma se qui tutto attorno è una porcheria, perché io devo rispettare qualcosa? È anche abbastanza semplice da capire: se voi andate a Portofino e arrivate dal mare, se non prestate attenzione, non capite perché è così bella. Se si presta attenzione scoprite che a Portofino c'è la ripetitività: quindi ogni palazzo non ha le persiane, o le tapparelle, ha solo le persiane verdi. I palazzi hanno solo dei determinati colori; la forma è sempre la stessa; i tetti sono orientati nello stesso modo: quello fa sì che tu guardi il porticciolo e trovi un'armonia in tutto quello. Oggi, se noi andiamo nei nostri centri storici, purtroppo, anche girando nella marina, magari si vedono dei palazzi ben conservati, e affianco si vede un palazzo degli anni Settanta costruito lì. Ma allora che sensibilità si può sviluppare se dici: eh no, non puoi toccare neanche una tegola perché il tuo tetto altrimenti...
17c'è la condivisione di andare verso quella direzione, e però per un altro verso c'è la necessità di avere molta attenzione alla questione del paesaggio. Cagliari essendo costruita su colli, e ci sono molte visuali dall'alto, pensiamo da castello verso Villanova, o verso Stampace, le cose che caratterizzano sono i tetti di Stampace, ma abbiamo trovato insomma un po' complicato immaginare che i tetti dei nostri quartieri storici potessero essere invasi da superfici riflettenti

if the panel is not visible why penalize a person who lives in the inner city and not authorize a PV installation?"[18]

However, the concept of aesthetics, according to experts, is not clear, widespread and defined between the citizens of Cagliari: to prove this, there's the complaint of the presence in the landscape (urban or not) of elements such as antennas, solar thermal, building permit violations, that allowed levels of tolerability towards aesthetically unacceptable interventions not be perceived by the community as a disorder. Also for this reason, and always defending the egalitarian discourse, they argue that renewable energy should and could be installed anywhere in the landscape, without affecting the aesthetics, through the implementation and proper use of integrated technologies. The words of M, engineer, analyses this issue in a comprehensive manner:

"*We had tried to build an installation with micro crystalline, two layers of glass inside with a spray product that served as photovoltaic. Very nice, and also produced, on a day like this, which is not very sunny, a pitched north-facing roof produced as a normal PV. A higher production despite having a lower exposure, also produced in days like this and, then: the performance was equivalent to polycrystalline. It costs more, the difficulty of installation is greater, but it was very interesting. We wanted to offer films, we have participated in all major exhibitions, both Italian and foreign in the last five years to see what were the trends and the most interesting products. There were some really spectacular products that in a facade like this you could put instead of glass, double glass with micro modules. These systems simply produced through the sun without having to put anything else. Neither tiles, nor anything else. But there was no chance!*"[19].

In conclusion, by investigating the issue of social acceptability of PV an important aspect has emerged: it is not possible to only pay attention to the characteristics of the technology, but it is necessary to think globally in terms of a process of conflict and negotiation. As a general rule, the term describes an incompatibility perceived conflict of interest between two or more parties to the conflict (Rubin et al., 1994)

There are many different types of possible conflict; these can be material or immaterial in nature. In more detail, in our case, there are several potential conflicts, for example, between residents, operating companies, engineers of the market, politicians, public servants, and environmental activists that have different interests and motivations. The topic of the acceptability provides, schematically, three types of fundamental approaches: the individualist approach, typical of the residents, whose acceptability of innovations is particularly linked to a desirable increase in knowledge of innovation; the hierarchical approach, supported by technical and political officials, which gives particular consideration to the institutions in the role of programming and control of the choices of installation of PV in towns and in rural areas; And finally, the egalitarian approach, typical of the experts, who emphasize the importance of technological advancement of photovoltaic but denounce a insufficient use of this: integrated interventions are not usual, are almost non-existent and this is given by the poor quality of the design and, therefore, by the lack of professional figures in PV market.

---

18 In Gallura e a Sassari sono più elastici. Noi valutiamo veramente caso per caso nel senso, se per esempio sui centri storici se l'intervento non è visibile obiettivamente e non tutti i centri storici sono uguali ci sono dei centri storici che hanno delle proporzioni interventi moderni contemporanei abbastanza degradati sei tu nel tetto piano con un parapetto ho il pannello ed oggettivamente non si vede perché penalizzare una persona che de abita in centro storico e non autorizzare il pannello e se non sono visibili

19 Avevamo provato a fare un installazione con un micro cristallino, cioè due strati di vetro dentro i quali c'era spalmato uno spray di prodotto che fungeva da fotovoltaico. Molto bello, funzionava anche con una giornata come questa, non molto soleggiata, alla fine un tetto con una falda esposta a nord, ci produceva quanto un fotovoltaico normale. Una produzione maggiore nonostante avesse un esposizione minore, produceva anche da giornate del genere e quindi a conti fatti la resa era equivalente ad un policristallino. Costava di più, la difficoltà di installazione è molto maggiore, però era molto interessante. Film e altro avremmo voluto proporli e provarli; noi ci siamo fatti tutti le principali fiere sia italiane che straniere negli ultimi cinque anni, per vedere quali fossero le tendenze e i prodotti più interessanti. C'erano dei prodotti veramente spettacolari, cioè, in una facciata come questa tu potevi mettere al posto del vetro un doppio vetro con i micro modulini, che ti facevano comunque vedere attraverso e che comunque rendevano. Producevano energia semplicemente dal passaggio del sole, senza dover mettere nient'altro. Nè tegole, né altro. Però non c'è stata possibilità!

Spain

The interviews conducted in Spain show that the acceptability of photovoltaic applications in the urban space is linked to the different environmental awareness developed by citizens; this appears strongly associated with the level of technical knowledge and industry information. The debate on PV acceptability does not relate to the negative impact that PV installations may be causing, but to the importance of architectural change. A technician interviewed in Barcelona says: "*the issue of integration of the architectural aesthetic point of view is much discussed, more here in this city with the presence of a lot of very important architects. So we have debated on what is beauty or not. So I don't know if in these cases it causes the loss of the objective technical opinion about integrated PV*"[20].

The interviewees consider PV installations an element of relevant change in the landscape, but they don't think that this may cause a negative aesthetic impact for citizens: PV is considered an added value for the city. According to the Cultural Theory, we can underline the presence of many egalitarian discourses: many interviewees argue that renewable energy should and could be installed anywhere in the landscape, without affecting the aesthetics; indeed, PV applications might become characteristic elements of the city. The architectural element can be considered more important than the sustainable side of PV applications, and innovation can be the key of implementation of the installations in the city. As confirmed by the observations of a technician:
"...This depends on the awareness of all of us. In the case of cities, I believe that the problem does not exist because we are working more on the topic of sustainable architecture. And the installation of these element on buildings, it can be useful to sell PV as a distinctive element."[21].
Technicians of PV sector argue that technologies today offer endless integration solutions; these possibilities, together with a possible coordinated design of architects, are the way to define the aesthetic problem an overcome issue: "*the architectural integration is residual in the PV market*"[22]says an expert of University of Madrid. Many interviewees consider relevant elements - such as the air conditioning in the facade or antennas - a really aesthetic problem, and consider the discussion about PV acceptability inappropriate, so "*discussing this in a city like Barcelona, where the use of air conditioning devices in all the facades of the buildings is allowed makes me laugh*"[23], says an activist of Som Energy.
The difference between applications in existing buildings and others in new constructions is the only difficulty mentioned by technicians: "*what can be easily integrated into what is already built ... then it will be a good idea to discuss what will be more or less complex to integrate, and it's fine.*"[24].
And more*: "well, it is obvious that there are conditions to assess the tilt angle and orientation. Therefore, the architectural design of the buildings ... it is obvious that in early drafts we have to consider the PV installation and find exposure..."*[25]
In according to the interviewees, Architectural normative, however, do not appear a barrier, but could be an important requisite to new projects, and consequently, to the implementation of PV in

---

[20] *Lo que pasa que a nivel estético la integración arquitectónica también hay mucho debate, y más en esta ciudad, llena de arquitectos y arquitectos ilustres. Entonces a veces hemos tenido puesdebateshasta surrealistas sobre lo que es bonito, lo que no es bonito. Entonces hay que ir, no se sé pierde un poco lo que es la objetividad estrictamente técnica o tecnológica*
21 Depende de la sensibilidad que tiene uno. En el caso de las ciudades yo creo que no tiene porqué con llevar una degradaciòn visual o estética porque cada vez se trabaja màs des de la arquitectura sostenible. Y cada vez entiendo que, el hecho que una edificaciòn incorpore estos elementos, pues puede ayudar a vender eso como elemento diferenciador
22 La parte de la integración arquitetonica es muy residuale en el mercado
23 Que se discuta esto en una ciudad como Barcelona donde se ha permitido el uso de aparatos de aire condicionado en todas las fachadas me hace reìr
24 Lo que se pueda integrar fácilmente en lo que ya está construido pues será buena idea desde el punto de vista de que será más fácil o menos complejo de integrar y de vaya bien
25 Bueno, a ver, es obvio que hay unos condicionantes pues de orientación y de inclinación que hay que atender. Entonces el diseño arquitectónico de los edificios pues es obvio ya en sus primeros bocetos pues tiene que tener en cuenta la incorporación de fotovoltaica y de ir a buscar una exposición…

Barcelona's urban space. Hierarchical discourses, therefore, emphasize that proper planning would promote greater development of PV sector in Spain.

Jordan

Qualitative interviews conducted in Jordan show that Photovoltaic systems are the most appropriate and suitable of renewable energy in city buildings and urban areas. The aesthetic issue is not considered a barrier or limit to the development of PV installations in the city: in the interviews, in fact, this topic is not very relevant. There are no clear references to knowledge as a factor which may facilitate greater acceptability of PV installations; Egalitarian discourses have come to light from the analysis of the interviews and argue that a proper study and use of integrated technologies will give a modern look at Jordanian cities. As confirmed by an electrical engineer: "*integrating solar systems in our designs not only do we save energy, but we also change, improve, the shape of our city, giving it a more modern identity*". Space linked to the problem of the disorder on the roofs of Aqaba "*which is usually the place where people place or store*" is a central point in the discussion, and find in photovoltaic an aesthetic improvement, as a technician says: "*our roofs are used to store all our junk, so having photovoltaic panels on the roofs will be a better view than actually seeing some of the cracked people end up storing on their roofs*".

So, for the interviewees, photovoltaic on the roof is the best solution, but on new constructions "*if you want to use it on facade, it should be considered during the design stage*"- says a technician interviewed.

PV on facade appears not possible in Aqaba, but of course in Amman where "*high raised buildings are covered by glasses so if you compensate the glass with the cells we will note have different shape of the building*".

Lebanon

All the people interviewed consider definitely PV the most appropriate kind of renewable energy for Beirut. Lebanon has an optimal Mediterranean climate, and could take advantage of solar energy "*like sunny or 8 months*" - says a technician; from this point of view, a technician, in particular, cites a comparison between Beirut and Barcelona, but there is a difference in a focal issue within the discussion about acceptability: all the interviewees consider Beirut a disordered city, without any design.

Among all those interviewed only two people - an environmental journalist and a banker - do not have their own idea about the visual impact and aesthetic change that PV could lead to the city, but they believe in the need to expand the installations, as says a technician: "for my part in the project with an environmental benefit is beautiful, but it's very personal".

All the others technicians and experts argue that the installation of photovoltaic technologies would give a more orderly and modern aspect to the city.

Hierarchical discourses characterize most of all the views of technicians and politicians: the main problem of Beirut is the lack of space and the strong disorder on the roofs, often used as a storage for tanks, tubes, and antennas. "*In Lebanon it would improve the urban landscape! As you can see ... you see concrete, TV, Antennas"* - says a politicians, and "*Already the roofs are filled with lots of equipment, water, tanks, dishes, satellite TV, A/C generator. Already the roof is not nice. On the contrary with PV you can make something nicer"* as confirmed by the considerations of a politician.

The technicians claim that more planning could be the best strategy for PV in urban spaces: more regulation would support the increase of PV on the roofs, and, as a result, would create a public

perception to use the roof for producing energy through photovoltaic panels and, at the same time, improve the aesthetic of their houses.
Experts, however, have a different position: they argue that, through a better understanding of technologies, they could reduce the space and maximize efficiency. Egalitarian discourses therefore emphasize the possibility to install PV in many areas in Lebanon, focusing especially on the glass and the integrated technologies: "*can we speak about design in Lebanon? (Laugh) we do not have design. On the contrary, it beautifies the building. There are new very interesting designs. In photovoltaic we can make all kinds of design. It's beautiful. We can have or make transparent or semi-transparent panels*". The experts interviewed also believe that glass could be the most appropriate installation, because it is useful to reduce space and to optimize the efficiency.
In Beirut there is electricity for 20 hours a day; for this reason experts think that the PV technology is the best solution for the city, especially in areas far from Beirut, where there are worst energy shortages. They consider storages the ideal solution for residential areas in the city: it is the most economical solution compared to the costs of rent and share of diesel generator. So, for this reason, PV panels with storage could be a strategy of "*more comfort and better electricity*", according to the considerations of an expert.

Tunisia

The qualitative interviews conducted in Tunisia show that the photovoltaic represents a great potential for Tunisia: however, the interviewees underline that, in the last years, there has been more interest in solar thermal energy than in photovoltaic system for the production of energy.
Politicians and technicians believe that more information is one of the most relevant factors to spread PV technologies to citizens.
All the people interviewed think that adopting photovoltaic plants in building will change the urban landscape of cities. According to the words of an engineer: "*A city is a collection of neighbourhoods and a given neighbourhood is a collection of buildings. That is why if the adoption of photovoltaic plants damage one building, it will definitely affect the urban landscapes of our cities*".
However, there are contrasting opinions about the aesthetic impact: PV can embellish buildings if experts "*must pay a lot of attention to the conception of the roofs*".
Many interviewees believe that there are countless devices that spoil the facade of the buildings, but PV would have a visual positive impact on the city. This impact would be negative for half of the interviewees; for the remaining part, integrated technologies, however, could become a resource of aesthetic improvement for the city, as says a politician: *There are many other things can affect the design of buildings. Personally, seeing glasses on roofs or ever in front of buildings won't chock me*". Among the experts- as highlight an engineer who said "*Maybe new course dealing with how to design a building with solar power technologies must be introduced in the Tunisia school for architecture*"- there is a need to train engineers and architects; in this way they can be a support to the consumers that, without correct information, would not be able to evaluate properly the aesthetical impact of their application.

Egypt
None of the stakeholders interviewed express opinions about the aesthetics of PV installation.

1.1.2 Perception Trust e Communication

Italy

All the people interviewed consider absolutely disappointing the current circulating information about energy issues and possible PV solutions; "*Many are convinced that PV is a rip off, they think you're setting them up*"[26], shows a experts interviewed.
"*This association was much more than just climate change: there was the energy: energy saving, more money...*" [27] as says a technician interviewed; an expert engineer, instead defines environmental awareness among the public as a paradox: "*In the sense that from a certain point of view, there is a highly developed environmental awareness in the sense that all those who have already seen that the problem of climate change is not a theoretical problem but is a problem that we are living on our skin. That there is an environmental sensitivity is now clear, because there is attention to the environmental issues that is very, very strong; and that there is a widespread tendency also - I'm talking about the population - towards environmental issues in terms of both the environment understood not only as an abstract concept but just as landscape protection, protection of identity, protection of the environment. Then if people do something from the energy point of view to solve, though in part, the problems of the climate is different...*"[28]
This limit can be overcome only through greater communication of accurate information to stimulate action: all the interviewees (citizens, experts, technicians and public servants) believe that politicians must support promotional activities aimed to increase renewable energy; photovoltaic innovation, specifically, is considered the most appropriate technology for our cities. In this sense, local administrators and public servants believe that PAES and initiatives such as Smart City projects have been great for raising public awareness towards the importance of environmental and energy issues; a technician says: "*I think that PAES helped a bit 'to put things together. Perhaps it may have been of help in that. Especially for awareness*"[29]; the interviewees emphasize the importance of the planning process in the smallest community to encourage awareness raising and promotion of PV. In this way an activist says: "*He who did have a certain culture and knowledge, as well as …obviously I'm talking about small percentages, not that someone who only finished middle school doesn't care, there are those interested in energy improvement and awareness, because they read, they are informed, and have their own culture*".
More specifically about PV, we have observed that institutions should offer more information to citizens on the functioning of technologies; indeed, as shown by a citizen during a focus group with people who had already installed PV in their own homes: "*maybe they should alert more, or perhaps better explain how the system works*"[30].
During the deliberative group, we showed citizens the images of integrated PV technologies: these attracted strong interest and sparked a debate on cost and functionality. First of all, the decision of consumers to install a PV system in their home is based on information obtained through Internet;

---

26 Molti sono convinti che il fotovoltaico sia una fregatura, pensano che tu gli stai fregando
27 C'era molto questa associazione, più che cambiamenti climatici c'era proprio l'associazione economia: risparmio energetico, più soldi
28 La parola giusta è un paradosso. Nel senso che da un certo punto di vista c'è una sensibilità ambientale molto sviluppata: nel senso che tutti quanti hanno ormai percepito che il problema dei cambiamenti climatici non è un problema teorico ma è un problema che stiamo vivendo sulla nostra pelle. Che c'è una sensibilità ambientale è ormai evidente, perché c'è un'attenzione verso le problematiche ambientali che risulta essere molto, molto forte; e che ci sia una propensione anche molto diffusa – io sto parlando della popolazione – verso le tematiche ambientali in termini sia diambiente inteso non soltanto come concetto astratto ma proprio come tutela del paesaggio, tutela della propria identità, tutela del patrimonio ambientale come dal punto di vista energetico, che poi le persone vogliono fare un qualcosa dal punto di vista energetico per risolvere, se pur in parte, i problemi del clima, è diverso...
29 Si, secondo me i PAES hanno aiutato un po' a rimettere insieme le cose. Forse possono essere stati d'aiuto in quello. Soprattutto per la consapevolezza.
30 Forse dovrebbero allertare di più , o forse spiegare meglio come funziona il sistema.

other options are the newspapers and word of mouth with neighbours or acquaintances that already have experience in the installation of photovoltaic.
Citizens who have already installed a PV system in their homes report experiences with unreliable dealers, that are unprofessional from a technical standpoint (for example there are installers who are simple electricians) and unstable/unreliable on the PV market. According to technicians, citizens continue to trust in large distributors such as ENEL, while entrepreneurs need to elaborate and provide accurate information on prices and benefits in detail. Many of the interviewees think that politicians do not know PV technologies and, therefore, are not able to plan actions concerning renewable energy and photovoltaic; according to engineers interviewed, the consequence of a lack of proper counselling is a discrepancy between policies aimed to the use of renewable energies and knowledge of technological innovations.
According to the experts interviewed, this problem can be solved either by increasing internal communication (with institutions) and external communication (with citizens). It is very important to underline what said by a technician, that shows his perception lack of information and communication: "*But I believe that the State, the Region or the Institution must inform all people about things, not just a few, well why is it then that ... well, can I tell you the truth? I do not know what it is ... a PAES! I do not know! For me it is very difficult*!"[31]
So, the most desirable public policies could be: the need to increase participative processes and invest on the management of governance; the necessity to educate and train citizens about environmental issues and energy saving ("*Educating the children that educate parents*"[32]); it is, also, essential to train students of elementary school, and then, increase relations with Universities and Research Institutes to open debates and promote awareness-raising.
Local administrators show the difficulty of making promotion directed to small businessman that does not contrast with citizen-interest: these actions must be transparent, so citizens do not perceive the existence of special interests to protect.

Spain

The interviews conducted in Spain show that trust in PV innovation is really linked to information and communication.
In the last twenty years, public awareness of environmental issues and the energy effects has increased: State subsidies for renewable energy have been instrumental in increasing the level of environmental awareness of the population, as perceived by all the interviewees and in particular a market technician, that says: "until a few years, we saw that they took state subsidies, and I think that since last years, mentality has changed and we are seeing people who really care about the environment"[33].

A technician interviewed explains, specifically, what has happened in Spain: " two last years, I believe that in the two last year two things have happened that caused this change: *On the one hand the crisis and on the other hand strong electric companies that, we mean, they have used the crisis to show us that the first important thing is the economy*"[34]. All the interviewees think that the negative perception about RE is caused by a substantial change of public policy; another

31 Però io credo che lo Stato, la Regione o le istituzione abbiano l'obbligo di far sapere le cose a tutti, e non solo a certi, perché succede poi che... ecco, ti dico la verità? ... io non so cosa è un PAES! Io non lo so! A me viene difficile!
32 Educando i bambini che educano i genitori
33 Hasta hace unos anos a las renovables... nos veian como los que se llevaban las subvenciones del estado, y creo que de uno anos a esta parte ha cambiado la mentalidad y se nos esta viendo un poco mas come gente que realmente se preocupa por el medio ambiente
34 Los dos ultimos anos creo que han pasado dos cosas que han hecho que esto cambiase. Por un lado la crisis y por otro lado las fuertes campanas de las companias electricas tradicionales que, digamos que han aprovechado la crisi para hacernos ver de que no hay para tanto, que no es tan interesante y que lo primero es la economia

interviewee explains that this insecurity perceived by citizens is linked to a specific event that he considers a "*handicap*" for Spain: "*We removed a royal decree, many times also with retroactive effect. That creates a legal uncertainty and in the end, people who would bet on this type of technology under these rules, then will not do it, because they do not trust in things told through royal decrees* **"**[35]

The main message of the media campaigns of the electricity sector is "*las renovables son caras*" and for this reason there is a widespread perception among the population that RE are very expensive, and that PV sector is the equivalent of speculation. As technicians says: "*There is a distorted message. Now the negative message weighs more than the positive, no? The message is that renewables are to blame for the rising price of electricity, debates etc ... Eh, in TV, radio, etc...*"[36].

All the interviewees, in particular technicians and activists, emphasize the need to raise public awareness on energy issues and its possible alternatives. All of them hope in desirable politics regarding actions aimed to the development of research. They believe, also, that education in primary school is an important strategy to increase public sensibility on environmental issues and on the PV market, as says a technician: "*Make promotion in schools. We also believe that children influence their parents and we have created a contest in "escoles green" for the creation of a video highlighting the benefits of consumption, that is to say that we are very active in this regard*".

As suggested by the diagram of Rogers, the cultural characteristics and the degree of knowledge of the people is key to confidence in innovation: indeed, as says a technician of PV market, people who would install PV in their homes are interested in this sector, "*but yet there isn't any access to the information at least that's the perception we have*"[37].

Lebanon

The analysis of interviews conducted in Lebanon reveals a growth in the public perception of environmental problems.

Cultural and social characteristics of people are linked to the knowledge about environmental issues and awareness: there is a general concern in public opinion about environment problems, because people heard about them on the media, TV and radio; but many interviewees consider "*engineers and educated people*" more sensitive about energy issues. As shown by a technician: "*people know about global warming but they don't relate it to energy*", and an expert says: "*all readers are elite, so TV should do more*".

The interviewees think that it is necessary to spread information to tell citizen how to reduce global warming and energy costs. This is emphasized by the words of a technician who says: "*the first information you should spread is how to reduce global warming by renewable energy. The second information to spread is telling them how. This is where technology comes in, you have to tell them RE is good, what is RE, you have to tell them solar water is good, PV is good* [...]"

Politicians and PV experts say that citizens ask information about PV technologies to banks, Ministry of Energy and to NREA (New and Renewable Energy Authority), but, first of all, they search for information on Internet. The problem of the lack of correct information could be solving with NGO actions "*with small but effective actions, advertising campaigns, etc.*" - as proposed by a journalist interviewed. Another barrier to increase trust in innovation is the lack of knowledge -

---

35 Se sacaron un real decreto, ademas, con efectos retroactivos en muchas ocasiones. Eso lo que genera, pues, bueno, una inseguridad juridica que todos hemos dicho mas de una vez y el hecho de que , pues que al final, pues la gente que a lo mejor apostarìa por este tipo de tecnologias bajo estas modalidades, pues prefiere no hacerlo porque no confìa en que luego las cosas sean como pretendidamente se les dice a traves de reales decretos, no"

36 Hay un mensaje distorsionado. Ahora pesa mas el mensaje negativo que el positivo, no? Eso es cirto, el mensaje de que las renovables son las culpables del incremento del precio de la elecrticidad, etc... Eh debates ,en la television, radio, etc..

37 Todavia no existe un accesso sencillo a este tipo de informacion, por lo menos es la perception que nosotros tenemos.

"*people should understand that it's a real investment, but in Lebanon environment is not a priority*," specified a politician- and expert on PV market.
To increase trust in PV innovations, various interviewees believe that informative campaigns in schools to educate students are necessary, because "*change comes from the young, not from an old person like me*" -as said by a politician. Another way to spread PV installations could be through "*pilot projects that are very important because it's how people get to be more sensitive to these issues. But pilot projects need to be executed in a very professional way"* says a politician interviewed.

Egypt

Personal and social determinants, in addition of course to knowledge and culture, influence Egyptian people in their environmental awareness. The energy problem most affects poorer classes because "*the richer class will be annoyed but they will not suffer as much as the poorer class in Egypt when there is a rise of energy prices*" - says a technical expert interviewed.
So, according to the interviewees, especially since the energy prices have raised, people have started to be aware of the importance of energy conservation and renewable energy solutions; first of all, this is related to frequent blackouts that they had in the last years, and the revolution, after which people started realising how serious the energy problem is; as shown by an expert, "*the production was less than the consumption, so people started realising the importance of renewables*".
There are two main barriers to trust in innovation, as shown by the interviews: lack of information, and lack of technical knowledge (qualified technicians). An expert reports that "*there are people who are willing but they neither have the ability* (technical and financial) *nor the information*." Media, as emerged in some interviews, do not transmit sufficient information about RE and PV technologies, or: as highlighted by activist and a director of specialised magazine "*the language by which the media addressed people about renewable energy was not correct*", because people often receive information in English – that appears targeted - and not in Arabic language.
This is among problems of awareness and mistrust. The lack of information could be resolved, according to the interviewees, with more governmental communication, "*in addition of NGOs and of the private companies. Everyone should put their hands together to spread awareness*". According to experts and technicians, people should not only get information through media, but also through practice activities like workshops or projects: indeed, many interviewees believe that – to increase use of PV systems and trust in innovation - politicians should establish the needs of the people and, accordingly, start to implement projects that could be beneficial; in this way, as said by a Sales Manager interviewed "*seeing the result will increase their awareness and with it there will be an increased use of renewables*".
To solve the absence of quality and expert installers on the market, experts believe that it is necessary to have regulation and more control on the PV market: "*there was no efficient supervision on receiving/taking over the products that are to be received.... if there would have been a specialised engineer when receiving, then he would have received (only) the good product. […] The major element, in my opinion, is good specifications, good products in the market and of course support/subsidy by the government would help disseminate them".*

Jordan

People find information about RE through media (TV and radio) that, first of all, speak about the high costs of energy and "*about global warming and these technologies but not in specific ways*". Media is considered very important by all the interviewees; they influence people perception, and

"*can give information for example for people that don't have this information before or they are below university grade*"; so, in order to increase awareness amongst people, media information about PV has to be increased "*with regards to the subjects, articles and researches talking about renewable energy*" - an expert says. A peculiar aspect of Jordan is trust in the institutions: citizens ask information directly the Minister of Energy, EDCO (Electricity Distribution Company) and NERC (National Energy Research Centre). As shown by a technician: *"I think there should be an awareness campaign, maybe driven by the government, but with the private sector again involved, because they are the suppliers and the contractors who use these system; they should publish the success stories and some of the facts and figures of photovoltaic which is not known"*.
In order to increase knowledge about technologies, experts interviewed recommend the development of large-scale projects, or pilot projects with international consultants "*to ask them about technologies, to ask them about best practices*".

Tunisia
Interviews conducted in Tunisia show that public opinions about environment issues is increasing in general, although- an expert says- "*most of us are not concerned by all issues related to the global warming and energy efficiency, or the environmental problem. In fact, the political issues preoccupy people for the moment*".
The main problem for increasing trust in RE and, specifically, in PV is the lack of information – or, even worse, the poor quality information channelled through media; the people interviewed believe that local press does not give a lot of attention to the environmental problems, as well as the associations working in this field. For this reason, many experts and technician interviewed, think that informative campaigns are necessary to increase environmental awareness amongst people, and to increase knowledge of PV technologies. Lack of information is, according to all the interviewees the real barrier against trust in innovation, in addition to high costs of PV systems. Actually, people get information about PV technologies through the Internet and media, but, according to some technician interviewed, "*it would be better if people speak with those who have already installed PV systems*".
To solve this lack of information and knowledge, experts recommend "*a national plan to enhance the communication concerning energy consumption and energy efficiency*", also through free PV installations for demonstration, and more monetary incentives to increase the PV market.

b) Market acceptability

Italy

In Italy due to the feed tariff program, the PV market had an important spread up in the last few years. This brought a lot of attention on renewable energy and especially on PV system diffusion, however the market in its complexity did not capitalize as it would. Frequently interviews showed that the role of installer "occupy" all phases during the installation process, as confirmed by an installer:

"I'm basically a plumber who is now in charge of PV due to necessity. My biggest challenge is to find clients ... I am alone, so I have to look for work, so I have to go to the customer, I must understand the needs of the customer and sell everything that exists. It can be photovoltaic, wind, boiler ... everything that can potentially interest him ... .You have to support clients in all and for all. You have to be supported by people who are capable... the client wants to be sure that what you sell him will go well..."[38].

The new installer was normally a plumber with different type of skills and job experience that believed in the PV sector as an opportunity to change-improve their work context:

"*Because the PV being so affordable and diffused, for a certain period there was a belief that those who made the PV were enriched. Then they made greenhouses for nothing, just to sell PV, then the lack of pure sellers, that is, there are vendors but they are not pure, the industry is paying the consequences"*[39]

Frequently the role of installer wasn't just "installation", but he assumed the project phase and the commercial part as well. This context was due to the outbreak of the market that generated a relevant number of micro-individual PV companies that were unable to overtaking subside period, closing after that. As a public servant confirmed about her direct experience in analysing project:

"...Typically photovoltaic systems are not made by designers but are made and presented by companies that deal, assemble, to all the practices, and therefore, have no interest in evaluating the integration of the panel within an overall project. They sell solar panels and have a standard approach to the presentation of the practice".[40].

The lack of a vendor role is more linked to the variable of trust. *(...) Or if there were sellers! (...). According to me there are too many poorly prepared and this is indeed, one of the critical issues lived in photovoltaic industry, and I think this has also caused the elimination and the end of the incentives*

(...) Eh okay, but they are sellers! Because I know that he was selling panties first and then he started to make photovoltaic.[41]

However, installers, according to some interviewees, represent the direct link between consumer and the PV market:

"However, the installer has a strategic role, because the installer is the one that brings together

---

38 Sono un idraulico fondamentalmente passato al fotovoltaico per necessità. Per fare quadrare I compiti….La mia difficoltà più grande è quella di trovare clienti….Sono solo, quindi devo cercarmi il lavoro, quindi devo entrare dal cliente devo capire le esigenze del cliente e vendergli tutto quello che esiste. Può essere fotovoltaico, eolico, caldaia…tutto quello che potenzialmente può interessargli….li devi accompagnare in tutto e per tutto . Devi essere affiancato da persone capaci il cliente vuole essere sicuro che quello andrà bene e non lo devi lasciare mai.

39 Perché essendo così conveniente, di grossa diffusione per un certo periodo è passato il segnale che chi faceva il fotovoltaico si arricchiva. Poi si è arrivato a fare serre anche per nulla, solo per vendere il fotovoltaico, quindi per la mancanza di venditori puri, cioè, ce ne sono ma non sono venditori puri, il settore sta pagando le conseguenze

40 In genere gli impianti fotovoltaici non vengono fatti da progettisti ma vengono fatti e presentati da ditte che si occupano di montare di curare tutta la pratica e quindi non hanno nessun interesse a valutare l'integrazione del pannello all'interno di un progetto complessivo loro vendono panelli fotovoltaici e hanno un approccio standard di presentazione della pratica

41 (…) o se ci fossero i venditori! (….) Secondo me ce ne sono troppi e poco preparati, anzi una delle criticità che si è vissuta nel fotovoltaico e che secondo me ha anche portato all'eliminazione , esaurimento veloce degli incentivi

(…) eh va beh, però sono venditori! Perchè io conosco che vendeva mutande e poi si è messa a fare fotovoltaico

other actors, because he should have a group that can afford to sell and also to make prices a bit lower...”[42]

Some technician agreed that the role are confused and the professionalism not developed are penalising the PV sector. On the other hand, some of the technician did not perceived this issue:

(...) There is no technical! It's different! There is a technician that takes care of it; unfortunately, the seller who has his own territory under control (because each vendor has its own area) there isn't

(...) But it is not so! He knows the new technologies, however, I noticed one thing: that the direct relation of certain things is important. Because the seller can create an interest... and that professional figure that yesterday ran and turned the territory with his suitcase, today is a figure that doesn't exist![43]

In this context PV firms face issues related to the general context of crisis, however some of the respondents confirmed that they see capability on the PV sector.

“The European module is ours, we produce that; we also buy Chinese module though, because people today also require the Chinese modules ... We produce modules in Umbria…we have been working on three shifts, including Saturdays and Sundays, 24/7. I say to you that he climbed on the roofs and installed together with his sons, and then he became a PV producer” [44].

Relocalize and reorganize the production represents an important step, especially for countries where the access to the raw material is not directly available and needs to be economically feasible:

“Prices vary depending on the silicon ... so the production is less and finding the cells is always a problem”[45].

Spain

The economic crisis Spain is facing, affect not only the PV sector:

“And Spain has been a leader in this market. Although now we are in a quite absurd situation, no? For many years Spain has led the sector of renewable energies and there are very good specialized companies that export their knowledge to the United States or other parts of Europe. So there are situations ... that are going down... now the whole issue with renewables are the developing policies on renewable issue that create the destruction of knowledge. It's a shame!”[46].

According to some interviewees the PV crisis is more related to the relevant changes applied to the Spanish legislation, as an expert confirmed:

Well, now with all this regulatory instability, with the suspension of the market in Spain, for example self-consumption, etc., etc. All Spanish companies are closing. Being forced into this, to do this type of energy, between 4-5 years when the crisis will end, we will go back to the Chinese

---

42 Però il ruolo strategico è quello dell'installatore, perchè l'installatore è quello che mette insieme gli altri soggetti perchè a lui conviene avere un gruppo a cui vendere e può permettersi anche di fare prezzi un pò più bassi…

43 (…) No, c'è il tecnico! È diverso! C'è il tecnico che se ne occupa; purtroppo il venditore che gira e che ha il suo territorio sotto controllo, perché ogni venditore ha un suo ambito di territorio, non c'è

(…) Ma non è così! È informato sulle nuove tecnologie però ho notato una cosa: che il rapporto diretto su certe cose è importante. Perché il venditore crea un interesse e quella figura professionalizzata che ieri girava con la sua valigia e si girava il territorio e faceva vedere i prodotti, è una figura che è finita.

44 Il modulo europeo è nostro, di nostra produzione; moduli cinesi che acquistiamo perchè comunque ai empi d'oggi richiedono anche il modulo cinese….produciamo fisicamente ..in Umbria..è un'azienda che lavora su tre turni, sabato e domeniche comprese 24 ore su 24….vi dico che questa persona qui saliva sui tetti ed installava insieme ai figli, poi sono diventati produttori

45 …I prezzi variano in base al silicio…quindi la produzione si abbassa e reperire le celle è sempre un problema

46 Y España ha sido líder en este mercado. Aunque ahora nos encontremos en una situación como bastante absurda, no? durante muchos años España ha liderado el segmento de las renovables y aquí hay empresas especializadas muy buenas que exportaban su conocimiento a Estados Unidos o a otras zonas de Europa. Entonces son situaciones como… a calado muy fondo, muy profundo, todo el tema de renovable aunque ahora pues se está desarrollando unas políticas que no acompañan en absoluto y que están conllevando la destrucción de todo su conocimiento. Es una lástima.

panel and will not produce our panel.[47]
However opinion regarding crisis in the PV sector are opposing. According to a representative of the PV sector:
All things considered, holdings are doing relatively well, I think extremely well. Furthermore in Spain we make our mark with regard to solar sector[48]*.*

Jordan

Respondents confirmed on one side the high potential of PV market, on the other side, they still show resistance to trust PV technologies due to the high cost, as well to the necessity of major efficiency. As confirmed by a technician:
The technology is becoming more affordable so the rice is becoming lower and the efficiencies are becoming higher…

Lebanon

Respondents presented in their interviews important element to analyse market acceptability and highlighting important topics on PV.
At the moment according to some interviewees, PV it's an option to solve of the basic need of having electricity and to avoid the cuts, principally in rural areas and not in urban centres.
In the present situation people install PV because they have electricity cuts and they don't want to have these generators who are polluting, making noise and very expensive
According to different interviews, improving the skills and the technical knowledge will guarantee professionalism and a good service and will support PV diffusion. As confirmed by different technicians on these topics*:*
First of all, we should be careful that not every supplier could offer PV service: not everybody has knowhow and professionalism. Lot of suppliers try to make profit we should have a selecting policy to choose suppliers licensed to install systems
I don't know if LCEC did public trainings. I think they selected the top 10 suppliers in Lebanon; they diffused the list on their website, saying to everyone that are the best to install PV system We also reduce customs duties to reduce the cost of PV system
Very few people have technical knowledge. We've lot of problems with wrong installation. People think that solar system is not a viable solution because often badly executed. Technicians aren't trained; they don't have the knowhow to execute such installations
According to a public servant, on this stage, market is unable to provide guarantee about the product, in order to justify the cost of PV:
…Because projects are expensive. Economically speaking are not profitable, we have a lot of technical problems (quality of products, maintenance, etc.)…Do we have guarantee?... I can't lie to people...while there is no guaranty, no control, and no subventions
The most important is: quality of product and guarantee results
The central role of the private PV sector as an important point of contact to sensitize citizen and widespread solar technologies is defined by the following fragments that highlight the necessity that the installers:
Installers and companies has to provide full information (how it works, how should be installed,

---

47 Bueno, ahora con toda esta inestabilidad regulatoria, con la paralización del mercado en España, con bloqueos por ejemplo el autoconsumo, etc., etc., pues están cerrando todas las empresas españolas. Y como estamos condenados a hacer esto, a hacer este tipo de energía, pues la volveremos hacer dentro de cuatro cinco años cuando pase la crisis pero con panel chino en vez de hacerlo con panel propio
48 En definitiva a las empresas les está yendo relativamente bien, creo que todo lo bien que se puede ir, además en España, en el tema solar, contamos con un nombre

how much money the will save what are the inconvenient of the system to support the client on his evaluation. This is due to the lack of public general information regarding PV installers having to represent a relevant point of contact and information.
Advertisement private market and companies as to satisfy this lack of communication and need to promote non only their product but inform on the general PV technologies to a not very aware population
At the same time has been manifested the need of a public control, to implement certifications systems experimented by international organization worldwide, to guarantee as third part the quality of the installations:
If you look at the technical part, for the moment for the PV there are no certifications. I know people at the Ministry they're working on it but for the moment it's not here so we still find companies making advertisement for very low costs and it's not working. And in some years you'll have a bad feedback, people will say it's not working very well. So for the moment the technical part is not available, neither the certification to install, neither the specifications of the system it should be installed; so it's free, it's for the private sector to decide. There were some models, with UNDP and CEDRO projects with LCEC but this technical model is not spreadable for everybody so everybody does whatever he wants. But still it's the beginning there is not too much errors because there is not too much projects but if the advertisement is coming and the technical is not here you will have a lot of errors in the installations.

Tunisia

The PV market sector as topic, it does not appears as central themed of discussion and debate in the interviews analysed. However we are able to identify 3 topics emerged about PV sector and its criticism principally related to financial matter:
1) The believe that people are not aware of climate change issue and so are to sensible about renewable energy, but are interested only about the cost of the energy. At the same time the as confirmed by an expert:
Tunisian population is more interested in cost related to the consumption of energy and high percentage of them ignores the term of global warming.
2) At the same time the *"Inexistence of the market and the doubt that people will pay more to have for example new building with an increase price due to PV".*
3) According to a technician the imitate spread of PV market is related to the labour market:
The reason behind the limited spread of RE are: shortage of skilled labour affects the competitiveness of business working in this field the RE market is not yet developed in Tunisia, who will commercialize the new technologies?

Egypt

The PV market function a central point of discussion in the interviews analysis. The information provided went in deep on the criticism and the drivers of the market, analysing the information from the commercial perspective to the consumer need. According to the interviewed the market, citizen and policies are strictly linked and need to be coordinated.
As well a quality product will be able to convince citizen about the importance of PV and Renewable energy.
According to an expert installer training it's a basic and central requirement to develop the market:
(*…) We are working on the capacity building, training and how to enhance the skills of everyone; decision makers, installers, engineers, consultants, we're working on all sectors.*
(…) It's very easy to speed this up, as you have said, as long as we have the market, the problem

is not the lack of skilled workers, the problem is the low quality of the product. The problem with the worker or installer is that there's no quality protection in the market. The absence of laws and standards allows low quality products to get in the country, so this has nothing to do with the installer or technician; it's already poorly done. That's a big problem and one of the challenges we're facing.

Trust the product and the technology, is related as well to the security of citizen in the PV sector: quality and certification are one of the most important action that the PV sector has to develop. The importance of a guaranteed product, it's not only related to the product per se, but to all the installation process: product, certificated skills for installer and a monitoring of the installation to verify the functionality. An energy efficiency consultant said:

There are two things, first of all. Or three things, you need information to the public, so they know when they buy something, that there's a certain quality, so this means, some way something what we have bought in the certification of these products but this certification has to be brought to the knowledge of the public, secondly. A well detailed training, so that end control of those companies who are installing that, and this normally you can do that by shifting the conventional subsidies for conventional energy in some way for pre subsidized on the renewable energy but link this to quality control for the product and quality control for the installers. This is for the household residential sites relevant as well as hotels systems and factory systems that you mean you have the same systems. That is the situation.

(…) The second part is guarantee from a third party, control, monitoring, certifying whatever, on the installations, so you have a guarantee as a customer that the thing is working and then there's somebody who will be as a third independent third party who will monitor what the installer or your provider is doing, minimum at the beginning till there's a certain quality guaranteed by experience.

The risk that can affect the PV sector, whether the certification will not be developed, it's related according to the expert, on the fact that consumer will not be able to distinguish between good product and service and cheap product and bad service:

The only the thing most probably happens is that people buy the cheapest version of the cheapest product with the cheapest installer and they put it on the roof just to prove that there's a system on the roof but nobody will be really be able and there's no agency or anybody in the country at the moment who can really do a monitoring of the systems, if they're working.

c) Socio political acceptability

Italy

Factors of top down policies and limited participation of the represent a constant discourse as showed in the following fragment, while mentioning the Sardinian Regional Energy Plan:
The Energy Plan should be a shared tool, so that the information, especially the proposals, do not immediately and exclusively get a "no" as an answer, but fall under a collective and shared vision[49].
Are public policies able to influence the opinion on RE and PV? The answer provided in this fragment shows that the effect of policies not linked to social participation have a decreasing effect on the interest and a real impact of social cultural changes:
(…) Because they were passive actors so far. Thus, the actions are top down. So a social based movement, from the bottom, there was no realize because of a will, but because they were stimulated with the money. If you think about how many PV systems were installed before incentives and what happened next, this is the answer![50]
In this context, reviewing the relationship between actors as well as the approach to the use of solar energy, concentrating on a communitarian, interchange use, it's central on the vision of realize a change on the energy model. According to the following expert:
Renewable energies are special energies that they still need some form of support, however, a form of social support type. So if you are seen as energy ... sorry for using the word "social", then have a value, the incentive is valid, but if they are social commissural need to use, then the power and the amount of energy that production[51].
As mentioned in the previous part of the theoretical context analysis, the SCOs view, it includes a communitarian approach able to provide advantage and benefits to group and individual:
We have always had the philosophy to finance small installations, possibly even network with an idea to get out of big producers in favour of a widespread production, there is a theme here, beside of those related to the environmental benefits... let's say …a theme about productive democracy and also well ... a matter of resilience of reducing dependence on a few poles that is important for us anyway (…)[52].

Tunisia

The relationship between political decision, public policies and citizen inclusion in the processes related to PV diffusion and implementation, appears lightly in the discussions raised during the interviews:
Stakeholders must know how to communicate with Tunisians, they have to set up a sustainable plan and be near to them as possible as they can.
The elements of political changes, that Tunisian were experiencing in the past months, emerged in

49 Il Piano Energetico deve essere uno strumento condiviso, in modo tale che le informazioni, e soprattutto le proposte, non abbiano immediatamente ed esclusivamente un no, ma rientrino in una visione collettiva e condivisa
50 (…) perché sono stati attori passivi in questo periodo. Cioè, le azioni sono calate sempre dall'alto. Quindi il movimento dal basso non c'è stato per una volontà, ma perché sono stati stimolati con dei soldi. Se lei va a pensare a quanti impianti fotovoltaici c'erano prima degli incentivi e cosa è successo dopo, la risposta è questa!
51 Le energie rinnovabili sono energie speciali che hanno ancora bisogno di una forma di supporto però una forma di supporto di tipo sociale. Quindi se sono viste come delle energie ...scusate il termine "sociali", allora hanno una valenza, ha valenza l'incentivo , ma se sono sociali bisogna commisurarle all'uso, quindi alla potenza e alla quantità di energia che producono
52 Noi abbiamo sempre avuto la filosofia di finanziare possibilmente impianti piccoli anche con un'idea rete di ...cioè... di uscire da grandi produttori da grandi impianti di produzione a favore di una produzione diffusa, c'è qui un tema a fianco a quelli dei benefici ambientali diciamo di...sono democrazia produttiva e anche di bè... anche di resilienza di minore dipendenza da pochi poli che per noi è importante insomma (...)

the interviews as element of a mixed characterization of drivers and barriers, a part of the analysis that will be reviewed on the final part of this social review report. However the opinion expressed by interviewees regarding the citizen perception in relation to PV and specially to their involvement to influencing solar power policies, assume different perspective:

Of course, no, most of people are not interested in new solar power technologies, so they are unable to influence solar power's policies. Indeed, the number of associations that is working in this field is limited (about 6 associations), and they are somehow, a profit driven organizations.

Oui je pense que l'opinion publique peut avoir une influence, une grande influence sur les politiques d'utilisation de l'énergie solaire et ça par les médias

Spain

Solar Energy policies and more in general renewable energy strategies have experienced dramatic changes in the last few years. A new governmental approach in relation to no fossil energies has cancelled the previous legislation retroactively as confirmed by a technician:

There have been many changes in legislation, some with retroactive effect. It also now seems to be, that is intended to approve another Royal Decree which may be the final escape of solar company from Spain and I think this is the main issue, let's say...[53]

In particular in the following fragment the interviewees shows on one side criticism on political decisions, and on the other side the fact that citizen are becoming more sensible regarding the issue of solar energies and starting to understand the political decision making scenario behind the energy sector.

I think that at this time yes, (people) start to be (conscious) since few years ago, and more recently been triggered this attack on renewables and the electricity bill increases and in all this context people start to open their eyes and see that, here, something it's just not working[54].

However, in the general context of this political lack of support just described, young people are identified by the activist interviewed as the social group that is getting more and more involved on the issue of the solar energy diffusion:

Man! Above all, young people. Mostly you can see, most of the people seen in the SOM ENERGIA environment. Well and also elderly who got involved long time ago in social activism and perhaps they got disengaged and now they see how the situation has evolved in the last years and so they just decide to get involved again [55].

Especially the change in policies and strategies has left in certain respondent, the idea that *there is a very clear administrative collusion starting with the complexity in which the electrical system has been projected*[56].

As mentioned by an activist, part of a SCO that was born to provide an answer to alternative consumption and support to citizen, the present legislation is not clear regarding self-consumption and the future policies seems to be directed towards limit it.

Well, in this moment (the barriers are) administrative, it's clear, isn't? First of all administrative (barriers), it is clear that on this stage PV for new installations should be for self-production and it

---

53 Ha habido muchísimos cambios de legislación, algunos con efectos retroactivos. Ahora también parece ser, que se pretende aprobar otro R.D. que puede suponer la huida definitiva de las empresa solares de España y creo que este es el principal, vaya.

54 Yo creo que en este momento sí que empiezan a estarlo (concientes) desde hace unos años, y más desde hace poco que se ha desencadenado este ataque a las renovables y los aumentos de la factura eléctrica y todo esto la gente empieza abrir los ojos y ver que aquí alguna cosa no acaba de funcionar.

55 Hombre sobre todo la gente joven. Sobre todo se ve, se ve en el entorno de SOM ENERGIA la mayor parte de la gente... Bueno y también gente mayor que, pues que había estado hace tiempo implicada en luchas y que quizás se había desenganchado y que ve cómo ha evolucionado los últimos años y que vuelve a .. (DP): Ya... (PP): A meterse. (DP): A vincularse.

56 Hay una connivencia muy clara de la administracion empezando por la complejidad con la que todo el sistema electrico esta disenado

seems that is going to be established a toll to this self-consumption (…)[57]
Also, in this context, the idea of solar energy as a democratic source, push groups of people to reflect on its use and try to overcome the barriers. This also shows actions of "rebellion" against the barrier that are going to be configured regarding self-production:
I'm part of the solar warriors, I have a guerrilla plugged at home and of course you can see it (…) It is a 100 solar kit, 200-Watt, whatever you want with an inverter behind and with a plug that you plug inside your house[58]*.*

Egypt

Interviews provide small elements in relation to public policies, citizen and governance. The discussion is mainly based on the criticism, desirable public policies and on market perspective.
Respondents analysed the fiscal/economic impacts of the existing policies measures, the present tariffs and the need for a coordinate action between bank and government for the credit access.
An important element related to the role of citizen on energy and cost it's the need to control and reduce the consumption (for citizen, as well as for the tourism industry).
A public sector commitment in the promotion of the PV sector, through communication and widespread in the educational sector and school, represents another element that has been mentioned.
Other criticism noted is the necessity to implement laws that already exist rather than making new ones.
Some interviews believe as well that without the creation of appropriate living conditions, no one will really care about energy and PV solar system.
The active and relevant role of civil society, on the changing scenario, it's central and effective to promote awareness on PV according to the following expert that confirms:
There's no doubt that civil society are working on small projects either by PV or standalone systems in off grid areas or for example recycling agricultural and organic waste that also generates energy in houses and small villages. Civil society has a big role in these projects, so all this raises awareness from one side, and helps the government in providing electricity from another side.
With regards to no governmental group organized, the following technician shows the need of put pressure on the government to promote PV effective policies and highlight the importance of creating the condition to be able to influence government strategies:
This is what we're actually trying to do through an NGO called "SEDA"; we're trying to put pressure on the government through the ministry of electricity, ministry of tourism and ministry of trade and industry. We organize meetings; we're creating a lobby that can force the government to implement its strategy.

Jordan

In Jordan, according to the expert interviewees, citizen is informed and ready for a transition to sustainable resources because the work in strengthening the sensibility and conscience on environmental issues has already started many years ago:
The bi-laws insist to have environmental impact assessment for the status depends on the project, including scoping session for groups from people from public and concerned departments either

57 Bueno en este momento administrativas, está claro eh?, número uno administrativas, está claro que en este momento la fotovoltaica para nuevas instalaciones debería ser en modalidad de autoconsumo y parece ser que se va a establecer un peaje a este autoconsumo…
58 Yo soy de los guerrilleros solares que tengo una guerrilla enchufada en casa y claro que se ve (…) Es un kit solar de 100, 200 vatios, lo que tú quieras con un inversor detrás y con un enchufe que tú lo enchufas dentro de tu casa.

from the public or private sectors and.... This regulation and part of ASEZA (...) Since about 14 years in Aqaba people here either in the public or private sectors they are now very well informed and lots of concern regarding environmental issues and also trained and have good background. The capacity building regarding the culture of environmental issues is already built and already working towards positive impact on the projects that are affecting or affected by the environmental issues, that's from the environmental point of view.

Jordan interviewees highlighted the important role that the Strategic National Energy Policy and the National Energy Policy are covering with regards to the transition from fossil fuels to renewable energy sources.

I think that our national energy policy or strategic national energy policy the most important one which is of course concerning with converting from no renewable energy to renewable energy, let us say resources, so I think it is the main important policy here in Jordan.

Policies have to address as well the need to increase the sensitivity of people towards renewable energies and photovoltaic in particular through: communication plans, workshop and pilot projects. The peer effect in this case will be generated according to the interviewer to citizen who will take example from those who want or already installed.

I believe so that people will be jealous of each other if some uses PV technology, they will copy each other….

A direct relationship between citizens and institutions, according to the interviewees, shows clearly the possibility that the public can influence policy. However the dialogue and coordination between citizen and government it's necessary to overcome criticism and make the transition happen.

I believe that the word of mouth, is the most effective in spreading the info, Institutions, need to invests more in marketing the concept

Lebanon

As mentioned in several occasions, taking into consideration peculiarities of each countries and its context, from the analysis appears a certain concern about the geopolitical context and the weak role of citizen in environmental and energy issue, as mentioned by an expert:

Yes, it is. But it's not easy to feel concerned by these issues when you live in our geopolitical context. They'll influence policies when all this mess will be calmer. But now we're seeing we're nothing, we are little paws, we can't do anything. It's not only here, it's in Syria, in Ukraine, in Egypt, we're nothing, and we're paws! We don't trust anymore our politics but it's the same thing in Spain for example. Media are not talking about it, it's really crazy, we can have millions of people in the streets and government is not doing anything. It's a real disinformation, in Lebanon, in France (they wanted to do Notre-Dame-des-Landes airport), protestors were bitten!

On the first fragment we observe a totally negative opinion about the role of public opinion as influencers, as well in the last fragment the focus is on the role of citizens as a group:

Well... In Lebanon public opinion is not able to influence any policy; even politics more important (safety, security, economic) there is a complete break between the public and the political. So for PV it'd be the same. We cannot influence, if you don't have a clear democratic politic policy game, we cannot influence. Well, this people (politics) can be influent if public people hear about it and if they want to do something, they will do it. But it will not come from influence of people, it will come from they are convinced it should be good, they will do it. But there is no way that public opinion influence politicians or the policies.

No trust in the private sector, but an important role has been allocated in the following fragment to individuals as a group, recognizing the capacity to build alternatives starting from daily and personal practice, as mentioned by an activist:

I think it should begin by the local scale via population, not via private sector. People should begin,

showing it's working in a village, in an area, and in a second area. It should begin by a personal initiative. Not a personal, a group initiative to prove we can live out of this system. I'm not talking about at an anarchist level; I'm talking about a community, which can be self-sufficient.

WP4 – Context Analysis

Phase 3: Survey

Coordinator: University of Cagliari (UNICA)– Department of social science and institutions (DiSSI) Italy

Authors: Vania Statzu, Elisabetta Strazzera (UNICA- DiSSI)

Pollsters:

Norma Baldino (UNICA-DiSSI, Italy)

Silvia Doneddu (UNICA-DiSSI, Italy)

Marta Alberti (ASCAME, Spain)

Salma El-Sahhar (CEEBA, Egypt)

Marion Schnorf (IRI, Lebanon)

Laith Basha (RSS, Jordan)

Hedi Essid (CCI –T , Tunisia)

WP4 Coordinator: Elisabetta Strazzera (UNICA-DiSSI, Italy)

Index

Introduction

The third stage of the activities scheduled for the WP4 -Context Analysis involved a survey of citizens from the partner countries of the FOSTEr in MED project. The survey was aimed at examining the attitudes, opinions, and preferences that households may have with respect to issues related to energy, energy efficiency, and renewables, with a particular interest on the attitudes toward photovoltaic technologies, including some integrated PV. This is finalized to understand which characteristics influence the respondent choices and behaviours.

The survey instrument has been designed on the basis of the results of the previous stages worked out in the Context Analysis, i.e. the desk analysis and the in-depth interview phase. The methodology employed for the construction of the questionnaire follows the steps of other previous projects handled by the DiSSI research group, dealing with the social acceptability of renewable energy technologies (see Notes, p.43).

Given the exploratory purpose of the survey, we opted for a convenience sampling method: 100 individuals were sampled in each partner country, for a total amount of 600 respondents.The survey was administeredin the period June – August 2014, in the cities where FOSTEr in MED had planned the pilot projects: Tunis (Tunisia), Alexandria (Egypt), Haddath (Lebanon), Barcelona (Spain), Cagliari (Italy). People were sampled randomly in streets, public venues, parks. A couple of questions were posed to select respondents: the questionnaire was administered only to home owners who had not a PV system installed in the house.Different contingent conditions have influenced the actual sampling in each country (for example, the choice of locations where to intercept potential interviewees was severely conditioned in Lebanon and Egypt by the turbulent socio-political conditions occurring in that period). The resulting sample precludes a generalization of the results to the population of the city (or even less of the country) where the interviews have been taken: for example, the share of high educated people in the selected samples is certainly higher than what observed in the corresponding populations. Notwithstanding this, we believe that the present analysis is useful to shed some light on awareness, attitudes, and preferences regarding the photovoltaic technology, among a class of people who can be a potential PV market target in our partner countries.

Chapter 1.

The questionnaire

The survey instrument, designed according to a methodology developed in previous studies, was structured in different sections.
The first section was devoted to analyse howeach respondent relates to the city where s/he lives. The aim is to understand what people feel about the aesthetic and social characteristics of the city, their relationship with other residents and the perceived environmental quality of the neighbourhood where they live. Drawing from work by Bonaiuto, Fornara, Bonnes (2003), we inserted three Likert scales with psychometric items in the questionnaire.The respondents were requested to indicate the extent of the agreement or disagreement with respect to some statements concerning the city, the neighbours and the neighbourhoods.
In the second section we gather information on opinions and attitudes toward energy and renewables, drawing from questionnaires used in Strazzera, Mura and Contu (2012); Strazzera, Mura and Statzu (2012); Strazzera, Mura, Fornara, Siddi (2013); Claudy, Michelsen, O' Driscoll (2011); Scarpa and Willis (2010); Claudy, Michelsen, O' Driscoll, Mullen (2011); and for specific reference to MENA countries: Zyadin, Puhakka, Ahponen, Cronberg, Pelkonen (2012); Zyadin, Puhakka, Ahponen, Pelkonen (2014); Kinab and Elkhoury (2012). The first question asked which sources in electricity production are considered the most suitable or desirable to be adopted in the national energy mix and which sources are currently used. The respondents were required to select three energy sources in both questions.Afterwards, we askedrespondents to indicate which technologies they would install in their house if they had to choose among solar thermal, roof and wall insulation, double and triple glazing, PV panels and PV panels plus storage,and which had been already installed in their houses. We then focus specifically on the PV technology. We first asked respondents to indicate which PV technology they would install in their houses. They had to rank three proposed options: to install a PV technology in the rooftop, or in windows and balconies or in the façade of the building. Subsequently we used a psychometric scale: people have to indicate the extent of their agreement or disagreement toward some statements about PV costs, PV aesthetical aspect, bureaucracy, technology etc.. The third question dealt with the peer effect: we asked people to indicate how much their choices to invest in PV could be influenced by an analogous decision taken by relatives and friends and by neighbours. In addition, we asked people to indicate how much they could consider the Public Administration choice as an example that could drive their decisions.
The following questions are related to governmental subsidies to promote the diffusion of the PV technologies. The first question verifies if people are aware about the existence of public subsidies and the second question asks to rank in order of preference four types of subsidies: a tax allowance, more favourable credit conditions, a feed-in tariff system and a net metering system.
Afterwards, respondents were asked to indicate which source of information they would seek if they needed information on PV, providing a rank of the first three choices.
Finally, we proposed a choice experiment, where the respondents had to express their preferences on different PV applications. Drawing from Fawcett, Ellingham, Platt (2008), and from White and Gatersleben (2011), we presentedfour pictures to the respondents: the first picture showing aresidential building in the city where the interview took place; the other three were modifications of the first picture, each with a different PV technology applied to the building. The respondents were requested to rank the alternative options; and in a follow up, we asked the re-

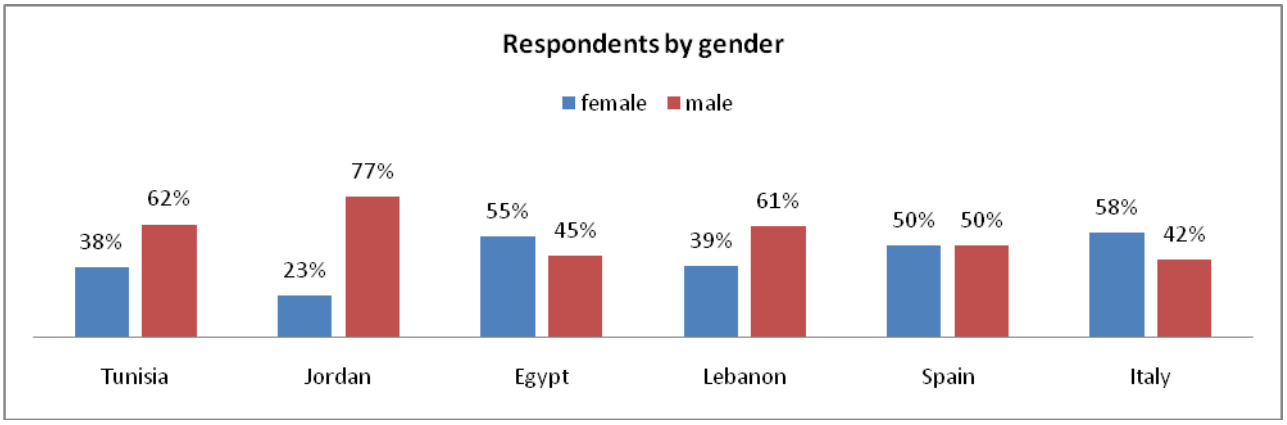
spondents to repeat the exercise after providing some information on costs and benefits of the alternative options.
After the choice experiment we enquired about the probability that in the near future the individual would install a PV system on the rooftop, on windows and balconies or in the façade of the house.
The final section of the questionnaire deals with demographic and socioeconomic characteristics, house and heating system characteristics, questions about the diffusion of air conditioner systems in houses and workplaces, electricity management habits and the amount of electric and energy bills.

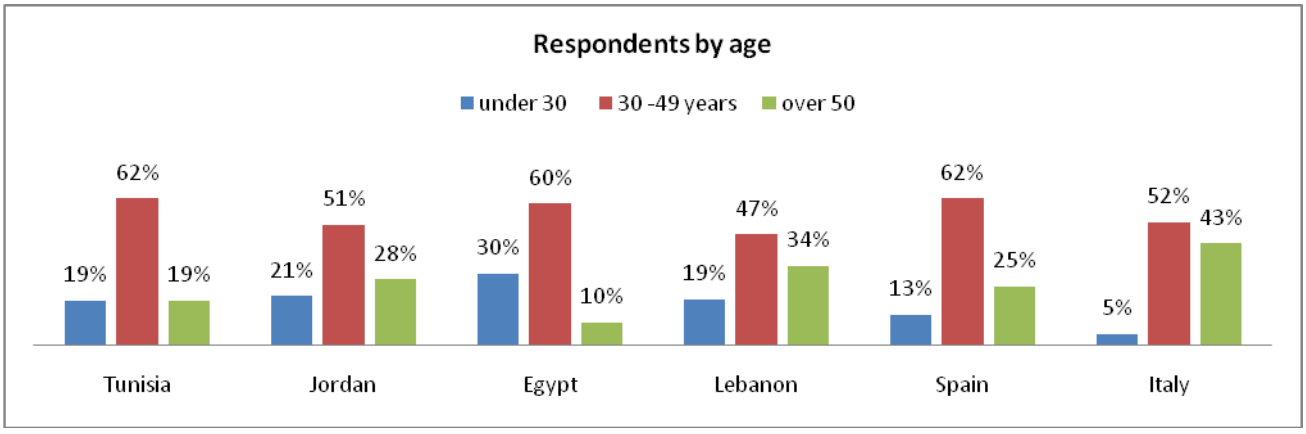
Chapter 2.

Description of the characteristics of the respondents

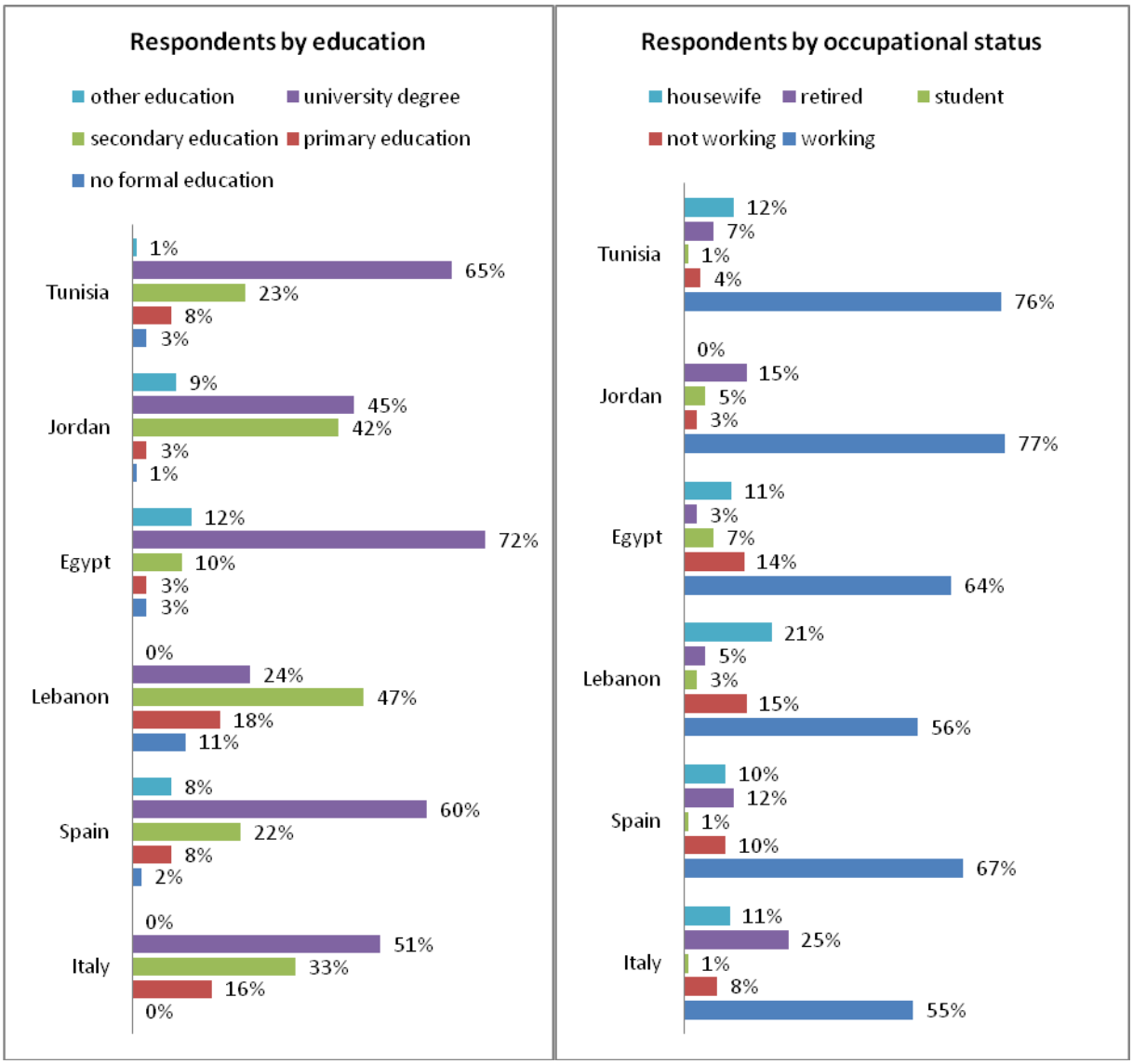
Socioeconomic characteristics

The gender distribution of the sample is somewhat unbalanced, since there is a prevalence of males, especially in Jordan, but also in Lebanon and Tunisia; on the other handthe Egypt and Italy samples contain a higher percentage of female respondents. As regards age, most respondents are in the class between 30 and 49 years; Egypt has the highest percentage of respondents under 30, while Italy the high percentage of over 50 respondents. This situation reflects the differences among countries in the age of population: in Tunisia, Jordan and Egypt more than 65% of population is less than 30 and less than 10% is more than 65; on the contrary, in Italy and Spain, 30% of population is less than 30 and nearly 20% is more than 65.

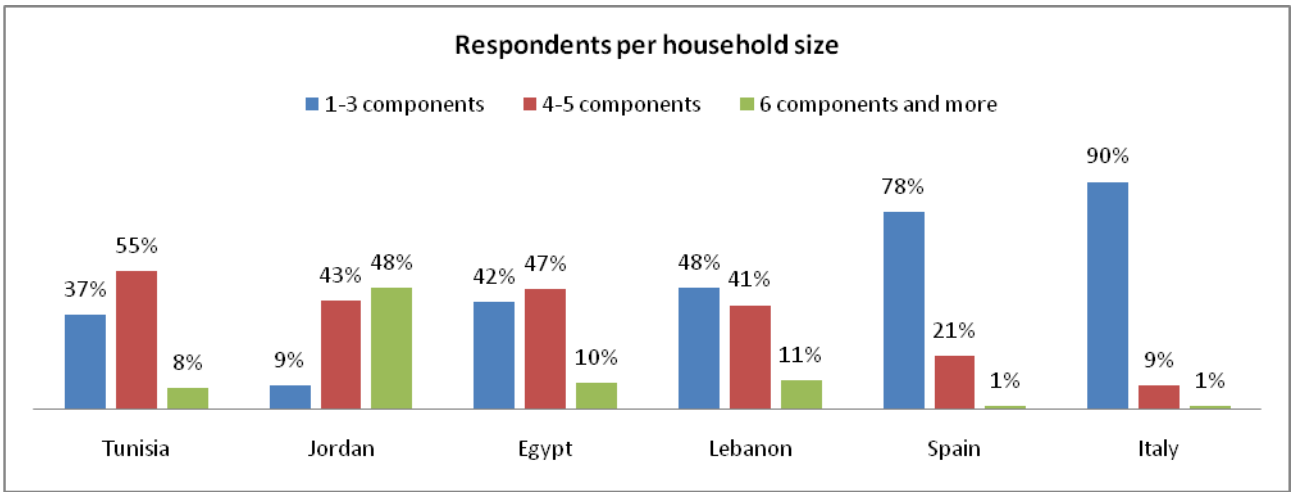


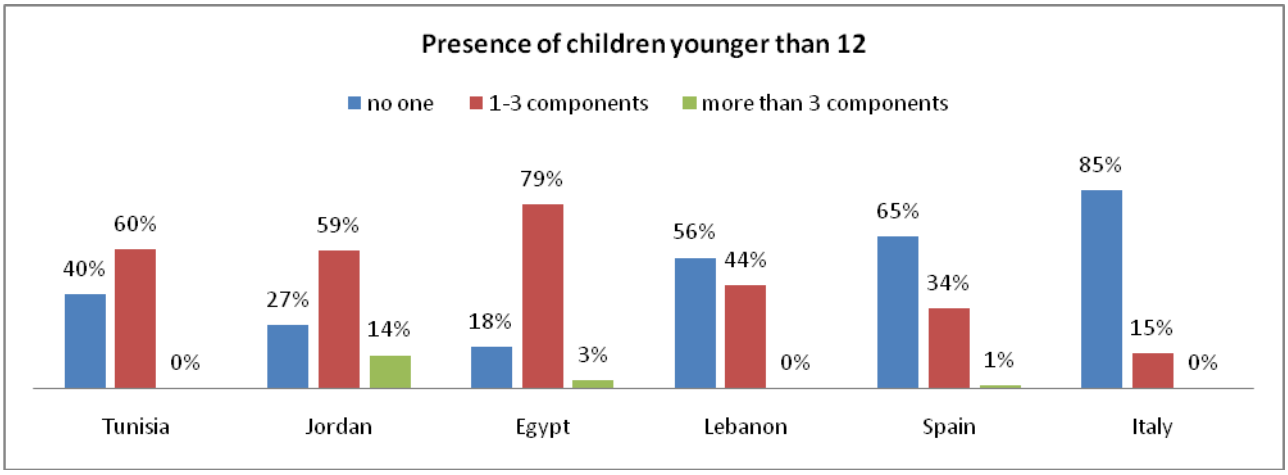


Most respondents hold a university degree: the only exception is Lebanon, where the mode is the secondary education level, and where a relevant percentage of respondents (11%) have not received formal education.
Most respondents are in working condition: only in the Italian sample there is a relevant percentage of retired (25%) and in the Lebanese sample of housewives (21%).

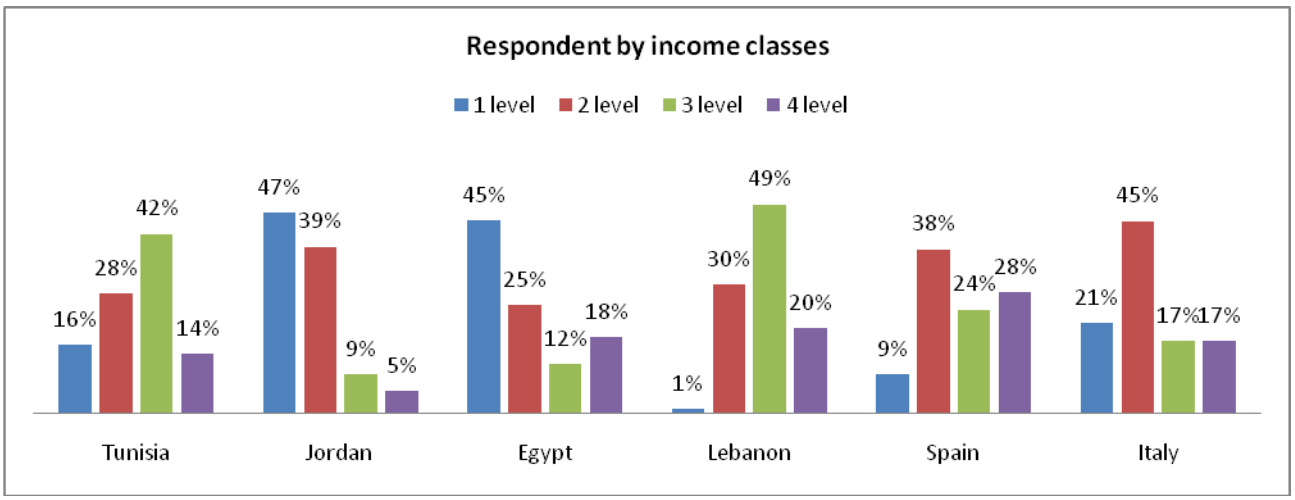


The household size of respondents from Lebanon, Spain and Italy is made by 1-3 people (90% in Italy and 78% in Spain), while in the other countries are more larger households: 4-5 components in Tunisia and Egypt, and in Jordan even higher sizes. This is in part reflected by the fact that in the Italian and Spanish samples the percentages of households with young children are quite low (respectively, in the 15% and 35% of the samples), followed by Lebanon (44%); conversely, in the other countriesmore than 50% of households have at least 1 child under 12.



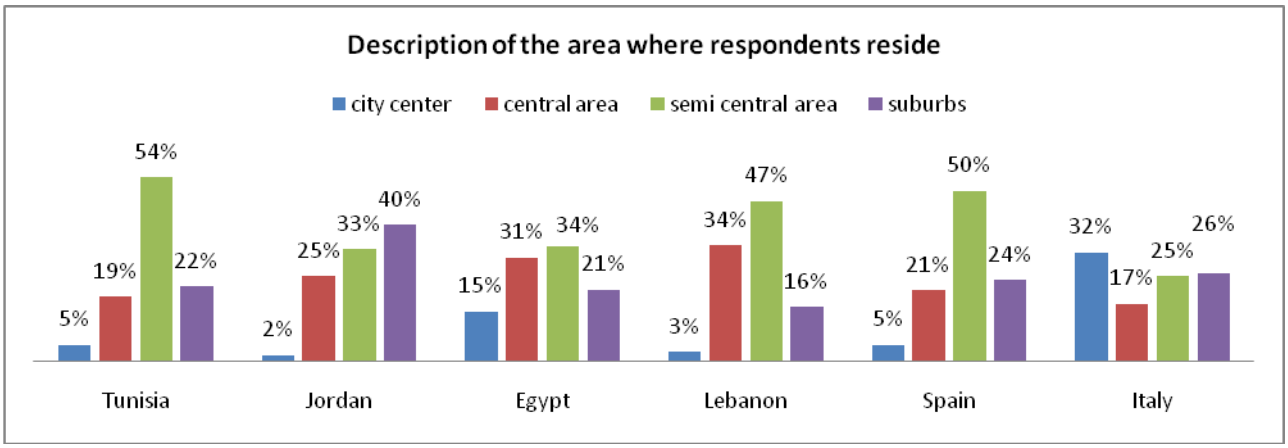


The graph below reports onthe household net income. The questionnaire contained customized categories for each country; and the respondent had to select her/his income class in a range of 4 classes. Most Jordanian and Egyptian respondents selected theirfirst income class, mostSpanish and Italian respondents were located in their second class, while Tunisian and Lebanese people placed themselves in their third income class.

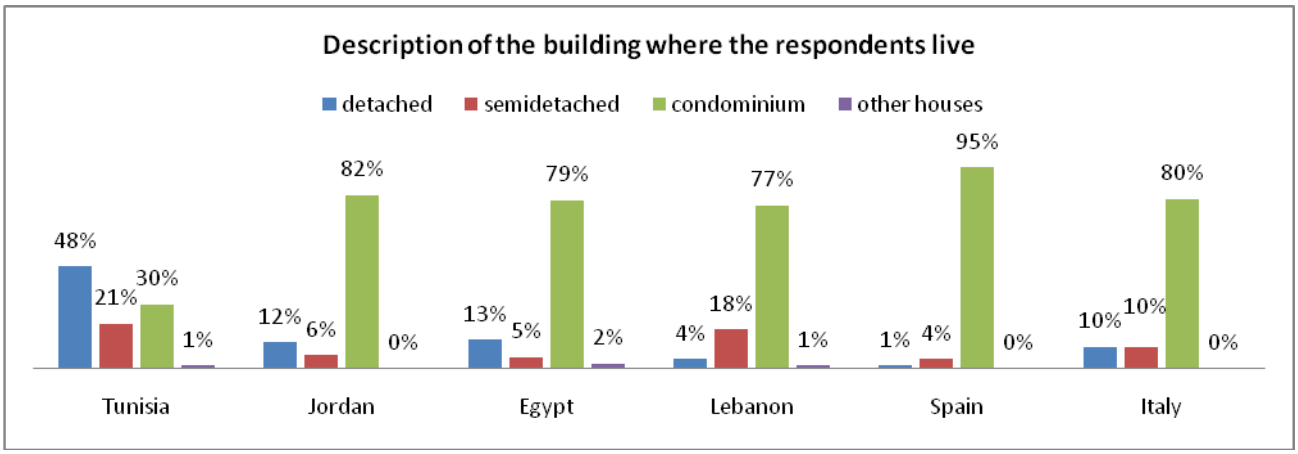


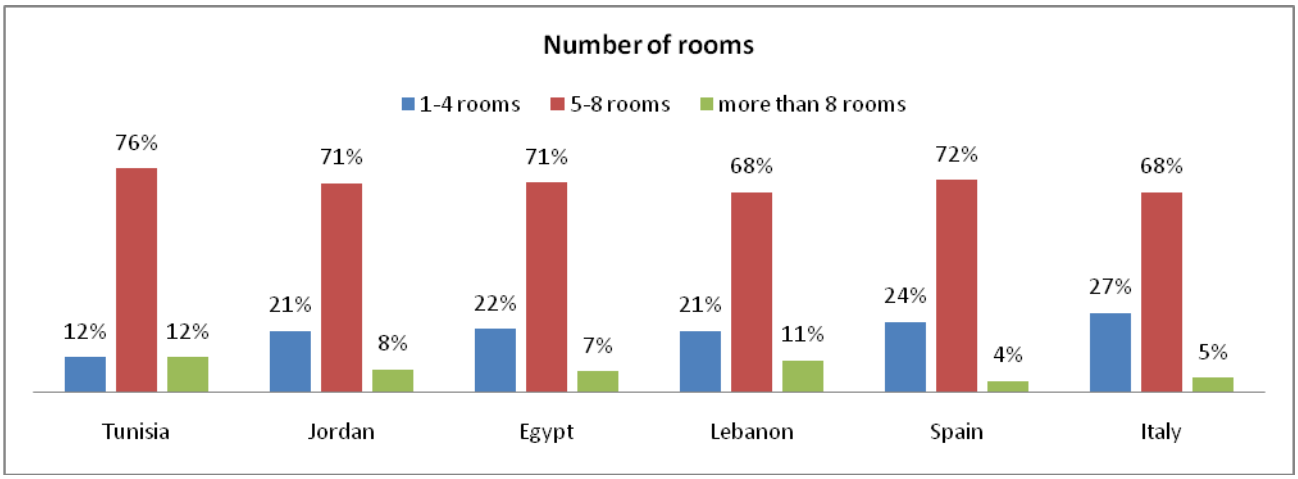
Characteristics of the dwelling

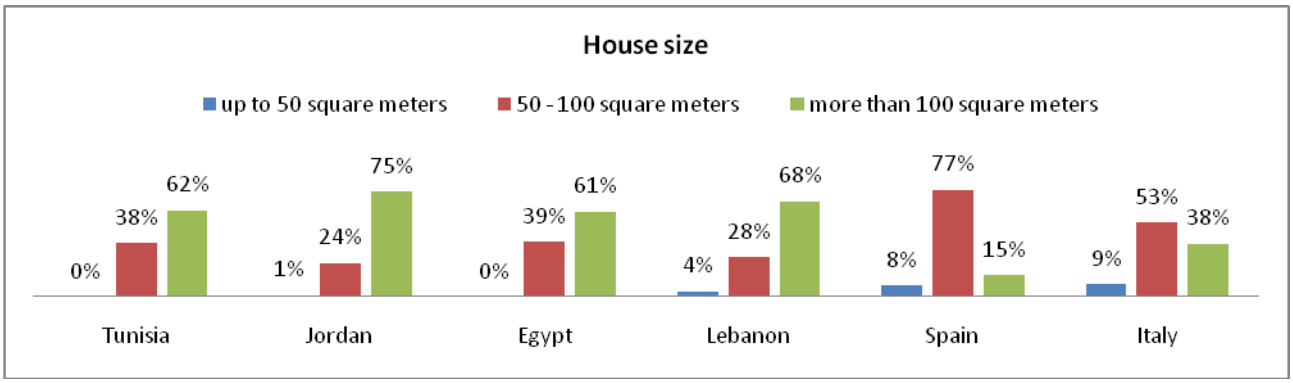
Most respondents from Tunisia, Lebanon, and Spain live in a semi-central zone;the other samples are more mixed, with 40% of Jordanians residing in the suburbs and 32% of Italians in the city centre.



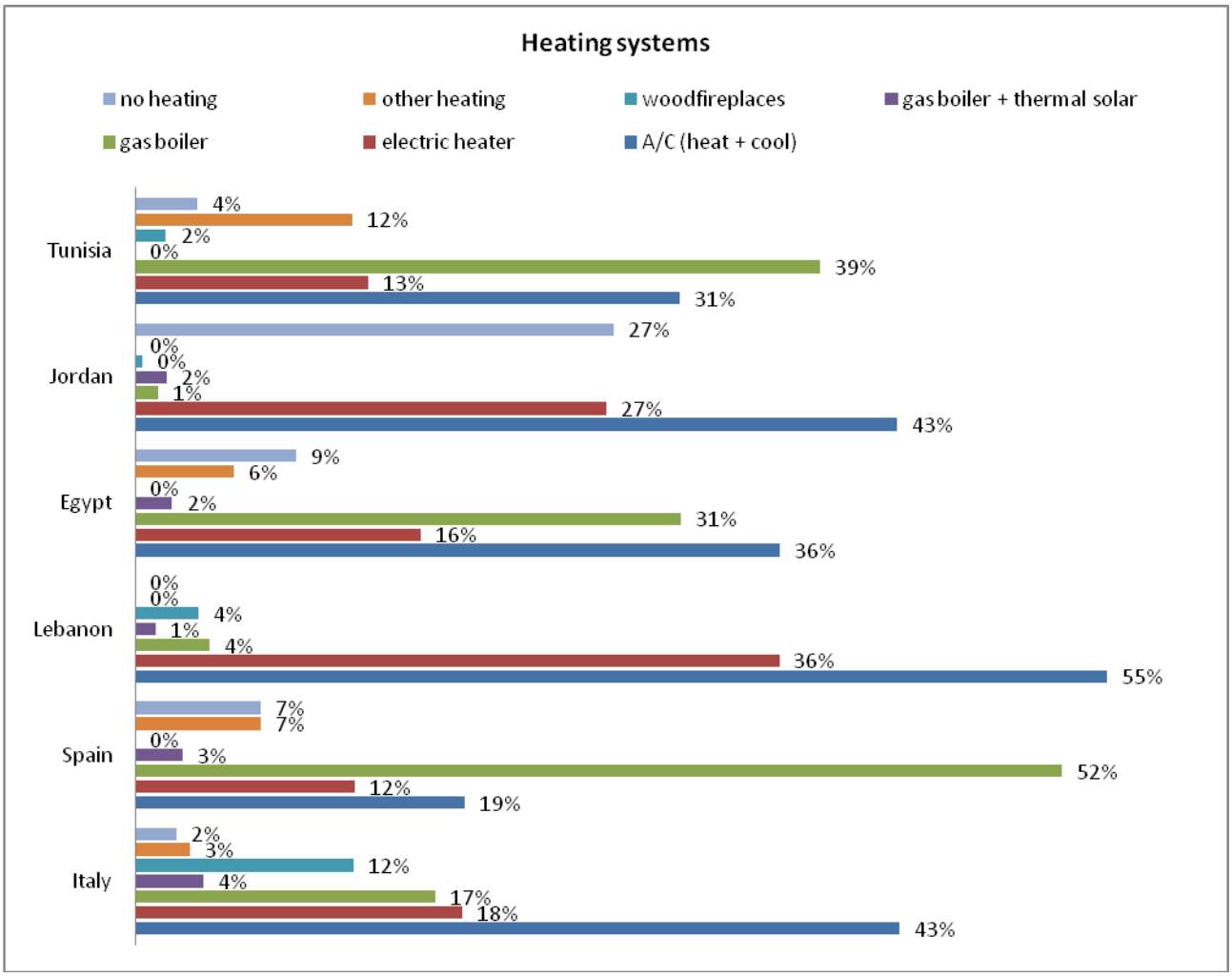
The vast majority of respondents live in a condominium; the only exception is the Tunisian sample, the majority of which lives in a detached house. Generally, houses have from 5 to 8 rooms and a size larger than 100 square metres in the samples from MENA countries, while in the Italian and Spanish samples they range from 50 to 100 square metres.



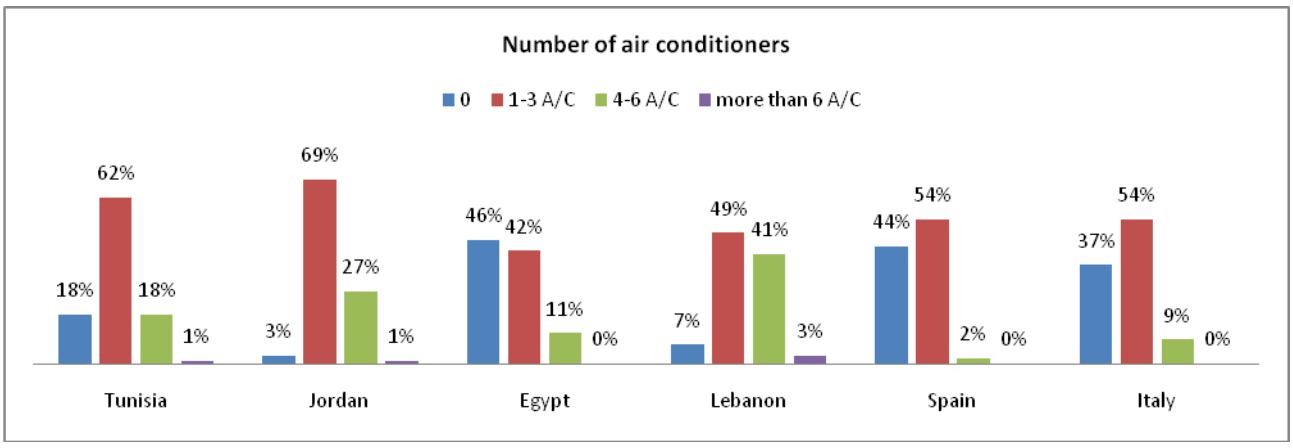




As regards heating, heat pumps are the most common technology adopted by respondents in the samples of Italy, Lebanon, Egypt and Jordan, while among Tunisian and Spanish households itis more common a gas fuelled heating system (but in Tunisia 31% of the households are also equipped with a heat pump system). In each country, but in Egypt, the majority of respondents have some heat pumps or A/C systems: 49% of Lebanese respondents, 54% of Spanish and Italian respondents, 62% of Tunisians and 69% of Jordanians have from 1 to 3 units; and 26% of Jordanian and 41% of Lebanese respondents have from 4 to 6 air conditioners. The wide diffusion of heat pumps and air conditioner appliances somehow confirms a finding reported in the desk analysis, i.e. that the peak of electricity consumption has been shifting from winter to summer.

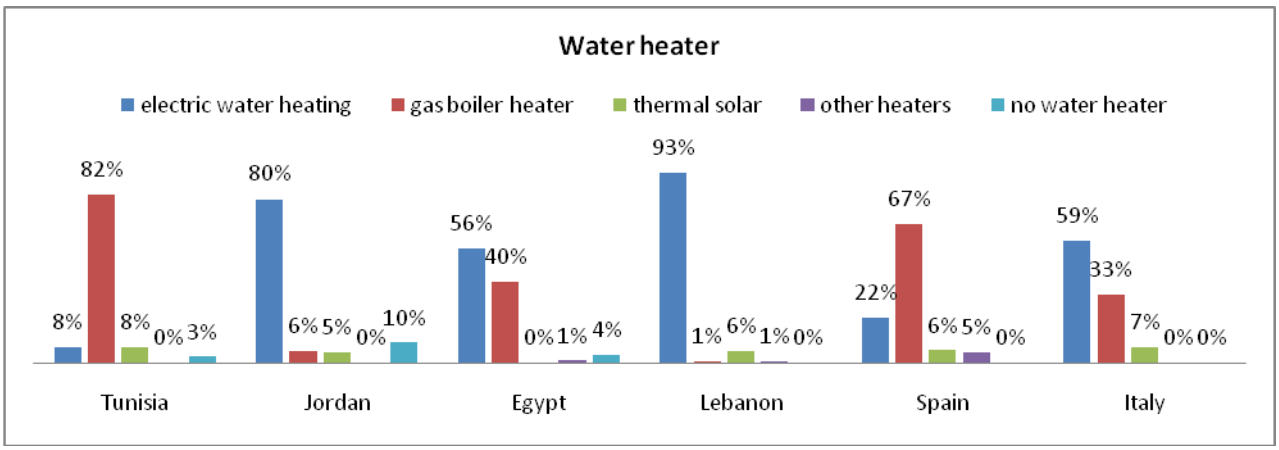


The need to satisfy the electricity demand for cooling houses in summer could be an important driver for PV technologies, though it should also be taken into account the high percentage of households endowed with electric heaters, especially in Lebanon, Jordan, and Italy (we recall that Sardinia is the only region in Italy not provided with piped natural gas).

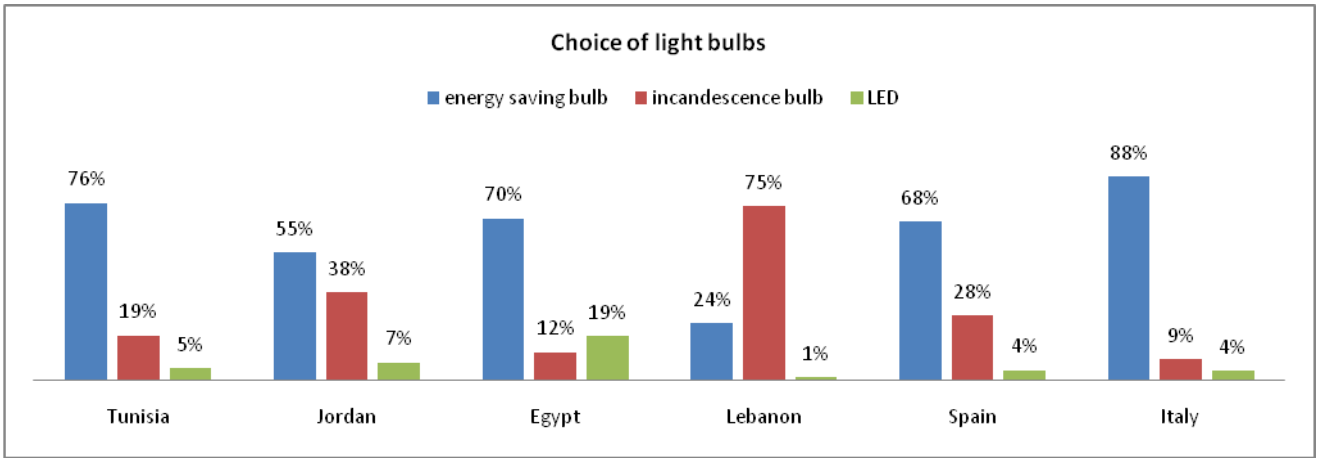


The next graph shows the technologies used in the households in our samples for water heating. In Jordan and Lebanon, and to a lesser extent in Egypt and Italy (Sardinia), a large majority still uses electric boilers, i.e. the most inefficient technology. Very few households (8% in Tunisia, 7% in Italy, 6% in Spain and Lebanon and 5% in Jordan) have adopted a solar thermal system. This

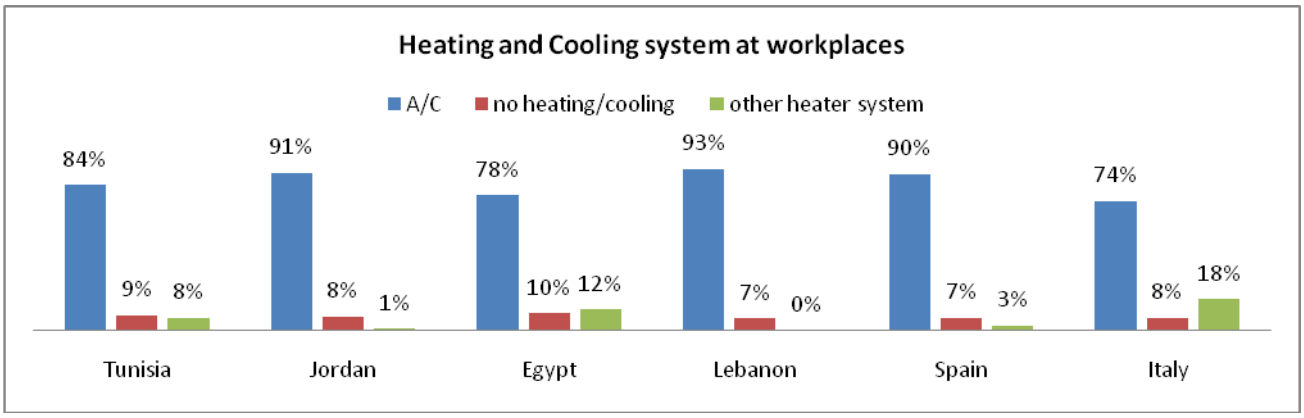
is quite regrettable, since solar thermal is a mature technology, relatively cheap and well suited to the climate conditions of Mediterranean countries. Indeed, the interest in the solar thermal technology emerged in a number of in-depth interviews conducted in the qualitative phase of our research; and, as we will see below, also for a large part of our respondents this technology would be their preferred investment for energy efficiency in the house. In some of our partner countries (Tunisia, Lebanon, Italy) some public programs and subsidies to enhance this technology has been introduced; it would be interesting to study how effective they are.



The next question is about the light bulbs used in the household, which provides some indication (given the regulations in force in each country) on the energy saving behaviour of our respondents. It is quite interesting to note that 19% of Egyptians use LED bulbs, while in all other samples the percentage is 7% or less. Most respondents mainly use energy saving bulbs: 88% of Italian, 76% of Tunisian, 70% of Egyptian, 68% of Spanish, 55% of Jordanian respondents. The exception is the Lebanese sample, with 75% of interviewees still using mainly incandescence bulbs; but also 38% of Jordanian, 28% of Spanish (although these bulbs are banned since 2012 in EU countries) and 19% of Tunisian respondents does the same.

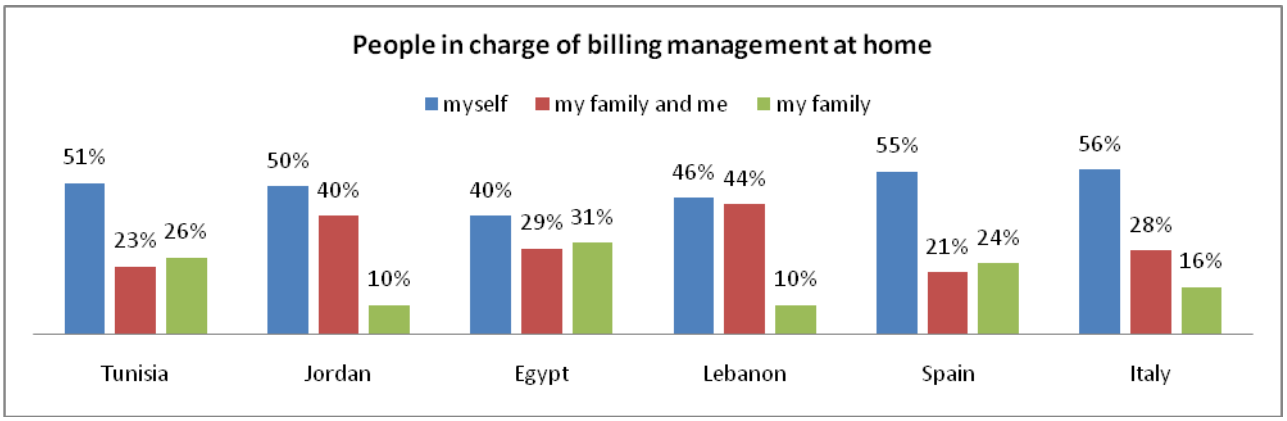


Finally, we asked which kind of heating and/or conditioning systems the respondents find at their workplace. Heat pumps and air conditioners are by far the most widespread, with percentages ranging from 74% in the Italian sample to 93% in the Lebanese; only in Italy (18%), Egypt (12%) and Tunisia (8%) other types of appliances are used.

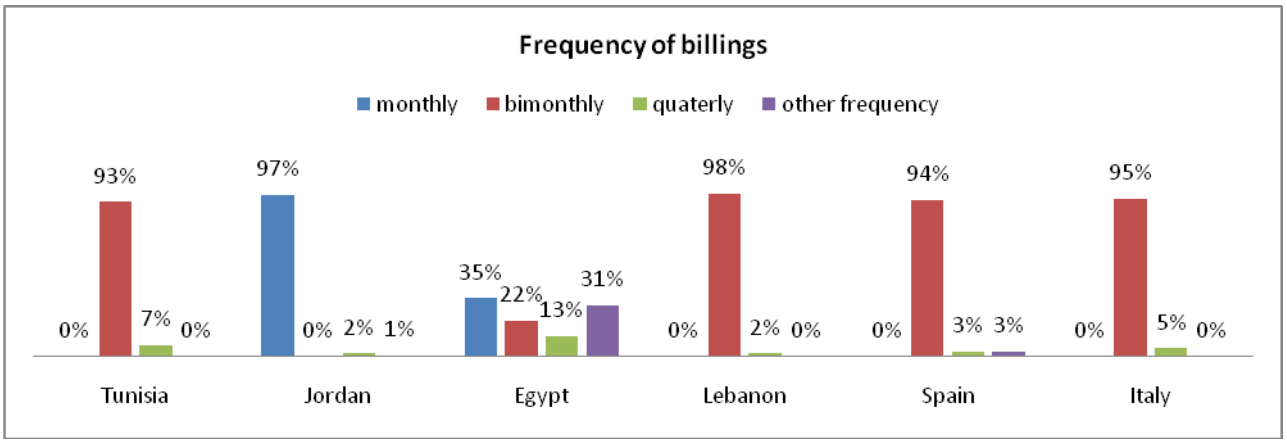


Electricity management

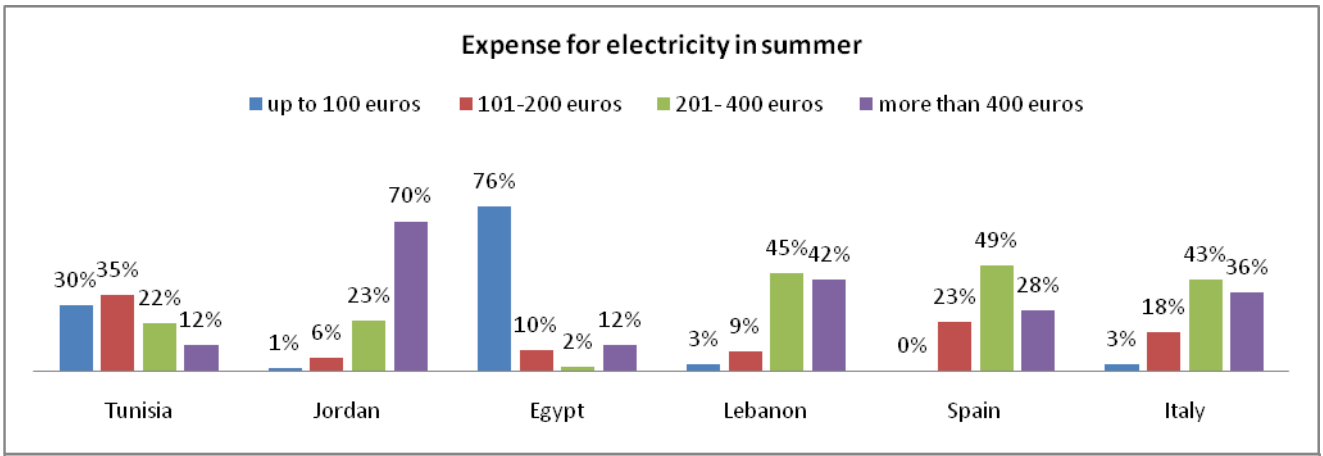
Half of the respondents are personally in charge of the electricity bill, with higher percentages in the Italian and Spanish samples. In Lebanon and in Jordan a relevant number of interviewees manage it with other family members, while 31% of Egyptian and 26% of Tunisian respondents do not manage the electric bill at all.

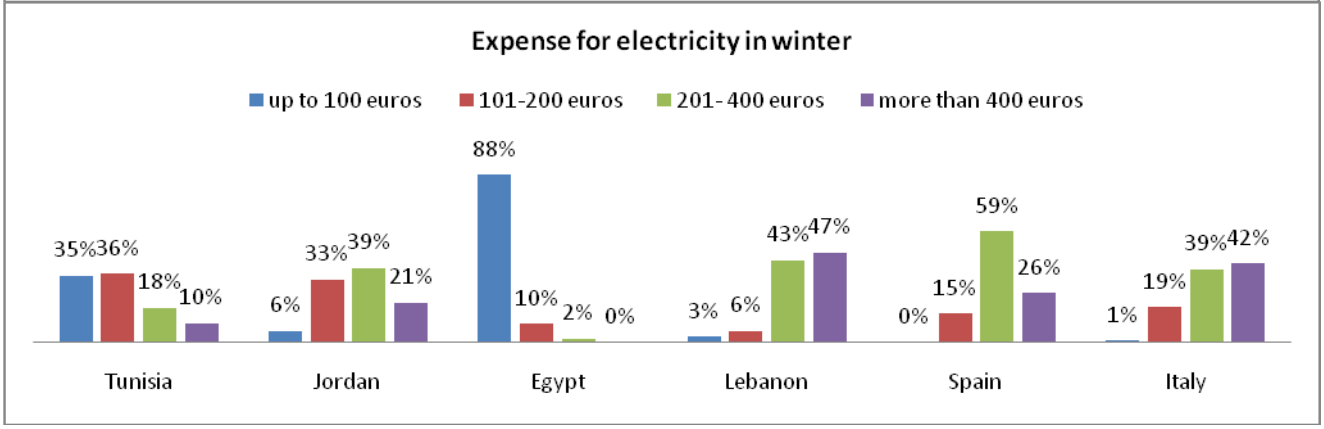


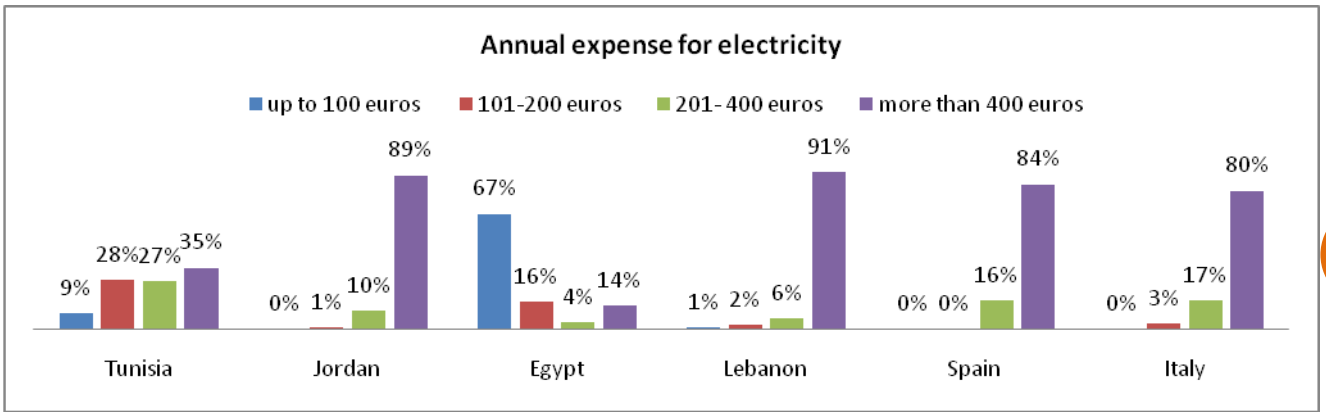
Most households in our samples have a bimonthly bill frequency; the exceptions are Jordan, where the bill is monthly, and Egypt, where there is a wide range of billings periods. We recall from the desk analysis report that only Spain and Italy have a competitive electricity market (although only a small percentage of customers have chosen the liberalised market: in 2012, only 20% of Sardinian residential customers and 27%of total Spanish customers); in all other countries, there is a monopolist, a state company, that sells the electricity service.



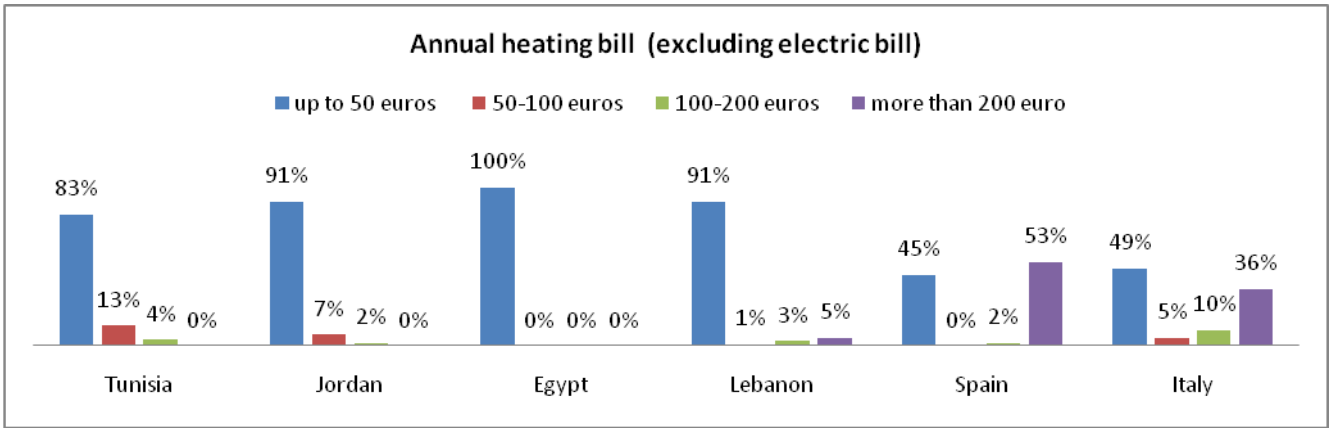
The comparison of the expenses for electricity showsthat Egyptians and Tunisian have the lowestbill amountboth in summer and winter (76% of theEgyptian respondents pay no more than100 euros per bill, an analogous percentage of Tunisian respondents no more than 200 euros).Lebanese people face the higher annual expense: this is due to the fact that Lebanese people pay two bills, as explained in the desk analysis. The first bill is the bill from the EDL, the state company, which has the monopoly of the electricity sector; the second bill is a charge they have to pay to illegal organizations in order to have a diesel generator and avoid energy shortages or cuts. Egyptian, Jordan and Tunisian respondents spend more money in summer months, confirming what we found in the desk analysis about the increasing electricity demand in summer months due to cooling needs (see pages 40-41 in the desk analysis report for details about the increasing diffusion of heat pumps and air conditioning for summer cooling and the consequences on the electric system).



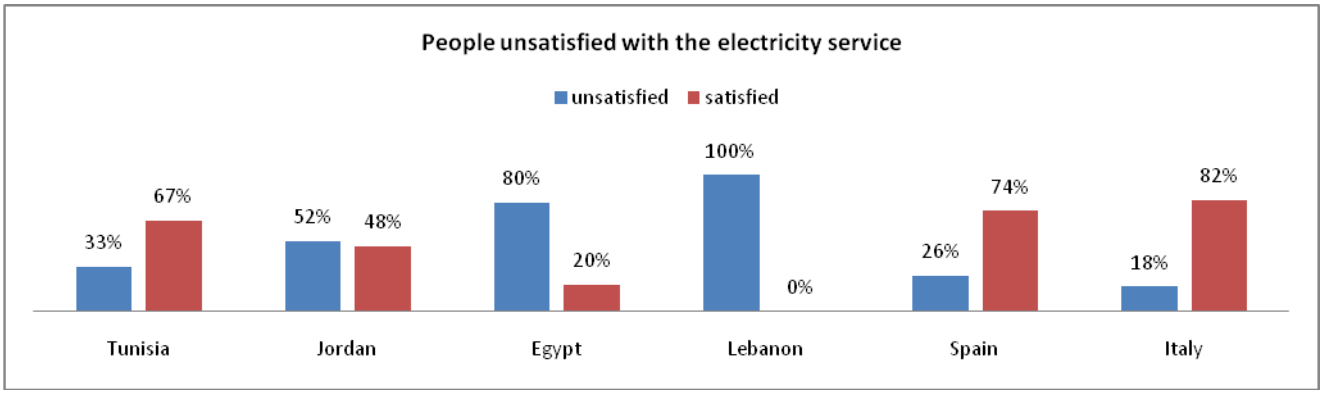




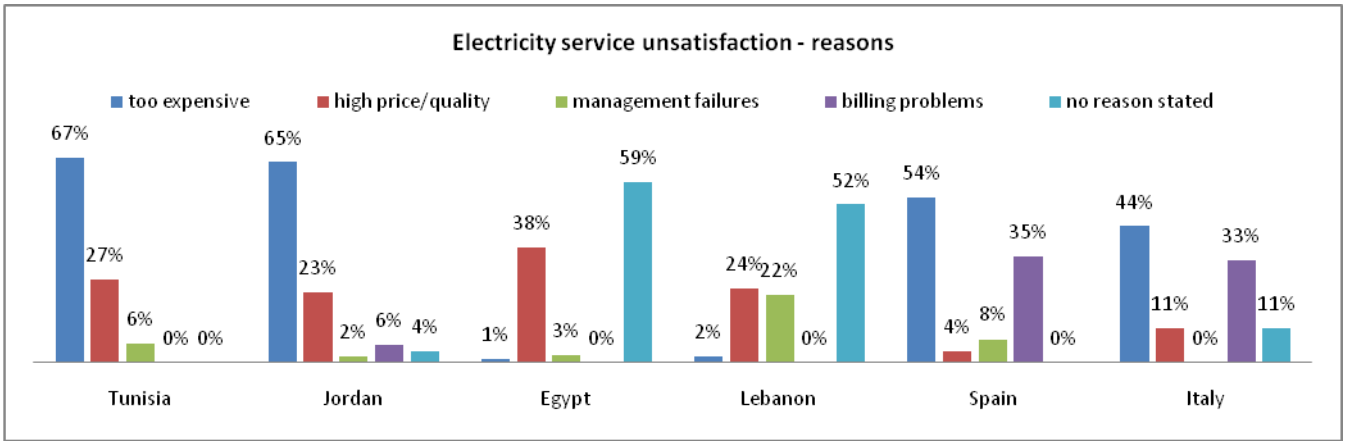
Heating bills (excluding electric bill) are quite low in all the MENA countries, while in Spain and in Italy the respondents are splitbetween the two extreme classes.



We asked whether households are satisfied or not with the service provided by the electric utility. Egyptian and Lebanese respondents are heavily unsatisfied (respectively 80% and 100% of interviewees are unsatisfied), followed by Jordanians (52%), while in the other countries the majority of respondents are satisfied.



We asked unsatisfied respondents to spell out the motivation through an open comment; these comments were then grouped in few categories. Tunisian, Jordanian, Spanish and Italian complainers lament the fact that bills are too high; in addition, Spanish and Italians complain about the billing, as they find that the bills not clearly written, it is too difficult to understand the structure of the tariff, and complain about the practice of billing estimated rather than actual consumption (the criticism is that the latter is generally overestimated, with balance at the end of the year: this way, the electric utility borrows money at no charge). Egyptian and Lebanese respondents indicate a too high price/quality ratio, which can be explained taking account of what found in the desk analysis and in the in-depth interview phases: in these countries electricity cuts and shortages are quite common. Lebanese customers also complain about the bad management of the electricity system by the EDL (which leaves room to illegal organizations, as thoroughly explained in the in-depth interviews).



Chapter 3.

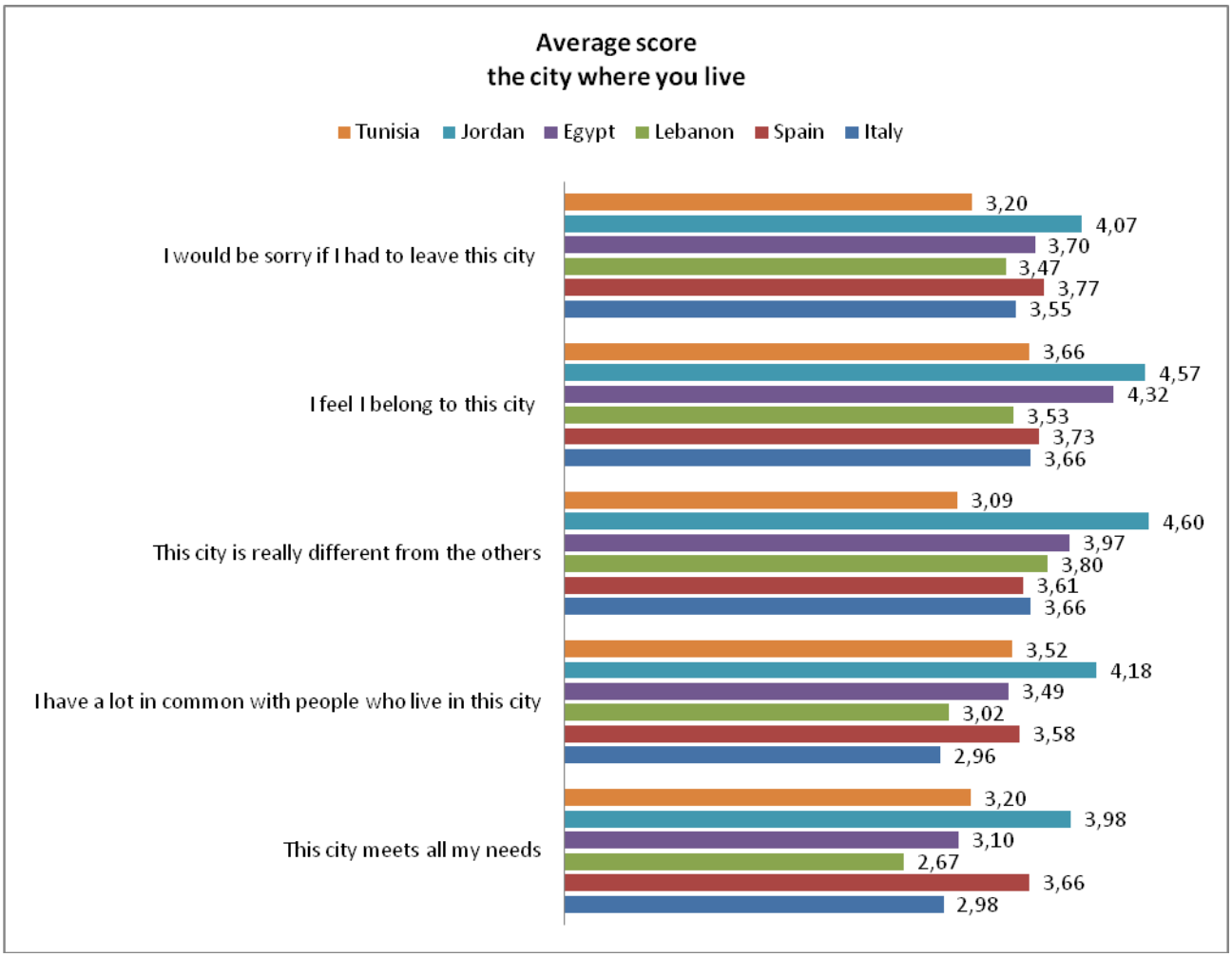
Knowledge and attitudes toward environment and energy

The chapter is focused on the description of psychological and cultural characteristics which can influence the individual's attitudes toward renewables and in particular PV energy, and preferences regarding PV installation in residential buildings. The data is collected through Likert scales questions.

Relationship with your city

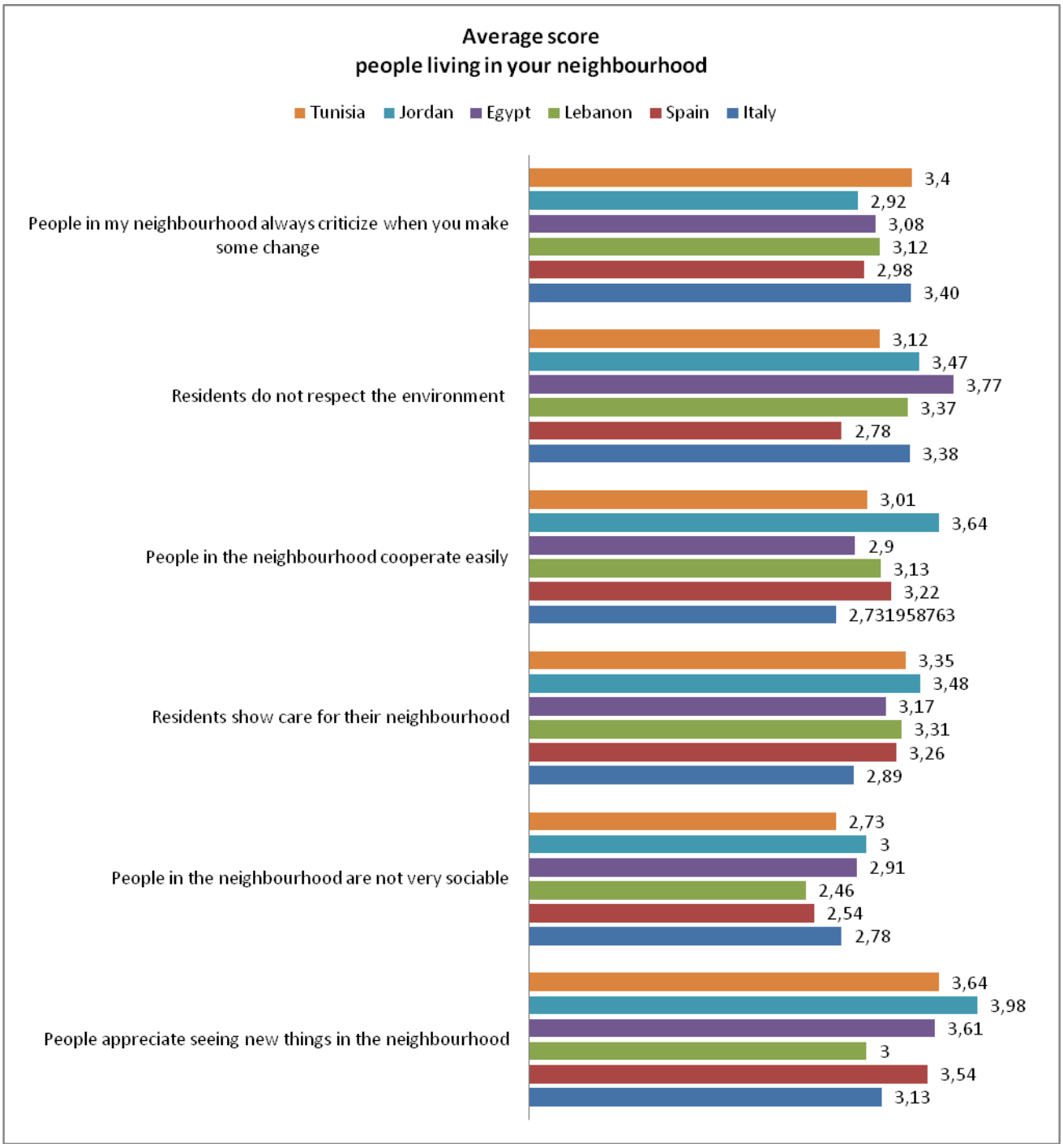
In this section we present the result of the first part of the questionnaire devoted to analysis of the feeling respect to the city, the neighbours and the neighbourhoods.
We asked people to indicate the extent of their agreement or disagreement to some statements. People had to attach a score from 1, that means "strongly disagree", to 5 that means "completely agree".
The results for each item are summarised in the Appendix.

***Question 1*. In the following question you are asked to indicate how much you agree or disagree with each statement regarding the city where you live.**
The scores are on average quite high: in particular the respondents in the samples from Jordan, Egypt, and Spain seem to have a strong attachment to their city. The sample from Italy (Cagliari) is less keen, especially regarding the issues of identification with other fellow citizens, and the capacity of the city to meet the residents' needs.



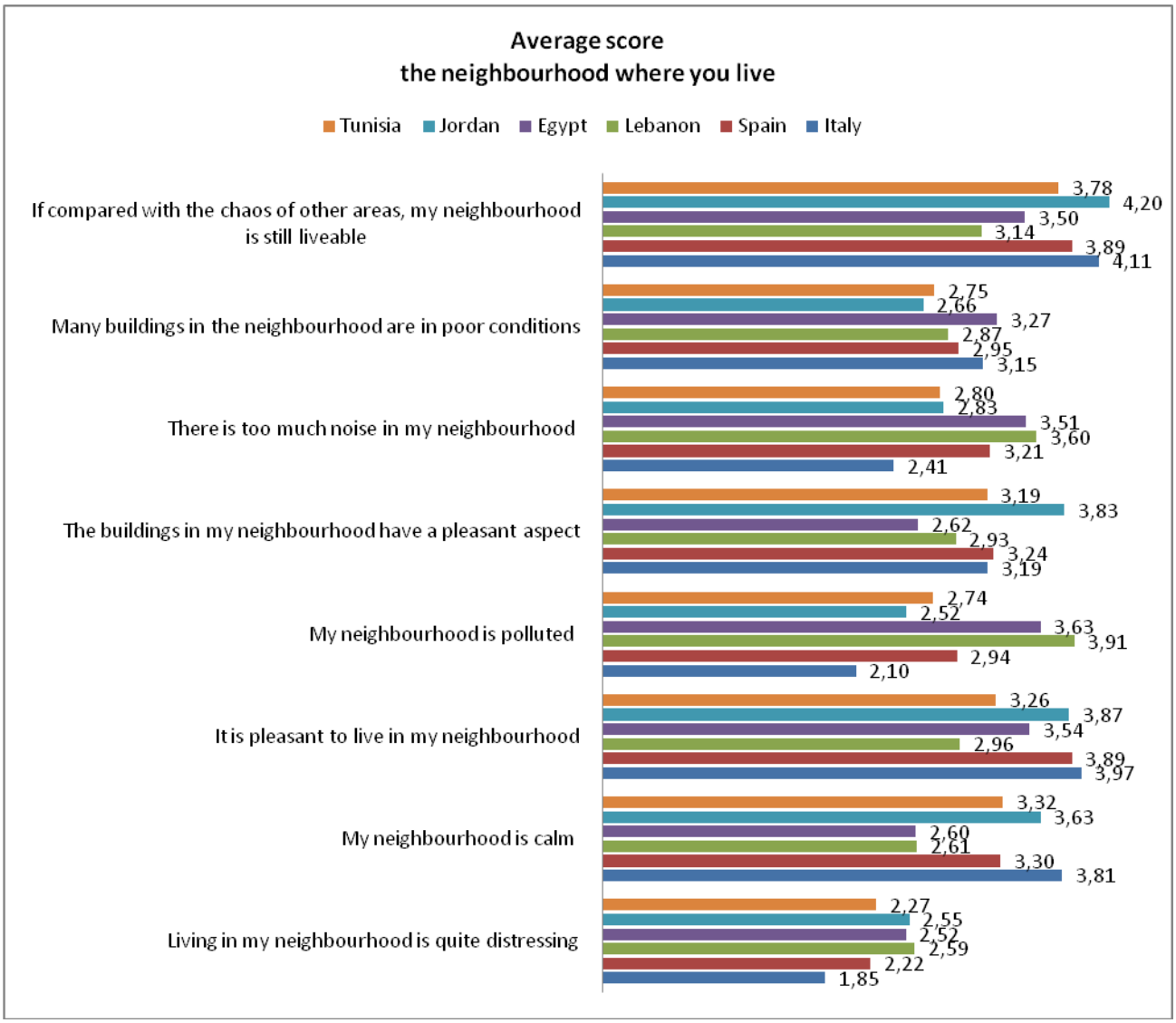
Question 2. **In the following question you are asked to indicate how much you agree or disagree with each statement regarding the people living in your neighbourhood.**

The second question is focused on the relationship that respondents have with their neighbours. In this case the responses are more neutral (the average scores are closer to 3, i.e. neither agree nor disagree to the statement). Again it seems that the Barcelona sample is characterized by positive feelings, while the Cagliari sample is the least sympathetic toward neighbours. It is also interesting to note how Lebanese respondents seem to stigmatize the lack of respect for the environment shown by residents in their neighbourhood.



Question 3. In the following question you are asked to indicate how much you agree or disagree with each statement regarding the neighbourhood where you live

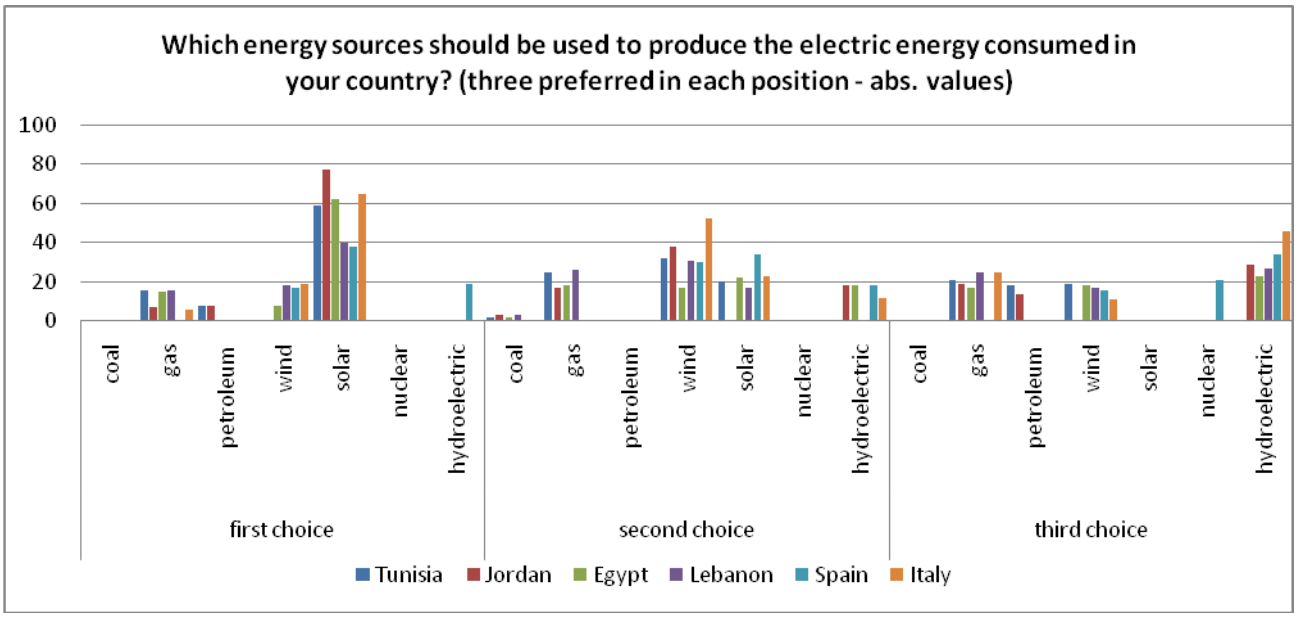
In all countries, most respondents consider the neighbourhood where they live as a liveable and not distressing place. However, in Lebanon and Egypt there are negative valuations about the level of pollution and noise in the environs; while in this case the best scores for the environmental quality of the neighbourhood are given by the Italian (Cagliari) sample.


Average score
the neighbourhood where you live
Tunisia
Jordan
Egypt
Lebanon
Spain
Italy
If compared with the chaos of other areas, my neighbourhood is still liveable
3,78
4,20
3,50
3,14
3,89
4,11
Many buildings in the neighbourhood are in poor conditions
2,75
2,66
3,27
2,87
2,95
3,15
There is too much noise in my neighbourhood
2,80
2,83
3,51
3,60
3,21
2,41
The buildings in my neighbourhood have a pleasant aspect
3,19
3,83
2,62
2,93
3,24
3,19
My neighbourhood is polluted
2,74
2,52
3,63
3,91
2,94
2,10
It is pleasant to live in my neighbourhood
3,26
3,87
3,54
2,96
3,89
3,97
My neighbourhood is calm
3,32
3,63
2,60
2,61
3,30
3,81
Living in my neighbourhood is quite distressing
2,27
2,55
2,52
2,59
2,22
1,85

Production of electricity in your country

Question 4. **In your opinion which energy sources should be used to produce the electric energy consumed in your country?**

In all countries the preferred source is solar energy, followed by wind energy (generally indicated as the second best choice), gas and hydroelectric. Petroleum, coal, and nuclear energy sources are less preferred. Moreover, we can notice some interesting differences among countries: respondents from Italy and Spain are less interested in using coal and petroleum than the other countries; Spanish are not keen on natural gas, but are interested in nuclear sources, which is seldom selected by peoplefrom other countries (in particular Italian and Lebanese respondents). The Tunisian sample is the least interested in hydroelectric power.



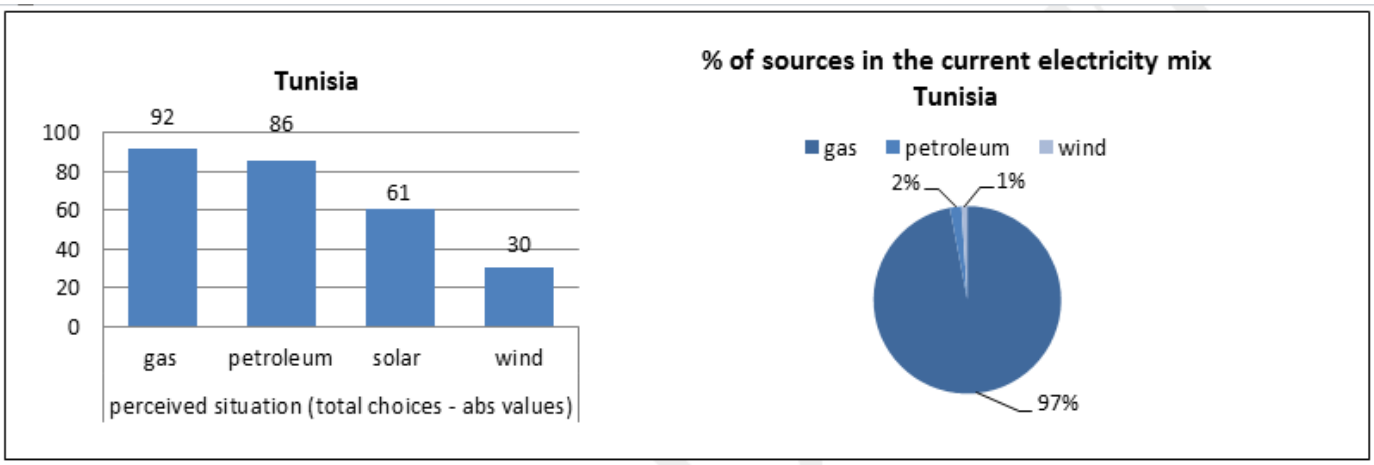
Abs. values		Tunisia	Jordan	Egypt	Lebanon	Spain	Italy
first choice	coal	7	0	3	4	1	1
	gas	16	7	15	16	11	6
	petroleum	8	8	5	10	1	5
	wind	4	4	8	18	17	19
	solar	59	77	62	40	38	65
	nuclear	4	1	4	8	11	2
	hydroelectric	1	2	7	4	19	2
Second choice	coal	2	3	2	3	0	5
	gas	25	17	18	26	3	6
	petroleum	10	10	7	12	5	0
	wind	32	38	17	31	30	52
	solar	20	9	22	17	34	23
	nuclear	2	4	9	2	10	0
	hydroelectric	9	18	18	11	18	12
thirdchoice	coal	2	7	7	9	3	0
	gas	21	19	17	25	11	25
	petroleum	18	14	13	12	1	1
	wind	19	12	18	17	16	11
	solar	14	7	8	9	12	5
	nuclear	9	12	9	2	21	4
	hydroelectric	17	29	23	27	34	46

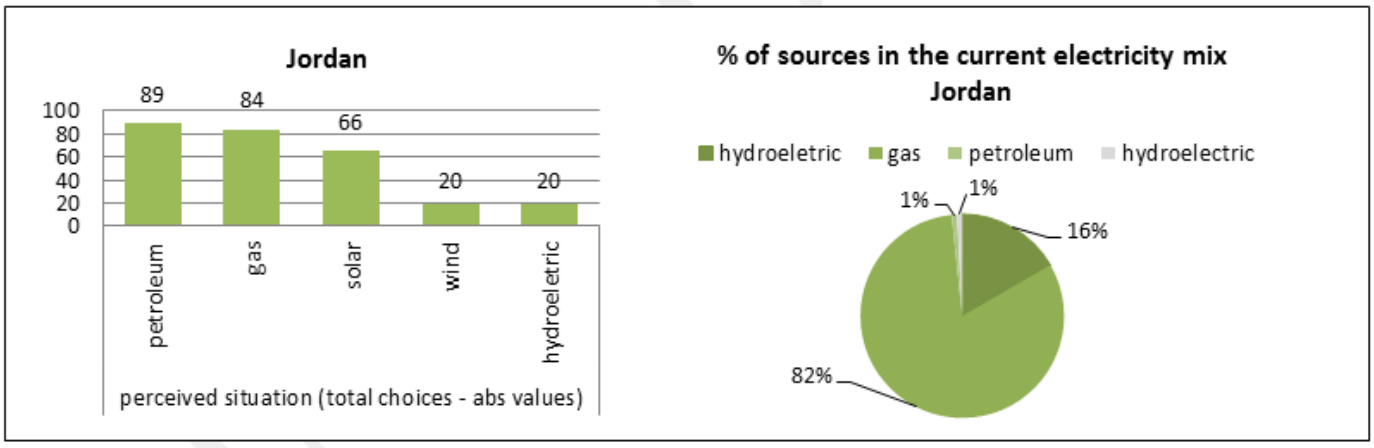
Question 4a. Can you indicate which are the most important sources currently used for the electric energy consumed in your country?

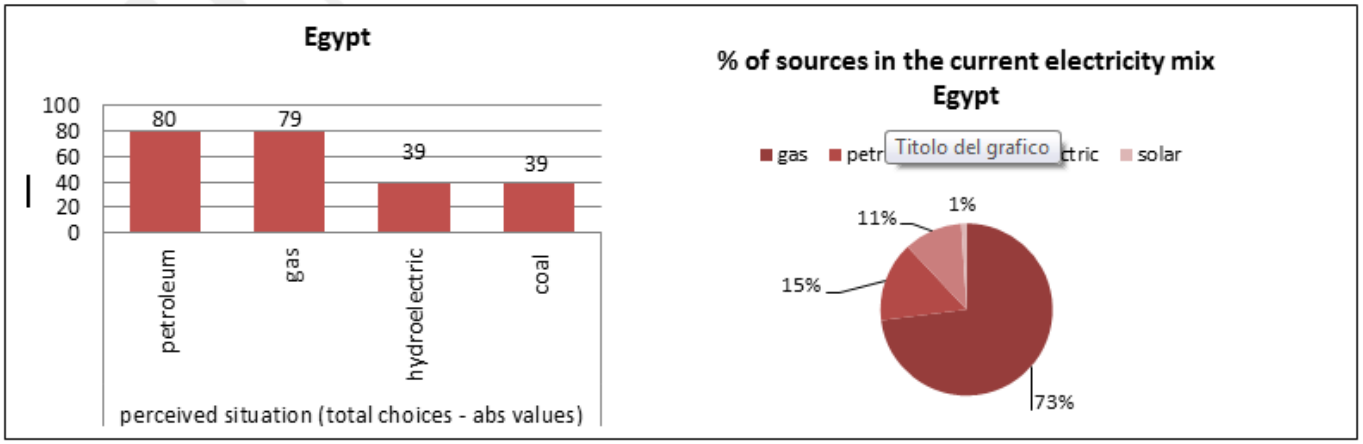
Overall, it seems that the interviewees were sufficiently aware of the composition of the national energy mix, even though they do not know the exact shares of sources in the mix. Correctly, in all

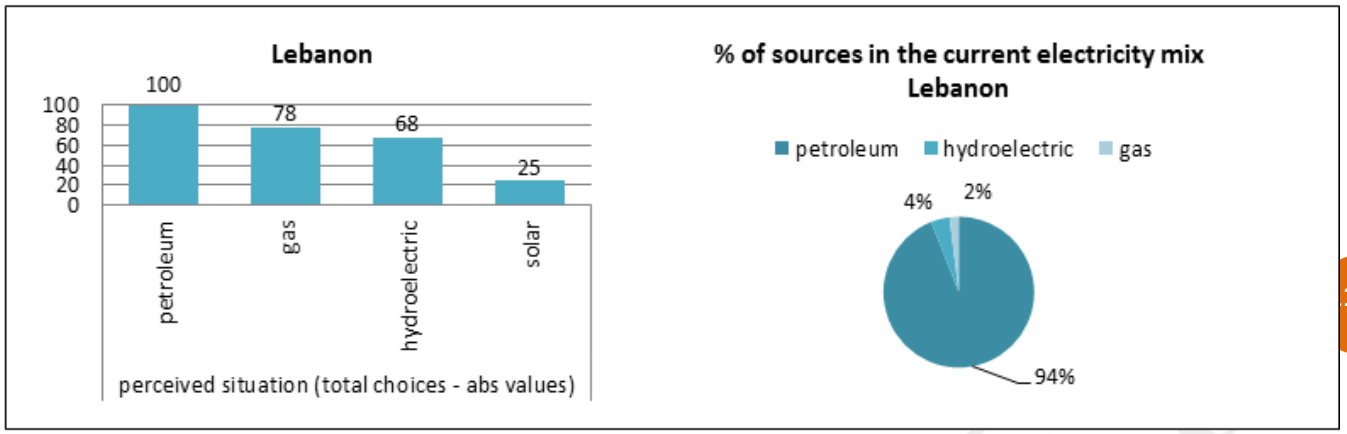
countries respondents indicate that fossil fuels are the most important energy source for production of electricity, but they believe that petroleum is mainly used, which is true only in Lebanon: in the other countries, natural gas is by far the most used fossil fuel. As regards the renewables sources in the electricity mix, it appears that Tunisian and Jordanian respondents overestimate solar and wind sources, and that Egyptian, Italian and Spanish respondents underestimate hydroelectric.

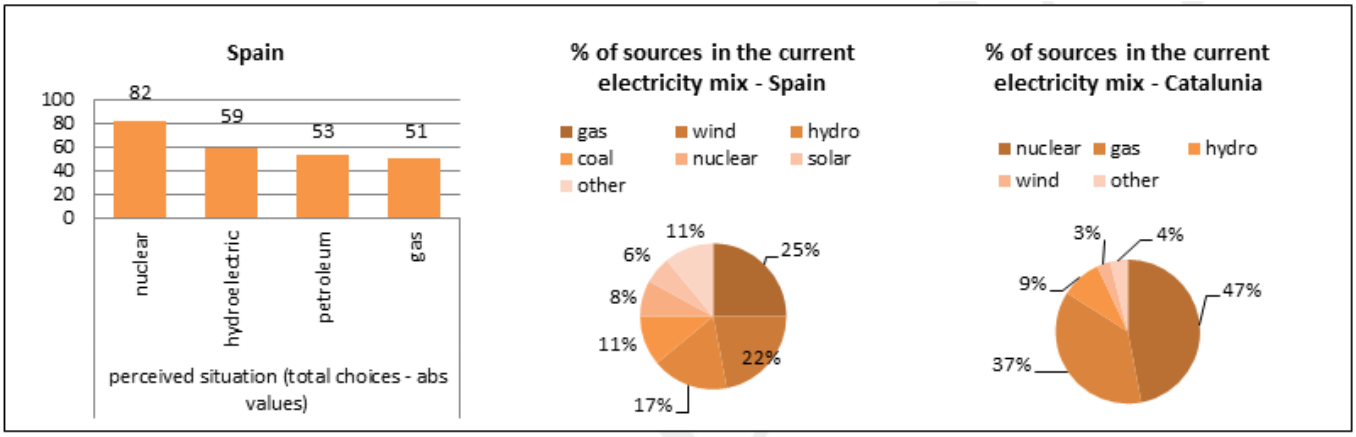
Nuclear energy is used only in Spain, as indicated by the respondents, and it looks like the respondents had made reference to the Catalonian rather than the national (Spanish) energy mix. Conversely, Italian responses reflect the national energy mix rather than the Sardinian.

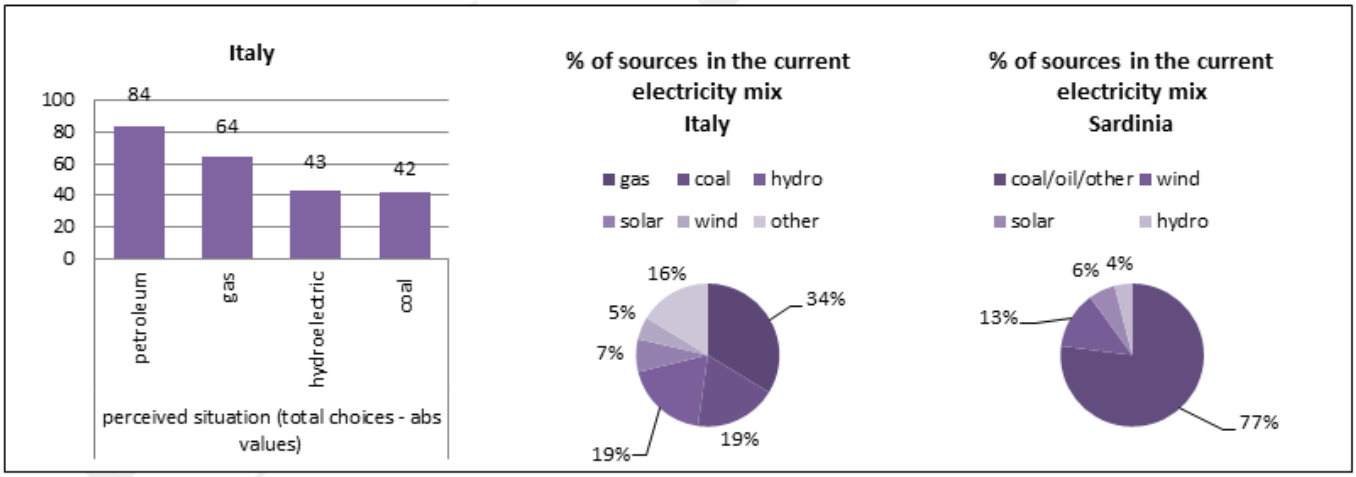










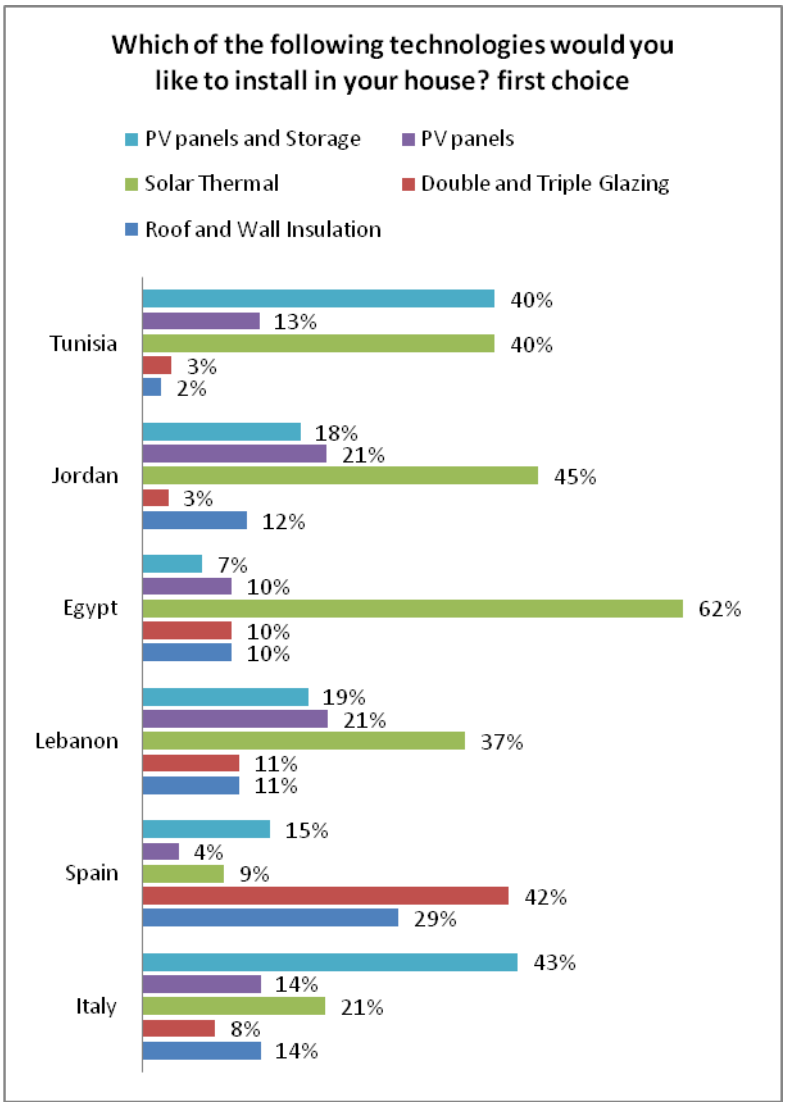


Source of data: Desk analysis (2012); national data for Spain are from Red Electrica de Espana (2013); Sardinian and Italian data are from ENEL and TERNA (2013)

Renewable technologies

Question 5. Which of the following technologies would you like to install in your house?

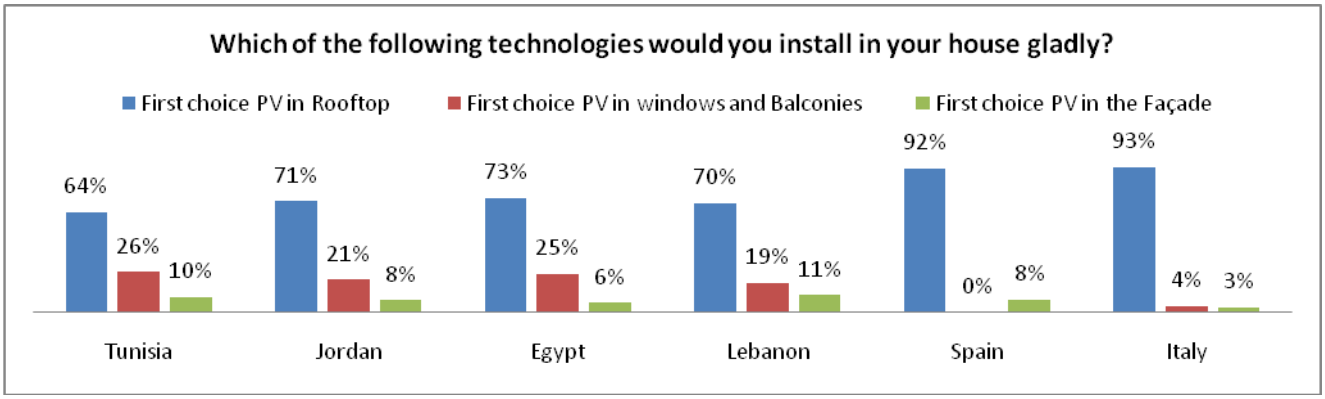
As anticipated above, many respondents in the MENA samples select the solar thermal technology as their first choice: particularly in Egypt, but also in Jordan this is on average the most preferred technology.
For Egypt, this result could be due to the fact that some recent laws try to improve the adoption of this technology (for example, in new compounds building have to be equipped with solar thermal, see Desk analysis chapter page 22). Besides, in Egypt solar thermal is widespread in the service sector, especially in health facilities and tourist structures, and there are some local manufacturers.
PV systems (with or without storage) are the first choice in Italy, Tunisia and Lebanon. It is interesting to note that in Italy, Tunisia and Spain PV with storage is selected more often than standard PV, while it is not the case for those countries where the often mentioned problem of energy outages is more serious.
The Spanish sample seems less interested in both thermal and PV solar energy production, and put in the first place energy saving measures: double and triple glazing and insulation.



Question 6. Considering only the PV technologies, which of the following technologies would you install in your house gladly?

Question 6 forces people to rank the three proposed PV technologies from the most preferred to the least preferred. The graph and the table below report the respondents' preferences on PV technologies. The main results could be summarized as follows:

- In all countries the standard technology with PV panels installed in the rooftop is the first choice for the majority of respondents, and even more so for Spain and Italy: there is possibly an anchoring effect to what is known, since these respondents have experience of seeing standard panels in the city buildings, but scarce (or none) experience of integrated PV in windows and balconies or in façades.
- Those who did not select the rooftop installation generally opted for the windows and balconies solution (with the exception of the Spanish sample)



	First choice			Second choice			Third choice		
	PV in Rooftop	**PV in windows and Balconies**	**PV in the Façade**	**PV in Rooftop**	**PV in windows and Balconies**	**PV in the Façade**	**PV in Rooftop**	**PV in windows and Balconies**	**PV in the Façade**
Tunisia	64%	26%	10%	14%	57%	29%	22%	17%	61%
Jordan	71%	21%	8%	12%	38%	50%	17%	41%	42%
Egypt	73%	25%	6%	16%	54%	28%	11%	21%	66%
Lebanon	70%	19%	11%	22%	47%	31%	8%	33%	58%
Spain	92%	0%	8%	7%	35%	58%	1%	65%	34%
Italy	93%	4%	3%	2%	72%	26%	5%	24%	71%

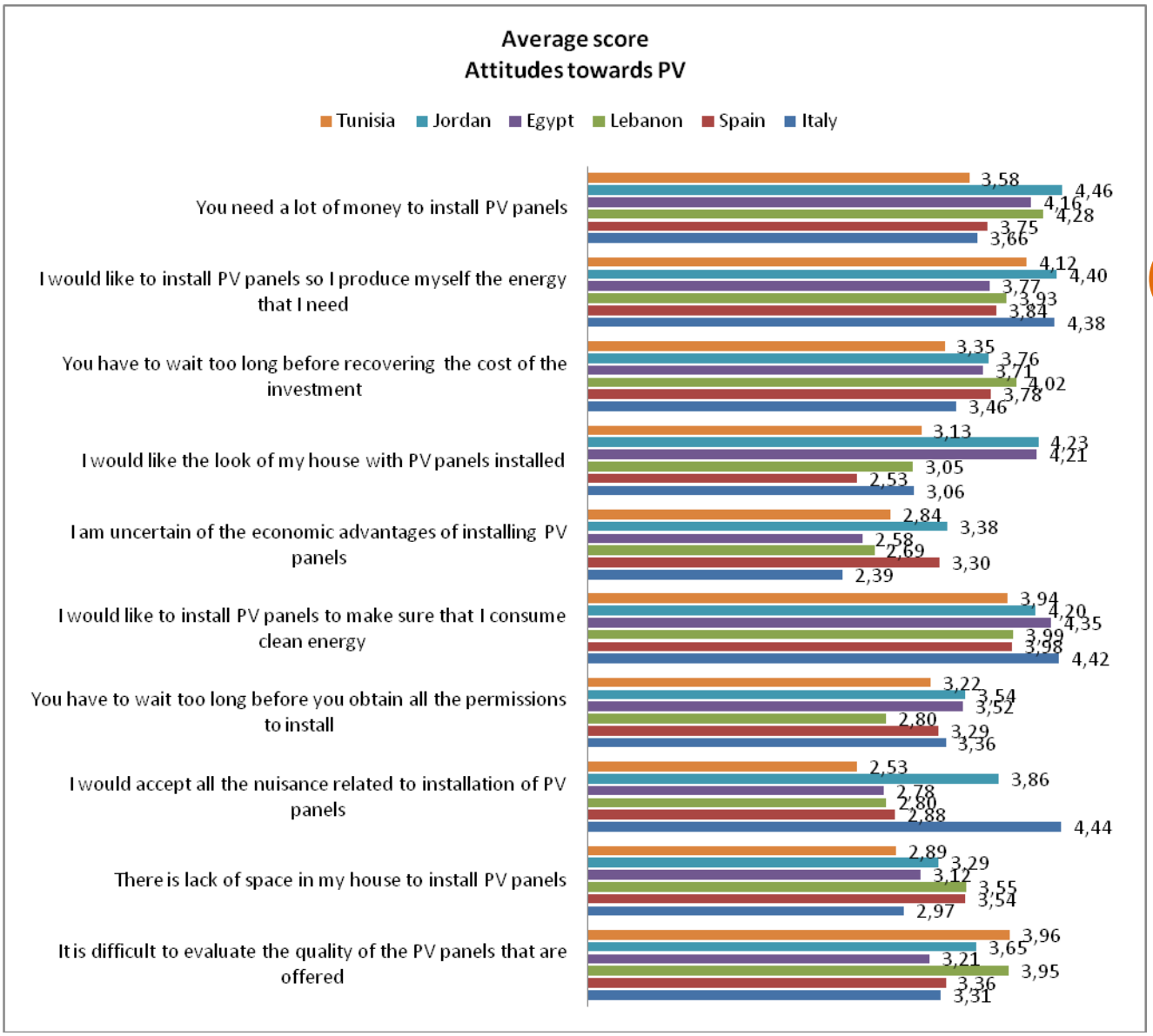
7. In the following question you are asked to indicate how much you agree or disagree with each statement regarding the PV technologies.

The next graph displays the average scores for each statement. In all samples, but especially in Jordan, Egypt and Lebanon, most people think that you need a lot of money to install a PV system in your house and, in a lesser measure, that the payback period would be too long. On the positive side, they would be happy to produce the electricity they need, and in most samples the respondents seem convinced of the economic advantages (only Spanish and Jordan respondents are not so sure).

The aesthetical considerations are mixed: while for Egyptians and Jordanians a PV system would ameliorate the aspect of the house, in the Italian, Lebanese and Tunisian samples the opinions are more neutral, and rather negative in the Spanish sample.

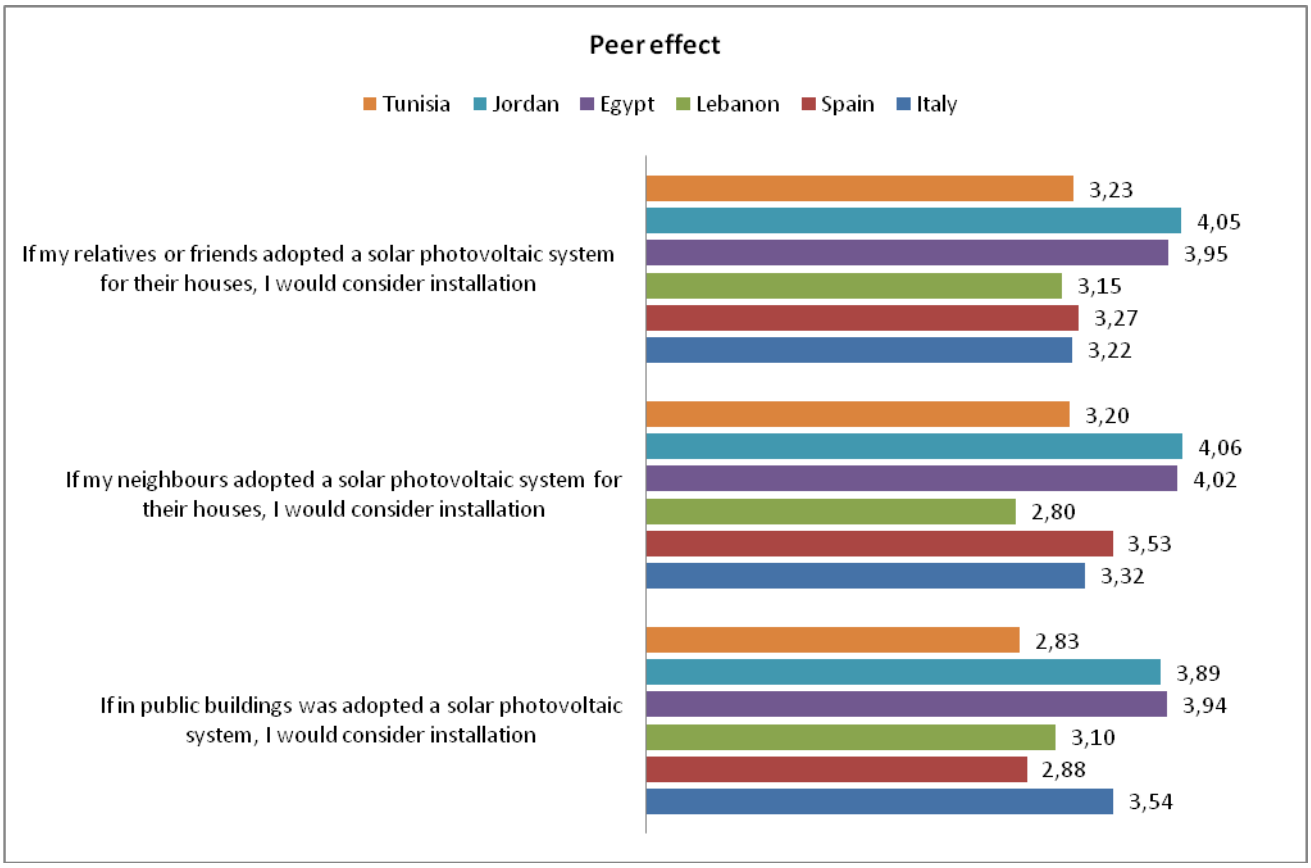
Concerning bureaucracy, respondents from all samples mildly agree that it would take a long time before obtaining all the necessary permissions; the only exception being Lebanon. This may be an obstacle for adoption, as well as consideration of other nuisances related to the installation: only Italian respondents seem quite ready to undergo the possible hassles, followed by Jordanians; the others are more undecided. Lack of space is often seen (also in our desk analysis and in-depth interviews stages) as one of the main barriers in the diffusion of PV systems in residential buildings, mainly in cities where condominiums are the most common typology of residential building. Most Lebanese people, followed by Jordanian and Spanish ones, agree that they have no enough space to install PV, while Egyptian, Tunisian and Italian people are split between positions.

The majority of respondents declares to be uncertain about the quality of PV panel you could buy: this problem is widely recognised in Lebanon, Italy, Tunisia and Jordan, while in Egypt and Spain many respondents have not a clear opinion. We recall that privileged interlocutors in the in-depth interviews signalled this as one of the main problems in the diffusion of PV panels in MENA countries.



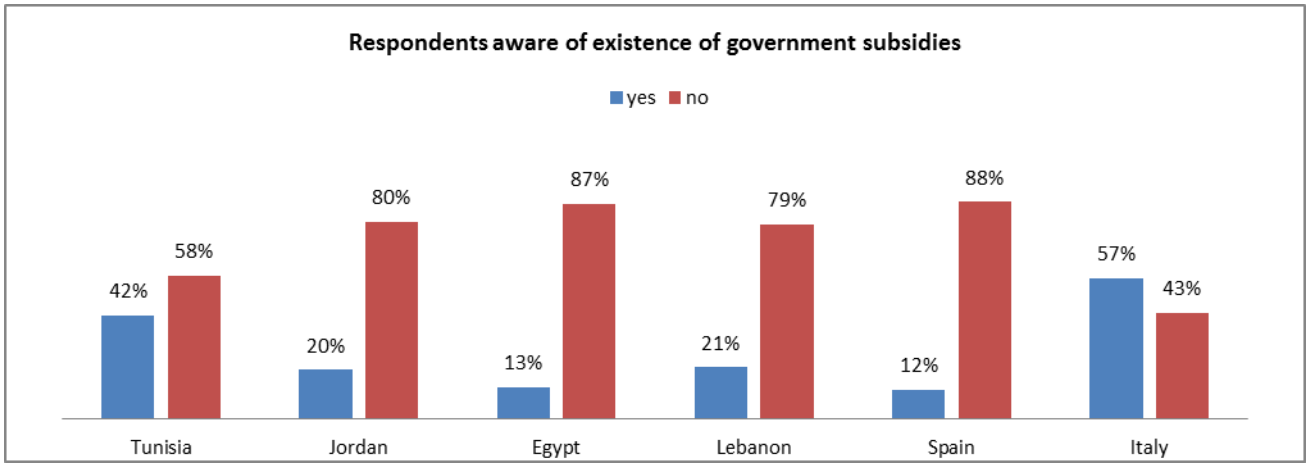
Question 8.In the following question you are asked to indicate how much you agree or disagree with each statement.

The following questions are aimed at understanding whetherthe respondents could be influenced by the choice made by relatives and friends, neighbours or public institutions. In the in-depth interviews we have seen that the role of example is indicated as one of the main tools to increase appreciation of PV technologies; more in general, imitation and “peer effect” is recognized as one of most important factors for the diffusion of a technology. Indeed we see that respondents in all samples, and especially those from Egypt and Jordan, show to be influenced by relatives’ and friends’ choices; and that a similar result holds for the influence of neighbours’ choices, with the exception of Lebanese respondents. Egyptian, Jordanian and in a lesser measure Italian respondents would also be influenced by the example of installations in public buildings, while respondents from other countries would not be so interested in this aspect.



Question 9.Are you aware of any government subsidies for renewable energy?

Only people who live in Italy indicate to have awareness of some form of public subsidies, while in all the other countries only a few percentage of people state to be aware. As shown in the following table, in almost all countries there are some subsidies or programs to promote PV: the communication could probably be improved.



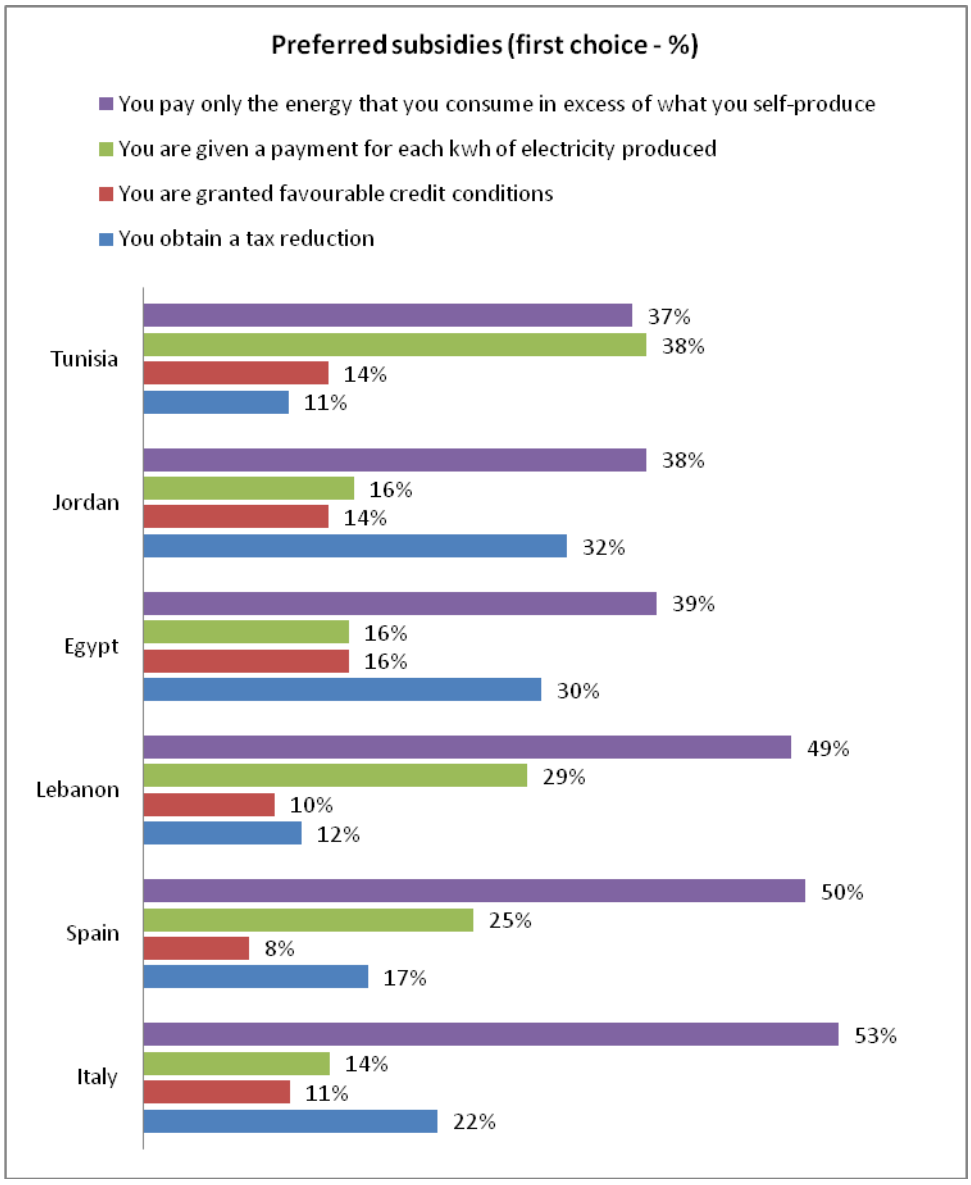
	Current subsidy programs
Egypt	Customs taxes reduction and technical assistance; feed-in tariff proposed
Lebanon	Loan incentives and net metering
Jordan	Customs and other tax reductions
Tunisia	Customs and tax reductions – Grants to install grid connected PV systems in buildings
Italy	Tax allowance for building renovation and energy efficiency –net metering
Spain	Currently, no incentives for PV in the residential sector; credit facilitations proposed.

Question 10. Suppose that the following subsidies are available to help installation of PV panels in residential buildings. Which one would you choose?

We presented a list of policy instruments commonly used by governments to sustain the diffusion of renewable energy investments in the residential sector, and asked the respondents to select and rank three options. The items are:

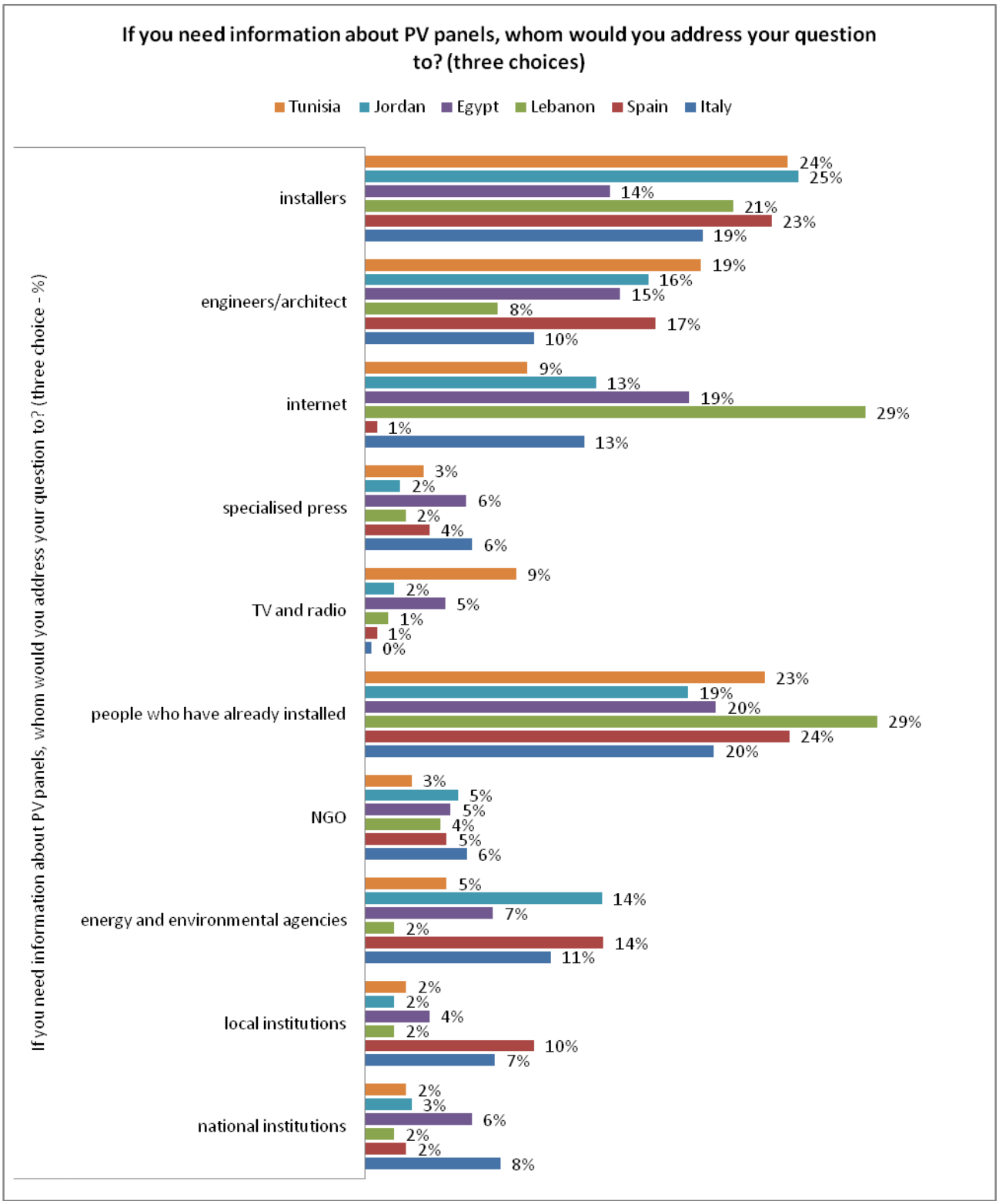
- A tax reduction (a tax allowance)
- Favourable credit conditions (lower interest rates than in the market)
- A payment for each kWh produced (a feed-in tariff system)
- Pay only the energy you consume in excess of what you self-produce (net metering)

The graph below shows that there is a strong preference in all countries for a system of net metering. Only in Tunisia this instrument is ranked second after a feed-in tariff system; the latter is the second best option for Lebanese and Spanish respondents, while Italians, Egyptians and Jordanians prefer a tax allowance. It can be interesting to confront these results with current or proposed programs adopted in these countries to support the adoption of PV technologies or other energy efficiency investments in the residential sector. Only in Lebanon and Italy there is a net metering program;in Jordan, Egypt and Tunisia there are reductions in customs; in addition, in Lebanon there are some loan incentives, which have also been proposed in Spain (where the feed-in tariff system has been abolished recently, and what is worse, with some retroactive effects); and in Italy there is a tax allowance (as regards Italy, we recall that the feed-in tariff system ended in 2013, and now the tax allowance is the only available incentive).



Question 11. If you need information about PV panels, whom would you address your question to?

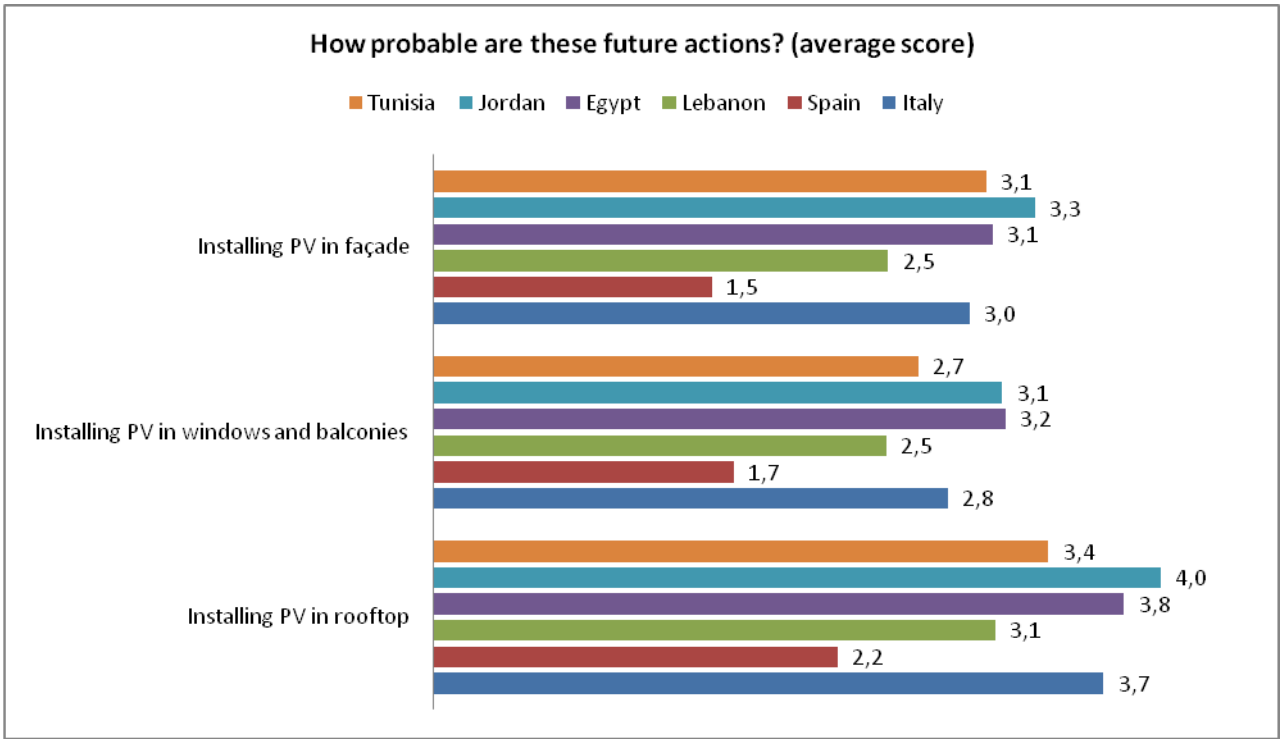
The in-depth interviews stressed the importance of conveying a correct information in order to enhance PV adoption, by increasing the level of confidence in the technology by consumers.
The graph below shows how people would collect information about PV. Generally, respondents would refer to people who have already installed PV systems in their houses, then to experts such as installers or engineers or architect, or would search through the Internet. The Spanish sample responds differently, since they would rely on energy and environmental agencies or local institutions rather than the Internet.
Generally speaking, traditional media such as specialised press and TV and radio are considered the less relevant sources. It is a not surprising result: in the in-depth interviews it merged that media - that is the main source of information for citizen about PV - do not transmit sufficient information about RE and PV technologies.



Question 12b. Howprobable are these future actions?

After the scenario-ranking experiment, which will be illustrated in detail in the next section, we asked people to indicate how probable they reckon that they will install one of the proposed PV technologies in the future.
The graph below show the average score for each sample of the individuals' stated probability to install a PV system in the rooftop and/or in windows and balconies and/or in the building façade.

The graph shows that overall the installation of PV in the rooftop receives higher scores: this is hardly surprising, since it was the best known (or in many cases the only known) PV technology. Anyway, the innovative technologies in windows and balconies and in façade seem to have received some attention in most samples. Lebanese and especially Spanish respondents show a lower propensity to invest in PV systems, and this is especially evident when the innovative technologies are considered.



Chapter 4.

Econometric results

PCA analysis

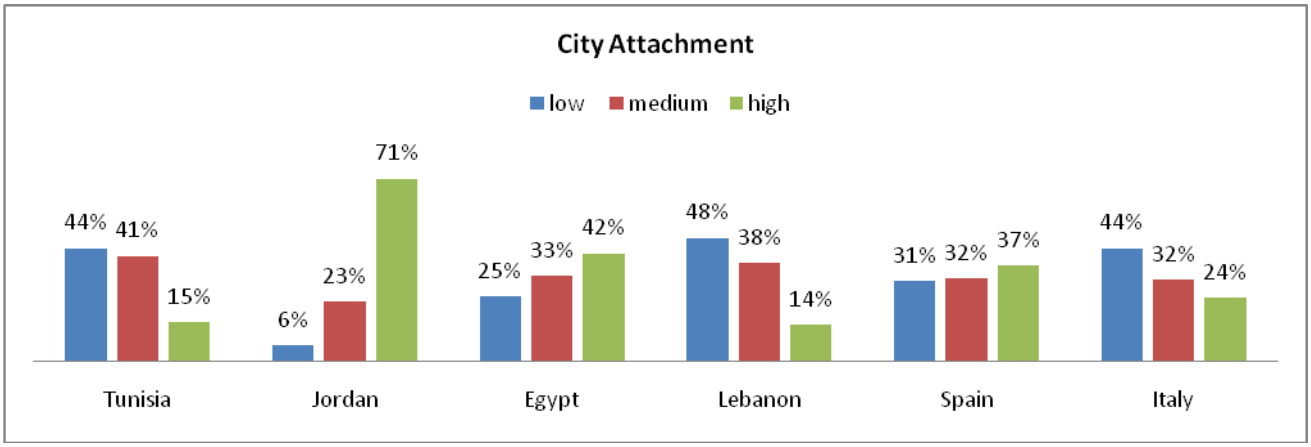
The information obtained through the Likert scales analysed in the previous section is used in the econometric analysis afterbeing processed with a Principle Component Analysis (PCA). PCA is a statistical technique that allows to summarize the data and identify individuals characterized by-different attitudes on specific issues under analysis.
The first three Likert scales in our questionnaire are related to the respondents' attitudes toward the city or neighbours or neighbourhoods. The PCA produces individual scores, which are transformed in a categorical variable: individuals with a high score are those more characterized by the description of the variables below.

As regards Question 1, the PCA provides a single component, characterizing people who:

- Are sorry to leave the city
- Feel theybelong to the city
- Think that the city where they live is really different from the others
- Feel havinga lot in common with other people
- Think that the city satisfy all their needs

We called this variable as "City Attachment".

This kind of attitude is especially common among Egyptian and Jordanianrespondents, and in a lesser measure Spanish. Anyway, it should be noticed that the score is individual: some Lebanese, Italian or Tunisian respondent could be classified as having a strong City Attachment, or the converse may be true for some Egyptian, Jordanian or Spanish respondents.

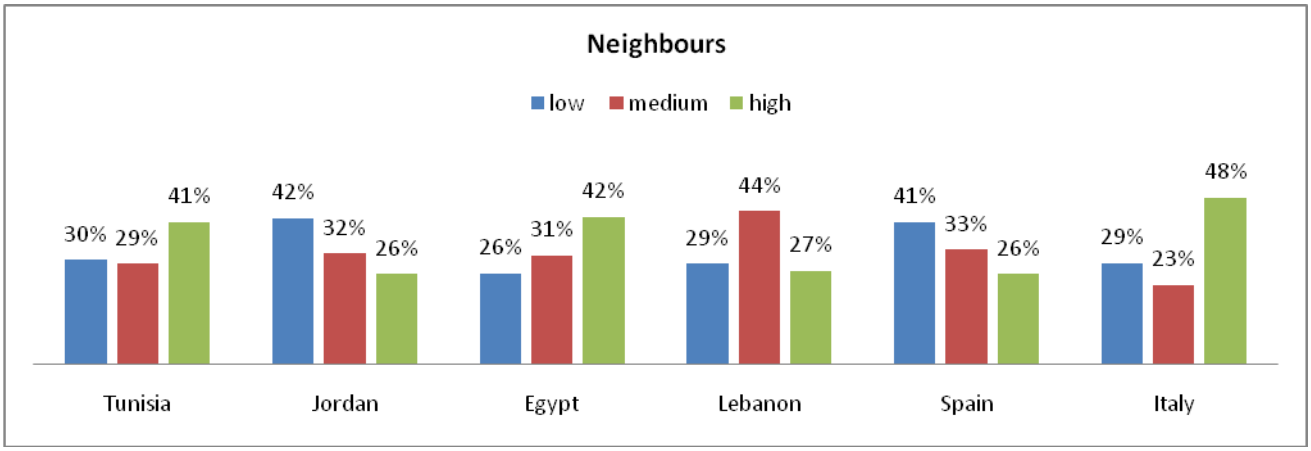


Regarding Question 2, the PCA again produces a single component, characterizing people who:

- Think that neighbours always criticise when you make some change
- Neighbours do not respect the environment
- Neighbours do not cooperate easily
- Neighbours do not show care for the neighbourhoods
- And are not sociable

We called this variable"Neighbours".

Data show that people who have not a good opinion of their neighbours are more common among Italian, Egyptian and Tunisian respondents.

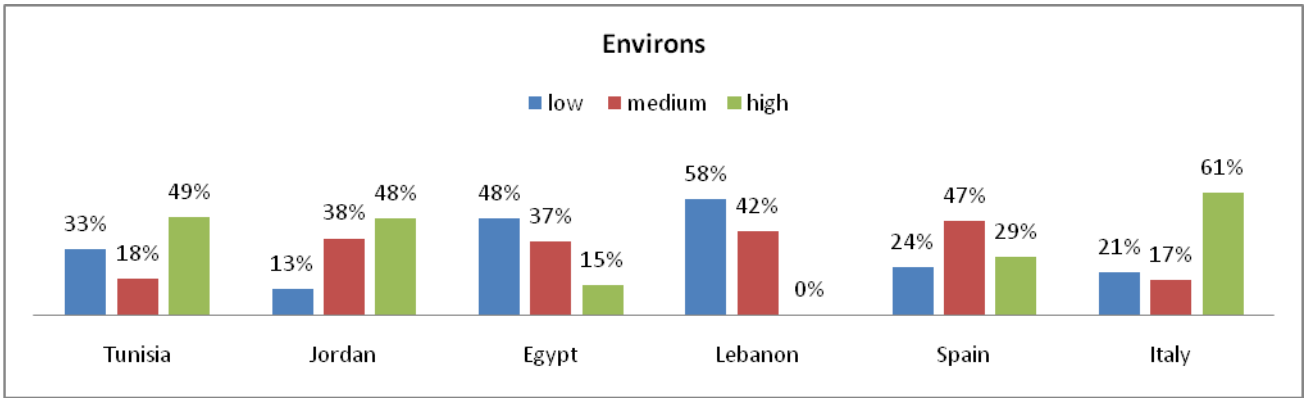


The PCA analysis on the third question statements produces a single component, which characterizes individuals who think that:

- The neighbourhood is more liveable respect to other more chaotic areas of the city, calm and not distressing
- The buildings in the neighbourhoodare in good conditions and with a pleasant aspect
- The neighbourhood is quiet and less polluted than other areas

We called this variable “Environs”.

People with this characterization are more common in the Italian, Tunisian and Jordanian samples, while they are very few in Lebanon.
This variable may be relevant because it could account for the aesthetic concerns about the shape of the buildings and the overall aspect of areas of the cities involved. The visual impact of PV installations on the urban environment was thoroughly discussed in the in-depth interviews stage of the research. While Italian and Tunisian privileged interlocutors raised concerns about the aesthetical changes that PV could determine, especially when talking of city centers, the Spanish ones were more positive on the architectural integration and innovation; and Egyptian, Jordanian and Lebanese stakeholders actually would see in PV applications an opportunity to improve the aesthetical aspect of many of their buildings and neighbourhoods.



The fourth question with a Likert scale regards individual attitudes toward PV. In this case the PCA analysis produced two components: broadly speaking, the first characterizes people who see PV pros, the second one people who see PV cons.

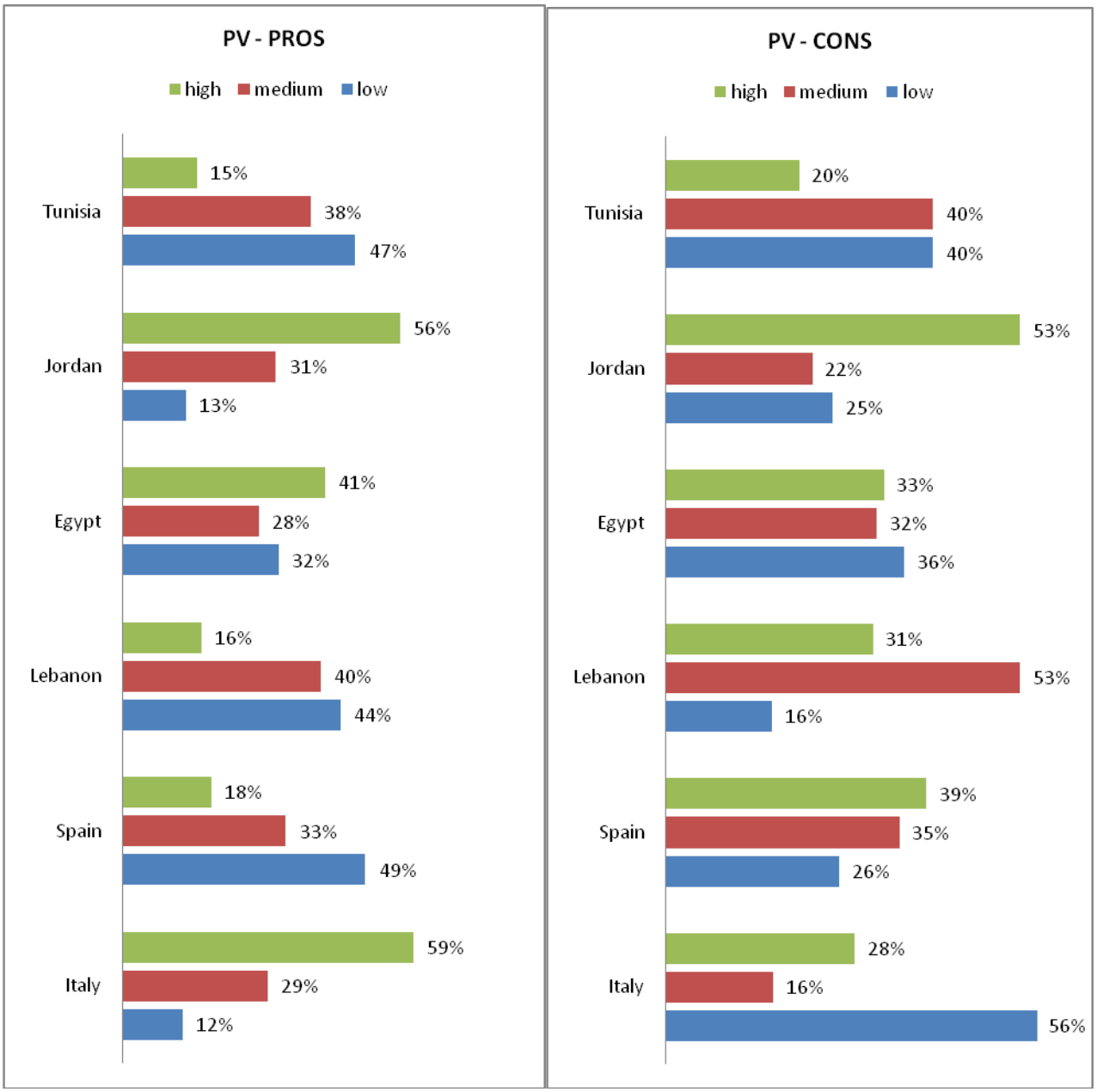
Respondents with high score in the first class:

- would like to install PV panels to produce themselves the energy that they need;
- would like the look of their house with PV panels installed;
- would like to install PV panels to make sure that they consume clean energy;
- would accept all the nuisance related to installation of PV panels.

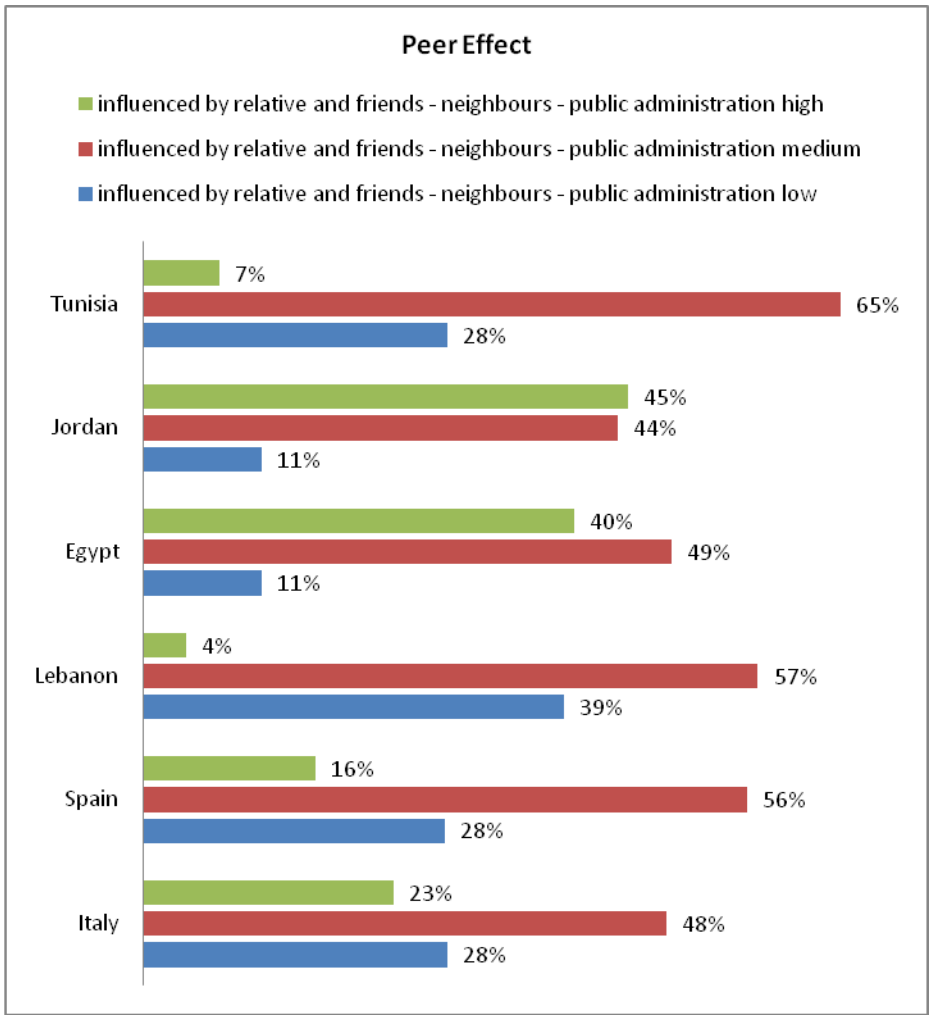
On the other hand, respondents with a high score in the second class would worry about

- the great amount of money required to install PV panels
- the long time required to recover costs;
- the bureaucracy
- the uncertain quality of PV panels offered
- the uncertain economic advantages of installing panels
- the lack of space in their houses

People from Italy have high scores in the first class, while people from Spain, and in a lesser measure form Lebanon, in the second class. Respondents from other countries are more or less equally distributed in the two classes.



The last PCA analysis is on the statements related to the influence by closest people, neighbours or public institutions. The PCA produced one component that characterizes the respondents who are strongly influenced by peers or public institutions. The graph below shows that these individuals are especially in the Jordan and Egyptian samples.


Peer Effect
influenced by relative and friends - neighbours - public administration high
influenced by relative and friends - neighbours - public administration medium
influenced by relative and friends - neighbours - public administration low
Tunisia
7%
65%
28%
Jordan
45%
44%
11%
Egypt
40%
49%
11%
Lebanon
4%
57%
39%
Spain
16%
56%
28%
Italy
23%
48%
28%

Econometric Models

In order to understand if there is any statistically relevant difference among countries in the choice of energy efficient technologies (question 5) we estimate a probit model for the probability of selecting each option as the first choice investment. The dummy variable for Italy is excluded to avoid perfect collinearity, so Italy is the reference base.
The results show:

- roof and wall insulation: with respect to Italians, only Tunisians and Spanish respondents have a statistically different behaviour: the former are less interested, while the latter are more interested in this option;
- double and triple glazing: the only statistically different behaviour is that of Spanish respondents, who are more interested in this option; individuals in all other countries respond on average in the same way;
- solar thermal: respondents from the MENA countries choose the Solar Thermal option more probably than Italians, Spanish respondents less probably, and the differences are all statistically significant;
- PV panels, only Spain shows a coefficient statistically significant: Spanish respondents are less interested in PV systems than Italians.
- PV panels plus storage: only Tunisians have a behaviour similar to Italians. The responses in all other countries are statistically different from Italy and show less interest in this new technology.

Probit estimation – Dependent Variable: First Choice is Roof and Wall Insulation YES =74 NO=526		
	Coefficients	**Standard Errors**
Tunisia	-0.927***	0.330
Jordan	-0.049	0.227
Egypt	-0.214	0.237
Lebanon	-0.155	0.233
Spain	0.543***	0.207
Constant	-1.126***	0.159
Log likelihood= -207.19		
N° observations: 600		
Pseudo R2= 0.075		
Level of significance: *** at 1%; ** at 5%; * at 10%		

Probit estimation – Dependent Variable: First Choice is Double and Triple Glazing YES =73 NO=527		
	Coefficients	**Standard Errors**
Tunisia	-0.476	0.310
Jordan	-0.476	0.310
Egypt	0.064	0.253
Lebanon	0.123	0.250
Spain	1.152***	0.222
Constant	-1.405***	0.182
Log likelihood= - 184.89		
N° observations: 600		
Pseudo R2= 0.168		
Level of significance: *** at 1%; ** at 5%; * at 10%		

Probit estimation – Dependent Variable: First Choice is Solar Thermal YES=197 NO=403		
	Coefficients	**Standard Errors**
Tunisia	0.483**	0.192
Jordan	0.716***	0.190
Egypt	0.942***	0.190
Lebanon	0.402**	0.193
Spain	-0.499***	0.227
Constant	-0.841***	0.142
Log likelihood= - 346.86		
N° observations: 600		
Pseudo R2= 0.087		
Level of significance: *** at 1%; ** at 5%; * at 10%		

Probit estimation – Dependent Variable: First Choice is PV panels YES= 78 NO=522		
	Coefficients	**Standard Errors**
Tunisia	-0.049	0.227
Jordan	0.320	0.213
Egypt	-0.214	0.237
Lebanon	0.248	0.215
Spain	-0.624**	0.277
Constant	-1.126***	0.159
Log likelihood= - 222.40		
N° observations: 600		
Pseudo R2= 0.041		
Level of significance: *** at 1%; ** at 5%; * at 10%		

Probit estimation – Dependent Variable: First Choice is PV panels plus a Storage device YES=132 NO=468		
	Coefficients	**Standard Errors**
Tunisia	-0.131	0.180
Jordan	-0.688***	0.193
Egypt	-1.327***	0.236
Lebanon	-0.727***	0.195
Spain	-0.853***	0.201
Constant	-0.227*	0.126
Log likelihood= - 288.95		
N° observations: 600		
Pseudo R2= 0.086		
Level of significance: *** at 1%; ** at 5%; * at 10%		

Next, we focus in particular on the latter option, with the aim of understanding who are the people who place first a PV system + storage among the different options for energy efficiency. It is important to stress the fact that this placement does not imply at all that these individuals will actually decide to make this investment, nor that they even imagine what they will: here the respondents were just asked to rank different technologies according to their preference, without any reference to future investment decisions.

Again we apply a Probit model, but now the individual characteristics are inserted in the model as regressors. In the table below we present the specification that best fits the data. The econometric analysis indicates that the profile of the individuals interested in this option is: most probably are males, they appreciate the positive aspects of the PV technology, and are aware of the existence of government subsidies for renewables. They would not rely on public agencies to gather information on the technology, and possibly pay higher than average electricity bills (although the latter coefficient is less significant). Even though they are not especially attached to the city where they live, they find their neighbourhood a nice place where to live.

Probit estimation – Dependent Variable: First Choice PV panels plus a Storage device YES=124 NO=403		
	Coefficients	**Standard Errors**
Male	0.355**	0.134
Total annual expense for electricity	0.138*	0.079
City attachment	-0.297***	0.088
Environ	0.221***	0.085
PV -Pros	0.413***	0.084
Subsidies awareness	0.340**	0.136
Information: energy and environmental agencies	-0.475***	0.156
Constant	-1.692***	0.242
N° observations= 527		
Log likelihood= -253.901		
Pseudo R2= 0.117		
Level of significance: *** at 1%; ** at 5%; * at 10%		

Another question (q. 12b) focused on the investment intention: we asked the respondents to evaluate the probability of making an investment in a PV system in the near future. The Likert scale range from 1: sure not to invest, to 5: sure to invest. In the next analysis we characterize the profile of people who stated to be sure to make this investment. We construct a dummy variable that takes value 1 for those people who indicated they are certain to install a PV system in the near future, and 0 for all other options. The table below reports the econometric results.

Probit estimation – Dependent Variable: people who are sure to install a PV technology in the future YES= 144 NO= 444		
	Coefficients	**Standard Errors**
People who live in the city centre	0.451**	0.207
People who live in a detached building	0.594***	0.182
People who use electric boilers	0.519***	0.143
People who have already adopted electric saving bulbs	0.216	0.154
City attachment	0.428***	0.090
PV-Pros	0.338***	0.089
PV panels or PV panel plus storage preferred technology	0.611***	0.141
Peer effect	0.566***	0.102
Subsidies awareness	0.320**	0.152
Information: people who have already installed a PV technology	-0.183	0.144
Information: NGOs	0.561***	0.180
Information: local institutions	-0.425**	0.204
Constant	-3.070***	0.275
N° observations: 588		
Log Likelihood: -228.455		
Pseudo R2= 0.302		
Level of significance: *** at 1%; ** at 5%; * at 10%		

People who have a positive attitude and attachment toward the city where they live are more interested to invest in PV systems.As expected, living in a detached house positively influence the stated probability of investment; and conversely, living in a condominium – the common condition in the cities involved in the project – will be a hinder: people living in an independent house have to face less stringent rules (and, as emerged in the in-depth interviews, they do not have to ask permissions to other tenants). The “adopters” are well informed of the existing subsidies to promote these technologies. They would be further pushed by seeing PV systems installed in friends/relatives/neighbours households, or in public buildings. They would prefer to gather information from NGOs: a possible interpretation is that these organizations are seen as not having a direct economic interest in selling or installing PV, like installers or engineers/architects, or other interests in the diffusion of PV such as local institutions. NGOs may be seen as providing a more“neutral” source of information. A more direct source of information would be seeing how the PV system works in other households or in public buildings; on the other hand these innovators would not base their decision on the information coming from people who have already installed the technology: as it will be discussed below, this is due to the fact that in this group of innovators there are people who would like to install new technologies, such as PV in façade or in windows and balconies, which could hardly be found when the survey took place. It is noticeable that both the specialised press and the Internet are not considered as a useful form of information by this group of respondents (the variables are not included as they were steadily not significant): this result contrasts with the findings in the in-depth interviews stage of the research, where many stakeholders indicated the Internet as the most important source of information for people interested in this technology. It may be argued that the Internet could provide at a first stage, general information while people really interested in buying a PV system will seek further information from the aforementioned sources.

In the following model we analyse the common traits and the differences between stated preference for the traditional PV technology (PV installed in rooftops) and the innovative technologies installed in the windows/balconies and in the façade. The dependent variables are

dummies constructed, as before, assigning the value 1 to those individuals who stated their intention to invest in the specific technology for sure, and 0 otherwise. The estimated model is a bivariate probit, which allows for correlation between the two choices.

Biprobit estimation – Dependent Variable: people who are sure to install a PV technology in the rooftop in the future YES= 116 NO=472		
	Coefficients	**Standard Errors**
People who live in the city centre	0.495**	0.211
People who live in a detached building	0.472***	0.179
People who use electric boilers	0.371***	0.145
People who have already adopted electric saving bulbs	0.119	0.156
City attachment	0.346***	0.092
PV positive	0.341***	0.091
PV panels or PV panel plus storage preferred technology	0.480***	0.144
Peer effect	0.492***	0.104
Subsidies awareness	0.249	0.154
Information: people who have already installed a PV technology	-0.144	0.146
Information: NGOs	0.495***	0.179
Information: local institutions	-0.290	0.205
Constant	-2.877***	0.273
Biprobit estimation – Dependent Variable: people who are sure to install a window/balcony or façade PV technology in the future YES= 73 NO= 515		
People who live in the city centre	0.451*	0.238
People who live in a detached building	0.291	0.205
People who use electric boilers	0.470***	0.173
People who have already adopted electric saving bulbs	0.478**	0.198
City attachment	0.388***	0.111
PV positive	0.367***	0.111
PV panels or PV panel plus storage preferred technology	0.342**	0.169
Peer effect	0.486***	0.119
Subsidies awareness	0.209	0.180
Information: people who have already installed a PV technology	-0.453***	0.166
Information: NGOs	0.424**	0.197
Information: local institutions	-0.529**	0.264
Constant	-3.371***	0.350
N° observations: 588		
Log Likelihood: -370.835		
Rho= 0.389		
Level of significance: *** at 1%; ** at 5%; * at 10%		

Both choices are related to a positive attitude toward the city and PV technology; examples by peers and institutions can influence both choices; the use of electric boilers in the household seems also a push to invest in both PV technologies. The main differences are in the dwelling characteristics: people living in condominiums are more likely to select the façade and windows/balconies integrated technologies; and in the source of information, since individuals who select the more innovative technologies are less likely to seek information from people who have already installed, and from local installers. It is confirmed the important role of NGOs in providing reliable information to this category of "innovators".

Choice Experiment

The last part of the questionnaire was dedicatedto a choice experiment: respondents were requested to rank four alternative options in two sets of exercises.
In the first set we present 4 pictures of a large building and 4 pictures of a small building; both buildings are representative of the actual build environment in each town were the survey has been administered. The first picture is: 1) the "status quo" option; the next three are renderings with a modification in the façade due to the installation of 2) monocrystalline PV panels plus some coloured polycrystalline glasses in the balconies;3) coloured polycrystalline glasses in the façade and in the balconies or windows;4) in this last case, we proposed different solutions depending on the building: in some cases, coloured polycrystalline glass in the balconies and a solar shading PV technology in the windows, in other cases a coloured amorphous glass in the façade. We refer to these options as 2): "monocrystalline", 3): "polycrystalline" and 4): "special case". In this first exercise set we provided information on the type of technology shown, but no other information was added on the production or costs of each installation. The respondents were asked to rank the status quo and the alternative options just based on their aesthetic preferences.
The aim of this exercise is to analyse how the respondents evaluate the application of PV modules in the façade of a building: it is important to stress (and this was done after the exercises) that these pictures do not represent real cases or real architectural projects and are not be taken as a real nor a desirable example of BIPV.
The second exercise proposed the same large and small building pictures but we included some information about the percentage of an average household electric consumption covered by the PV installation proposed and the cost of purchasing the technology (without installing cost). The numbers provided were roughly indicative of the different cost/efficiency ratio of the different technologies, but could not be taken as an example of real costs and production level (and again this was recalled after the exercise). The aim of the exercise is to understand if information on the economic aspects pertaining to the proposed technologies could have an effect on their social acceptability.
The exercises, with the pictures and relevant information, are reported in Appendix.
The econometric results of the ranked ordered logit models are reported in the Tables below. It should be noted that the cases are less than 600 in the estimations because some individuals did not complete the exercises (11 and 12 respondents for, respectively, the exercises with the Large and the Small buildings).

Large Building:

- Italian, Tunisian and Jordanian respondents prefer all PV solutions to the status quo. In particular, Italians like best the special case (a solar shading technology), while this is the least preferred application in all other countries. Egyptian and Lebanese respondents pre-

fer the status quo; while for Spanish respondents the status quo is not significantly different from the monocrystalline and the polycrystalline, but they are all preferred to the special case.

- After economic information has been provided, the rank of preferences changes: in the Italian sample, now the monocrystalline is the best, followed by polycrystalline, special case, and the status quo the least preferred. Also for Jordanian and Lebanese respondents there is a switch in the position of the mono and polycrystalline applications; the latter is now the preferred option for Jordanians, while for Lebanese the status quo remains the best. In Egypt individuals are now undecided between the status quo and all other options; conversely, in Spain the order is now more clear, with the monocrystalline preferred to polycrystalline, then the special case, and the status quo ranked worst.

-

Ranked ordered logit – Dependent Variable: picture ranking Large building BASE: each country*status quo				
	no economic information		**with economic information**	
	Coefficients	**Standard Errors**	**Coefficients**	**Standard Errors**
Italy*monocrystalline	2.013***	0.254	3.744***	0.35
Italy*coloured polycrystalline glasses	1.805***	0.247	2.861***	0.331
Italy*special case	2.121***	0.253	2.357***	0.32
Tunisia*monocrystalline	2.132***	0.238	3.282***	0.3
Tunisia *coloured polycrystalline glasses	2.01***	0.234	2.890***	0.287
Tunisia *special case	0.905***	0.215	1.567***	0.254
Jordan*monocrystalline	1.54***	0.217	3.501***	0.302
Jordan *coloured polycrystalline glasses	1.649***	0.221	2.408***	0.277
Jordan *special case	1.196***	0.22	1.625***	0.253
Egypt*monocrystalline	-0.939***	0.201	0.149	0.187
Egypt *coloured polycrystalline glasses	-1.138***	0.207	-0.149	0.195
Egypt *special case	-1.473***	0.225	-0.283	0.21
Lebanon*monocrystalline	-0.49***	0.179	-0.403**	0.187
Lebanon *coloured polycrystalline glasses	-0.479***	0.182	-0.568***	0.186
Lebanon *special case	-1.682***	0.213	-3.346***	0.361
Spain*monocrystalline	-0.194	0.183	1.332***	0.202
Spain *coloured polycrystalline glasses	-0.12	0.178	1.25***	0.201
Spain *special case	-1.119***	0.197	0.644***	0.197
Number of observations	2356		2356	
Number of cases	589		589	
Log Likelihood	-1606.081		-1387.288	
Level of significance: *** at 1%; ** at 5%; * at 10%				

Small building

- Also in the small building exercise Italian, Tunisian and Jordanian respondents prefer the options with an installation, while the respondents from other countries prefer the status quo. The special case is again the less appreciated technology in all countries but Italy, where it ranks second.
- When information on electricity production and investment costs is added, the preferences change. Tunisian and Jordanian respondents now prefer the monocrystalline to the polycrystalline; the monocrystalline and special case switch positions for Italians. More importantly, in the other countries there is not any more a clear preference for the status quo option: Lebanese respondents now rank the same the status quo and the monocrystalline, while the other technologies are still less preferred. The preferences stated by Spanish and Egyptian respondents change a lot: Spanish respondents now prefer the monocrystalline PV application, followed by the polycrystalline which is preferred to both the status quo and the special case; while for Egyptian respondents, all options now are ranked the same:
-

Ranked ordered logit – Dependent Variable: picture ranking Small building BASE: each country*status quo				
	no economic information		**with economic information**	
	Coefficients	**Standard Errors**	**Coefficients**	**Standard Errors**
Italy*monocrystalline	0.693***	0.207	1.998***	0.242
Italy*coloured polycrystalline glasses	1.789***	0.216	2.196***	0.238
Italy*special case	1.356***	0.209	1.228***	0.219
Tunisia*monocrystalline	2.31***	0.261	3.67***	0.327
Tunisia *coloured polycrystalline glasses	2.312***	0.262	3.311***	0.316
Tunisia *special case	1.708***	0.251	1.559***	0.26
Jordan*monocrystalline	1.401***	0.212	3.59***	0.3
Jordan *coloured polycrystalline glasses	1.709***	0.217	2.435***	0.264
Jordan *special case	1.124***	0.212	1.215***	0.229
Egypt*monocrystalline	-0.48**	0.193	0.181	0.187
Egypt *coloured polycrystalline glasses	-0.953***	0.207	0.000	0.199
Egypt *special case	-1.297***	0.218	-0.098	0.205
Lebanon*monocrystalline	-0.457**	0.179	-0.093	0.187
Lebanon *coloured polycrystalline glasses	-1.043***	0.19	-1.109***	0.201
Lebanon *special case	-1.735***	0.212	-3.473***	0.355
Spain*monocrystalline	-0.249	0.179	1.684***	0.214
Spain *coloured polycrystalline glasses	-0.073	0.187	1.677***	0.216
Spain *special case	-1.344***	0.21	-0.038	0.198
Number of observations	2352		2352	
Number of cases	588		588	
Log Likelihood	-1603.941		-1364.737	
Level of significance: *** at 1%; ** at 5%; * at 10%				

Finally, we analyze the experimental data applying a specification with individual characteristics covariates.

Large Building:

- Individuals who see the positive elements of the PV technology, and individuals well informed of the governmental subsidies for investments in energy efficiency, prefer all PV solutions to the status quo. This result is hardly a surprise, since these individuals are evidently especially interested in technical innovations, and particularly in PV, that enhance the energy performance of the buildings. Somehow more unexpected is the strong positive effect of the variable related to the positive feelings that individuals have toward their environs: it seems that this class of people is particularly attracted by renovation in the façade of the buildings that involves application of PV modules. The ranking of the three applications is varies with covariates: for example, PV-pros is associated with a preference for the “special case” application, while environ is associated with a preference for the monocrystalline application. People who would be influenced by the example of peers and public institutions also prefer the applications to the status quo, even though the effect is less prominent; while it is interesting to see how people who would seek information on PV systems on the Internet or from people who have already installed clearly propend for the status quo option.
- After that economic information has been provided, more respondents prefer the PV applications to the status quo. The variable pertaining to people who would seek information from installers now becomes more significant (these individuals are now more interested in the PV applications), while loses significance the variable relative to information from people who have already installed (these individuals are now less negative towards the innovative PV applications). The rank of preferences changes for PV-Pros people: they now rank the monocrystalline (which is generally the most cost-efficient technology) as their favourite application, and the special case is now the least preferred of the technical solutions.

Ranked ordered logit – Dependent Variable: picture ranking Large building BASE: each country*status quo				
	no economic information		with economic information	
	Coefficients	Standard Errors	Coefficients	Standard Errors
Environs*monocrystalline	0.971***	0.178	1.568***	0.216
Environs *coloured polycrystalli-neglasses	0.953***	0.177	1.289***	0.207
Environs *special case	0.948***	0.176	1.167***	0.196
PV positive *monocrystalline	0.434***	0.169	1.166***	0.199
PV positive *coloured polycrys-talline glasses	0.608***	0.17	0.822***	0.192
PV positive*special case	0.677***	0.171	0.699***	0.185
Peer effect*monocrystalline	0.289*	0.157	0.16	0.171
Peer effect *coloured polycrystal-line glasses	0.316**	0.155	0.277*	0.166
Peer effect *special case	-0.033	0.158	0.073	0.163
Subsidies*monocrystalline	0.919***	0.192	0.982***	0.221
Subsidies *coloured polycrystal-lineglasses	0.947***	0.191	1.011***	0.215
Subsidies *special case	0.837***	0.188	0.824***	0.206
Asking information to people who have already in-stalled*monocrystalline	-0.245	0.153	0.334**	0.163
Asking information to people who have already installed *coloured polycrystalline glasses	-0.394***	0.153	0.14	0.159
Asking information to people who have already installed *special case	-0.758***	0.154	-0.2	0.157
Asking information to install-ers*monocrystalline	0.144	0.155	0.437***	0.167
Asking information to installers *coloured polycrystalline glasses	0.256*	0.153	0.51***	0.161
Asking information to installers *special case	0.075	0.154	0.399**	0.158
Looking for information on the Internet*monocrystalline	-0.339**	0.149	-0.377**	0.163
Looking for information on the Internet *coloured polycrystalline glasses	-0.555***	0.151	-0.727***	0.157
Looking for information on the Internet *special case	-0.446***	0.155	-1.15***	0.16
Number of observations	2356		2356	
Number of cases	589		589	
Log Likelihood	-1726.456		-1560.641	
Level of significance: *** at 1%; ** at 5%; * at 10%				

Small building

- Also in the small building exercise the covariates PV-Pros, environs, subsides and examples are associated with a preference for the PV applications; the "special case" application seems attractive (especially for PV-Pros people, and individuals informed of subsidies, but also the residents satisfied with their environs). The variables relative to information on the internet and information from people who have already installed are associated with preference for the status quo.
- When economic information is provided, the interest toward the PV applications increases, and the preferences shift toward the more productive technologies, i.e. monocrystalline and polycrystalline, while the less productive solution, i.e. the "special case", is generally ranked last among the technological options.

Ranked ordered logit – Dependent Variable: picture ranking Small building BASE: each country*status quo				
	no economic information		**with economic information**	
	Coefficients	**Standard Errors**	**Coefficients**	**Standard Errors**
Environs*monocrystalline	0.516***	0.172	1.211***	0.201
Environs *coloured polycrystalli-neglasses	0.929***	0.174	1.259***	0.195
Environs *special case	0.867***	0.17	1.011***	0.182
Positive attitude toward PV *monocrystalline	0.396**	0.165	0.962***	0.193
Positive attitude toward PV *coloured polycrystalline glasses	0.576***	0.17	0.767***	0.187
Positive attitude toward PV *special case	0.628***	0.169	0.709***	0.178
Peer effect*monocrystalline	0.477***	0.154	0.738***	0.17
Peer effect *coloured polycrystal-line glasses	0.359**	0.157	0.517***	0.165
Peer effect *special case	0.099	0.157	0.234	0.159
Subsidies*monocrystalline	0.212	0.184	0.431**	0.209
Subsidies *coloured polycrystal-lineglasses	0.417**	0.184	0.575***	0.201
Subsidies *special case	0.601***	0.18	0.544***	0.19
Asking information to people who have already in-stalled*monocrystalline	-0.342**	0.151	0.075	0.161
Asking information to people who have already installed *coloured polycrystalline glasses	-0.521***	0.154	-0.028	0.158
Asking information to people who have already installed *special case	-0.768***	0.151	-0.512***	0.151
Asking information to install-ers*monocrystalline	0.362**	0.15	0.652***	0.165
Asking information to installers *coloured polycrystalline glasses	0.695***	0.151	0.581***	0.159
Asking information to installers *special case	0.228	0.151	0.143	0.152
Looking for information on the	-0.207	0.148	-0.406**	0.16

Internet*monocrystalline				
Looking for information on the Internet *coloured polycrystalline glasses	-0.598***	0.15	-0.674***	0.156
Looking for information on the Internet *special case	-0.515***	0.15	-0.839***	0.156
Number of observations	2352		2352	
Number of cases	588		588	
Log Likelihood	-1736.221		-1556.999	
Level of significance: *** at 1%; ** at 5%; * at 10%				

Conclusions

As discussed in the Introduction, the results of our research cannot be used to make inference on the population of the cities where the survey was administered: the samples are not representative of the populations. However, we gain some interesting insights on the characteristics of the individuals who may generate a potential demand for innovative PV technologies, and on drivers or hinders to the adoption of PV systems in the residential sector.

Some of the hypotheses that emerged in the desk analysis and in the in-depth interviews had been confirmed by our results: for example, how citizens relate with their city and their neighbourhoods, the role of awareness and information, the importance of demonstrative projects that can raise such awareness, especially regarding the economic and productive aspects of the technology.

Indeed, we have seen that potential "adopters" (i.e. those individuals who said that they are certain to install a PV system in their house in the near future) have a positive attitude and attachment toward the city where they live. They are well informed on the existing subsidies to promote these technologies, and would be further pushed toward the investment if they could see PV systems installed in friends/relatives/neighbours households, or in public buildings.

As expected, space constraints may be a hinder to the decision to install a PV system: innovative PV modules that do not require permissions (by authorities or by other tenants in the condominium) could help to circumvent the problem.

Another relevant issue is how the information is conveyed. Although in the in-depth interviews the Internet was often identified as a good source of information that would help the diffusion of PV technologies, our results show that it is important that other sources are available for those who are seriously interested in the investment; moreover, this information should be perceived as "neutral", i.e. not coming from professionals or organizations that hold a private interest in the investment.

Similar results were found when we examined the social acceptability of different PV applications on residential buildings in the urban context. Individuals characterized by positive feelings toward the environmental aspect of their neighbourhood are especially keen on the PV applications, that are strongly preferred to the status quo solution (with no PV modules installed). The role of specific information, awareness of the pros of the PV technology, and of governmental subsidies are also positively associated to this kind of preference: this is clearly confirmed in the experiments, since when technical and economic information is provided, the preferences for the most beneficial technologies increase significantly.

Finally a comparative analysis across partner countries reveals that Italian, Tunisian and Jordanian respondents seem to be the most interested in PV technologies, either when considering a possible investment for their household, and when evaluating PV applications in the buildings presented in the choice experiment. The Spanish respondents are those who especially see the problems and risks associated with a PV investment (here the recent problems related to the termination of the feed in tariff system, and the retroactivity of some effects may have played a role); and would be more interested in other types of energy efficiency investments. Also in the choice experiments they propend for the status quo, and switch preference only in front of clear economic advantages. Lebanese and Egyptian respondents are in between the two positions: it seems that much more work should be required to raise awareness of the benefits of PV applications in the residential sector especially in the latter three countries.

References

Bonaiuto M., Fornara F., Bonnes M. (2003). *Indexes of perceived residential environmental quality and neighbourhood attachment in urban environments: a confirmation study on the city of Rome*. Landscape and Urban Planning 65(1-2), pp. 41-52

Claudy M.C., Michelsen C., O' Driscoll A. (2011). *The diffusion of microgeneration technologies – assessing the influence of perceived product characteristics on home owners' willingness to pay*. Energy Policy, 39(3), pp. 1459-1469

Claudy M.C., Michelsen C., O' Driscoll A., Mullen M.R. (2011). *Consumer awareness in the adoption of microgeneratio technologies: an empirical investigation in the Republic of Ireland*. Renewable and Sustainable Energy Reviews, 14(7), pp. 2154-2160

Fawcett W., Ellingham I., Platt S. (2008). *Reconciling the architectural preferences of architects and the public: the ordered preference model*. Environment &Behavior 40(5), pp. 599-618

Kinab E., Elkhoury M. (2012). *Renewable energy in Lebanon: Barriers and solutions*. Renewable and Sustainable Energy Reviews, 16(7), pp. 4422-4431

Scarpa R., Willis K. (2010). *Willingness-to-pay for renewable energy: Primary and discretionary choice of British households' for micro-generation technologies*. Energy Economics, 32(1), pp. 129-136

Strazzera, E., Mura M., Contu D. (2012). *Combining choice experiments with psychometric scales to assess the social acceptability of wind energy projects: A latent class approach*. Energy Policy, 48, pp. 334-347, Elsevier

Strazzera, E., Mura M., Statzu V. (2012). *Powering the change: a Contingent Valuation study on the determinants of demand for green vs. brown energy*. Journal of Environmental Economics and Policy, 1(2), pp. 146-173, Routledge

White E.V., Gatersleben B. (2011). *Greenery on residential buildings: Does it affect preferences and perceptions of beauty?*. Journal of Environmental Psychology 31, pp. 89-98

Zyadin A., Puhakka A., Ahponen P., Cronberg T., Pelkonen P. (2012). *School students' knowledge, perceptions, and attitudes toward renewable energy in Jordan*. Renewable Energy 45, pp. 78-85

Zyadin A., Puhakka A., Ahponen P., Pelkonen P. (2014). *Secondary school teachers' knowledge, perceptions, and attitudes toward renewable energy in Jordan*. Renewable Energy 62, pp. 341-348

Notes

Recent research projects on energy handled by the DiSSI research group:

- Analysis of demand and social acceptability of technologies for the production of energy from renewable sources in Sardinia, financed by Region of Sardinia -L.R.7/2007 - call 2008;
- Monetary evaluation of the environmental impact of wind farms in Sardinia: an application of the Choice Experiments method, financed by the Bank of Sardinia Foundation (2009);
- Social acceptability of solar plants: representation and evaluation, financed by the Bank of Sardinia Foundation (2010)
- Analysis of residential demand for green vs brown energy in Italy, financed by Region of Sardinia -L.R.7/2007 – scholarships for young researchers call 2009;
- Enhancement and optimal management of environmental resources in the ecosystem of the area of Arborea: a research of the economic value and environmental and social ac-

ceptability of a project for the production of biogas from manure, financed by Region of Sardinia -L.R.7/2007 - call 2010

- Farewell or see you soon? Assessing public attitudes towards nuclear energy in Italy after Fukushima, financed by ENEL Foundation, prize Energy for Research, call 2013.

Appendix 1. Statistical results

Question 1. In the following question you are asked to indicate how much you agree or disagree with each statement regarding the city where you live.

	Strongly disagree	Nearly disagree	Neither agree nor disagree	Nearly agree	Strongly agree
I would be sorry if I had to leave this city					
Tunisia	13%	21%	19%	26%	21%
Jordan	8%	4%	11%	27%	50%
Egypt	15%	4%	10%	38%	33%
Lebanon	4%	14%	29%	37%	16%
Spain	7%	10%	16%	33%	34%
Italy	15%	9%	15%	26%	35%
I feel I belong to this city					
Tunisia	2%	15%	18%	45%	20%
Jordan	0%	3%	2%	30%	65%
Egypt	5%	2%	5%	32%	56%
Lebanon	2%	12%	26%	51%	9%
Spain	8%	7%	23%	28%	34%
Italy	12%	7%	18%	27%	36%
This city is really different from the others					
Tunisia	5%	24%	39%	21%	11%
Jordan	0%	1%	4%	29%	66%
Egypt	3%	9%	15%	34%	39%
Lebanon	0%	8%	22%	52%	18%
Spain	4%	14%	25%	31%	26%
Italy	2%	14%	24%	34%	26%

I have a lot in common with people who live in this city					
Tunisia	2%	14%	21%	56%	7%
Jordan	1%	5%	14%	35%	45%
Egypt	9%	13%	18%	40%	20%
Lebanon	6%	27%	31%	31%	5%
Spain	3%	8%	35%	36%	18%
Italy	15%	26%	20%	26%	13%
This city meets all my needs					
Tunisia	7%	28%	17%	34%	14%
Jordan	2%	11%	13%	35%	39%
Egypt	15%	18%	25%	26%	16%
Lebanon	11%	36%	32%	17%	4%
Spain	7%	16%	10%	38%	29%
Italy	15%	22%	21%	31%	10%

Question 2. **In the following question you are asked to indicate how much you agree or disagree with each statement regarding the people living in your neighbourhood.**

	Strongly disagree	Nearly disagree	Neither agree nor disagree	Nearly agree	Strongly agree
People in my neighbourhood always criticize when you make some change					
Tunisia	5%	18%	25%	36%	16%
Jordan	15%	25%	28%	17%	15%
Egypt	12%	18%	28%	32%	9%
Lebanon	0%	26%	38%	34%	2%
Spain	10%	20%	36%	30%	4%
Italy	11%	12%	22%	34%	20%
Residents do not respect the environment					
Tunisia	15%	22%	14%	34%	15%
Jordan	8%	16%	20%	33%	23%
Egypt	4%	16%	16%	27%	37%
Lebanon	0%	25%	19%	50%	6%
Spain	9%	36%	30%	18%	7%
Italy	6%	21%	23%	30%	21%
People in the neighbourhood cooperate easily					
Tunisia	11%	23%	26%	34%	6%
Jordan	3%	13%	27%	31%	26%
Egypt	13%	24%	32%	22%	9%
Lebanon	0%	21%	47%	30%	2%
Spain	3%	17%	40%	35%	5%
Italy	12%	29%	35%	21%	3%

Residents show care for their neighbourhood					
Tunisia	5%	14%	28%	48%	5%
Jordan	4%	16%	30%	28%	22%
Egypt	8%	16%	31%	41%	4%
Lebanon	1%	20%	35%	35%	9%
Spain	4%	16%	36%	38%	6%
Italy	16%	24%	22%	28%	9%
People in the neighbourhood are not very sociable					
Tunisia	13%	35%	21%	28%	3%
Jordan	18%	17%	27%	23%	15%
Egypt	11%	27%	32%	20%	10%
Lebanon	7%	44%	45%	4%	0%
Spain	9%	45%	30%	15%	1%
Italy	14%	36%	19%	18%	12%
People appreciate seeing new things in the neighbourhood					
Tunisia	1%	11%	23%	53%	12%
Jordan	1%	4%	20%	46%	29%
Egypt	5%	12%	27%	29%	27%
Lebanon	4%	24%	43%	26%	3%
Spain	2%	7%	34%	49%	8%
Italy	8%	22%	32%	23%	14%

Question 3. In the following question you are asked to indicate how much you agree or disagree with each statement regarding the neighbourhood where you live

	Strongly disagree	Nearly disagree	Neither agree nor disagree	Nearly agree	Strongly agree
If compared with the chaos of other areas, my neighbourhood is still liveable					
Tunisia	7%	13%	8%	39%	33%
Jordan	2%	0%	12%	48%	38%
Egypt	7%	14%	20%	40%	19%
Lebanon	3%	33%	16%	43%	5%
Spain	0%	13%	17%	38%	32%
Italy	5%	7%	7%	33%	47%
Many buildings in the neighbourhood are in poor conditions					
Tunisia	21%	31%	11%	26%	11%
Jordan	17%	35%	24%	13%	11%
Egypt	11%	18%	22%	31%	18%
Lebanon	4%	24%	54%	17%	1%
Spain	15%	25%	22%	26%	12%
Italy	16%	17%	19%	29%	18%
There is too much noise in my neighbourhood					
Tunisia	22%	32%	7%	22%	17%
Jordan	16%	28%	24%	21%	11%
Egypt	11%	17%	14%	26%	32%
Lebanon	2%	8%	21%	66%	3%
Spain	9%	22%	23%	31%	15%
Italy	32%	29%	13%	15%	10%

The buildings in my neighbourhood have a pleasant aspect					
Tunisia	8%	24%	23%	31%	14%
Jordan	4%	6%	17%	49%	24%
Egypt	22%	24%	31%	16%	7%
Lebanon	0%	27%	53%	20%	0%
Spain	3%	26%	22%	42%	7%
Italy	11%	19%	20%	38%	11%
My neighbourhoodispolluted					
Tunisia	17%	29%	25%	21%	8%
Jordan	18%	34%	30%	14%	4%
Egypt	8%	12%	17%	35%	28%
Lebanon	0%	5%	11%	72%	12%
Spain	14%	25%	22%	31%	8%
Italy	38%	33%	13%	10%	5%
It is pleasant to live in my neighbourhood					
Tunisia	8%	19%	24%	37%	12%
Jordan	2%	4%	30%	33%	31%
Egypt	5%	13%	29%	29%	24%
Lebanon	4%	26%	42%	26%	2%
Spain	2%	7%	14%	54%	23%
Italy	8%	3%	16%	29%	43%
My neighbourhoodiscalm					
Tunisia	17%	15%	6%	43%	19%
Jordan	5%	15%	16%	40%	24%
Egypt	28%	25%	18%	15%	13%

Lebanon	3%	51%	29%	16%	1%
Spain	7%	20%	23%	36%	14%
Italy	7%	13%	11%	29%	39%
Living in my neighbourhood is quite distressing					
Tunisia	31%	31%	22%	12%	4%
Jordan	21%	32%	24%	15%	7%
Egypt	27%	20%	34%	12%	7%
Lebanon	6%	48%	30%	13%	3%
Spain	25%	44%	17%	12%	2%
Italy	47%	31%	11%	9%	1%

Qestion7. In the following question you are asked to indicate how much you agree or disagree with each statement regarding the PV technologies.

	Strongly disagree	Nearly disagree	Neither agree nor disagree	Nearly agree	Strongly agree
You need a lot of money to install PV panels					
Tunisia	3%	11%	25%	47%	14%
Jordan	1%	0%	9%	32%	58%
Egypt	2%	4%	14%	36%	44%
Lebanon	0%	1%	4%	61%	34%
Spain	6%	5%	22%	42%	25%
Italy	2%	14%	20%	43%	20%
I would like to install PV panels so I produce myself the energy that I need					
Tunisia	0%	4%	11%	54%	31%
Jordan	3%	3%	5%	29%	60%
Egypt	7%	8%	20%	31%	34%
Lebanon	0%	1%	24%	56%	19%
Spain	6%	4%	20%	40%	30%
Italy	1%	1%	7%	40%	51%
You have to wait too long before recovering the cost of the investment					
Tunisia	2%	8%	52%	29%	9%
Jordan	5%	8%	21%	38%	28%
Egypt	5%	9%	19%	44%	23%
Lebanon	0%	3%	15%	59%	23%
Spain	5%	5%	31%	25%	34%
Italy	8%	13%	25%	31%	22%

I would like the look of my house with PV panels installed					
Tunisia	4%	20%	41%	27%	8%
Jordan	0%	4%	15%	35%	46%
Egypt	2%	2%	15%	35%	46%
Lebanon	8%	24%	28%	35%	5%
Spain	14%	37%	32%	16%	1%
Italy	10%	23%	29%	25%	12%
I am uncertain of the economic advantages of installing PV panels					
Tunisia	16%	25%	22%	32%	5%
Jordan	10%	18%	20%	28%	24%
Egypt	24%	25%	27%	14%	9%
Lebanon	10%	32%	41%	13%	4%
Spain	9%	17%	24%	35%	15%
Italy	34%	28%	9%	20%	8%
I would like to install PV panels to make sure that I consume clean energy					
Tunisia	0%	7%	17%	51%	25%
Jordan	1%	6%	9%	40%	44%
Egypt	1%	2%	10%	35%	52%
Lebanon	0%	5%	14%	58%	23%
Spain	4%	4%	19%	36%	37%
Italy	1%	4%	3%	35%	57%
You have to wait too long before you obtain all the permissions to install					
Tunisia	0%	10%	63%	22%	5%
Jordan	7%	8%	36%	22%	27%
Egypt	4%	3%	51%	21%	21%

Lebanon	13%	33%	20%	29%	5%
Spain	4%	8%	56%	19%	13%
Italy	6%	13%	37%	25%	18%
I would accept all the nuisance related to installation of PV panels					
Tunisia	23%	29%	22%	23%	3%
Jordan	3%	14%	16%	28%	39%
Egypt	21%	21%	29%	17%	12%
Lebanon	12%	25%	41%	15%	7%
Spain	11%	24%	37%	22%	6%
Italy	1%	3%	6%	30%	60%
There is lack of space in my house to install PV panels					
Tunisia	17%	28%	19%	22%	14%
Jordan	16%	17%	14%	28%	25%
Egypt	13%	17%	32%	19%	18%
Lebanon	3%	15%	20%	48%	14%
Spain	10%	11%	19%	35%	25%
Italy	27%	14%	16%	19%	23%
It is difficult to evaluate the quality of the PV panels that are offered					
Tunisia	2%	6%	22%	34%	36%
Jordan	9%	9%	20%	32%	30%
Egypt	10%	11%	42%	20%	16%
Lebanon	0%	4%	23%	47%	26%
Spain	6%	14%	38%	22%	20%
Italy	9%	12%	28%	39%	11%

Question 8.In the following question you are asked to indicate how much you agree or disagree with each statement.

	Strongly disagree	Nearly disagree	Neither agree nor disagree	Nearly agree	Strongly agree
If my relatives or friends adopted a solar photovoltaic system for their houses, I would consider installation					
Tunisia	7%	17%	26%	44%	5%
Jordan	4%	5%	11%	42%	38%
Egypt	5%	5%	17%	36%	37%
Lebanon	9%	16%	31%	39%	5%
Spain	11%	9%	32%	38%	10%
Italy	18%	9%	22%	33%	17%
If my neighbours adopted a solar photovoltaic system for their houses, I would consider installation					
Tunisia	8%	16%	28%	42%	5%
Jordan	2%	9%	10%	39%	40%
Egypt	2%	4%	18%	42%	34%
Lebanon	10%	31%	34%	19%	6%
Spain	5%	10%	29%	39%	17%
Italy	15%	10%	20%	36%	18%
If in public buildings was adopted a solar photovoltaic system, I would consider installation					
Tunisia	12%	18%	47%	19%	3%
Jordan	1%	9%	21%	38%	31%
Egypt	7%	5%	13%	37%	38%
Lebanon	8%	16%	39%	32%	5%
Spain	13%	25%	34%	17%	11%
Italy	13%	7%	19%	34%	26%

Appendix 2. Choice experiment: pictures and economic information

Large Building (Italy, City of Cagliari)

(A) Status quo

(B) Monocrystalline panels + coloured polycrystalline glasses in balconies

(C) Coloured polycrystalline glasses in the façade and in balconies

(D) Coloured polycrystalline glasses in balconies and a solar shading PV technology

Economic information

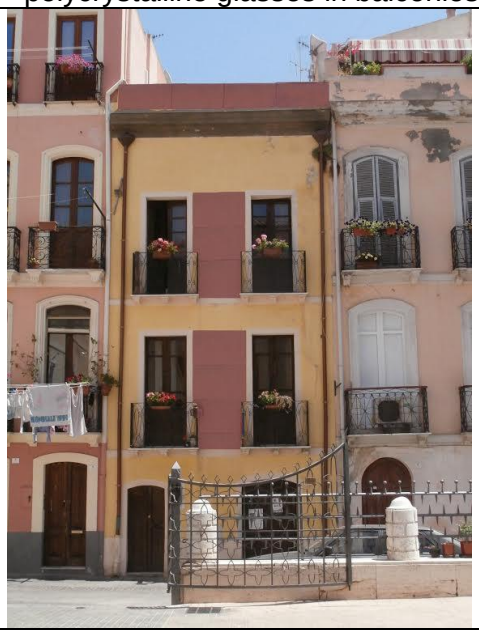
Model	Electricity production per apartment as the % of average household consumption covered	Cost of PV panels per apartment (euros)
A	0	0
B	43	1,477
C	30	1,645
D	22	1,000

Small Building (Italy, City of Cagliari)

(A) Status quo

(B) Monocrystalline panels + coloured polycrystalline glasses in balconies

(C) Coloured polycrystalline glasses in the façade and in balconies



(D) Coloured amorphous PV technology in façade

Economic information

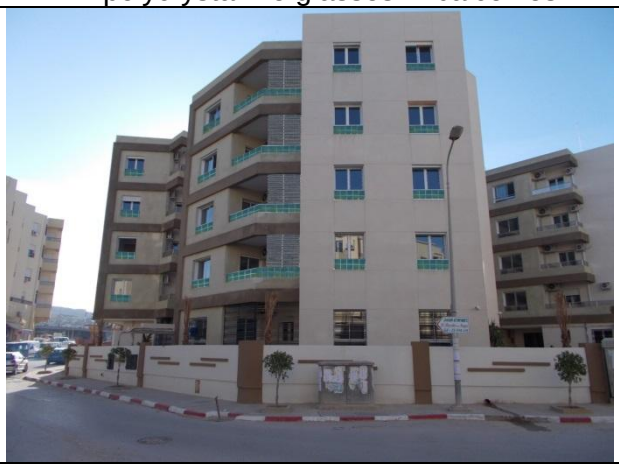
Model	Electricity production per apartment as the % of average household consumption covered	Cost of PV panels per apartment (euros)
A	0	0
B	35	1,148
C	22	987
D	11	1,284

Large Building (Tunisia, City of Tunis)

(A) Status quo

(B) Monocrystalline panels + coloured polycrystalline glasses in balconies

(C) Coloured polycrystalline glasses in the façade and in balconies



(D) Coloured polycrystalline glasses in balconies and a solar shading PV technology

Economic information

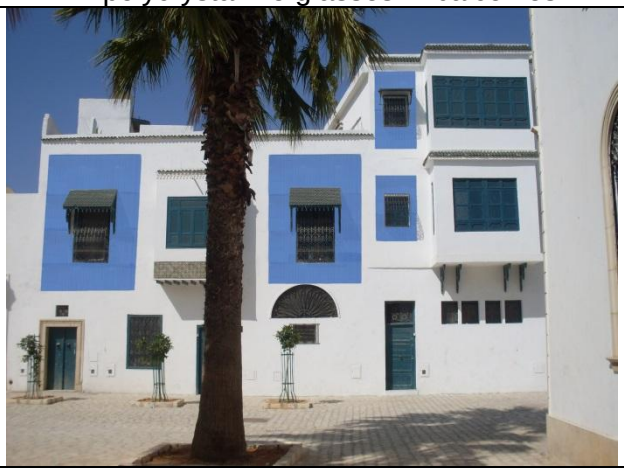
Model	Electricity production per apartment as the % of average household consumption covered	Cost of PV panels per apartment (euros)
A	0	0
B	45	1,477
C	31	1,316
D	23	1,000

Small Building (Tunisia, City of Tunis)

(A) Status quo

(B) Monocrystalline panels + coloured polycrystalline glasses in balconies

(C) Coloured polycrystalline glasses in the façade and in balconies



(D) Coloured amorphous PV technology in façade

Economic information

Model	Electricity production per apartment as the % of average household consumption covered	Cost of PV panels per apartment (euros)
A	0	0
B	45	1,477
C	31	1,316
D	30	3,452

Large Building (Lebanon, City of Haddath)	
	
(A) Status quo	(B) Monocrystalline panels + coloured polycrystalline glasses in balconies
	
(C) Coloured polycrystalline glasses in the façade and in balconies	(D) Coloured polycrystalline glasses in balconies and a solar shading PV technology

Economic information

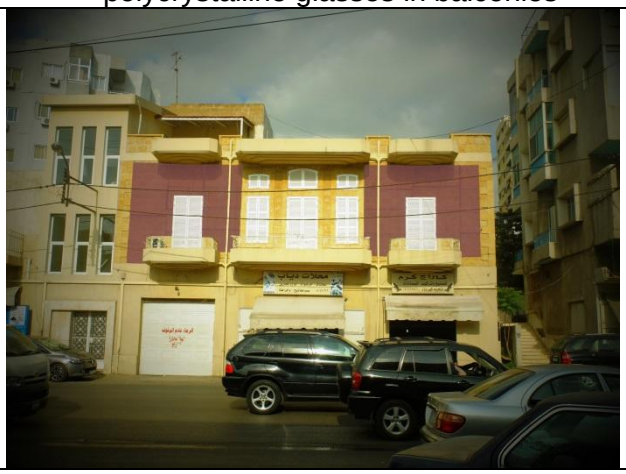
Model	Electricity production per apartment as the % of average household consumption covered	Cost of PV panels per apartment (euros)
A	0	0
B	31	903
C	27	987
D	18	673

Small Building (Lebanon, City of Haddath)

(A) Status quo

(B) Monocrystalline panels + coloured polycrystalline glasses in balconies

(C) Coloured polycrystalline glasses in the façade and in balconies



(D) Coloured amorphous PV technology in façade

Economic information

Model	Electricity production per apartment as the % of average household consumption covered	Cost of PV panels per apartment (euros)
A	0	0
B	34	819
C	27	987
D	24	2,397

Large Building (Jordan, City of Aqaba)

(A) Status quo

(B) Monocrystalline panels + coloured polycrystalline glasses in balconies

(C) Coloured polycrystalline glasses in the façade and in balconies

(D) Coloured polycrystalline glasses in balconies and a solar shading PV technology

Economic information

Model	Electricity production per apartment as the % of average household consumption covered	Cost of PV panels per apartment (euros)
A	0	0
B	29	819
C	23	987
D	16	673

Small Building (Jordan, City of Aqaba)

(A) Status quo

(B) Monocrystalline panels + coloured polycrystalline glasses in balconies

(C) Coloured polycrystalline glasses in the façade and in balconies

(D) Coloured amorphous PV technology in façade

Economic information

Model	Electricity production per apartment as the % of average household consumption covered	Cost of PV panels per apartment (euros)
A	0	0
B	37	1,148
C	31	1,316
D	30	2,946

Large Building (Egypt, City of Alexandria)

(A) Status quo

(B) Monocristallyne panels + coloured polycrystalline glasses in balconies

(C) Coloured polycrystalline glasses in the façade and in balconies

(D) Coloured polycrystalline glasses in balconies and a solar shading PV technology

Economic information

Model	Electricity production per apartment as the % of average household consumption covered	Cost of PV panels per apartment (euros)
A	0	0
B	37	1,148
C	31	1,316
D	26	2,623

Small Building (Egypt, City of Alexandria)

(A) Status quo

(B) Monocristallyne panels + coloured polycrystalline glasses in balconies

(C) Coloured polycrystalline glasses in the façade and in balconies

(D) Coloured amorphous PV technology in façade

Economic information

Model	Electricity production per apartment as the % of average household consumption covered	Cost of PV panels per apartment (euros)
A	0	0
B	37	1,148
C	23	987
D	16	673

Large Building (Spain, City of Barcelona)	
	
(A) Status quo	(B) Monocristallyne panels + coloured polycrystalline glasses in balconies
	
(C) Coloured polycrystalline glasses in the façade and in balconies	(D) Coloured polycrystalline glasses in balconies and a solar shading PV technology

Economic information

Model	Electricity production per apartment as the % of average household consumption covered	Cost of PV panels per apartment (euros)
A	0	0
B	43	1,477
C	30	1316
D	22	1,000

Small Building (Spain, City of Barcelona)	
	
(A) Status quo	(B) Monocristallyne panels + coloured polycrystalline glasses in balconies
	
(C) Coloured polycrystalline glasses in the façade and in balconies	(D) Coloured amorphous PV technology in façade

Economic information

Model	Electricity production per apartment as the % of average household consumption covered	Cost of PV panels per apartment (euros)
A	0	0
B	35	1,148
C	22	987
D	18	2,089

Disclaimer

This report has been produced with the financial assistance of the European Union under the **ENPI CBC** *Mediterranean Sea Basin Programme*. The contents of this document are the sole responsibility of **University of Cagliari** (UNICA) and **FOSTEr in MED** project partners and can under no circumstances be regarded as reflecting the position of the European Union or of the Programme's management structures.

The total budget of FOSTEr in MED project is 4,5 million Euro and it is financed for an amount of 4,05 million Euro by European union through the ENPI CBC Mediterranean Sea Basin Programme (www.enpicbcmed.eu)

Statement about the Programme

The 2007-2013 ENPI CBC Mediterranean Sea Basin Programme is a multilateral Cross-Border Cooperation initiative funded by the European Neighborhood 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, Palestine, Portugal, Spain, Syria (participation currently suspended), Tunisia. The Joint Managing Authority (JMA) is the Autonomous Region of Sardinia (Italy). Official Programme languages are Arabic, English and French (www.enpicbcmed.eu).

General statement on the European Union

European Union is made up of 28 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.

For more information, please contact: Project Management Office UNICA - DICAAR via Marengo 2 – 09123 Cagliari (Italy) Tel +39 070 6755811; email: management@fosterinmed.eu; website: www.fosterinmed.eu

We are social!
http://twitter.com/fosterinmed
http://slideshare.net/fosterinmed
http://youtube.com/fosterinmed
http://facebook.com/fosterinmed

FOSTEr in MED Partnership

FOSTErinMED

Beneficiary

Università degli Studi di Cagliari

University of Cagliari
DICAAR and DSSI (Italy)
www.unica.it

Project Partners

PP1

ASCAME

Association of Mediterranean Chambers of Commerce and Industry (Spain)
www.ascame.org

PP2

Centro Servizi per le Imprese
Camera di Commercio Cagliari

Special Agency
Centre of Services for Enterprises (Italy)
www.csimprese.it

PP3

The Confederation of Egyptian European Business Associations

Confederation of Egyptian
European Business Associations (Egypt)
www.ceeba.org

PP4

IRI
INDUSTRIAL RESEARCH INSTITUTE

Industrial Research Institute (Lebanon)
www.iri.org.lb

PP5

الجمعية العلمية الملكية
Royal Scientific Society

Royal Scientific Society (Jordan)
www.rss.jo

PP6

CCIT

Chamber of Commerce and Industry
of Tunis (Tunisia)
www.ccitunis.org.tn

PP7

REGIONE AUTONOMA DELLA SARDEGNA

Autonomous Region of Sardinia
Industry Department (Italy)
www.regione.sardegna.it

Associate

fondazione SARDEGNA MEDITERRANEA

Sardinia Mediterranean Foundation (Italy)
www.sardegnamediterranea.org

WP4 Team – Department of Social Sciences and Institutions, University of Cagliari
Norma Baldino, Silvia Doneddu,Aide Esu, Marina Mura, Vania Statzu, Elisabetta Strazzera

Project
funded by the
EUROPEAN UNION

ENPI
CBCMED
CROSS-BORDER COOPERATION
IN THE MEDITERRANEAN