

WP 4: THE REGIONAL STATE OF THE ART IN LEBANON



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1. A regional Solar Policies overview in Lebanon: preliminary state of the art and needs identification for the SHAAMS POLICY ACCELERATOR

The Lebanese republic is a country in the east Mediterranean located in western Asia. The country's surface is 10452 Km² and is divided into 4 distinct physiographic regions: the coastal plain, the Lebanon mountain range, the Bekaa valley and the anti-Lebanon mountains. The population of Lebanon was estimated to be 4,125,247 in July 2010.

Lebanon has a moderate Mediterranean climate. In coastal areas, winters are generally cool and rainy whilst summers are hot and humid. In more elevated areas, temperatures usually drop below freezing during the winter with heavy snow cover that remains until early summer on the higher mountaintops.

The economy of Lebanon is a developing economy, with a private sector that contributes to 75% of aggregate demand and a large banking sector that supports this demand. With regards to other economic data on Lebanon, the International Monetary Fund (IMF) estimated that the country's nominal GDP rose from USD 39.0 billion in 2011 to USD 41.3 billion in 2012 (against USD 41.8 billion in the previous edition). It would reach USD 43.8 in 2013 (USD 44.4 billion previously) and USD 46.7 billion in 2014 (USD 47.1 billion previously). Lebanon's GDP per capita estimates stood at USD 9,856 in 2011, USD 10,311 in 2012, USD 10,793 in 2013 and USD 11,348 in 2014.¹

1.2 Institutional organisation of the solar sector

Energy production²: Electricity of Lebanon (EDL-Electricité du Liban) is a public institution with an industrial and commercial vocation under the control of the Ministry of Energy and Water (MEW). It was founded by Decree No. 16878 dated July 10, 1964, and mandated the responsibility of the generation, transmission, and distribution of electrical energy in Lebanon. Thus, the electricity sector is monopolized by EDL Company that, currently, controls over 90% of the Lebanese electricity sector (including the Kadisha concession in North Lebanon). Other participants in the sector include hydroelectric power plants owned by the Litani River Authority (public company), concessions for hydroelectric power plants owned by Ibrahim and Al Bared (private companies) that sell their electrical production to EDL, and distribution concessions in Zahle, Jbeil, Aley, and Bhamdoun , where EDL provides

¹ <http://libanon.um.dk/en/news/newsdisplaypage/?newsid=23af4cf3-3a56-494c-a013-d75ec89b7369>

² Ministry of Energy and Water Policy Paper 2010

them with energy at reduced prices (50 to 75 LL/kWh as compared to the real cost of 255 LL/kWh).

Losses on the grid are reported amounting to 40%, 15% corresponds to technical losses while the remaining are non-technical losses.

There is a serious deficit in the generation capacity to meet demand. It is noticed that the demand increases versus a decreasing rate of supply and this fact increases the shortage gap and exerts large pressures on the government and society.

The average capacity and imports available in 2009 was 1500 MW; the average demand was 2000-2100 MW and the instantaneous peak in the summer was 2450 MW. The total energy demand in 2009 was 15,000 GWh (7% increase from 2008) whereas the total production and purchases was 11,522 GWh (6% increase from 2008) which resulted in energy not supplied (deficit) of 3,478 GWh (23%). The supply of energy averaged 21.22 hours for greater Beirut area and 15.79 hours for the South with an average of 18 hours (75%) for the whole country.

The effective revenue received by EDL is much below its generation costs at 14-18 €cents/kWh inflated by outdated and inefficient facilities, increased oil prices and internal social conflicts. As a result, EDL has accumulated structural deficits (LL 1.8 trillion in 2011 or EUR1 billion or 3.5 GDP). These are partly covered by high public subsidies (17 % of state budget in 2007 and 35 % in 2011) on the form of fuel subsidies and deficit compensation for EDL. Over the last decade, state expenses to cover the losses of EDL are estimated to be above EUR 8.5 billion.³

According to MoEW these are the main problems:

- Existence of uncollected electrical consumption bills (~5% in 2009 [MEW 2010])
- High non-technical losses (~ 20%)
- There is no planned maintenance of the MV/LV substation assets and problems arising are dealt with on a "action-reaction" basis
- The age profile of MV/LV transformers indicates that 37% of the transformer assets are over the average life expectancy (20 years)
- There are severe overloading problems on the Beirut area MV networks
- No financial independency within the Directorate to ensure good functionality

The trend in Lebanon's energy sector is towards foreign investment and partnerships with the private sector to develop and supplement the output of national institutions, in parallel with the government's financial support.

Investment opportunities are plentiful with more than US\$ 20 billion worth of projects planned or underway in the country's water and electricity sectors, including:

- US\$ 4.5 billion for electricity development plan
- US\$ 9 billion for sewage plants

³ Sustainable energy policy roadmap for Lebanon – PWMSP Nov 2012

- US\$ 9 billion for water projects

In addition, recently discovered natural gas reserves in Lebanese territorial waters off the country's southern coast present interesting exploitation prospects.⁴

Self-generation plays a large role in electricity supply and demand in Lebanon despite the high level of electrification (99.9%). Individual or community-based back-up generators are commonly used in the industrial sector as well as among low-voltage consumers (households and commerce).

Based on data provided by the policy paper for the electricity sector, the current demand on electricity stands at around 2,400 MW, while the actual supply is limited to around 1,500 MW.

The policy paper also aims at achieving a solid 5,000 MW of production after 2015. Accordingly, the total electricity production capacity by 2020 should be 6,700 MW.

As part of this plan, the Lebanese Center for Energy Conservation (LCEC) was formed within the Lebanese Ministry of Energy and Water (MEW) to supervise energy efficiency and renewable energy in Lebanon and oversee the implementation of the National Energy Efficiency Action Plan (NEEAP) covering more than 10 national initiatives in the fields of energy efficiency, renewable energy and green buildings.

The plan also includes the construction of an infrastructure for handling the gas and this will include a liquefied natural gas pipeline along the Lebanese coast. In the long run, the plan calls for investing another US\$ 1.65 billion so Lebanon can produce 5,000 MW of electricity.⁵

Renewable Energy

In the 2009 Copenhagen Climate Summit, the Lebanese government made a pledge to develop renewable energy production capacity to reach 12 percent of the total electricity supply by 2020. A share of 12 percent of 6,700 MW would mean a production capacity of 804 MW to be ensured by means of renewable energy production. This "political" commitment is a major milestone of the "policy paper for the electricity sector" that was developed by the Lebanese Energy Ministry in 2010.

Two initiatives are in particular targeted to advance the adoption of renewable energy: The CEDRO ("Country Energy Efficiency and Renewable Energy Demonstration Project for the Recovery of Lebanon") project started in 2007 was supported with funding of US \$ 9.76 million from the Spanish government and the United Nations Development Program (UNDP). These funds already realized 71 PV demonstration projects with a total capacity of 100 kilowatts on public buildings in Lebanon.

Moreover, the Lebanese government wants to further strengthen the Lebanese Center for Energy Conservation (LCEC), an organization founded in 2002 to be the central contact

⁴ www.energy-lebanon.com

⁵ www.energy-lebanon.com

point for renewable energy and energy efficiency projects from domestic and foreign investors. Previous achievements of LCEC are the introduction of net metering by the state-owned utility "Électricité du Liban", and the implementation of the "National Energy Efficiency and Renewable Energy Support Action" program (NEEERA) by the government. NEEERA provides discounted government loans for the construction of decentralized PV systems at an interest rate of 0.6% and a repayment period of up to 14 years. Both initiatives are currently canvassing an additional project budget of ten million dollars for the next three to five years in order to further facilitate and support the extension of PV in the country.⁶

The Law 462.⁷

It was issued in 5/9/2002, constituted of 7 chapters and 49 articles. It defines the role of the Government as well as the rules and principles organizing the sector as well as the basis of transferring it or its management, totally or partially to the Private Sector. Ministerial officials have completed the revision of Law 462 in 2012, which will be submitted for the approval of the government and the Parliament. Changing Law 462 is the only legal framework that could allow the private sector to take part in renewable energy production. In parallel, the law implemented by decree 16878/1964 and 4517/1972 which gives EDL exclusive authority in the generation, transmission, and distribution areas is still being applied.

2010 Policy Paper.⁸

The policy paper covers 3 distinct strategic areas with 10 specific initiatives in a comprehensive program of 42 action steps:

I. Infrastructure: (1) Generation; (2) Transmission; and (3) Distribution

II. Supply and demand: (4) Fuel Sourcing; (5) Renewable Energies, (6) Demand Side Management / Energy Efficiency, (7) Tariffs

III. Legal framework: (8) Norms and Standards (9) Corporatization of Électricité Du Liban, (10) Legal Status

The policy will result in a solid power sector with more than 4000 MW generation capacity in 2014 and 5000 MW after 2015

This policy commits to launching, supporting and reinforcing all public, private and individual initiatives to adopt the utilization of renewable energies to reach 12% of electric and thermal supply by starting a pre-feasibility study on Photovoltaic (PV) farms.

This policy paper commits to the preparation and spreading of the culture for proper electricity use through the adoption of the Energy Conservation law and institutionalize the Lebanese Center for Energy Conservation (LCEC) and launch a national plan for energy

⁶ www.solarnovus.com : [Lebanon: Government Wants to Promote Renewable Energy](#) 26Feb2013

⁷ Law for electricity sector organization – Law 462

⁸ 2010 Policy Paper by the Ministry of Electricity and Water of Lebanon

conservation in 2010, Increasing the penetration of Solar Water Heaters (SWH) and devise innovative financing schemes in collaboration with the banking sector to achieve the slogan "A solar heater for each household", and Setting-up the National Energy Efficiency and Renewable Energy Account (NEEREA) as a national financing mechanism and develop the ESCO (Energy Service company) business dealing with energy audit applications.

1.3 The energy/solar strategy in Lebanon

NEEAP⁹

The National Energy Efficiency Action Plan (NEEAP) is one of the projects that has started in the Arab region. It was introduced as a result of intensive cooperation between the energy department in the League of Arab States (LAS), the Regional Center for Renewable Energy and Energy Efficiency (RCREEE), the EU funded regional projects MED-EMIP and MED-ENEC. The Lebanese NEEAP (2011-2015) developed by the Lebanese Center for Energy Conservation (LCEC) has identified five main renewable energy technologies: wind, hydro, solar thermal, solar power, and bioenergy. Other, less important sources include geothermal, wave energy and others.

The Ministry of Energy and Water adopted the NEEAP on 21 December 2010 and it was approved by the Council of Ministers of Lebanon on 10 November 2011.

NEEAP is constituted of 14 initiatives where the 7th initiative aims to start the development and promote the generation of electricity through the execution of Photovoltaic (PV) and Concentrated

Solar Power (CSP) farms (100 to 200 MW of installed capacity)

SWH & PV strategies¹⁰

Lebanon has embarked on a national initiative to develop the solar water heating market in Lebanon. The initiative is a joint effort between the Energy and Water Ministry and UNDP Lebanon through funding by the Global Environment Facility (GEF). In The total installed capacity in this sector was 43,500 SQM in 2011, with a hot water storage capacity of 3,313,427 liters leading to an annual energy consumption reduction of 28,292 MWh. The target for 2020 is the installation of 1,050,000 SQM of solar systems. With the direct involvement of the Central Bank of Lebanon, the actual achievements for 2010 and 2011 much exceeded expectations. The target for 2020 can be estimated to replace 120 MW of production capacity (worst case scenario estimation).

⁹ The National Energy Efficiency Action Plan for Lebanon – January 2012

¹⁰ The residential Solar water heaters Market in Lebanon in 2011 – September 2012 – study by LCEC

As for other solar technologies, photovoltaic solar applications and concentrated solar power plants (CSP) could account for an estimated 100-150 MW by 2020. While the first type of decentralized applications have begun all over the country (industries, schools, houses), the cost for the CSP is still relatively high, but it is expected to drop drastically in the following few years.

Other Stats¹¹

On a study made for many countries by the renewable energy policy network for the 21st century, the country report for Lebanon showed these numbers below:

Energy production = 194 ktoe/yr

Energy consumption = 3561 ktoe/yr

Renewable energy target 2020 = 12%

In 2011 : 4.5% share of renewable energy in electricity consumption

In 2010 : 0.28 GW total installed renewable energy capacity

In 2011 : energy production for solar PV = 93.0 kwh and solar heating cooling = 210 Mwh¹²

Financing incentives¹³

The NEEREA (National Energy Efficiency and Renewable Energy Action) scheme is dedicated to support the financing of energy efficiency and renewable energy (EE and RE) projects all over Lebanon.

NEEREA aims at the effective implementation of EE and RE projects in Lebanon by Lebanese commercial banks through offering both technical and financial support. NEEREA allows the private sector getting near 0% interest loans from commercial banks to cover extra costs of incorporating energy efficiency and renewable energy components in development projects, buildings and industries.

The NEEREA is a result of the joint efforts between the MoEW, the LCEC and BDL. The beneficiary would address a local commercial bank with the complete technical and financial study. The commercial bank would send the documents to the central bank of Lebanon (Banque du Liban, BDL). BDL would ask for the technical comments of the Lebanese Center for Energy Conservation (LCEC) to issue the approval on the loan.

During the year 2011, a total number of 12,197 solar water heaters were installed in Lebanon. The estimated market value for these systems is around 18,131,183 USD. Out of this total number, 3,557 solar loan applications were submitted as part of the national

¹¹ Renewable interactive map – REN21 – Country Profile : Lebanon - www.map.ren21.net

¹² RENEWABLE ENERGY POLICY NETWORK FOR THE 21ST CENTURY

http://www.map.ren21.net/Lebanon_Renewables_Profile

¹³ The National Energy Efficiency and Renewable Energy Account

financing initiative launched by the end of 2010. All applications were accepted to benefit from interest-free loans for periods ranging from 1 to 5 years, with 48.3% of the applications being eligible to benefit from the 200 USD subsidies (a total of 1,717 applications). The remaining 1,840 applications did not benefit from the 200 USD subsidies.

Electricity saving : The solar water heater can save up to 90% on the water heating bill, which could correspond to around 25% of the total electricity bill of a typical Lebanese residence.

Energy Audits Campaign

Energy audit actions were done to 128 sites by LCEC that launched an energy audit program to assist Lebanese energy consuming tertiary and public buildings and industrial plants in the management of their energy through this program.

P.S: Residences in Lebanon have an incremental tariff starting at 35 LBP (0.023 USD) up to 200 LBP (0.133 USD) per kWh, while it costs the EDL 0.171 USD for each kWh produced/purchased and operated. The gap of 0.039 USD is covered by the Lebanese government in the form of subsidies to the electricity sector.

Solar energy PV farm

The idea behind the Beirut River Solar Snake is to cover the concrete structure, around 6 meter above river level, with solar panels and to generate, as a start, 1MW which will be linked to the grid via an inverter. The river will be covered with 20,000m² of solar panel space in the first phase.

The final goal is to generate 10MW and in order to do so, 6.5km will be covered with solar panels. The money generated from phase 1 will be reinvested in the project.

The maximum budget is set to a maximum of \$4 million. But this cost is projected to decrease knowing that similar projects in Jordan cost around \$2.3 million without taking into consideration the cost incurred by the structure.

Moreover, the French Embassy will provide Lebanon with a solar panel testing platform which will serve as a lab. This will also have educational purposes for all parties concerned including students. I see it as a mean to involve the population. The pre-qualification bid announcement for the Beirut River Solar Snake project took place on April 2013.

1.4 LEBANON 2020 and the MED Solar Plan

Primary energy demand within the Mediterranean Partner Countries (MPC) is forecasted to increase by 70% over the next 20 years.

According to the information obtained it is envisaged that by 2020 a total of 12% of electricity and thermal energy will be produced from renewable energy in Lebanon.

The stated targeted has been declared formally by the government and has been reconfirmed in the National Energy Efficiency Action Plan that was developed by the LCEC and approved by the Lebanese Government in 2011 as the main road map for energy efficiency and renewable energy for the years 2011-2015.

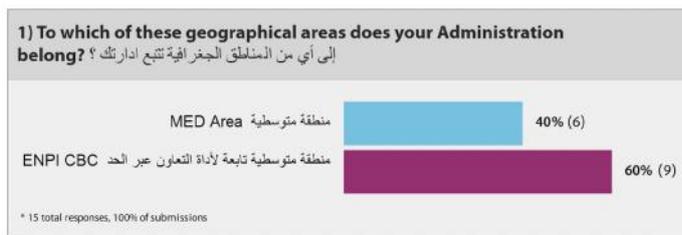
Presently no specific targets for solar/PV has been defined. It is recommended to clearly define contribution targets for solar/PV. It is also recommended to extend target horizon from 2015 to 2020 in order to attain 2020 targets.

The presently targeted horizon only covers the period up to 2015. It is recommended to extent target horizon from 2015 to 2020 in order to attain 2020 targets.

1.5 Barriers and facilitators to the strategy implementation: Analysis and results

The survey method that BIAT followed is sending the targeted population an email containing an introduction about SHAAMS project and a link for the survey which was developed using the adobe forms central tool: <https://adobeformscentral.com/?f=6ghlGqSbFsMTwviBDW4Yhw>. We contacted almost 40 individuals (decision makers and experts) related to the policy development of solar energy in Lebanon from public institution and governmental agencies that have already been part of renewable energy programs. We got 15 total responses on the survey.

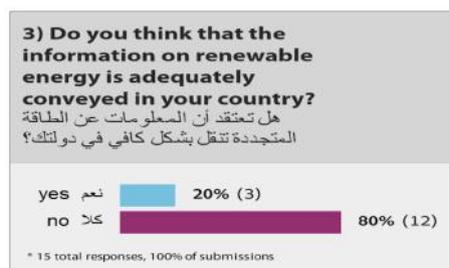
- 60% of the 15 respondents considered that their administration belong to ENPICBC area while 40% belong to MED area.



- 67% of the 15 respondents' roles are in professional areas in the questioned organizations while 33% hold positions in political and institutional area



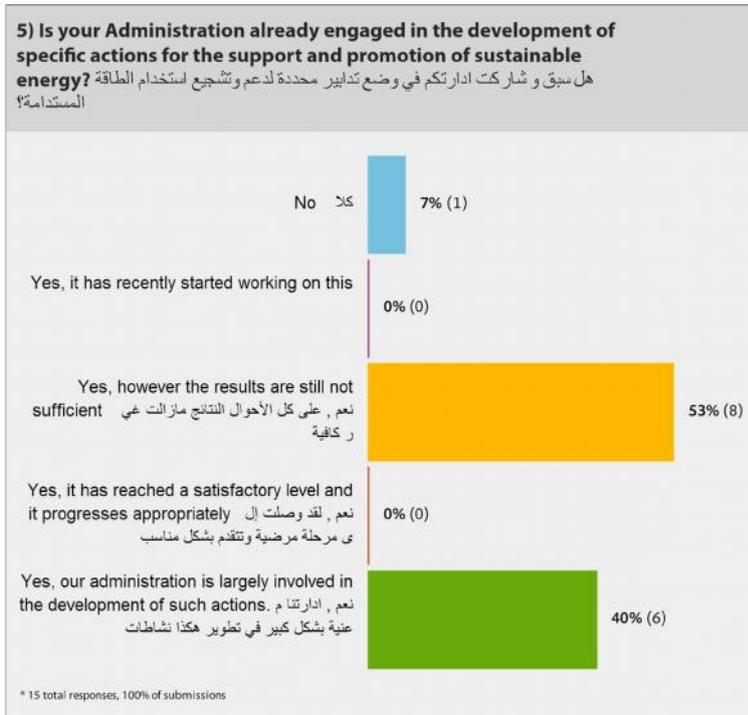
- 80% of the 15 respondents found that the information on renewable energy is not adequately conveyed in Lebanon. That gives a clear insight that the energy policy and strategy should be addressed to wider range of individuals and decision makers across governmental and public institutions.



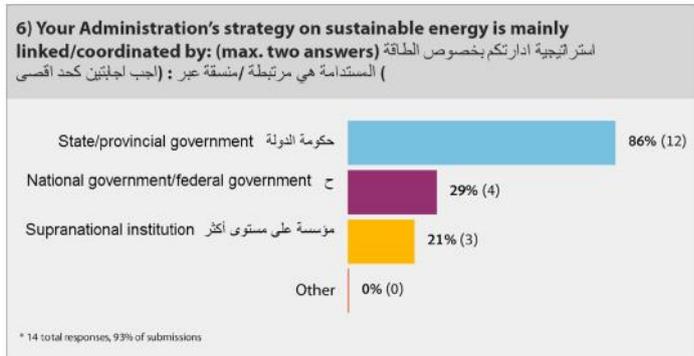
- Citizens formed 40% of the stakeholders that these administrations' strategy is addressed while NGOs and enterprises together formed 40%.



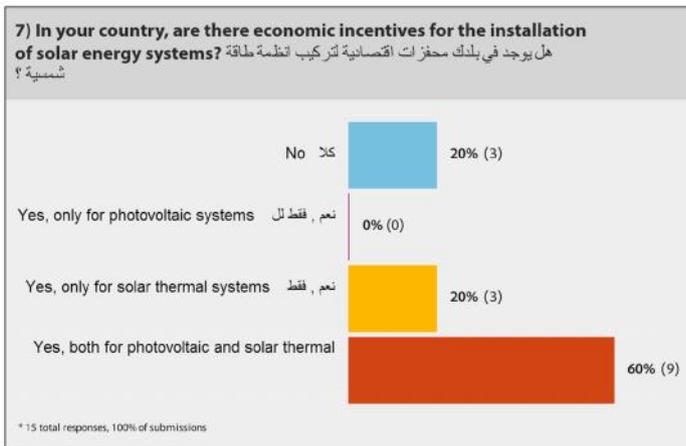
- 93% of the 15 administrations who responded on the questionnaire were already engaged in the support and promotion of sustainable energy. But the more important indicator is that 53% still see the results in this sector not sufficient.



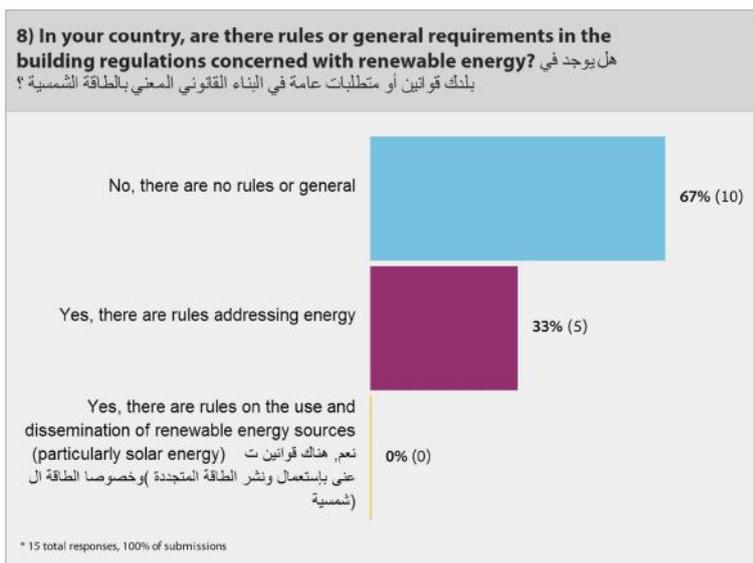
- 12 of the 15 respondents' sustainable energy strategy is linked or coordinated by Lebanon's ministry of energy and water.



- Basically the NEEREA financial scheme provided support to Solar systems

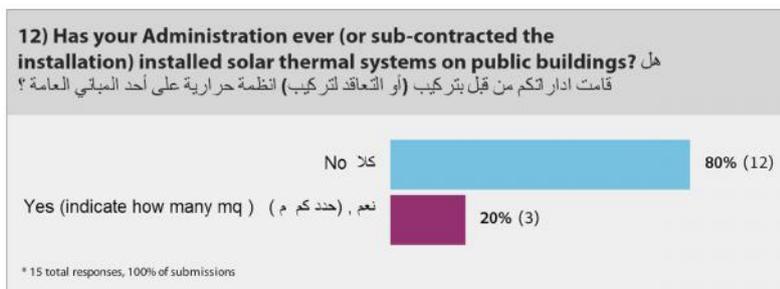
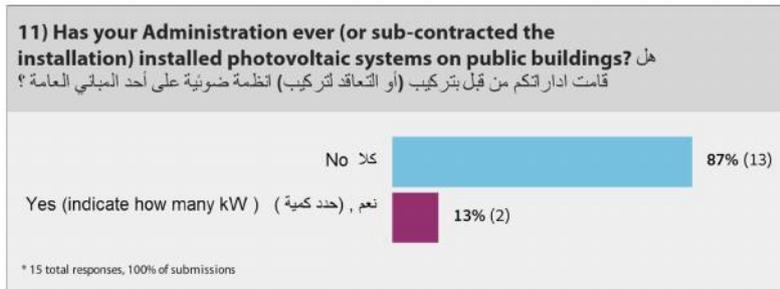
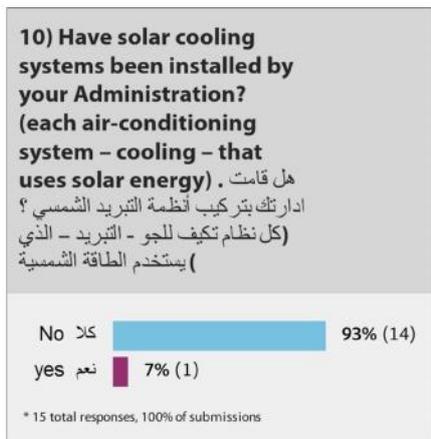


67% of respondents found that there are no rules and requirements in building regulations concerned to renewable energy. The NEEAP and the political paper 2010 are basically the two main frameworks that set guidelines for the renewable energy sectors in Lebanon.





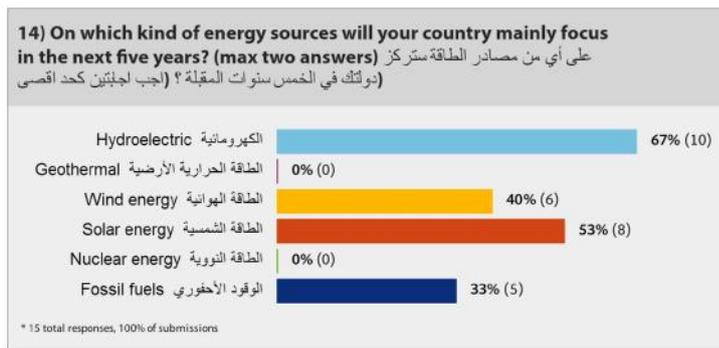
- The following set of answers show that solar systems are not widely installed on public buildings (93%) while more than 80% of the administrations that already been engaged in solar energy programs are not involved in installing PV or SWH systems.



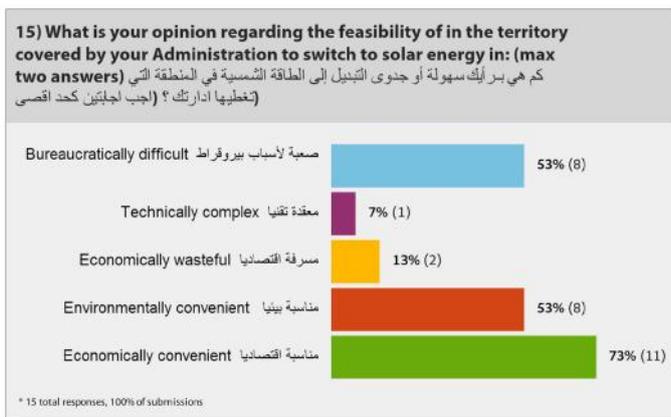


- 60% of the 15 administrations do not have energy managers position among their human resources

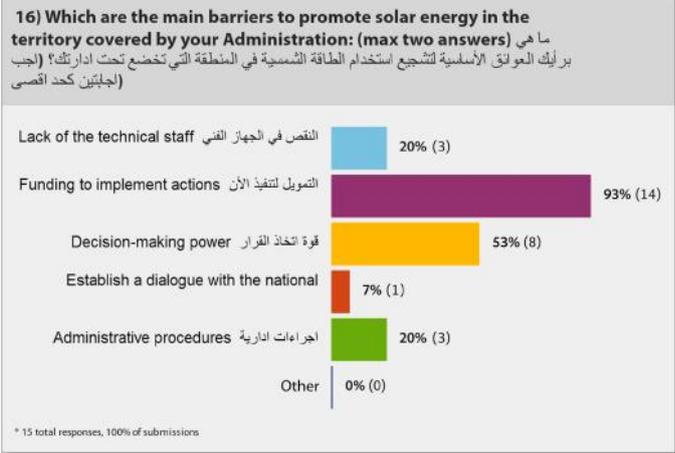
- Hydro electric power is one of the main energy sources that the Lebanese state will focus on in the next five years. Solar energy comes in second place.



- Switching into solar energy is economically and environmentally convenient but still difficult for bureaucracy reasons.



- Many barriers were considered important for promoting solar energy in Lebanon, but the most challenging barrier is funding in order to implement actions that promote for the sector.



1.6 SWOT analysis and results

	HELPFUL (To achieving the objective)	HARMFUL (To achieving the objective)
INTERNAL ORIGIN	<ul style="list-style-type: none"> • Strategy defined through the 2010 policy paper & NEEAP • NEEREA • Solar sector is still an emerging market in Lebanon • Willingness for a public-private dialogue from both private and public institutions. • Many national players might be involved in actions that will help enhancing the policy. • SWH standards 	<ul style="list-style-type: none"> • Lack of Funding • No clear dissemination of solar energy policies and strategies and studies on the sector. • No specific law for Renewable Energy • Need for more experts in public institutions. • Presently no tax support schemes exist for RES in Lebanon • Decision making is centralized • The national energy strategy is not enough linked to the MSP • The private public is still limited
EXTERNAL ORIGIN	<ul style="list-style-type: none"> • Lebanon is represented in RECREEE • Four EU ENPICBC solar energy projects will be ran in Lebanon during the next 3 years • Prices of solar energy solutions are becoming more affordable. • An energy conservation law is presently under preparation. It is envisaged that in the future this law will constitute the main regulatory framework for EE and RE 	<ul style="list-style-type: none"> • Government is not stable • Not enough awareness for banking sector on solar energy market growth opportunities. • Decision making is related to politics more than economy. • Concentration on other energy sources • Geographical position of Lebanon

The expertise, success stories and lessons learned from the NEEREA would be taken into consideration in designing any new financial scheme for EE&RE.

In particular, for SWH and PV, consider Tunisian PROSOL14 type support scheme and adopt Feed in Tariffs and net metering for PV small projects. A close cooperation with the domestic financial sector as well as continuous coordination with national and donor initiatives (e.g. EU, UNDP) is needed to cover the priority sectors.

Revising or preparing regulations has to go through multiple steps and time-consuming processes within the government and the parliament, including consultations with stakeholders. A lack of information on energy policies and awareness on EE&RE by stakeholders and actors of the legislative process may be an issue, possibly generating misunderstanding and bottlenecks.

Lack of awareness and information of the financial sector, low electricity administrated prices and high subsidies for all customers.

¹⁴ Sustainable energy policy roadmap for Lebanon – PWMSP Nov 2012

1.7 Global conclusions for the policy accelerator in Lebanon

The state of Lebanon has set objectives to foster the sector of solar energy even though the ministry of electricity and water did not finalize the review and restructuring of the law 462 neither the issuance of a law related only to solar energy. There is need to do a private-public dialogue in order to foster the solar energy market through awareness campaigns, discussions, workshops and studies in order to align the policy generation mechanism to the market need.

This action needs to involve many players such as ministries, banks and other public institutions to define a financing scheme that could serve the interest of most of the stakeholders.

After publishing the NEEAP (2011-2015), the MoEW and LCEC are preparing a new NEEAP that includes more initiatives and guidelines and try to link it more to the Mediterranean solar plan since the relationship is not clearly defined yet.

Through the WP5 meetings, SHAAMS could advocate for:

- Subsidizing the PV sector through feed-in tariffs higher than the EDL regular rates.
- Breaking the monopoly of EDL by allowing individual producers (such as private generator operators or industries) sell electricity to other consumers.

This is to mention that we should take in advantage of the four strategic ENPI CBCMED related solar energy are now running in Lebanon since they have many activities in common in the next 3 years related to performing awareness sessions, suggesting policy enhancement, defining experts pools, performing training activities and defining financial support schemes.



2. The SHAAMS ENTERPRISE RESEARCH ACCELERATOR in Lebanon

2.1 The R&D for energy and the solar market in Lebanon

Research and Development

- Only policy guidelines encouraging R&D in the renewable energy field have been recorded.
- There is no national research body focused on renewable energies in general.
- The Lebanese National Center for Scientific Research (LNCSR) solar energy department has been closed for more than three years.
- The Industrial Research Institute (IRI) is conducting Energy Saving Projects with the Ministry of Industry and Ministry of Energy. The Industrial Research Institute (IRI) received a test bench.
- Some private companies and NGOs are active in promoting renewable energy.
- Major universities provide energy-related courses: courses in renewable energy, demand side management, energy efficiency, and energy planning and policy. New masters programs exist at the Lebanese University and Saint Joseph University):
 - o The Renewable Energies master, one year night classes
 - o The Oil and Gas masters, 2 years full-time morning classes @20,000\$ in English language (supported by Total and the French Petroleum Institute)
- A number of universities from Lebanon, Jordan and Syria have agreed to start collaboration on renewable energy and energy efficiency.
- There are only a few specific research projects actually conducted in Lebanon.

Certification and Standardization

- The IRI label is still not functional, the present one concerns the equipment security not its performance.
- The Lebanese Standards Institution LIBNOR (official organization affiliated with the council of ministers and in charge of standardization in Lebanon) is undertaking a large work of standardization.
- No university laboratory is equipped with a test bench for solar collectors.
- The Order of Architects and Engineers of Beirut is trying to integrate the SWH in the building license. So far ducts for solar energy have to be integrated in the building plans, but no implementation is required.



2.2 The R&D and the market strategies

a) Domestic Solar Water Heaters (DSWH)

The Solar thermal market mainly comprises individual units (DSWH). The market for collective systems, which are deemed to be more efficient, is not yet developed.

The main problem impeding the development of the individual residential SWH market is the fact that most buildings in Beirut and other large Lebanese cities are high buildings, as:

- Building heights lower the effectiveness of SWH.
- There is a lack of space on the rooftop + rooftop is a common space (problems might arise with neighbours)
- Maintenance becomes complicated and costly.

Such systems work better in villages and suburbs with lower construction height.

Distribution, Sales and After-Sales:

- Few installers offer a guarantee on the efficiency of the system, and consumers are not aware that they can claim such a guarantee.
- Some installers offer only a guarantee against manufacturing defects.
- Few installers also offer an annual maintenance contract.
- Few manufacturers or importers create a distribution network.

In Lebanon, the installation rate of DSWH is increasing but has not reached the level that affects the energy utilization mode on the country level. Market penetration studies predict that the volume will increase significantly in the future.

In 2005, there were 15 enterprises dealing with systems assembly locally. Now, only one enterprise is still assembling locally (Kypros) and even exporting to Arab countries. The rest have opted for importing from Turkey or China, because systems are cheaper. The market growth rate has been 10% to 15% yearly, it still has growth potential because we are behind Israel and Cyprus, but solar heating for individual sanitary water systems will eventually reach a max.

Collective water heating is interesting:

- o Because the individual systems market will reach a maximum
- o Because it offers scale economy (gaining roof surface for 10 flats apartments)
- o Because this has been tested within the REACT (EU MED) project (one installation in a hospital in Marrakech, and another installation in a hotel in Jordan on the dead sea; the Baabda public hospital in Lebanon third installation planned in the same framework could not complete due to lack of budget)

So far only a few collective projects have been installed and tested in Lebanon.

b) Photovoltaic Solar Power (PV)

The PV market is still very new to Lebanon. In 2008, only a handful of contractors installed PV systems, but now 30 companies are in the business. However the number of installations is still very low.

The important decrease in prices has not helped the market boom. (In 2008, a 2-kW PV system with storage was approximately US\$28,000. Four years later, the current cost is US\$12,000.)

Indeed hindrances to the development of this sector are due to:

- A lack of a proper policy: though the net-metering system exists, the feed-in tariff is the same as the buying tariff. While most developed countries have supported the PV market through a feed-in tariff subsidy: the feed-in tariff is much higher than the regular tariff for buying electricity from the national supplier.
- Though financing facilities are available (circular 316 of Banque du Liban, giving a loan over 14 years with a 4-year grace period - Kafalat PV scheme, launched in 2013, allows companies have a guarantee on an additional loan even if they already benefit from a Kafalat scheme), getting the approval through the commercial banking circuit is very long and complex (it took an installer 6 months in order to get the approval).
- The absence of EDL power 24/24 lowers the efficiency of a PV system, as the system cannot feed-in the national network when EDL is absent.
- The overall context in the country (political instability, vandalism risk, war risk) hinders large investments in a PV system (over half a million of USD for an industry) that would give a return over the long term.
- Industrial investors who have a capital to invest would rather invest in additional production facilities that would increase their turnover, instead investing in PV that would decrease their production costs.
- Finally, investors are reluctant to invest in a new product that does not yet have a significant number of successful installations yet.
- The installation of bi-directional meters might be slow.
- Technical problems still exist (instability of EDL electricity, as the voltage goes sometimes below 180V, etc.).

The following gives a sectoral approach for PV in Lebanon:

- Industrial plants and large enterprises, hotels, resorts, etc:
Lebanon is ready for PV projects in this sector. Such projects can have a positive cash-flow over the 25-30 years forecasted.

Estimations for prices of a kWh are the following:

- Private generator: 28c
- EDL: 9c for industries, 12c for other enterprises (in the higher tranches)
- PV: 5c without batteries, 10c for a short-time battery back-up, up to 64c with a longer battery back-up plan.

Installations could feed-in the EDL network or be isolated. In order to have a financially interesting installation, the use of storage (batteries) should be avoided.



However the main reason why investors refrain from installing a PV system in this promising sector is the lack of confidence in PV systems, which are still new in Lebanon. Therefore awareness-raising campaigns to be implemented by SHAAMS (image of PV, financial aspect, etc.) could have a very beneficial role. One of the SHAAMS WP6 seminars could target the subject of using PV in the industrial / large enterprises sector.

- Irrigation is an interesting sector for PV.
In areas where water resources are not very deep (for example 50 meters underground resources), a PV system could be used in an efficient way. That would require a small power system for ignition. Moreover, during rainy days irrigation is not necessary so the lack of sun is not a problem. In the Bekaa valley where most Lebanese agriculture is located, the atmosphere (lack of humidity) gives a good solar irradiation. Currently irrigation relies heavily on diesel generators, which are costly (high cost per kWh produced) and not environmentally-friendly. A Lebanese company that the SHAAMS team met has installed such a system in the Bekaa valley.
- Private electricity producers can be potential users of PV systems, and integration of PV with the private generators can give a strong boost to the PV sector. As such a seminar could target this issue.
- In the residential sector, PV is not yet financially interesting.
- Regarding large-scale installations, the problem of the absence of EDL network 24/24 can be overcome by feeding the electricity production central, which is always operational.

Two main initiatives are leading the way in decentralized photovoltaic power in Lebanon:

- Lebanese Center for Energy Conservation (LCEC), is currently on the road to becoming Lebanon's main institutional reference in terms of government renewable energy and energy efficiency policy.
- The CEDRO project was established to implement renewable energy demonstration projects across public sector buildings.
- Over 100 kW of PV systems have been uniquely designed and installed by the CEDRO project, which is distributed over 71 public facilities across the country,
- The LCEC and the CEDRO will be obtaining funds of US\$10 million in the coming three to five years to continue the promotion of PV systems across the country.



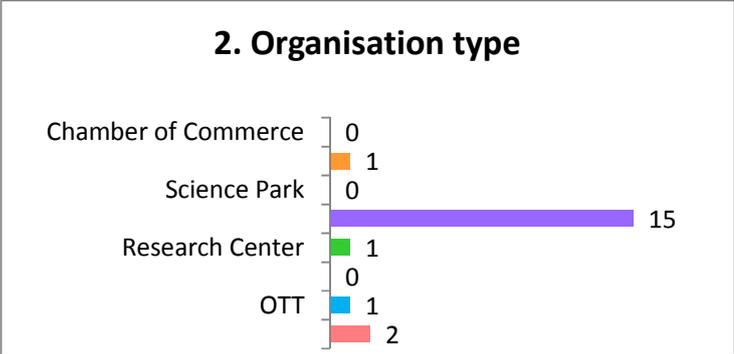


2.3 Economic, market and financial barriers and facilitators to the strategy implementation: results and analysis

The method for conducting the survey was an initial phone contact, followed by an email. The questionnaire was posted online, using the Adobe Forms Central tool:

<https://adobeformscentral.com/?f=KfuPqLnFVkf4JUQ9c17CCw>

100 entities were contacted for the survey, with the following profile: SMEs, individual experts, universities or research centres. 20 answers were collected through the website (ratio of 20%), and the analysis is provided here below.



2. Organisation type:

The breakdown of respondents by type is given in the following table.

Most respondents (75%) are SMEs.

4. Are you aware of your country's policy/legislation on solar energy systems?

80% of respondents are aware of Lebanon's policy / legislation on solar energy systems. References given are summarized in the following table:

References on Lebanon's policy / legislation on solar energy systems:
Ministry of Energy and Water - LCEC
National Energy Efficiency Action Plan (NEEAP 2011-2015)
National Energy Efficiency and Renewable Energy Action (NEEREA): Circular 236, giving green loans with interest subsidy
Electricité du Liban (EDL) / Net-metering
Some laws drafts in parliament
LIBNOR
CEDRO
UNDP
Certification from IRI
ESCWA
ALMEE

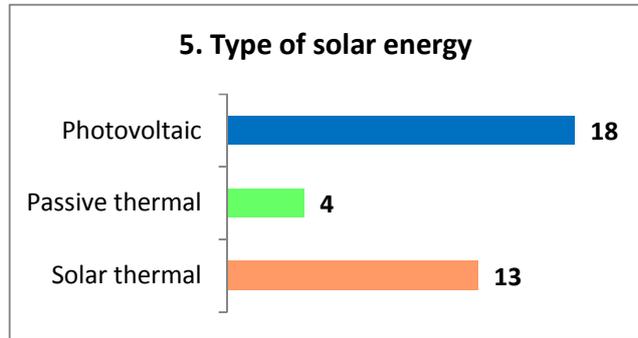


5. What type of solar energy subjects you are interested in?

86% of respondents are interested in photovoltaic energy, while 62% are interested in thermal energy.

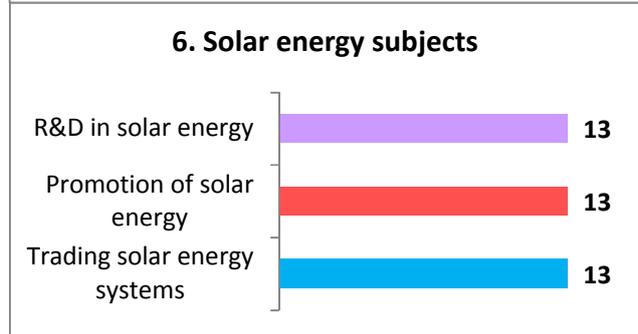
Other systems mentioned by respondents were the following:

- geothermal and CHP.
- solar cooling.
- completing our Inverter offer with photovoltaic panels.



6. What type of solar energy subjects you are interested in?

19 out of the 20 respondents answered the question, and in average respondents showed the same interest for the three subjects.



7. Do you have links to solar energy labs?

6 respondents (30%) have a link to a solar energy lab, while 13 don't (1 blank answer). Two of them have both an in-house lab and access to an outsourced lab.

8. What kind of equipment and practices are available for this lab?

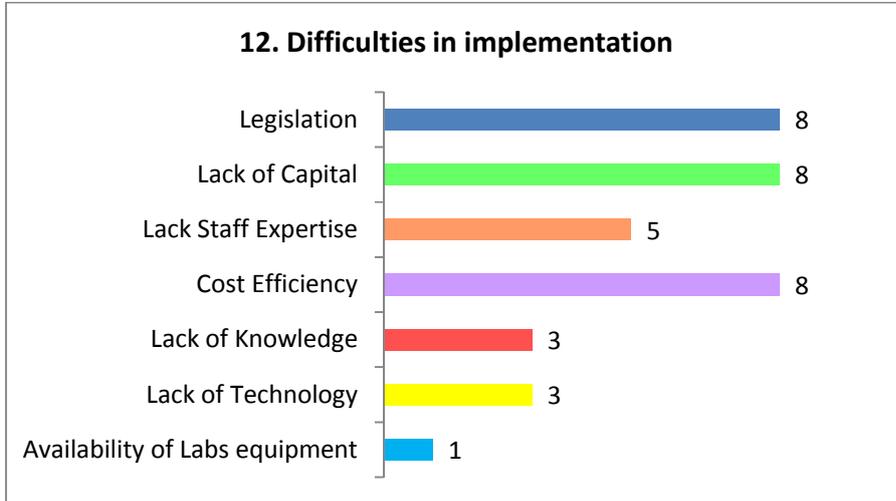
Answers were the following:

- PV Generation system
- PV Panels
- Dedicated software
- EN 12975 testing equipment

There was no mention about labs related to thermal systems, even though so far this is the most frequently type of system installed in Lebanon.

Yes / No questions:	YES	NO	No answer	Total
9. Have you adopted or used solar energy systems in your organization?	14	6	-	20
10. Have you implemented or been part of a solar energy subsidized/grant program? (international donors or government)	8	11	1	20
11. Do you have the intention to invest in a solar energy project/program/system or upgrade an already existing one?	17	3	-	20
13. Do you work with experts or specialists outside your organization on solar energy subsidized/grant program? (international donors or government)	13	5	2	20

12. Please define the two main difficulties in implementing solar energy system in your organization



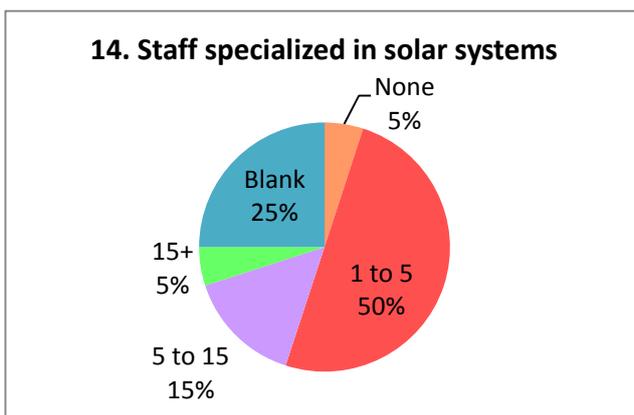
Legislation, lack of capital, and cost efficiency are the most frequently mentioned difficulties.

Other mentioned difficulties are:

- The lack of space
- The lack of government support
- Space restriction
- No financial availability

14. How many among your organization's staff are specialized on solar systems?

Answers to this question are coherent with the fact that most operators in the solar sector are small companies. Half of respondents have between one and five persons specialized in solar systems.



15. What is the initial amount invested to implement a solar energy system in your organization?

8 respondents answered this question. Figures provided are quite dissimilar, as shown by the following table:

15. Initial amount
\$ 1,000
\$ 3,000
\$ 5,000
\$ 15,000
\$ 40,000
\$ 50,000
€ 50,000
\$ 100,000

16. What is your yearly budget for operating your solar energy system?

Five respondents answered this question.

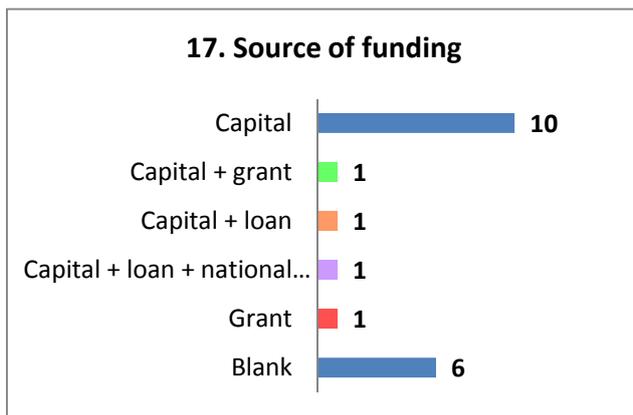
Answers are the following:

16. Yearly operating budget
\$ 150
\$ 300
Change batteries every ten years approx. €7,000
No budget
Zero

17. What is the source of funding of your organization's solar energy system?

Out of the 14 respondents having answered this question, only one has benefited from a national support scheme, which is rather surprising.

Most respondents stated that they have only used capital.

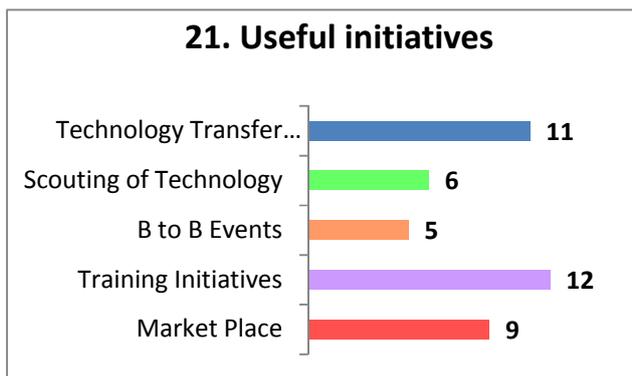


<u>Yes / No questions:</u>	YES	NO	Blank	Details:
18. Does your organization have any link or cooperation with public institutions or governmental agencies on the subject of solar	12	6	2	- LCEC (cited 9 times) - UNDP - LSES

energy?				- Universities, schools, hospitals
19. Is there any national or EU based support institutions on solar energy subject?	10	9	1	- EU Delegation - LCEC - LSES - UNDP - Foster - NABCEP in the USA - GTZ - Quali-PV label in France
20. Do you have any future plans on implementing solar energy solutions?	19	1	-	
23. Is there in your organization an office/person actively involved in facilitating technical, entrepreneurial and financial support?	12	8	-	

21. What kind of private/public initiative do you think can be relevant to cover your organisation's needs?

All respondents answered this question, and this shows their interest in initiatives aiming at supporting this sector.



22. How does the organization organize the commercialization process with respect to:

- Licensing
- Start-up or spin-off
- No commercialisation process identified

Only three respondents answered, the three of them stated that there was no commercialisation process identified. Two respondents stated that the question was not clear, and this is supported by the low level of answers to this question.

2.4 SWOT analysis

	HELPFUL (To achieving the objective)	HARMFUL (To achieving the objective)
INTERNAL ORIGIN	<ul style="list-style-type: none"> - Private sector operators are dynamic and quick to follow innovation in this domain. - Companies are usually aware of existing legislation. - Financing means are available (though limited). - Environmentally-friendly sector. - Possibility to implement personalized services (connection to the grid + private generator). - Possibility to implement innovative solutions (such as sun shades over building frontages). - University curricula in renewable energies are available in Lebanon. - 2 promising sectors for PV: a) industries, large enterprises, resorts and b) irrigation 	<ul style="list-style-type: none"> - Cooperation in research between enterprises and universities / research centres is almost inexistent. - Lack in testing facilities. - No economy of scale (small operators). - Few distribution networks (small operators). - Lack of staff expertise within companies. - Regarding residential systems: lack of space over the roof, and potential problems with neighbours. - Barriers to the entry of competitors are low. - Business owners might be oriented towards the technological aspect of the business and might disregard the marketing / commercialization aspect. - The initial investment required from users is a barrier for choosing a solar system. (Users tend to lack thinking on a long-term basis). - In PV: lack of previous records of successful PV installations. - Financing is long and complex to obtain.
EXTERNAL ORIGIN	<ul style="list-style-type: none"> - Some solutions (government renting renewable energy from private producers) are used in order to overcome delays and loopholes in the reform of the electricity sector in Lebanon (Law 462). - National support schemes have started to be implemented since 2010. - PV prices are on a decreasing trend. - The market for collective thermal systems is still unexploited. - Possibilities of vertical integration. - Good solar exposure for the country. 	<ul style="list-style-type: none"> - Lack of subsidy policy: traditional electricity still cheaper to obtain than PV electricity. - Delays in the reform of the electricity sector and loopholes in relative law (Law 462) hinder the development of this sector. - Technical problems (absence of EDL network 24/24 and instability of the network). - Instability in the country (war risk) - Certification (IRI) when importing solar products is sometimes slow to obtain. - Lack in awareness raising about solar solutions.

2.5 Global conclusions

The Lebanese PV sector is still in an emerging phase. The growth of the sector is conditioned by the reform of the electricity sector, including the setting up of a regulatory authority and the effective implementation of net metering.

The residential solar thermal market, which had been stagnant during the first decade of 2000, experienced a strong growth with the launching of the national schemes in 2010 (interest-free loans + subsidy of 200 USD per system). The market for collective thermal systems remains unexploited.

The survey shows that most operators in this sector are convinced by initiatives aiming at supporting the sector, as they are eager to participate in such events.

The following provides an overview of the solar sector's needs in Lebanon as identified by SHAAMS:

- The following activities have been deemed to be relevant to cover the SMEs needs (survey question 21):
 - a) Training initiatives
 - b) Technology transfer
 - c) Market place
 - d) Scouting of technology
 - e) B2b events
- Seminar topics that could effectively address the needs of the sector in Lebanon could include the following:
 - Using PV in the industrial / large enterprises / resorts sector (awareness, financial aspect, technical aspect, case studies and best practices).
 - Using PV in irrigation (awareness, financial aspect, technical aspect, case studies and best practices). Such as seminar would address PV installers on one hand, and wine / agriculture products producers on the other hand.
 - Integration of PV with private electricity generators: potentialities and technical aspects.
 - Collective Water Heaters: awareness, best practices, lessons learnt.
 - Smart Grid:
 - Energy mix to compensate renewable sources production fluctuations (solar electrical energy)
 - Stocking energy in primary source (water pumped back up at night time)

- R&D: need to foster cooperation between research centres and SMEs, and to facilitate access for SMEs to solar labs (only 30% of survey respondents have access to a solar lab). It is suggested to involve actively solar research centres and academia in SHAAMS WP6 activities.

3. The SHAAMS SOCIAL ACCELERATOR in Lebanon

3.1 The public awareness in the Lebanon

There is an important awareness and interest in Lebanon in environmental topics, as well as a readiness to collaborate, related to environmental topics from which solar energy, but technicalities and more informational content regarding solar field should be developed and highlighted in communication.

3.2. The Partnerships and initiatives in the solar sector

In order to support the social acceleration for SHAAMS, partnerships should target academic sector, media and press as well as environmental organizations.

3.3. The main barriers and facilitators to the public participation and the public awareness about solar energy: analysis of the results

- Question 1: Categories of respondents

30% represent academic and research institution organizations
 35% represent
 20% represent consultants, architects and contractors
 15% represent Students and scholars

- Question 2: Regarding the country you are living in : what do you think is the actual percentage of renewable energy of the total energy production:

75% of the respondents consider that the actual percentage of renewable energy of the total energy production is less than 10% in Lebanon while 25% estimate that it is between 10 and 40%.

- Question 3: Regarding the country you are living in: what do you think is the actual percentage of solar energy of the total renewable energy production?

70% of the respondents think that the actual percentage of solar energy of the total renewable energy production is less than 10% in Lebanon, while 30% consider that it varies between 10 and 40%

- Question 4: When talking about solar energy we have to distinguish between three main types described below. Which of these types you think should be given priority

- 100% of the respondents think that solar thermal is very important (Solar thermal being the uses the sun's heat to provide hot water for homes or swimming pools).
- 20% of the respondents think that photovoltaic energy is not important; 40% think that it is important, and 40% think that it is very important. (Photovoltaic energy being the Uses of energy from the sun to create electricity to run appliances and lighting. A photovoltaic system requires only daylight – not direct sunlight – to generate electricity).

- o 40% of the respondents think that passive heat is important, and 60% think that it is very important. (Passive heat: This is heat which we receive from the sun naturally. This can be taken into account in the design of buildings so that less additional heating is required).

- Question 5: Regarding the country you are living in: what kind of energy mix would you like to see in twenty years?

20% of the respondents want to see 100% renewable energy in Lebanon in 20 years, 40% want 50% renewable energy, and 40% want 25% renewable energy.

- Question 6: Regarding the situation in your country: what would you say are the main barriers which hamper a further development of renewable energy solutions?

- Lack of information of civil society: Not important 25% Slightly important 50% Important 25%

- Lack of pressure from civil society to further develop renewable energies
Not important: 20% Slightly important: 20% Important: 40% Very important: 20%

- Lack of political will of decision makers: Very Important: 90%

- Lack of willingness of business sector: Important: 50% Very important: 50%

- Lack of sufficient foreign investment: Slightly important: 25% Rather Important: 50% important: 25%

- Lack of sufficient renewable energy sources: Not important: 25% Slightly important: 75%

- Question 7: Do you think that the production of renewable energy is in general more expensive than the production of energy based on fossil or nuclear sources?

60% think that the production of renewable energy is more expensive, and 40% think the opposite.

- Question 8: Do you think that you have enough knowledge and information about how to save energy at home or at your working place?

60% think that they know how to save water at home or work, 20% don't know, and 20% are not sure if they know.

- Question 9: Climate Change is considered one of the greatest environmental and economic challenges of the 21st century. Regarding your country, do you think that this threat is taken seriously into consideration when decision makers decide about the best energy solutions for the country?

35% consider that this threat is taken seriously and 65% consider that it is not taken seriously.

- Question 10: What do you think you could do to influence the discussion and decision making process regarding the future energy policy in your country?

- o Participate in public hearings and roundtables on energy issues: 60%
- o Participate in campaigns or education activities: 20%
- o Collaborate with a political party: 20%
- o Collaborate with a NGO: 40%

- Question 11: Did you ever hear of Earth Hour or any other campaign dealing with Climate Change and/or renewable energies 75% have heard of Earth Hour Campaign and 25% haven't.

3.4 SWOT Analysis

Based on the above results, some elements were considered in the SWOT analysis giving a clearer overview about the context

	HELPFUL (To achieving the objective)	HARMFUL (To achieving the objective)
INTERNAL ORIGIN	<p>STRENGTHS</p> <ul style="list-style-type: none"> o A majority participate in public hearings and roundtables on energy issues o Majority of respondents collaborate already with NGOs around environmental activities o 60% think that they know how to save water at home or work 	<p>WEAKNESSES:</p> <ul style="list-style-type: none"> o The actual percentage of renewable energy of the total energy production is less than 10% o Lack of information of civil society
EXTERNAL ORIGIN	<p>OPPORTUNITIES:</p> <ul style="list-style-type: none"> o Respondents consider that solar thermal is very important o People are willing to collaborate with organizations for awareness campaign and activities 	<p>THREATS</p> <ul style="list-style-type: none"> o Lack of political will of decision makers o Climate change threat is not taken seriously into consideration when decision makers decide about the best energy solutions for the country o Main barriers for further development of renewable energy solutions is lack of political will of decision makers

3.5 Global conclusions

We can conclude that major players who promote solar energy and environmental awareness are academic institutions and organizations so it is important to focus on these sectors regarding awareness campaigns and targeted initiatives.

Lebanese citizens think that little renewable energy is being used in Lebanon. They think that solar thermal is the most important type of solar energy so awareness campaign should highlight the importance of remaining types. Nevertheless, they would like to see improvement regarding renewable energy, thus preferring to see 25% or 50% of renewable energy used in Lebanon, so probability is they will be cooperative with related initiatives.



When it comes to explaining the lack of use of renewable energy in the country, Lebanese people think that it is mainly due to political reasons and secondly to the business sector, so the strategy can start by focusing on business corporations which can be through CSR programs and general awareness campaigns, events... In order to improve the use of renewable energy in Lebanon, respondents believe that they should participate in public hearings and roundtables about the subject, along with collaboration with NGOs. What is remarkable is that people are willing to cooperate with environmental initiatives; the strategy should consider several aspects of promotion, highlighting the importance of renewable energy and environment. This can be done through general awareness campaign (social media, conferences, articles and publications, etc) and engaging activities promoting environmental responsibility in collaboration with academic institutions and organizations (NGO). This can play an influence on decision-making authorities and shall facilitate the collaboration with them, after mobilizing citizens and business representatives.

Important initiatives to consider for the sector:

- Activities and communication focus should target academic sector in Lebanon and environmental organizations (conferences, public hearings, social media, articles and publications, thus, mobilizing key actors...)
- There is a great interest from the media to environmental awareness which will support SHAAMS project, having a power of influence on society
- Project is in line with an environmental priority in Lebanon
- A good strategy for the private sector is to focus on business sector and raise awareness through CSR and social programs.

4. SHAAMS common indicators for the sectors analysis.

Indicator	Category		Exists by end of 2011	Exists by end of 2012	Exists by end of 2013	Exists by end of 2014	Exists by end of 2015	Notes
Region of reference: Lebanon								
1 - N° of solar systems in the region	Solar thermal power							Not Available
	Solar thermal application in hot water, space heating, drying, solar cooling		96,048	110,334	124,620	138,906	153,191	Estimation based on Global SWH project (and residential SWHs market in Lebanon in 2011 report).
	Solar PV systems		72	80	120	180	200	CEDRO+NEEREA+Private
	Installed power per capita							Not Available
2 -Total investments in solar energy in your region	Grant schemes to support private investments		1.5Million USDs +100Million USDS	1.5Million USDs Ministry of Energy and Water additional Grant for SWHs. 100Million USDs could be leveraged in loans through the NEEREA financing mechanism for RE and EE projects including solar.				
	No of solar systems in public buildings		19	19	19	19	19	CEDRO
	Money invested on raising		400,000 USDS	600,000 USDS	800,000 USDS	1Million USDS	1Million USDS	Global SWH project: 1 million USD 2009-2014

	awareness (training, communication)							
	Which technology does the state support?		PV and SWHs	Ministry of Energy and Water provides grants of 200USDs for qualified SWHs (mainly the ones conformant with the Lebanese standards). BDL provides 0%- interest loans for RE in general including PV.				
3 – Total solar energy production in your region	Total energy generated from the solar energy							Not Available