THE RESIDENTIAL SOLAR WATER HEATERS MARKET IN LEBANON IN 2011

HOW CAN SOUND GOVERNMENTAL POLICIES BOOST A GREEN ECONOMY

LEBANESE REPUBLIC
MINISTRY OF ENERGY AND WATER

UNDP

gef

SEPTEMBER 2012
Beirut, Lebanon

L.C.E.C.
Lebanese Center for Energy Conservation
المركز اللبناني لحفظ الطاقة

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How can sound governmental policies boost a green economy

A United Nations Development Programme (UNDP) Publication
The GEF Global Solar Water Heaters Project-
The Lebanese Center for Energy Conservation (LCEC)

September 2012
Beirut, Lebanon

RESIDENTIAL SOLAR WATER HEATERS

THE REPORT

The United Nations Development Programme (UNDP) is the UN's principle provider of development, advice, advocacy and grant support. With 131 country offices, it has long enjoyed the trust and confidence of governments and NGOs in many parts of the developing as well as developed world. It is typically regarded as a partner rather than as an adversary, and its commitment to a universal presence proved especially useful in post-conflict situation and with states that have been otherwise isolated from the international community.

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United Nations Development Programme, www.undp.org.lb
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Note: The information contained within this document has been developed within a specific scope, and will be updated in the future.

FOREWORD

This report is commissioned and produced by the GEF "Global Solar Water Heating Market Transformation and Strengthening Initiative" project, managed by the United Nations Development Programme (UNDP) and implemented by the Ministry of Energy and Water through the Lebanese Center for Energy Conservation (LCEC). The financing was provided by the Global Environment Facility (GEF), the Ministry of Energy and Water in Lebanon (MEW), and the United Nations Development Programme (UNDP).

The GEF-funded initiative started in mid 2009. In 2010, the project team succeeded in drafting a financing mechanism for the development of the SWH market which received the direct support of the Minister of Energy and Water H.E. Mr. Gebran Bassil. Adopted by the Ministry of Energy and Water, the mechanism was adopted by the Government of Lebanon on 10 March 2010.

The objective of the report is to offer a comprehensive overview of the solar water heaters market in Lebanon through a detailed analysis of the market in the year 2011. The importance of this analysis is that it reflects the direct impact that the Ministry's initiative has had on the market, in an attempt to show how sound governmental policies can boost a green economy.

This current study aims at collecting and analyzing information about the small scale residential (individual) solar thermal market performance in the year 2011, including market evolution through the study of sales activities, the effect of loans, and the contribution of governmental subsidies.

It is crucial to note that the success of this national financing mechanism is the result of direct and close cooperation among three major players: the Ministry of Energy and Water, the Central Bank of Lebanon, and the United Nations Development programme (UNDP). In this regard, the GEF Global Solar Water Heaters Project- the Lebanese Center for Energy Conservation (LCEC) would like to acknowledge the efforts invested to make this project a success.

The implementation of this national financing initiative was made true with the support and encouragement of the Governor of the Central Bank of Lebanon Mr. Riad Salameh. The continuous coordination and involvement of the Financing Unit at BDL made the loans procedure move smoothly. Mr. Wael Hamdan and Mr. Mazen Halawi had a major share in boosting the effect of this national mechanism.

The main analysis and writing of this current report is done by Mr. Nader Hajj Shehadeh (GEF- UNDP Global SWH Project Team Member, LCEC Energy Engineer). The design and layout is done by Ms. Tracy Barakat (Graphic Designer).

The GEF Global Solar Water Heaters Project team has strived to offer a comprehensive report that could be used as a reference document for the solar thermal market in Lebanon. The team is keen to keep updating this document in the future. All comments and suggestions are welcome at the following email address: energy@lcecp.org.lb

The GEF Global Solar Water Heaters Project Team
The Lebanese Center for Energy Conservation (LCEC)
Ministry of Energy and Water- Beirut, Lebanon
August 2012

LIST OF ACRONYMS & ABBREVIATIONS

BDL	Central Bank of Lebanon
BLC	Banque Libanaise pour le Commerce
BLF	Banque Libano-Française
BLOM	Banque du Liban et d'Outre-Mer
BSL	Societe Nouvelle de la Banque de Syrie et du Liban
CDM	Clean Development Mechanism
CER	Certified Emissions Reduction
CO_2	Carbon Dioxide
CPC	Compound Parabolic Concentrator
EDL	Electricite du Liban
ESCO	Energy Service Company
FP	Flat Plate
GEF	Global Environment Facility
GHG	Greenhouse Gases
GWh	Giga Watt Hour
IBL	Intercontinental Bank of Lebanon
IRI	Industrial Research Institute
IRR	Internal Rate of Return
ISC	Integral Storage Collectors
kg	Kilo gram
kWh	Kilo Watt Hour
LBP	Lebanese Pound
LCEC	Lebanese Center for Energy Conservation
Libnor	Lebanese Norms Institute
MEW	Ministry of Energy and Water
MW	Mega Watt
MWh	Mega Watt Hour
NEEAP	National Energy Efficiency Action Plan
NPV	Net Present Value
Sq.m	Square Meters
SWH	Solar Water Heater
UNDP	United Nations Development Programme
US	United States
USD	United States Dollars

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EXECUTIVE SUMMARY

This report provides analysis and evaluation of individual residential solar water heaters market in 2011 and the performance of companies over the period of 12 months. Methods of analysis used included a survey based on the loan applications submitted to the Central Bank of Lebanon through commercial banks, and investigation of sales volumes through personal communication with companies' directors. This combined with demographic and geographic data collected, presents the different market penetrations.

Results of data analysed show that around 30% of the individual residential solar water heating units installed during 2011 were through the interest-free loan program launched by the BDL and MEW, of which 48% benefited from the $200 subsidy offered by the MEW. The total installed capacity in this sector was 43,500 sq.m in 2011, with a hot water storage capacity of 3,313,427 liters leading to an annual energy consumption reduction of 28,292 MWh, and thus avoiding a power capacity of 3.68 MW of electricity production. This corresponds to saving around 18,389 tons of CO_2 equivalent emissions annually.

Doing business as usual, a total of 20,000 sq.m for residential solar water heaters were expected to be installed in 2011, the program contributed to the installation of 23,500 sq.m. This has led to a reduction of $78,470 in the annual subsidies paid by the Lebanese government with a total saving of $1,122,912 over the period of 15 years, having an internal rate of return of 22%.

Installations were distributed all over the country, with Mount Lebanon, Nabatieh, and Bekaa having the biggest shares among the 8 governorates including Beirut. In terms of districts, Zahleh, Metn, and Nabatieh have witnessed most of the installations.

The average storage area per system is 266 liters at an average cost of $1,487. Products are mostly Chinese with more than 70% of the collectors and more than 42% of storage tanks coming from China, while Lebanese products are less common with 18% of collectors and 36% of storage tanks.

The report finds a positive driving impact of the SWH subsidy and interest-free loan initiative, with economic feasibility and promising growing potential, reaching at the recommendation to conduct further awareness activities in some regions of the country where the penetration of SWHs is not well established.

2011 IN NUMBERS

- ✓ 12,197 SOLAR WATER HEATERS ARE INSTALLED IN THE RESIDENTIAL SECTOR OF LEBANON IN 2011.
- ✓ THE ESTIMATED MARKET VALUE FOR SOLAR WATER HEATERS IN LEBANON REACHED 18,131,183 USD IN 2011.
- ✓ 3,557 CITIZENS BENEFITTED FROM INTEREST-FREE LOANS OFFERED AS PART OF THE NATIONAL FINANCING MECHANISM.
- ✓ 1,717 CITIZENS RECEIVED THE 200 USD GRANT SUBSIDIES OFFERED BY THE MINISTRY OF ENERGY AND WATER.
- ✓ 43,500 SQUARE METERS OF SOLAR WATER HEATERS COLLECTOR AREA IS INSTALLED IN 2011.
- ✓ 53 COMPANIES OUT OF 110 WORKING IN THE SOLAR WATER HEATERS SECTORS ARE QUALIFIED BY THE LEBANESE CENTER FOR ENERGY CONSERVATION (LCEC).
- ✓ 8 LEBANESE COMMERCIAL BANKS ARE INVOLVED IN THE NATIONAL FINANCING MECHANISM THROUGH THE LOAN APPLICATIONS RECEIVED FROM THE CENTRAL BANK OF LEBANON.
- ✓ 69% OF THE SYSTEMS INSTALLED AS PART OF THE NATIONAL FINANCING MECHANISM ARE VACUUM TUBES SYSTEMS WHILE 29% ARE FLAT PLATE SYSTEMS.
- ✓ SOLAR WATER HEATERS INSTALLATIONS SAVED A TOTAL OF 18,390 TONS OF CO_2 ANNUALLY AFTER EQUIVALENT.
- ✓ SOLAR WATER HEATERS INSTALLATIONS RESULT IN YEARLY SAVINGS OF 3,754,687 USD.

BACKGROUND

1. The GEF Global Solar Water Heaters Initiative

Back in 2009, the Ministry of Energy and Water (MEW) and the United Nations Development Programme (UNDP) signed a new agreement to launch the project "global solar water heaters market transformation and strengthening initiative" funded by the Global Environment Facility (GEF). This project is part of the GEF initiative covering 6 countries worldwide: Albania, Algeria, Chile, India, Lebanon and Mexico.

The national initiative is in line with the previous efforts invested by the MEW and UNDP in the energy efficiency and renewable energy sectors through the Lebanese Center for Energy Conservation (LCEC).

The initiative aims at accelerating the market development of solar water heating in Lebanon with an objective to facilitate the installation of 190,000 m2 of new installed collector area over the period 2009-2014, an annual sale of 50,000 m2 reached by the year 2014, and most importantly lay the foundation for an expected continuing growth to reach the set target of 1,050,000 m2 of total installed solar water heaters capacity by 2020.

In terms of energy savings, this has been estimated to correspond to over 16 MW of avoided new fossil fuel power capacity by using solar instead of electricity for water heating, and estimated cumulative greenhouse gas reduction potential of over 3 million tons of CO_2 from 2009 to 2020. The figure below shows the actual estimated installations as well as the projected future outcomes.

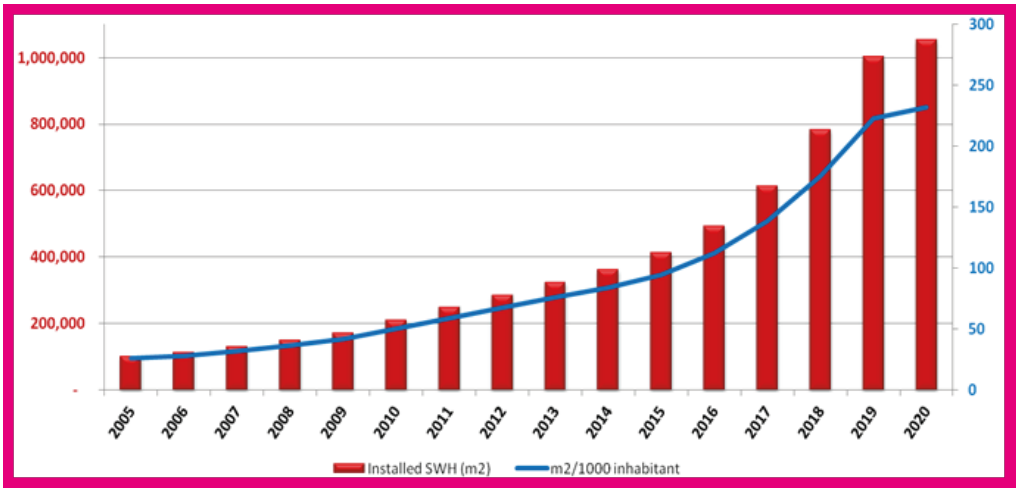


Figure 1: Estimated current and future solar installations in Lebanon (2005-2020)

The initiative is developed on four levels: establishing an environment at the policy and financial levels for the promotion of solar water heating in Lebanon; raising awareness and increasing information about the market; implementing pilot projects and setting up certification and quality control schemes. All the activities are captured and reported as lessons learnt for future needs.

With a total budget of 1.1 million USD, the main partners of the initiative are the Ministry of Energy and Water, the Ministry of Finance, the Order of Engineers and Architects, the UNDP CEDRO project, and others. Through the good alignment of efforts, LCEC hopes the initiative will be able to leverage at least 50 to 100 million USD (about 50% to 100% of the total investments needs) over the period 2009-2014.

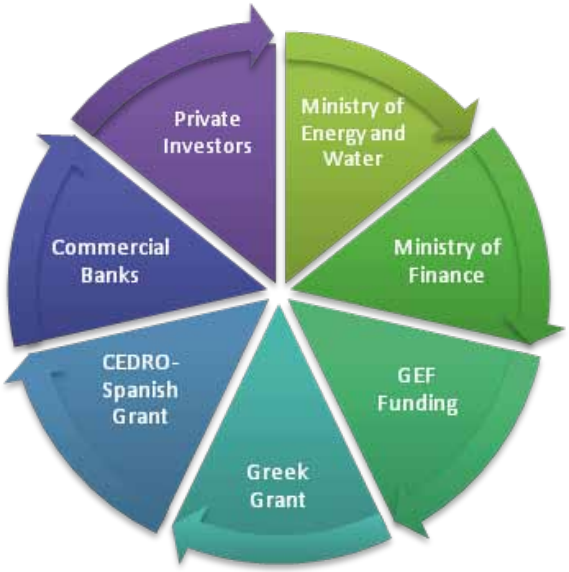


Figure 2: Alignment of efforts to leverage at least 50 to 100 million USD

The success of the initiative is measured through the adoption of a national system for adequate product standards, labeling and quality control scheme (harmonized with international schemes); the enhanced capacity of the supply chain to offer their products and services and verified customer satisfaction; and the adoption of financial incentives and legislative reforms and most importantly, the creation of a solar financing mechanism.

Effectively, on 10 March 2010, the Government of Lebanon approved the national financing mechanism for solar water heaters.

2. The National Financing Mechanism for Solar Water Heaters

In its decision No. 59 dated 10 March 2010, the Council of Ministers of Lebanon approved the national action plan submitted by the Ministry of Energy and Water for the promotion of energy efficiency and renewable energy in Lebanon with a total budget of 9 Million US Dollars. The plan was prepared by the Lebanese Center for Energy Conservation (LCEC) in the framework of the GEF-funded "Global Solar Water Heaters" initiative. The national action plan included three components dedicated to: energy efficient lighting, solar water heating and efficient public street lighting.

The second component of the action plan consists of the setup of a national financing mechanism for solar water heaters to be managed by the Central Bank of Lebanon (BDL). It also aims at subsidizing 7,500 solar water heaters with an ambitious final target "a solar water heater for every house" using a budget of USD 1.5 million allocated as grants to final beneficiaries. The mechanism offers residential home owners interest-free loans over a 5-year period to be secured by Lebanese commercial banks.

According to the action plan, residential users can benefit from the interest-free loans to get a solar water heater system. In addition, beneficiaries can benefit from the 200 USD subsidies to be discounted from the total cost of system purchased in conformity with standards set by the Lebanese authorities. For this purpose, the LCEC has set a national certification and quality control scheme for solar water heaters suppliers and installers, which aims at controlling the quality of the products offered and improving the performance of the companies in the field in order to ensure satisfactory experience with solar water heating systems at the user level.

3. Loan Applications Process

Users interested in installing solar water heaters at their premises can apply for the interest-free SWH loan at any of the commercial banks offering this service. The bank would provide a list of qualified companies issued by the LCEC with full contact details as shown in Appendix 1.

Users wishing to benefit from the USD 200 subsidy in addition to the interest-free loan should contact any company from the list to purchase a solar water heater requesting the products approved by LCEC. Wishing to benefit from the loan without any subsidy, users have the freedom to choose any company with no restrictions to be listed by LCEC.

The user then applies for a solar loan providing the commercial bank with the required documents in addition to the official invoice issued by the solar water heaters dealer. Once the loan is accepted by the commercial bank, it is officially forwarded to the BDL in a list of several similar loan applications. The BDL in turn removes any implications of the costumer name to guarantee banking secrecy, and sends the list of applications to the Ministry of Energy and Water for review.

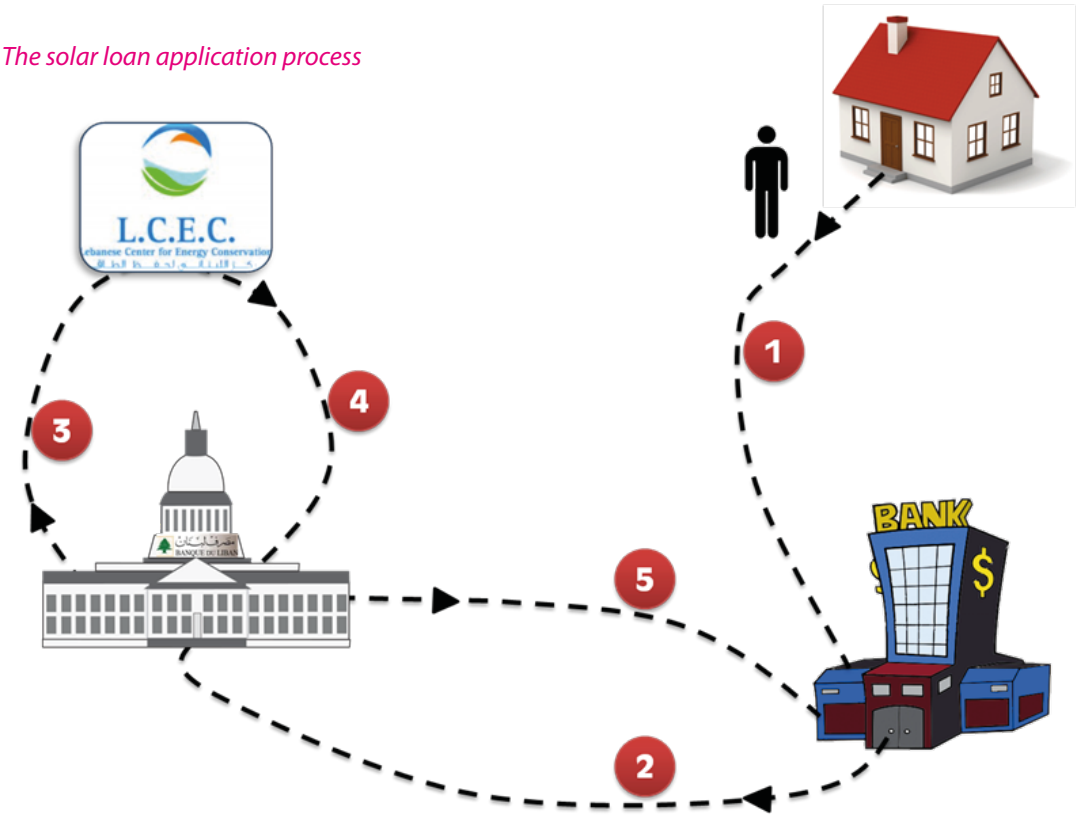
The Ministry delegates the LCEC to evaluate the applications, which makes sure to guarantee fair evaluation and ensure consumer satisfaction and asks for copies of applications' invoices to study the product offered by the supplier and make sure the quality conforms with LCEC qualification requirements.

Based on the results, a response with the approval and rejection of subsidies for the applications is sent to the Ministry, and then officially forwarded to the BDL, which in turn notifies the banks and transfers the total amounts of subsidies within a matter of days.

From here on, it is the bank's responsibility to contact their clients and notify them of the results. Clients getting the subsidy will receive a credit of $200 on their balance which will be reducing the repayment period.

This process takes around 60 to 90 days based on quantity of applications and availability of information.

Figure 3: The solar loan application process



4. The Qualification of Solar Water Heaters Companies

In October 2010, LCEC launched a qualification campaign offering eligible companies the possibility to benefit from any initiative given by the Ministry of Energy and Water in the framework of a national plan to promote solar water heaters, including the setup of financial incentives to consumers willing to install SWH systems.

Qualification was based on two criteria according to European Norms (EN 12975/6): the eligibility of the company corresponded to 70% of the total qualification score, while the performance and eligibility of the products offered by the company accounted for 30% of the total score.

Until May 2012, 53 companies out of 110 were qualified by LCEC and the list of qualified companies was published in an official list distributed to commercial banks.

The first version of qualified companies was issued in December 2010 with an acceptance of 78% of the 23 applications submitted to LCEC. Evaluation was done monthly with 8% of the 26 applications received for the second version in January 2011 accepted, then 43% in February, and 80% in March the same year. The 5th version was issued in September 2011 with 15 new companies making it to the qualification list, and only 1 out of 5 applications was accepted in the sixth version of February 2012. The final version issued in July 2012 witnessed 2 companies passing out of the 8 applications submitted.

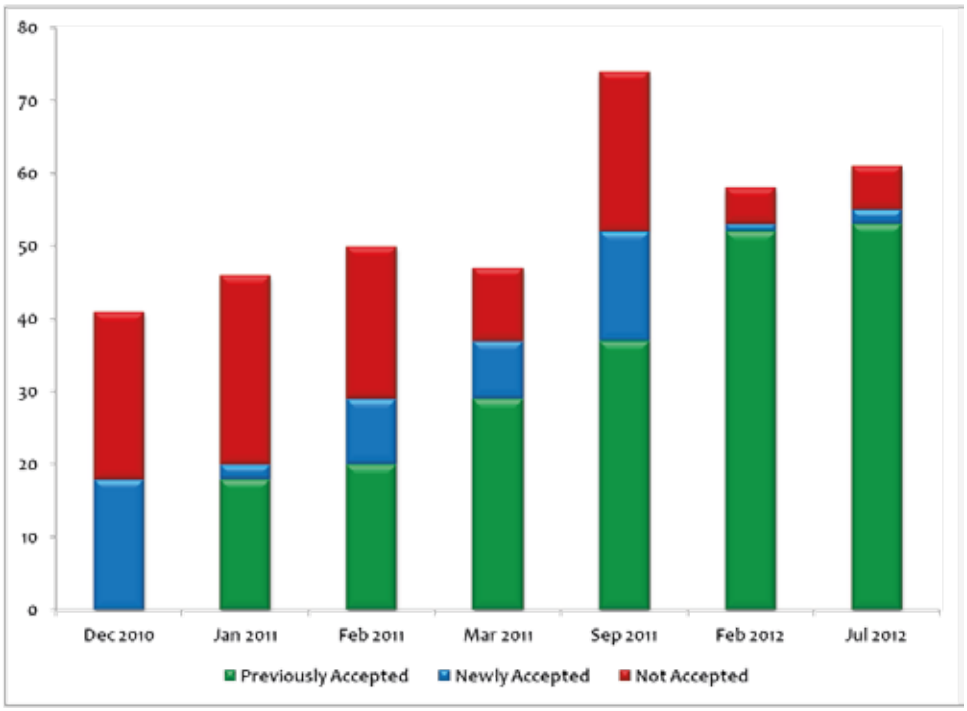


Figure 4: Prequalification applications submitted to LCEC (Versions 1 to 6)

INTRODUCTION

The solar water heaters market is witnessing a remarkable increase since few years from now, with the number of companies working in this sector increasing from 25 in 2005 to more than 110 by the end of 2011. This growth is the result of an increased market demand driven by a combination of an increased awareness among beneficiaries, and most importantly the setup of the national financing mechanism and grant subsidies offered by the Ministry of Energy and Water and the Central Bank of Lebanon.

The purpose of this study is to offer the actual market development of solar water heaters in Lebanon for the year 2011. The study collects information about the market growth and focuses on 2011 as a baseline year for market analysis, in an aim to determine the installed capacity and investigate the different factors pertaining to the solar water heaters purchase and installation during the year.

It is important to note that the study focuses on the solar water heaters installations for individual residential consumers. The results of the study are based on the detailed applications received from the Central Bank of Lebanon (BDL) for the request of loans, as well as on a detailed survey on the number of systems installed either directly or through direct payments to the suppliers. The survey is conducted by the Global SWH Project team.

The current report strives to answer the following questions: how effective is the SWH national financing mechanism? What is the effect of introducing the solar loan on the overall residential solar thermal market? What are the market characteristics in terms of products, demand, and response level? What is the economic and environmental impact of the program at the national level? In trying to answer these questions, the report gives a comprehensive overview of the solar water heaters market development.

In terms of methodology, the following section offers detailed information on the main elements of analysis, including study rationale, sources of data, estimations, calculations, but also study limitations and constraints.

The report is then divided into 3 main chapters, namely the direct results of the study, the analysis of the market, and the economic and environmental impact of the market development. The three sections are followed by a conclusion including some recommendations for the future.

The chapter "Results of the Study" reports the total installations by company and loan applications by commercial bank. This includes installations done through the solar loan and through other financing mechanisms. The installations are reported in terms of number of systems, collection area, and storage capacity. The results are presented by time and region of occurrence to compare monthly evolution and regional distribution, in addition to the product specifications and the country of origin of products available in market.

The chapter "Analysis of the Results" provides further investigation and benchmarks resulting from the study performed. The average collection area requirement and system expenses are deduced for different types of systems. In addition, the installations per region are further analyzed to get the density of installations per inhabitant and the performance of companies in each governorate, in addition to the level of activity of each bank by region.

Finally, the section "Economic and Environmental Impact" presents the electricity and economic savings, in addition to the greenhouse gases emissions reduction resulting from this program. It is then concluded with an economic feasibility study to have the net present value and internal rate of return for the initiative as a whole.

STUDY METHODOLOGY AND LIMITATIONS

The study includes a quantitative analysis of the residential solar water heaters installations being directly and indirectly promoted through the interest-free loans in 2011. Simulations were also conducted to quantify the installed systems paid in cash and private "dealer-to-consumer" loans or agreements.

To quantify the number of solar water heaters installed in 2011, the study used information from the applications for solar loans received by the Ministry of Energy and Water from the Central Bank of Lebanon. The information collected included number of systems, geographic location, capacity, country of origin, and other useful factors.

In order to estimate the overall installed systems and the direct as well as indirect impact of this initiative, companies were contacted and surveyed to estimate the additional installations at the individual residential levels.

The data used in the study had a number of limitations. To begin with, the study included 84 companies out of 110 present in the market. Despite the fact that 26 companies did not take part in this study, the results are not affected since the market share of these companies is relatively low.

On the other hand, the data provided by the participating companies regarding their overall sales and the share of the loans were insufficient in some cases. The analysis takes this fact into consideration and adjusts the final results accordingly.

Finally, the invoices provided did not always include all sufficient information like addresses and the origins and brands of the products used. Some data was retrieved through direct contact with the suppliers but others needed to be estimated based on the companies trends and activities.

The study was carried out in the period of February- July 2012, during which the applications received in 2011 and the first half of 2012 were collected to extract the required information to a comprehensive spread sheet used for the analysis.

The loan applications received from the Central Bank of Lebanon involved 8 Lebanese commercial banks namely: Al Ahli International Bank, Banque Libanaise pour le Commerce (BLC), Banque Libano-Française (BLF), Banque du Liban et d'Outre-Mer (BLOM), Fransabank, Intercontinental Bank of Lebanon (IBL), BankMed, and Societe Nouvelle de la Banque de Syrie et du Liban (BSL).

The total number of companies involved is 84, with the number of loans starting from a single loan per company to 732 loans per company for the period from October 2010 to May 2012. Among these companies, 77 were involved in this study specifically limited to the year 2011. The companies involved in the analysis are available in Appendix 2.

Data is collected from the applications and then combined with the results of the survey conducted with the companies to reach overall figures of the residential solar water heaters in Lebanon during the year of interest.

CHAPTER 1

RESULTS OF THE STUDY

RESULTS OF THE STUDY

1.1 Solar Water Heaters Installations

The current section provides the total number of individual solar water heater systems installed in 2011 in Lebanon. In this section as well in all other sections to follow, the installed solar water heaters are divided into 3 categories (depending on the means of financing):

- Solar water heaters installed through the national financing mechanism (loan with 0% interest and a repayment period of up to 5 years) but which did not benefit from the 200 USD grant offered by the Ministry of Energy and Water;
- Solar water heaters installed through the national financing mechanism (loan with 0% interest and a repayment period of up to 5 years) and which benefit from the 200 USD grant offered by the Ministry of Energy and Water;
- Solar water heaters installed either through direct cash payments or private "dealer-to-consumer" loans or agreements.

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- Solar water heaters installed either through direct cash payments or private "dealer-to-consumer" loans or agreements

Results are presented in terms of number of installed units of solar water heater systems, the total surface area measured in square meters, and finally the volume of hot water in tanks measured in liters.

1.1.1 Installed Units

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 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.

The 8,640 additional systems were purchased and installed either in cash, personal loans, or in direct supplier-consumer quarterly payments.

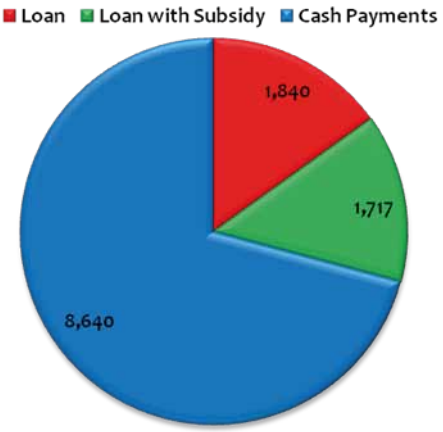


Figure 5: Installed systems by means of financing

It is important to note that the total subsidy provided by the government during 2011 for the 1,717 applications amounts to 343,400 USD and facilitating direct loans with a monetary value of 5,287,583 USD and driving a national market with a size of 18,131,183 USD. Accordingly, subsidies by the Ministry of Energy and Water amount to around 1.89% of the total market size.

It is also worth noting that the Government of Lebanon has allocated 1.5 million USD to be spent as subsidies on solar water heaters systems (200 USD grant). The amount spent is 2011 represents around 22.9% of the total budget set for the subsidy program.

1.1.2 Capacity Installations

In terms of collector surface area, the 12,197 installed systems correspond to an installed capacity estimated to exceed 43,500 square meters of collector area. Out of this total, around 11,695 square meters of collector area were installed through the solar loans initiative.

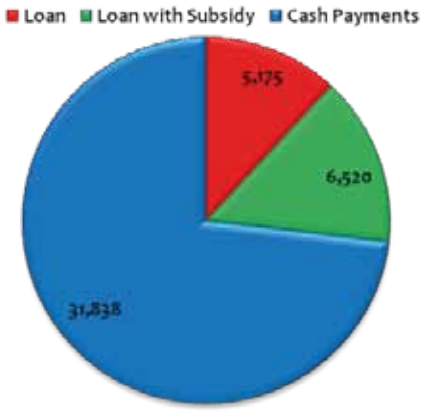
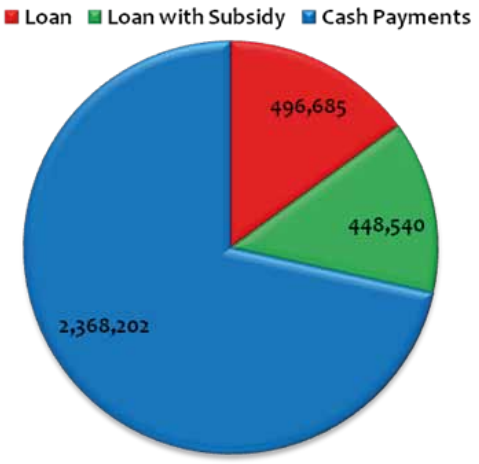


Figure 6: Installed collection area in square meters by means of financing

In terms of storage capacity, the total installed storage capacity in 2011 is estimated at around was 3,313,427 liters, equivalent to 3,313 cubic meters of hot water capacity. Out of this total, the storage capacity installed through loans is 945,225 liters (distributed as follows: 496,685 liters through loans and 448,540 liters through loans with subsidies).

Figure 7: Installed storage capacity in liters by means of financing



1.2 Monthly Distribution and Geographic Distribution

Although the national financing initiative (loan program) was approved in March 2010, the actual implementation was officially launched by the end of 2010. Following a national media campaign by the Ministry of Energy and Water, banks started internal and external campaigns to promote the interest-free loans and encourage customers to benefit from this program.

The current section presents the monthly variation of the installation of solar water heaters systems in 2011. This variation includes only the 3,557 systems purchased as part of the national financing mechanism.

In addition, the geographic distribution per caza is presented. This includes the distribution of loans without subsidies and those subsidized.

1.2.1 Monthly Variation

During the first quarter of 2011, the average monthly installation rate was 382 systems. This average value drops to 316 in the second quarter, and 219 in the third quarter. Then it rises again to reach an average of 269 installations during the last quarter of 2011.

The overall monthly average installation rate is 296 systems, peaking in February with 401 systems, and reaching its lowest in July with 181 systems as shown in Figure 7.

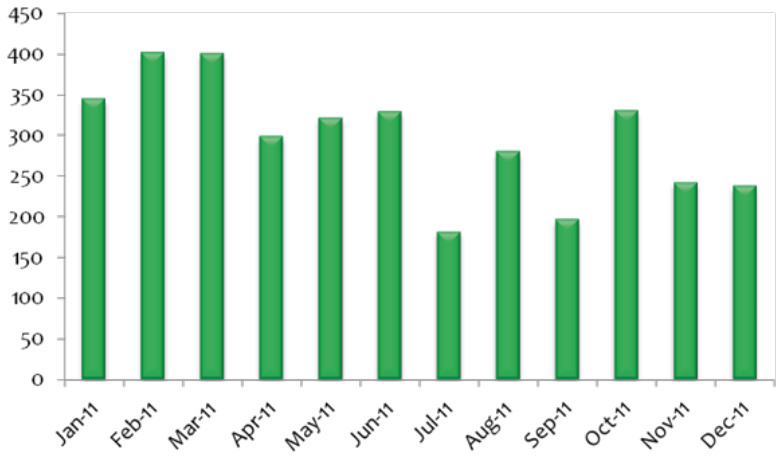


Figure 8: Monthly installations of solar water heaters through the loan

1.2.2 Geographic Distribution

In terms of geographic distribution, Mount Lebanon seems to have the highest share of solar water heaters installation with a share of 29% of the installed systems, followed by Nabatieh and Bekaa with 21% and 17% respectively.

For loans with subsidized systems, the share of Bekaa drops to 5%, keeping Mount Lebanon and Nabatieh leading with 30% and 27% of the subsidized applications respectively.

One interesting interpretation of the drop in the share of Bekaa from 17% to 5% is the fact that a large number of the loan applications belong to companies which are not qualified with the LCEC.

It is also important to note that for both loans without subsidies and those with subsidies, Beirut has very low share of 2% for loan applications and 3% for subsidized systems as shown in Figure 8.

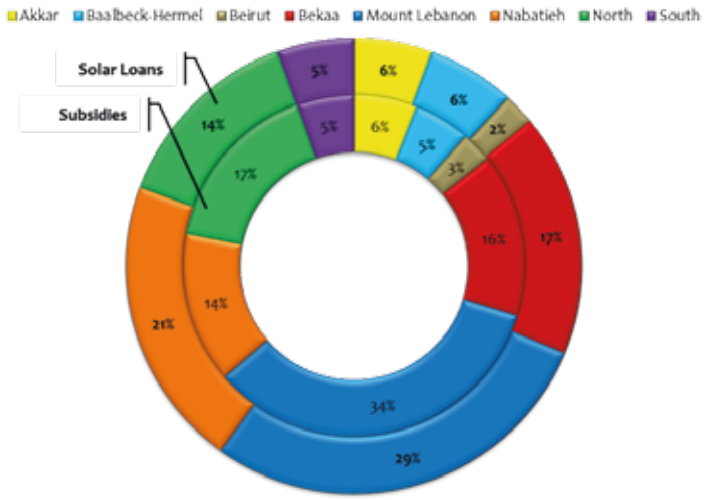


Figure 9: SWH installation loans and subsidies distribution by governorate

A more analysis at the level of cazas show that the caza Zahle ranks first with 514 installations, followed by Metn with 416 installations. Three cazas follow South Lebanon, and these are Nabatieh, Marjeioun, and Bint Jbeil with 251, 244, and 223 installations respectively.

Zahle has a lower share of subsidies of 10% of the subsidized systems per district, keeping Metn on top with 249 systems, Bin Jbeil with 210, and Marjeioun with 201 subsidies as Figure 9 shows.

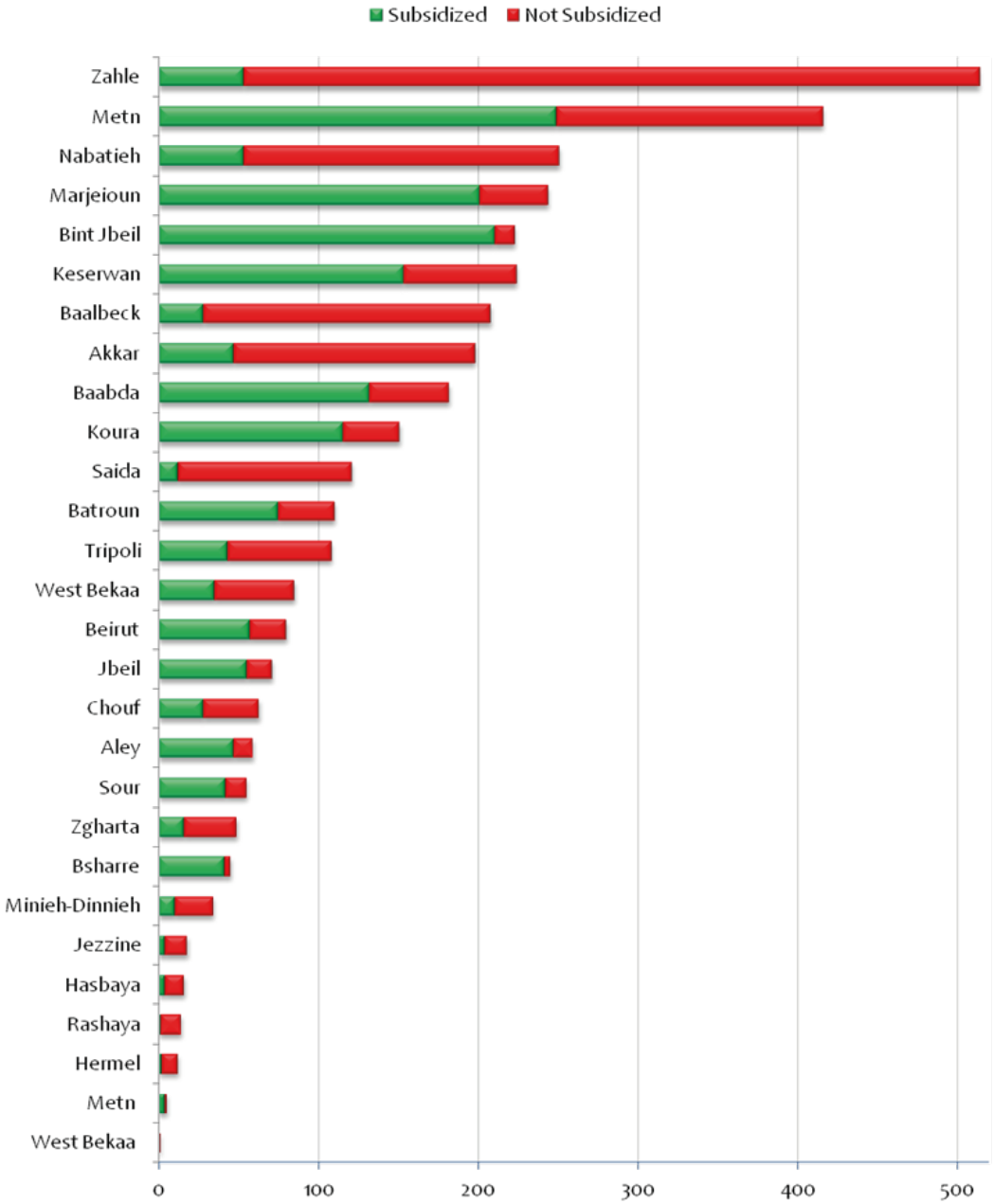


Figure 10: SWH installation distribution by district

1.3 Performance of Companies

During 2011, a total of 77 companies were involved in this national initiative with companies having negligible market shares to others leading with as much as 27% of the total market size. The leading company is Kypros, one of the oldest solar water heaters companies in Lebanon. One important aspect is that Kypros is a local manufacturer of good quality solar water heaters. Ranking second is Green Arms, a relatively young company which started the national solar water heating project launched during the first quarter of 2011, and targeting rural and remote areas through a simplified financing scheme.

With projections and forecasts resulting from the survey conducted with solar water heating companies, Kypros is by far the market leader with 1,653 installations per year with an average daily installation of 5.5 systems assuming around 300 working days per year. Second ranks Green Arms with 569 installations per year.

Figure 10 includes companies with more than 10 systems installed during 2011, and shows the installations performed with and without the support of subsidies and the solar loan program by company, in addition to the installations performed with other means of financing.

On the other hand, in terms of installed collection capacity, Kypros has installed around 3,252 square meters through the loan program while exceeding 8,550 square meters in total. On the other hand, Green Arms installed 1,186 square meters through loans with a total installed capacity of 1,235 square meters in 2011 as shown in Figure 11.

Companies like Technicorp, Solar Power, and Kanaan Trading were more oriented towards other means of financing making 2,522, 1,900, and 1,631 square meters of solar water heaters installations in 2011 respectively.

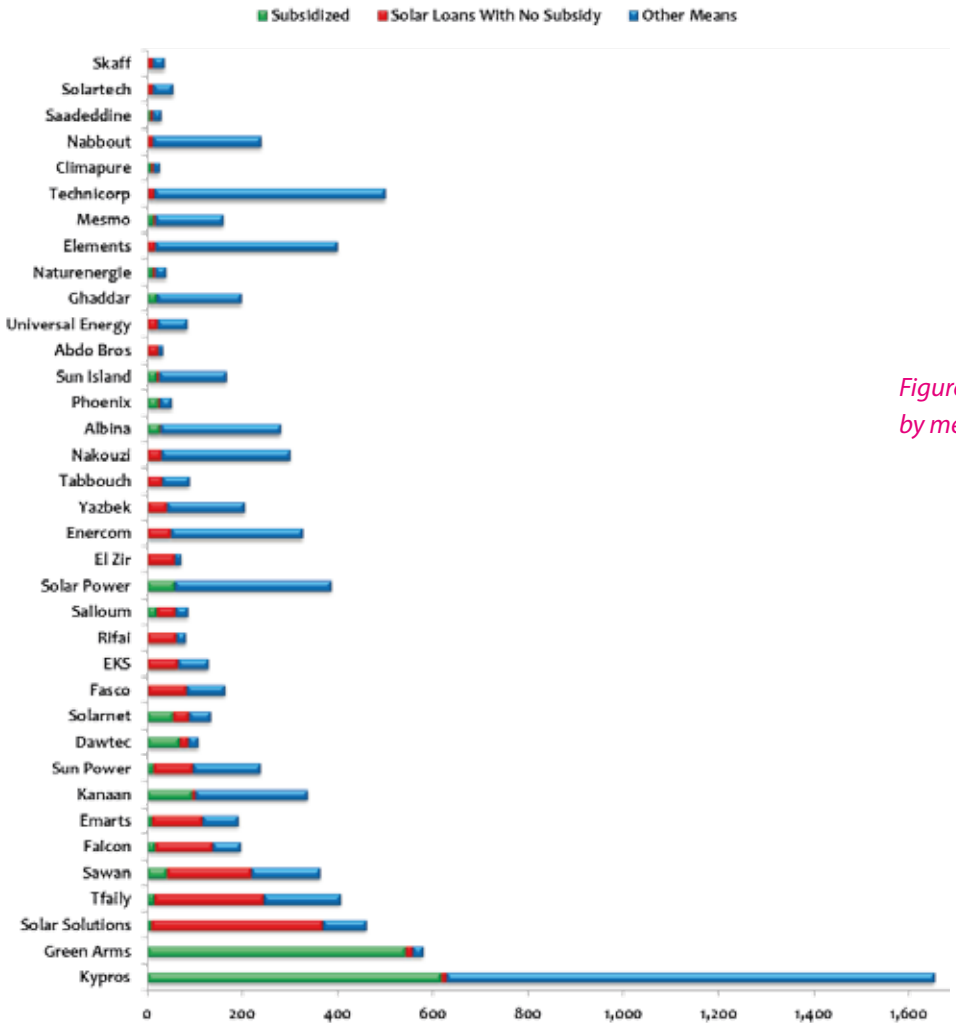


Figure 11: Companies installed systems by means of financing in 2011

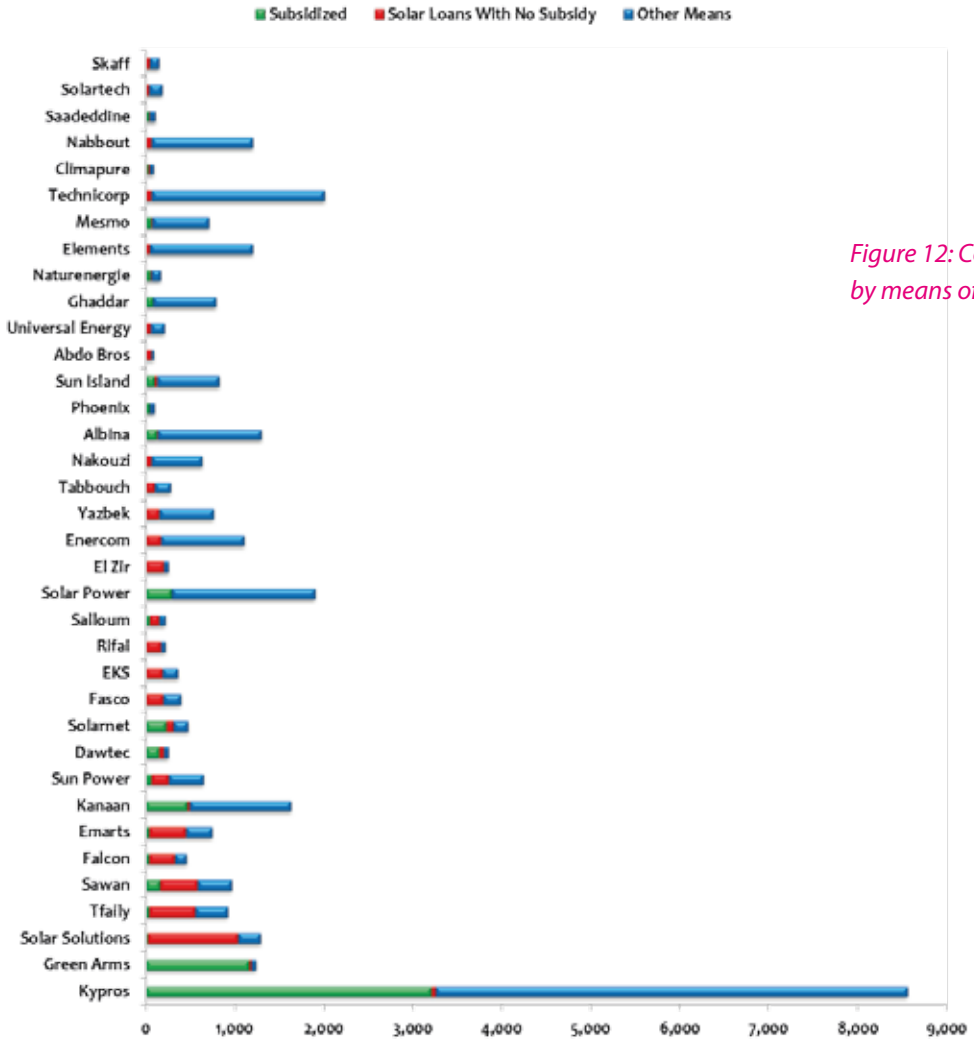


Figure 12: Companies' installed capacity by means of financing in 2011

1.4 System Types of Solar Water Heaters

There are two major types of solar water heaters spread globally; the oldest and more mature technology is flat plate collection, while the more advanced and lately adopted technology is evacuated tubes collection. Batch solar water heaters, sometimes referred to as Integral Storage Collectors (ISC), have less penetration and are used in minor applications.

The systems installed through the solar loan program were majorly vacuum tubes with 2,477 systems installed, compared to 1,054 of flat plate collection type as Figure 12 illustrates.

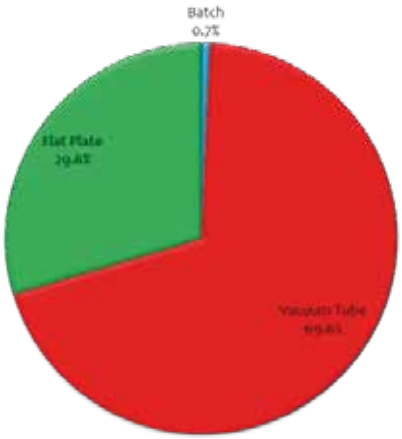


Figure 13: Systems installed through the loan by system type

For the collector type, open vacuum tube systems, also known as all glass or water only evacuated tubes, has been sold most through the loans making 65.5% of the overall sales, followed by flat plate selective coating, also commercially known as Tinox or Blutinox, with 25.2% as shown in Figure 13

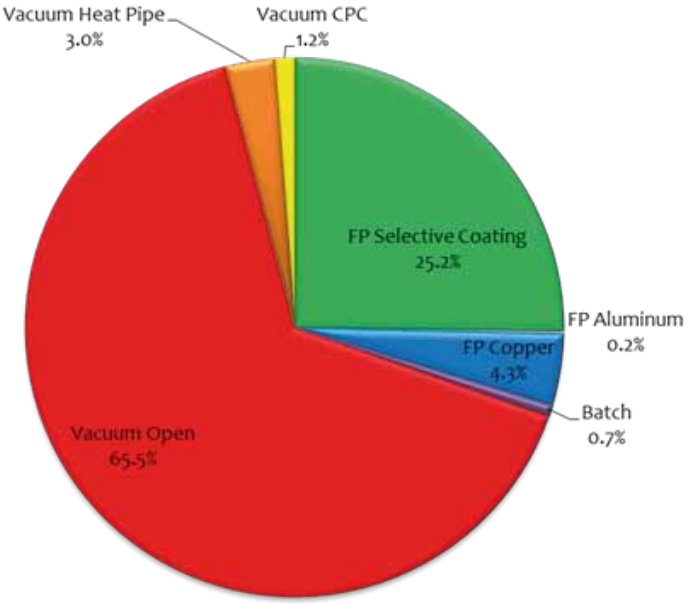


Figure 14: Systems installed through the loan by collector type

Comparing the collection area capacity, vacuum tubes are characterized with higher efficiency leading to less collection area. Thus, 54.8% of the installed capacity through the loans was from vacuum tubes and 44.8% from flat plate collection as shown in Figure 14.

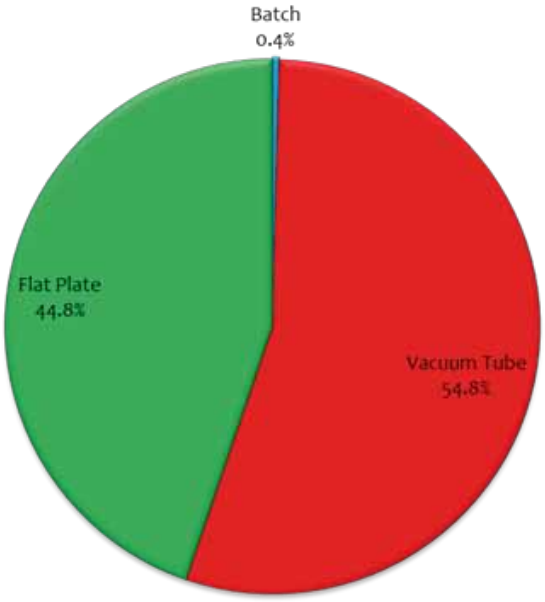


Figure 15: Installed collection area in square meters through the loan by system type

For the collector type, again open vacuum tube systems have been installed with a total collection area of 6,035 square meters, followed by flat plate selective coating with 4,538 square meters as shown in Figure 15.

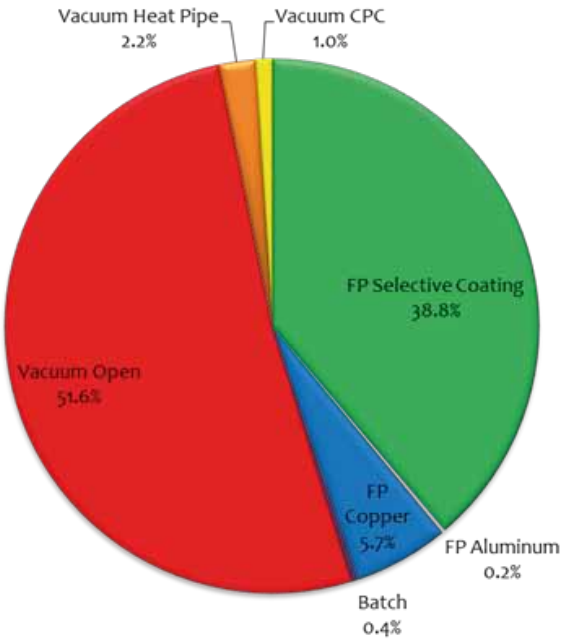


Figure 16: Installed capacity in square meters through the loan by collector type

The results show that subsidies granted are more for flat plate collectors that take 57.1% of the total subsidized systems, with almost 75% of the collection area subsidized as shown in Figure 16 and Figure 17.

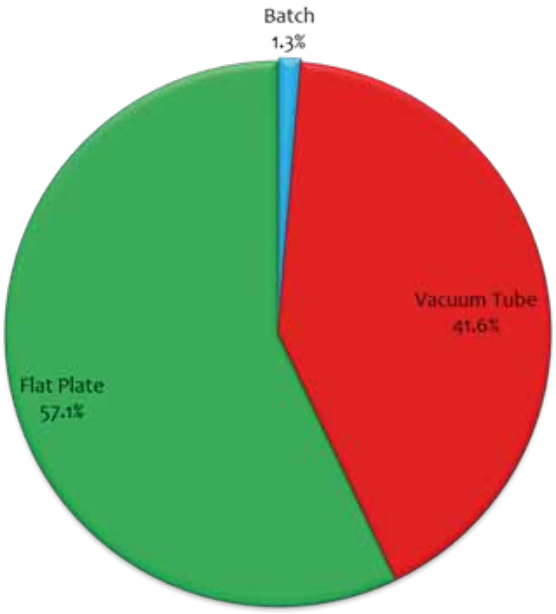
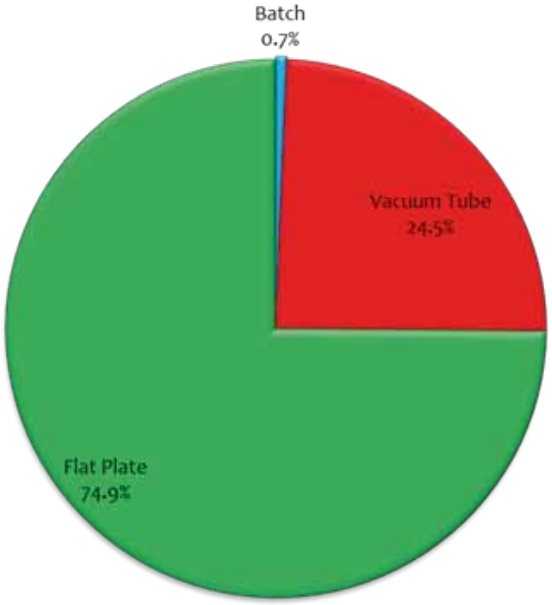
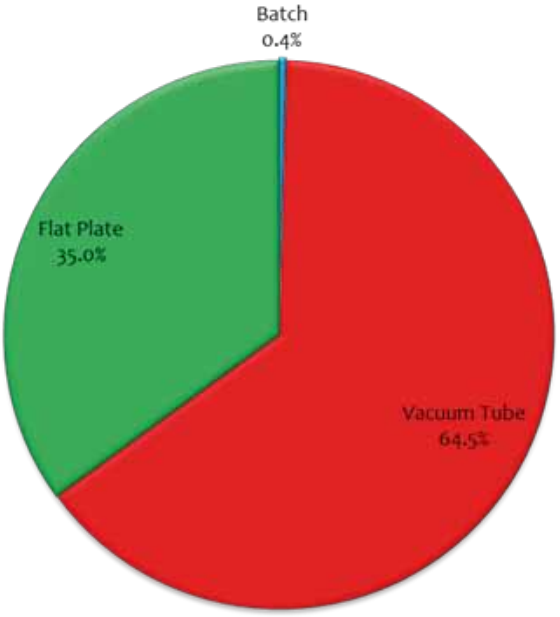


Figure 17: Installed systems benefiting from the subsidy by system type



Similar to the solar loan applications, the market as a whole is dominated by vacuum tubes at 64.5% of the overall market estimated to be 7,810 systems. This keeps flat plate collectors second with 4,238 systems, and a minor share for batch systems with 52 systems only as shown in Figure 18.

Figure 18: Installed capacity in square meters benefiting from the subsidy by system type



Unsurprisingly, open vacuum tube systems have the lion's share with 59.5% of the overall market with 7,202 systems installed, followed by flat plate collectors with selective coating with 3,236 systems as shown in Figure 19.

Figure 19: Total installed systems by system type

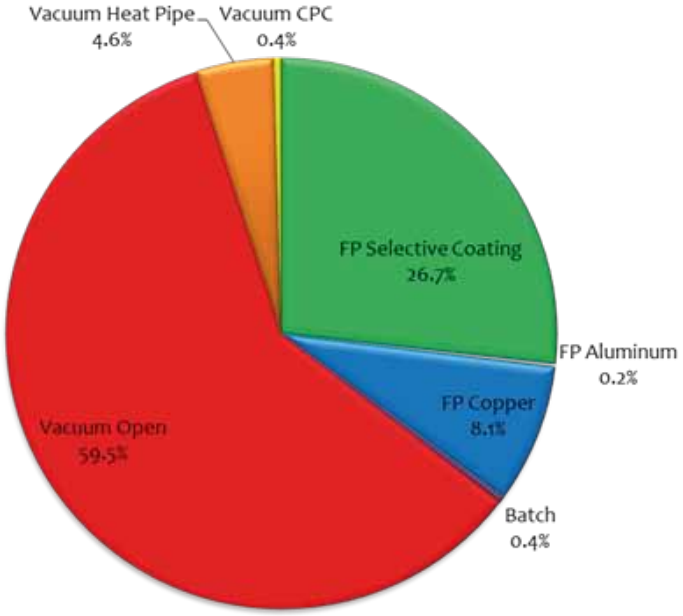


Figure 20: Total installed systems by collector's type

In terms of collection capacity, 20,525 square meters of open vacuum tube systems were installed making 47.6% of the total installations compared to 16,023 square meters of selective coating flat plate collectors, this shows that vacuum tube systems are installed in smaller capacities. The installed capacity share is shown in Figure 20.

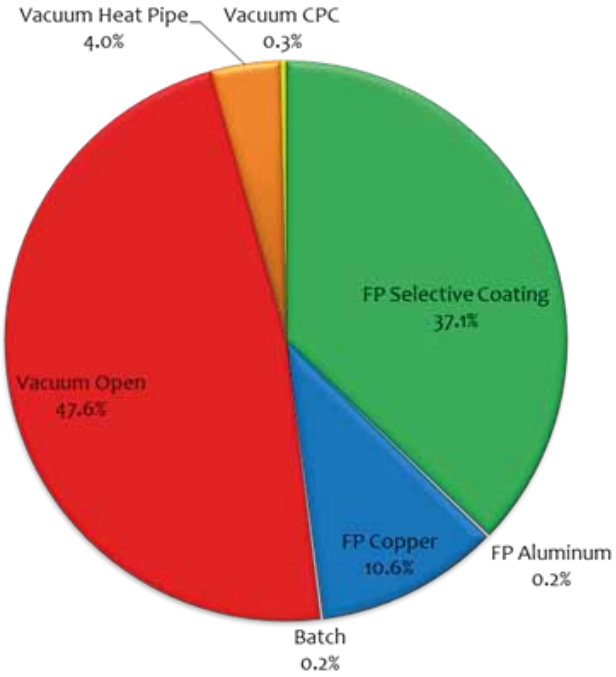


Figure 21: Total installed capacity in square meters collector's type

1.5 Countries of Origin

Most of the vacuum tube collectors in the market come from China, thus Chinese products are widely spread in the market. Almost 70% of the collectors and 42% of the tanks sold through loan applications were of Chinese origin. The closest competition comes from Lebanon, Turkey, and India, with minor shares for Italy, Greece, the Netherlands, France, and Syria as shown in Figure 21 and Figure 22.

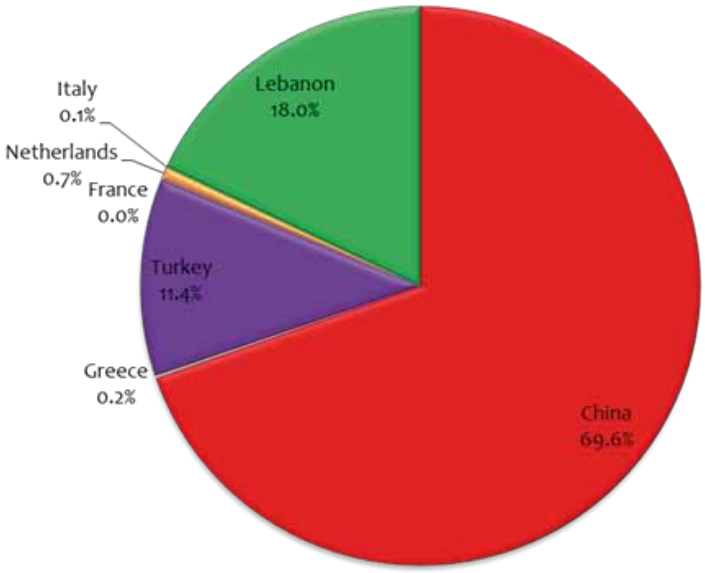


Figure 22: Country of origin of collectors installed through the loan program

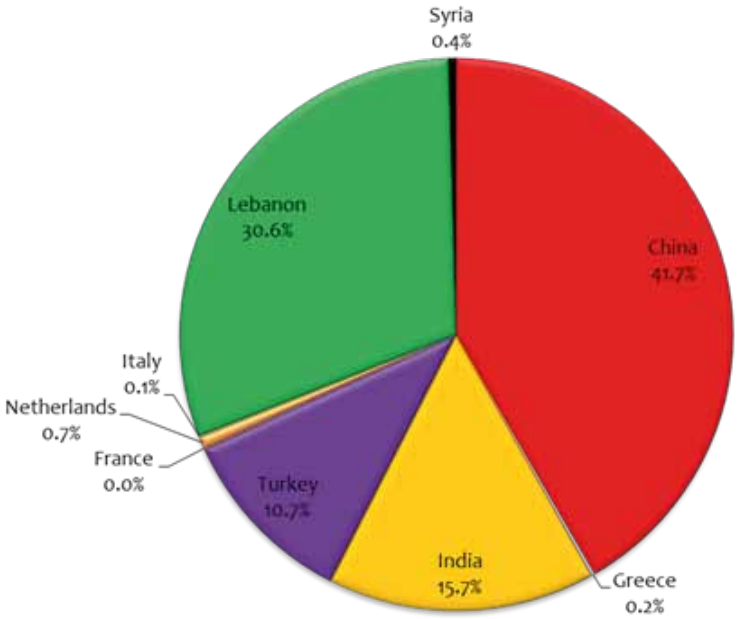


Figure 23: Country of origin of tanks installed through the loan program

Among these systems, subsidies went majorly for Chinese, Lebanese, and Turkish collectors and tanks, in addition to Indian tanks used in vacuum tube systems as Figure 23 and Figure 24.

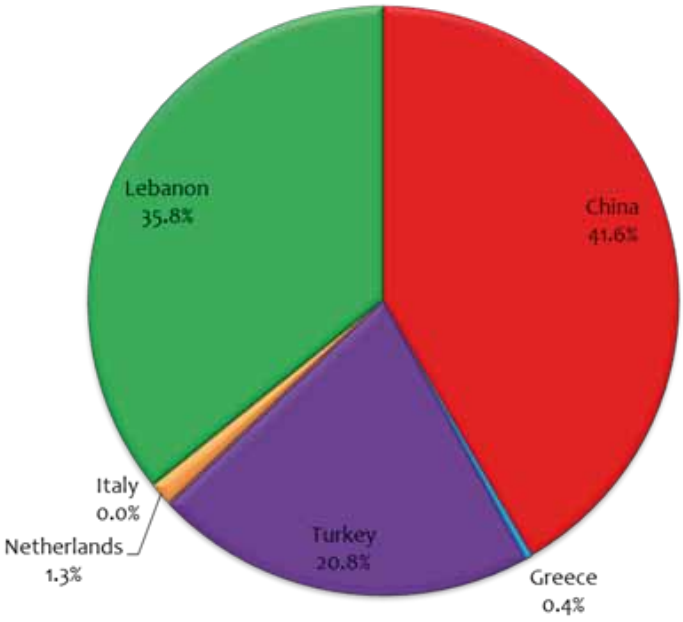


Figure 24: Country of origin of collectors subsidized through the loan program

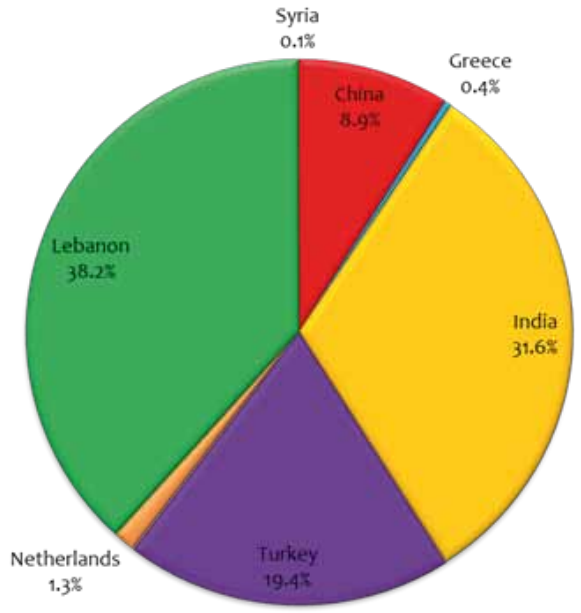


Figure 25: Country of origin of tanks subsidized through the loan program

Comprehensively, the market is mainly dominated by collectors from three major countries namely China, Turkey, and Lebanon, making more than 98% of the collectors being installed in the market. China ranks first with around 7,926 systems installed in 2011. Second are Turkish collectors with 2,071 systems, and then Lebanese with 1,886. Figure 25 illustrates the collectors shares by country of origin.

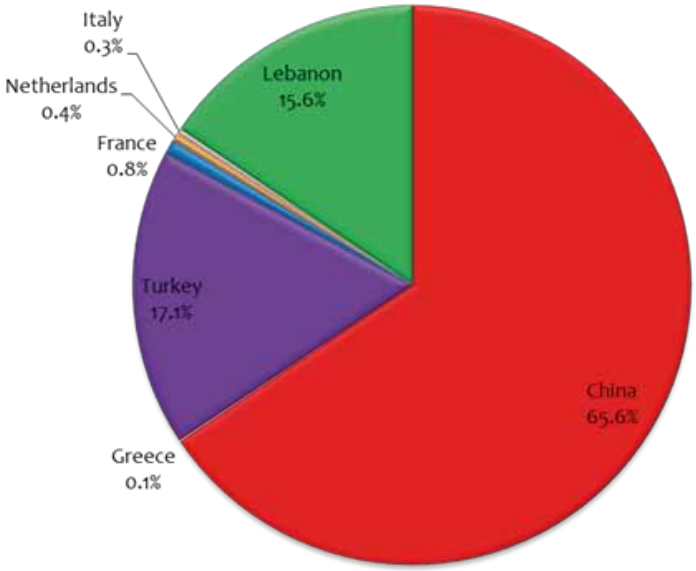


Figure 26: Overall shares of installed collector in 2011 by country

1.6 Banking Sector Involvement

As soon as the initiative was announced, three local commercial banks participated in the launching and were part of the campaign. These banks were BLF, FransBank, and Credit Libanais. With the actual launching of the program, BLF and FransaBank continued their involvement along with 4 other banks namely BLC, BankMed, IBL, and BLOM.

In April 2011, BSL and Al Ahli International Bank joined the loan program, while later in 2011 FransaBank and BLC minimized their activities, keeping 7 commercial banks offering interest-free loans by the end of the year as shown in Figure 26.

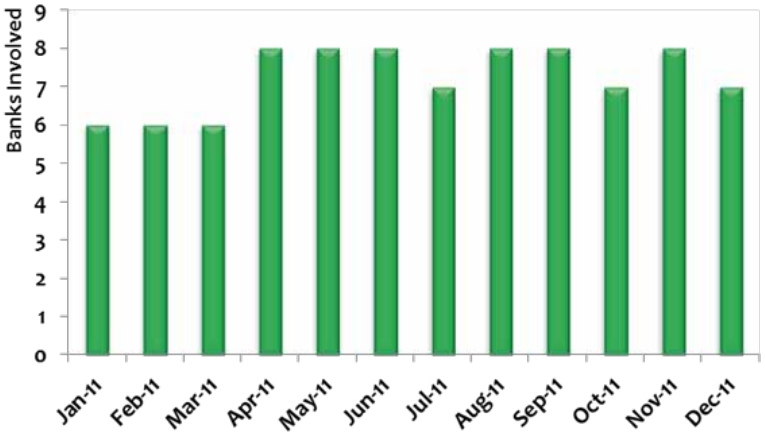


Figure 27: Number of banks involved in the program through 2011

BLF started as the most active bank and ended the year with the highest share giving 1,016 interest-free loans in 2011, followed by BankMed with 916, and BLOM Bank with 677. Banks like BSL and Al Ahli had lower shares with 1 and 0.4% respectively as Figure 27 shows.

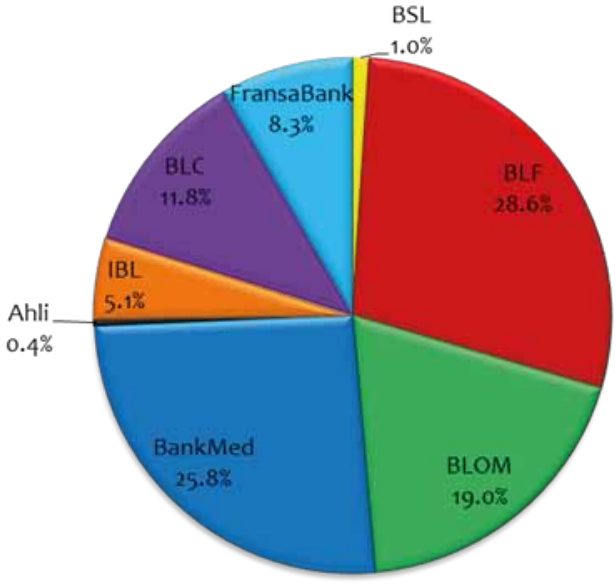


Figure 28: Share of loans provided in 2011 by bank

Since subsidies are restricted to qualified companies, not all applications are qualified to benefit from the subsidies. This changes the share of subsidies provided by bank, as well as the overall share with 37.5% coming from BankMed, and a drop in BLF share to 20.3% almost equal to BLC that has a share of 20.4% as shown in Figure 28.

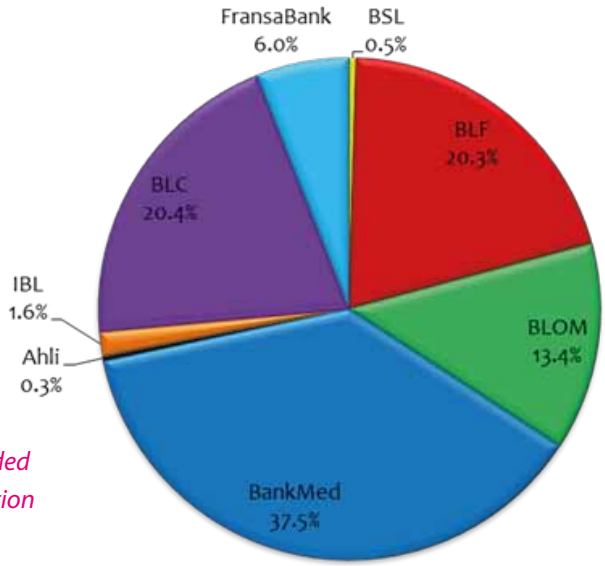


Figure 29: Share of subsidies provided in 2011 by bank of application

CHAPTER 2

ANALYSIS OF THE RESULTS

ANALYSIS OF THE RESULTS

2.1 COLLECTION REQUIREMENTS

2.1.1 Collectors Area

The area of solar collectors is determined based on the solar insolation and the collector's efficiency. Theoretically, the collection area is determined using the energy balance formula:

$$\frac{(\rho \times V \times c \times \Delta T)}{3600} = Q \times A \times \eta_c$$

With:

ρ: density of water (kg/liter) = 0.995 kg/liter
V: volume of water (liter)
C: Specific heat (kJ/kg K) = 4.1784 kJ/kg K
ΔT: Difference in temperature (K)
Q: Solar insolation (kWh/m2)
A: Collection area (m2)
η_c: Efficiency of collector (%)

In order to heat 100 liters and increase its temperature by 40°C, at a daily solar insolation of 5 kWh/m2, and at a collector efficiency of 60%, the formula would be as follows:

$$\frac{0.995 \times 100 \times 4.1784 \times 40}{3600} = 5 \times A \times 60\%$$

This leads to a requirement of a collection area of 1.53 square meters. Technical rules of thumb for Lebanon claim 1.5 to 2 square meters of solar collection per 100 liters of hot water storage.

In practice, the average collection area being installed in Lebanon is 1.237 square meters per 100 liters of storage capacity. This is an average of all types of collectors and based on different collector efficiencies.

2.1.2 Collectors Area by type

Vacuum tube systems are characterized with a higher efficiency than flat plate collectors, and thus requiring less collection area for the same storage volume, ranging from an average of 0.89 to 0.97 square meters for a 100 liter storage capacity. Batch systems come from one source and have a collection area of 1.23 per 100 liters, while flat plate collectors are installed starting from an average of 1.79 square meters to 1.89 square meters per 100 liters. Figure 29 shows the collection area requirement for each type of solar collectors.

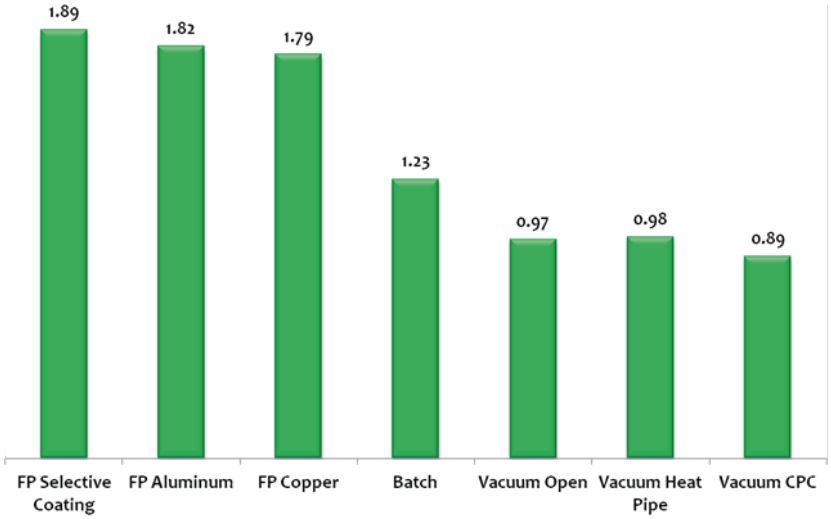


Figure 30: Collection area required by collectors type per 100 liters

2.2 SYSTEM EXPENSES

2.2.1 Cost per Capacity Unit

The average price of a solar water heater in Lebanon is estimated to be $1,487 with an average system size of 266 liters. The cost varies by system type and it is noted that the cost is higher for qualified products than nonqualified ones.

Referring to the overall applications submitted, the average system cost is 559 USD per 100 liters. For products not qualified by the LCEC, the average price is 504 USD per 100 liters (less than 116 USD than the average price) compared to 620 USD for qualified products sold by companies qualified and approved by LCEC.

2.2.2 Cost by Type

The average price for solar water heaters varies by system type with batch heaters having the highest cost of 15.5 USD per liter, and vacuum CPC systems having the lowest price with an average of 3.3 USD per liter. As Figure 30 illustrates, batch systems are the most expensive, followed by flat plate collectors and then vacuum tubes.

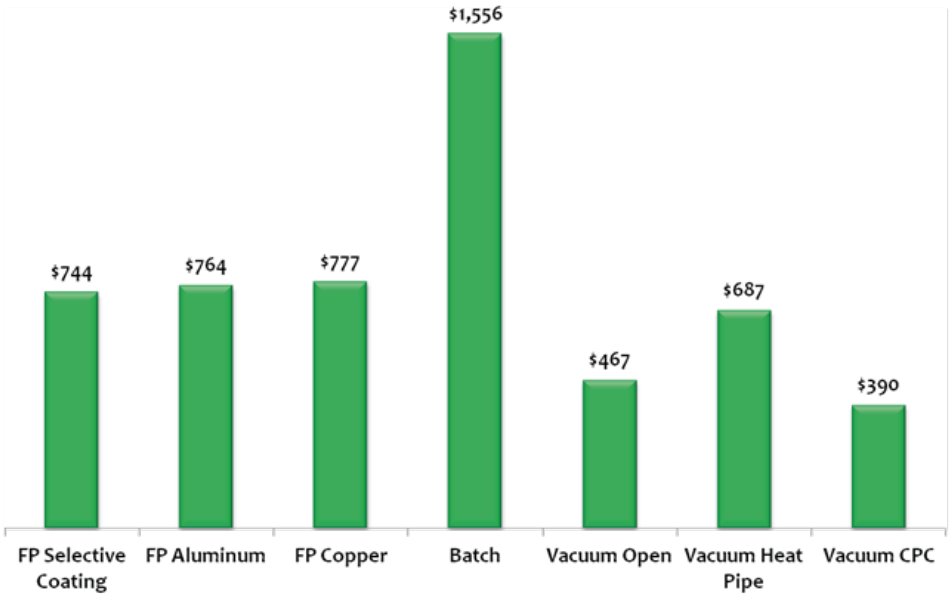


Figure 31: Average price of solar water heaters per 100 liters

Prices vary from a supplier to another based on the changing conditions of the installation. For example, on average, vacuum CPC collection system are offered at prices from 3 USD to 5 USD per liter, while flat plate selective coating are offered from 5 USD to 14 USD per liter as shown in Figure 31.

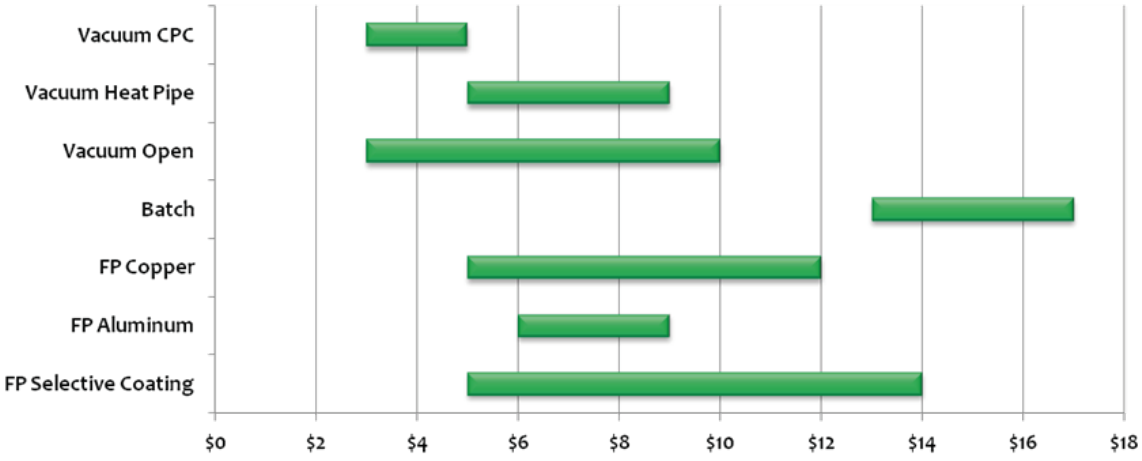


Figure 32: Prince range of solar water heaters per liter for each type of collectors

2.2.3 Cost by Country of Origin

European products are the most expensive products available in the Lebanese market, with French, Italian, and Dutch products starting at a rate of 13 USD per liter. Greek products are somehow less expensive, while Turkish products have a wide range at 5.6 USD to 11 USD based on the product type. Chinese products are the least expensive with a rate of as low as 3.25 USD per liter as shown in Figure 32.

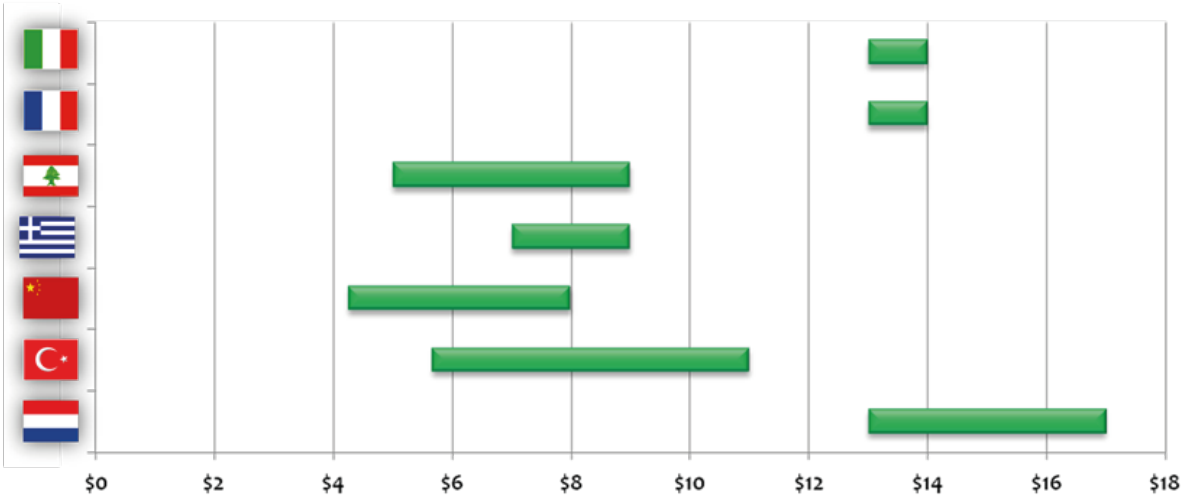


Figure 33: Price range in USD per liter of products by country or origin

Broken down by type of collector, the least expensive Chinese products are vacuum CPC products, while Lebanese products are more expensive when having selective coating. Figure 33 shows the price range in details for different types and different countries of origin.

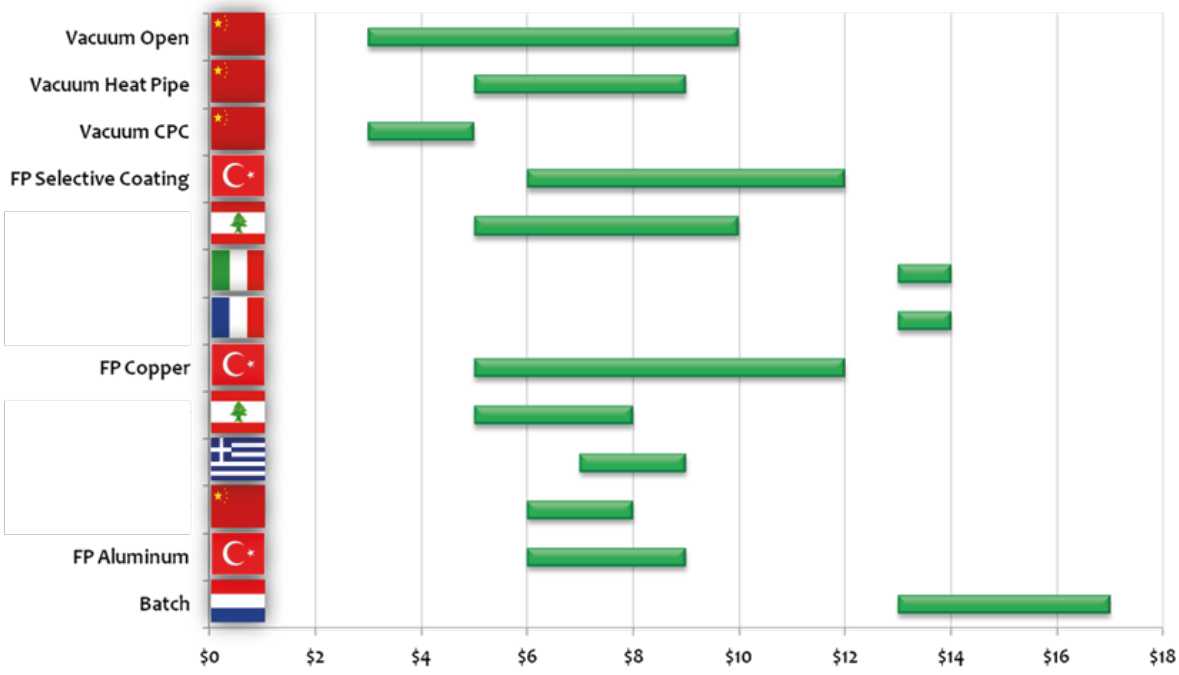


Figure 34: Prince range per liter for each type of collectors by country of origin

2.3 REGIONAL DISTRIBUTION

2.3.1 Installations Density by Region

The most active regions in Lebanon through the solar loans program were located in rural and semi-rural areas. The highest installation capacity was in the district of Marjeioun with 5.39 square meters per 1,000 inhabitants, followed by Bint Jbeil and Zahle with 3.83 and 3.56 square meters per 1,000 inhabitants respectively. Then follow Bsharre and Batroun with 3.46 and 2.89 square meters per 1,000 inhabitants respectively.

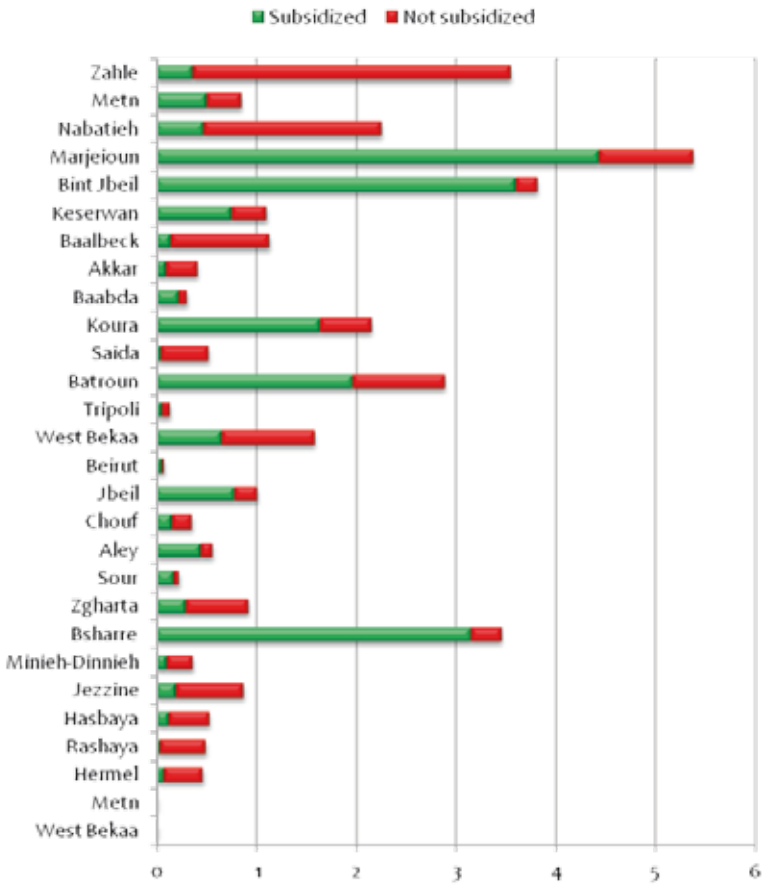


Figure 35: Installed capacity through the loans in square meters per 1000 inhabitants

2.3.2 Companies Activity by Region

Companies' level of activity varies from a region to another. This depends on the coverage of the company and the demographics of the region. The highest shares in the governorate of Akkar goes for a company that has no selling activities in any other region of Lebanon, while the company leading the market in the Bekaa and Baalbeck-Hirmel doesn't seem to be covering other regions.

Only one company is present among the top 10 of all governorates. This company is the market leader with highest shares in the governorates of Beirut, Mount Lebanon, and North Lebanon.

Figure 35 to Figure 42 present the top 10 dealers in each governorate with their market share during the year 2011.

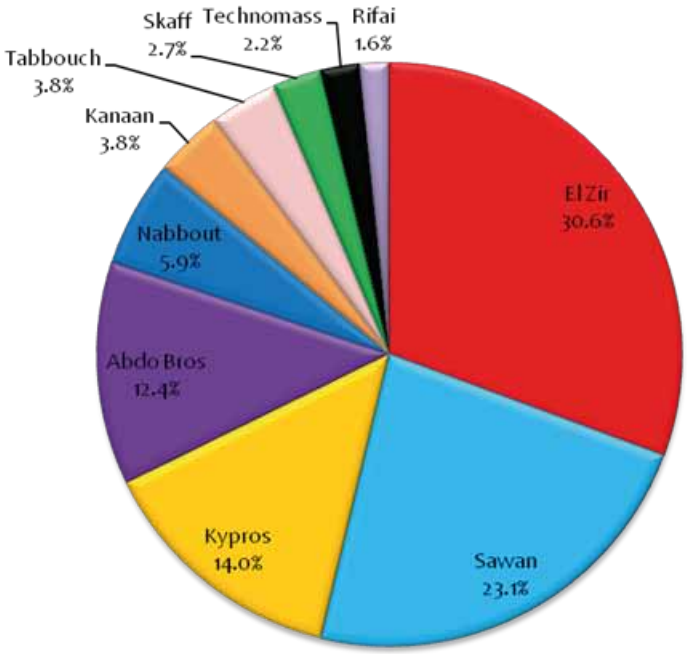


Figure 36: Top 10 solar dealers in the governorate of Akkar

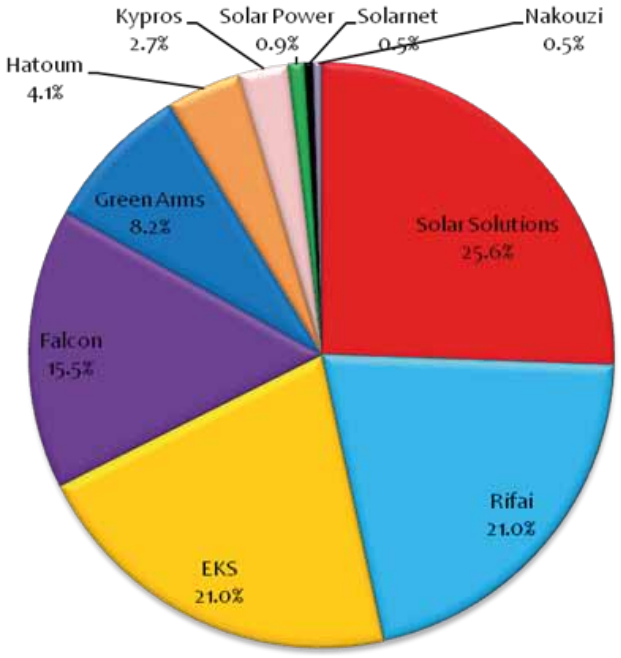


Figure 37: Top 10 solar dealers in the governorate of Baalbeck-Hermel

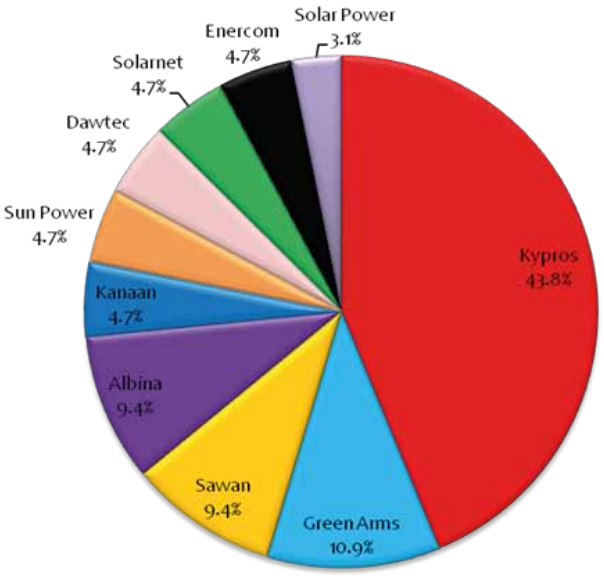


Figure 38: Top 10 solar dealers in the governorate of Beirut

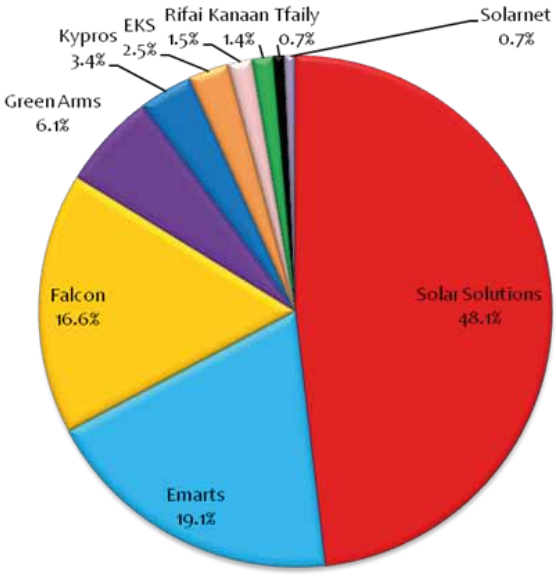


Figure 39: Top 10 solar dealers in the governorate of Bekaa

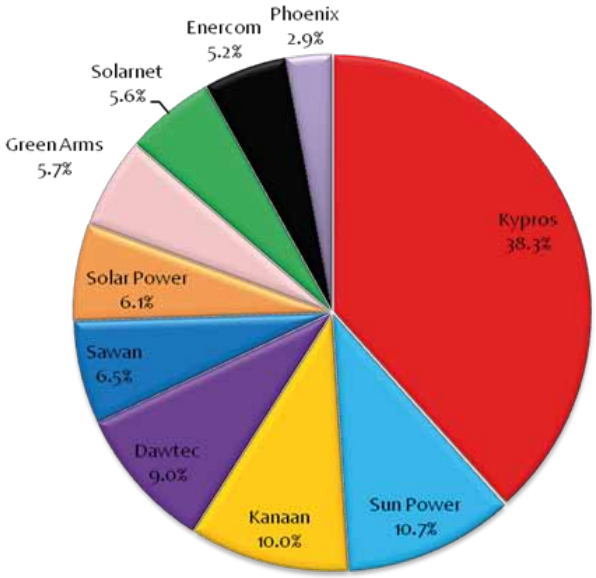


Figure 40: Top 10 solar dealers in the governorate of Mount Lebanon

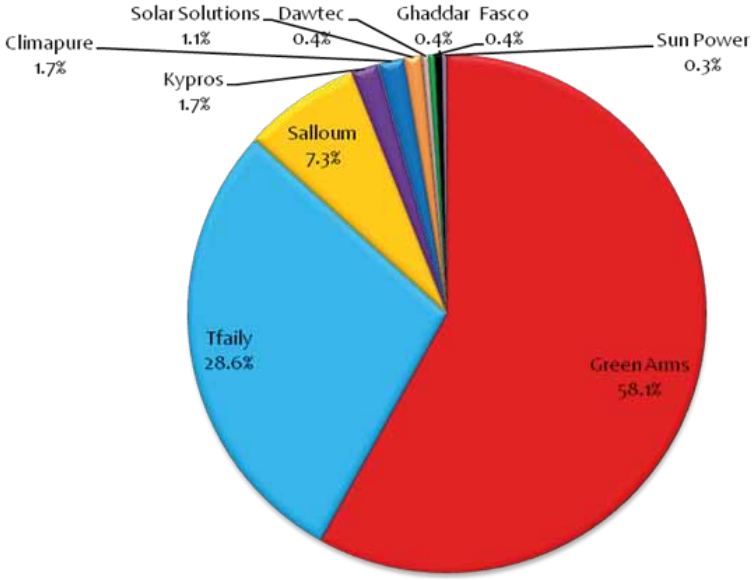


Figure 41: Top 10 solar dealers in the governorate of Nabatieh

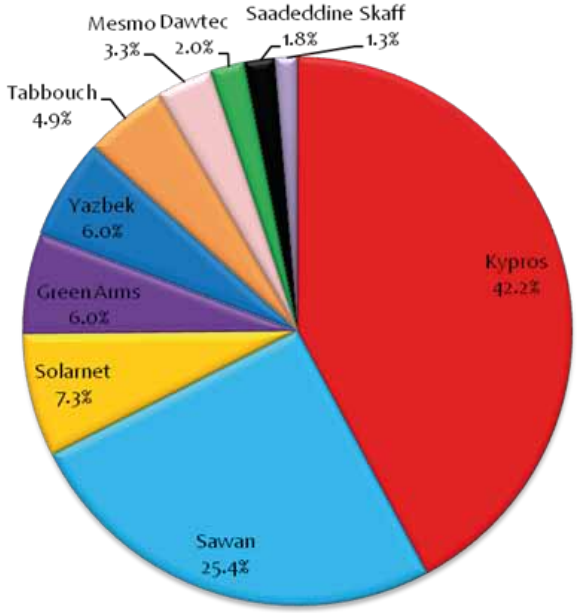


Figure 42: Top 10 solar dealers in the governorate of North Lebanon

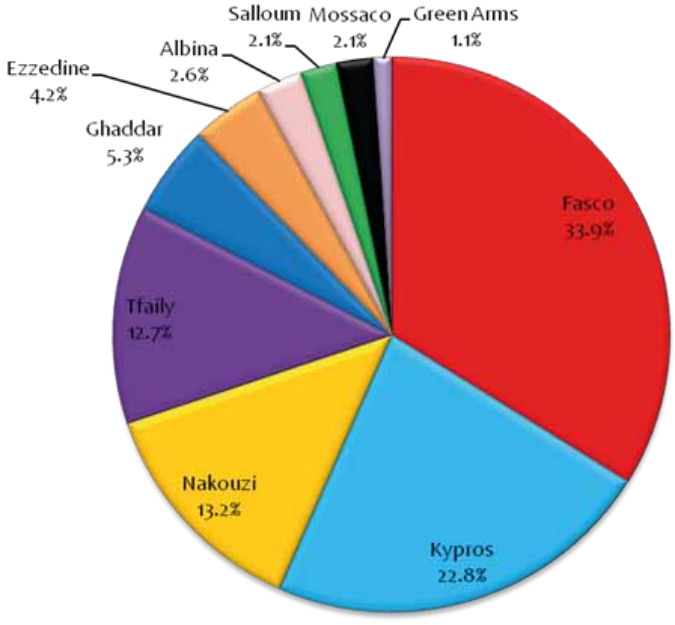


Figure 43: Top 10 solar dealers in the governorate of South Lebanon

2.4 BANKS COVERAGE

2.4.1 Banks Activity by Region

Banks have their regional concentrations with focus on certain areas that they believe is more productive. In Akkar, IBL Bank is the most active with 56.6% of the applications, while in other North Lebanon regions BLC and BLF are more active. In the cazas of Beirut, BLF, BLOM, BankMed, and FransaBank lead with almost equal shares. In southern Lebanon, BankMed leads in the caza of Nabatieh, while BLF shares the lead with BankMed in other southern regions.

In the Bekaa and Baalbeck-Hermel regions, BLF, BLOM Bank, and BankMed are all very active making together shares of more than 80% in each caza, as shown in Figure 43 to Figure 50.

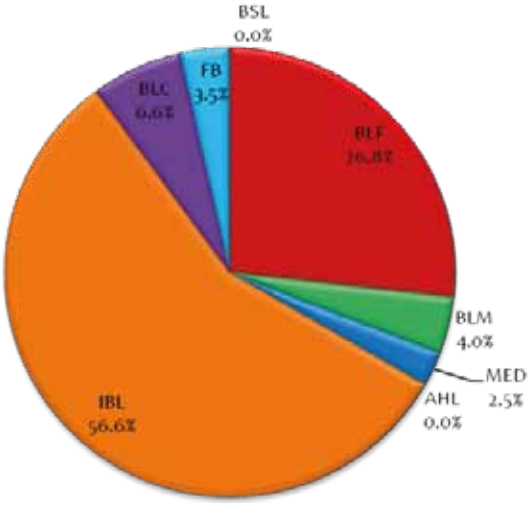


Figure 44: Banks shares in the governorate of Akkar

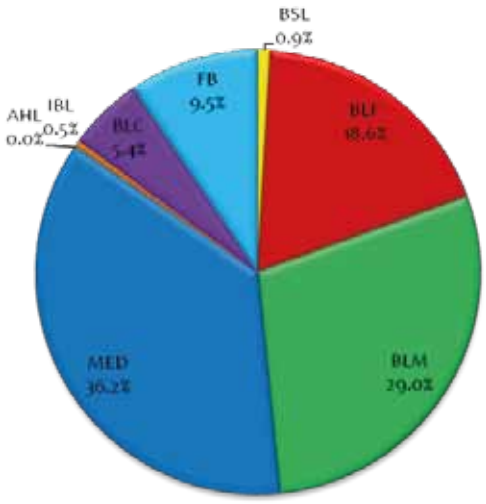


Figure 45: Banks shares in the governorate of Baalbeck-Hermel

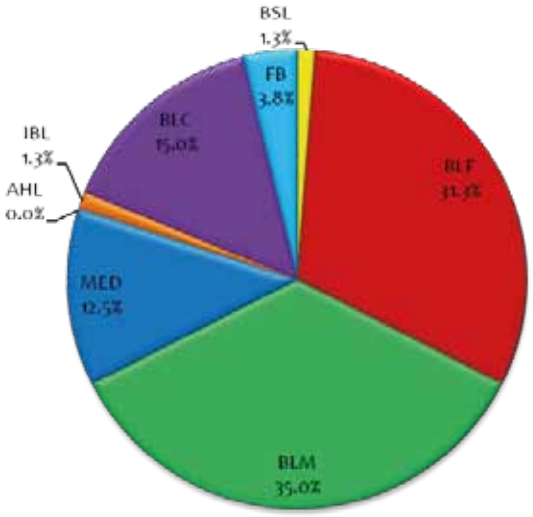


Figure 46: Banks shares in the governorate of Bekaa

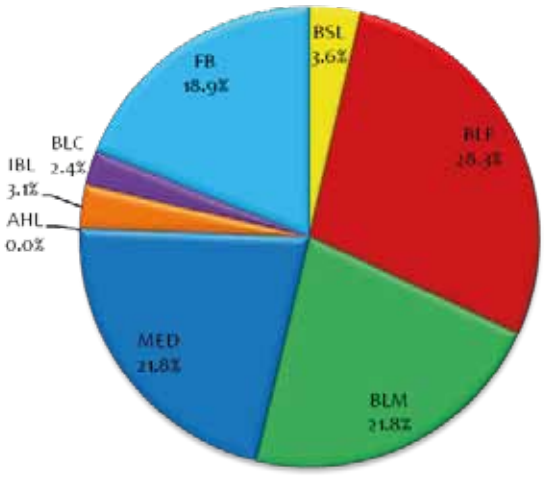


Figure 47: Banks shares in the governorate of Beirut

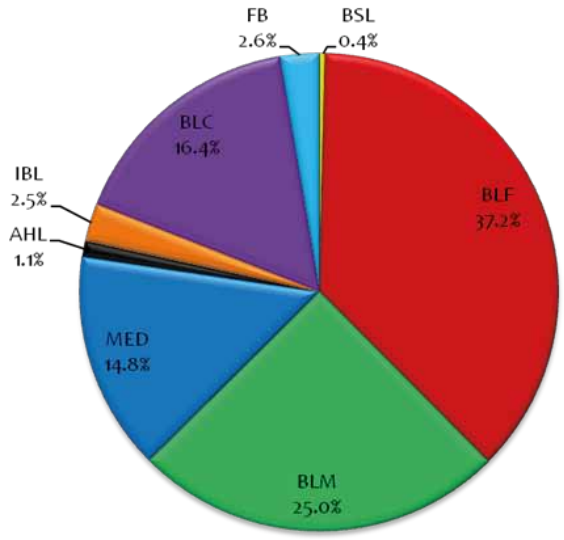


Figure 48: Banks shares in the governorate of Mount Lebanon

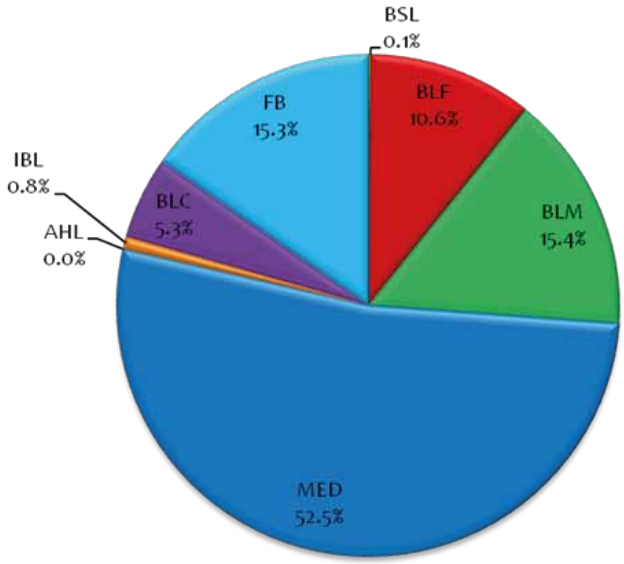


Figure 49: Banks shares in the governorate of Nabatieh

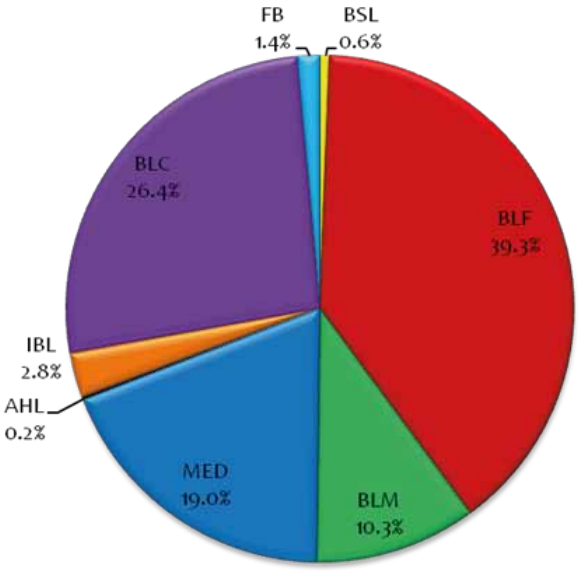


Figure 50: Banks shares in the governorate of North Lebanon

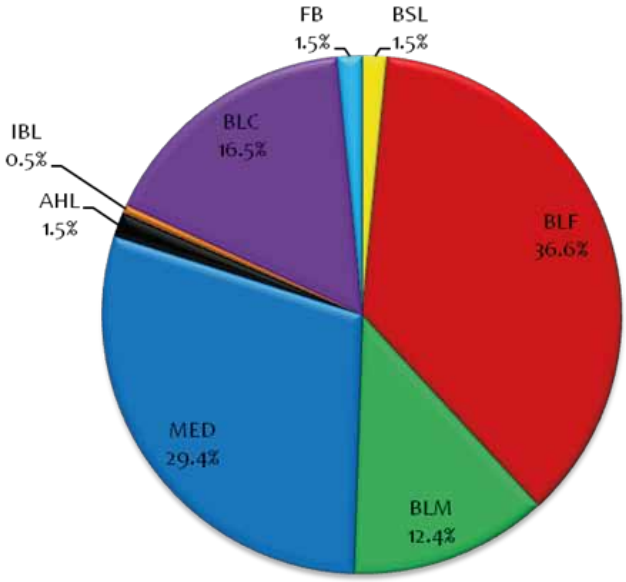


Figure 51: Banks shares in the governorate of South Lebanon

2.4.2 Banks Activity by Month

The number of applications submitted to banks varies by month, mainly depending on the lobbying for the program from the bank's side. The banks being initially involved in the program had a strong start but unfortunately witnessed some drop with time, while other banks that lately got into the program made strong leaps and increased their activity on monthly basis as shown in Figure 51 to Figure 58.

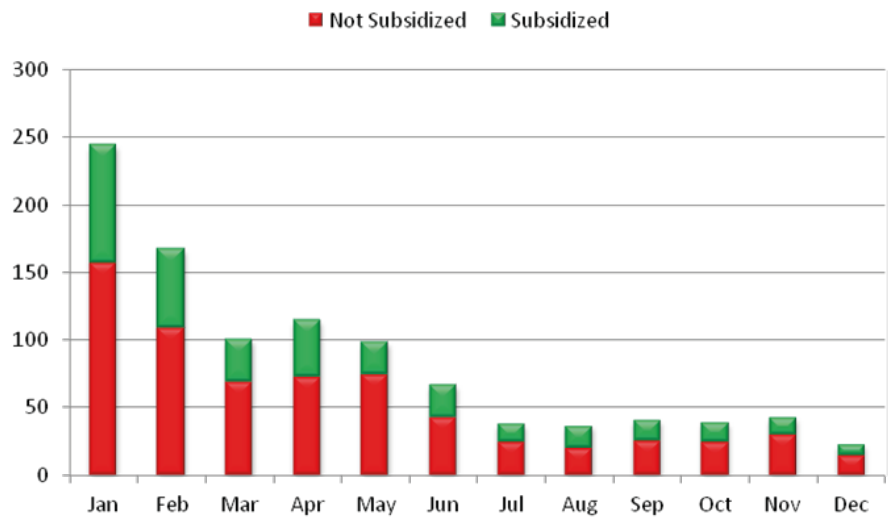


Figure 52: All solar loan applications made at BLF Bank

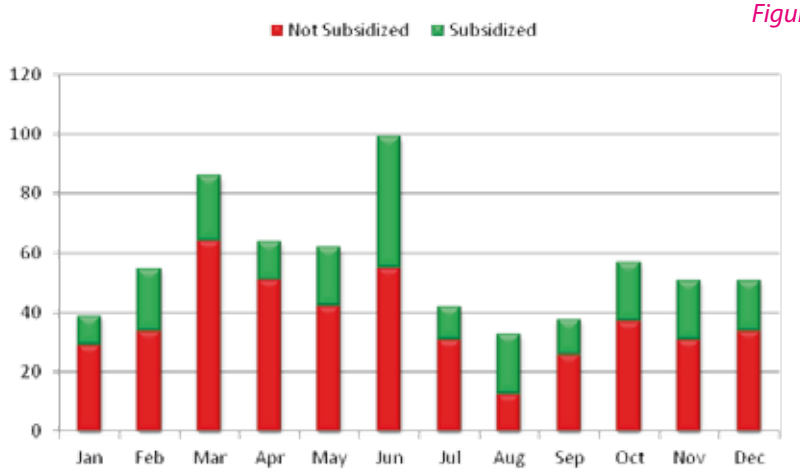


Figure 53: All solar loan applications made at BLOM Bank

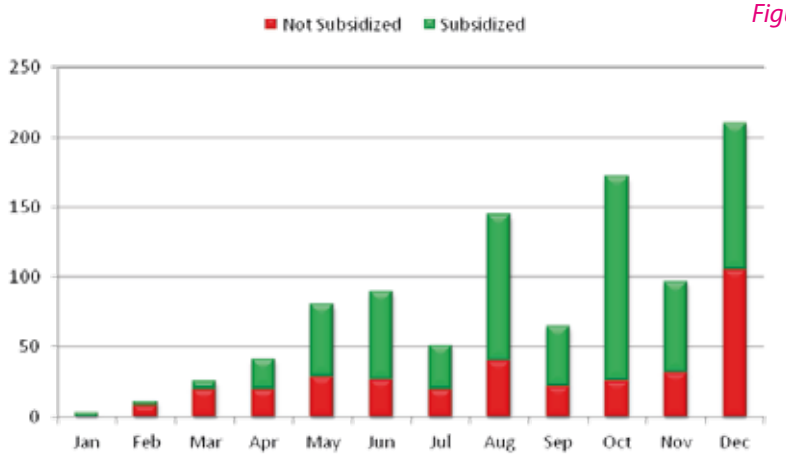


Figure 54: Allsolar loan applications made at BankMed

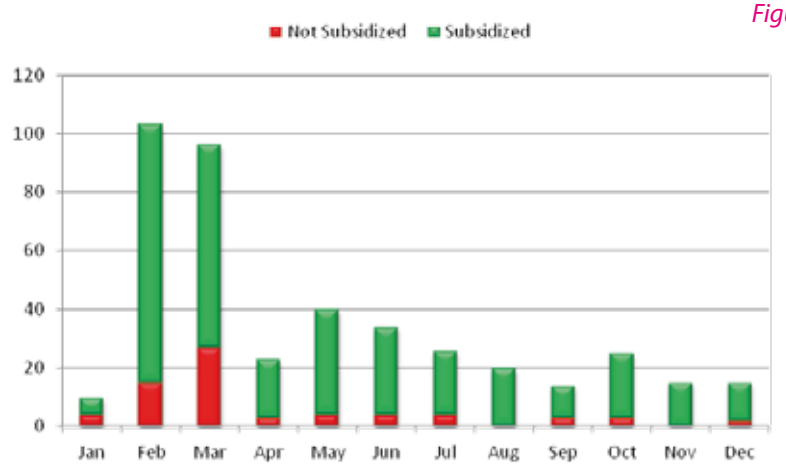


Figure 55: All solar loan applications made at BLC

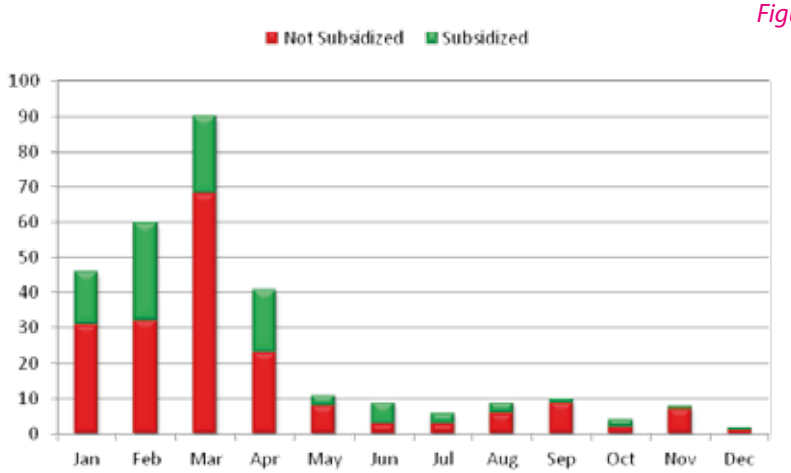


Figure 56: All solar loan applications made at FransaBank

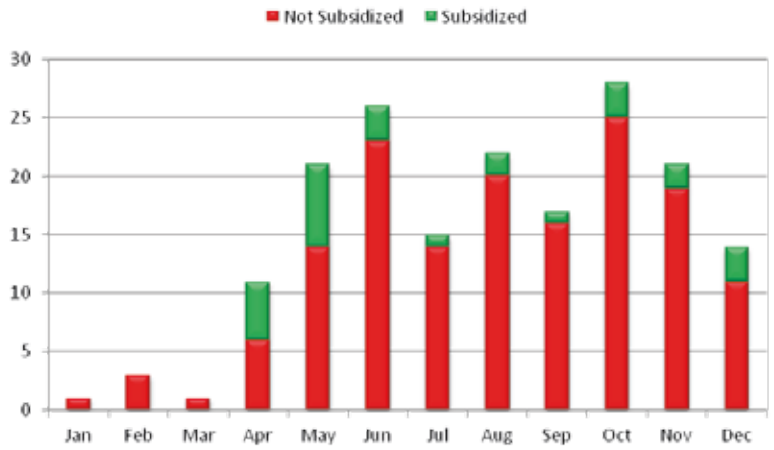


Figure 57: All solar loan applications made at IBL Bank

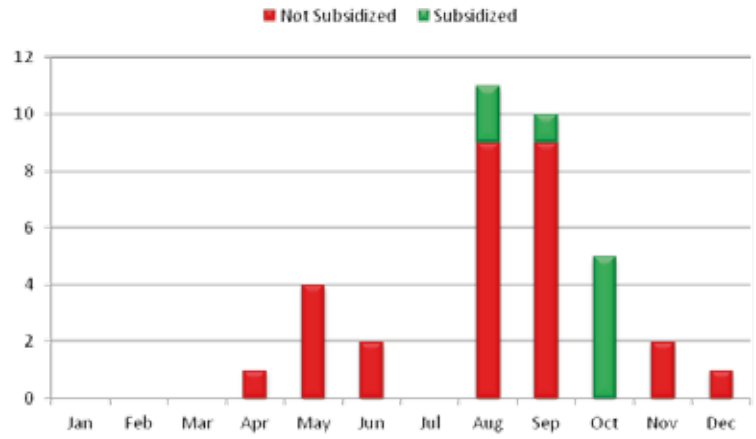


Figure 58: All solar loan applications made at BSL Bank

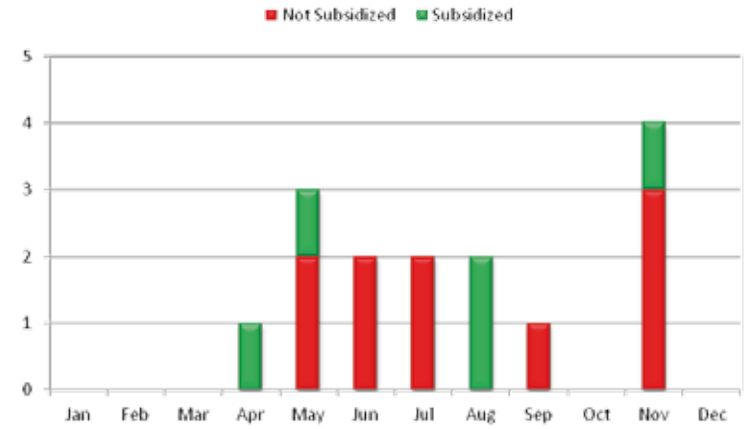


Figure 59: All solar loan applications made at Ahli International Bank

At the beginning of the year, BLF was the most active bank, but witnessed some drop in its share mainly due to the interest of other banks and their involvement in the program. During the second half of 2011, BankMed had the biggest share making around 55% of the overall applications made in December 2011 as shown in Figure 59.

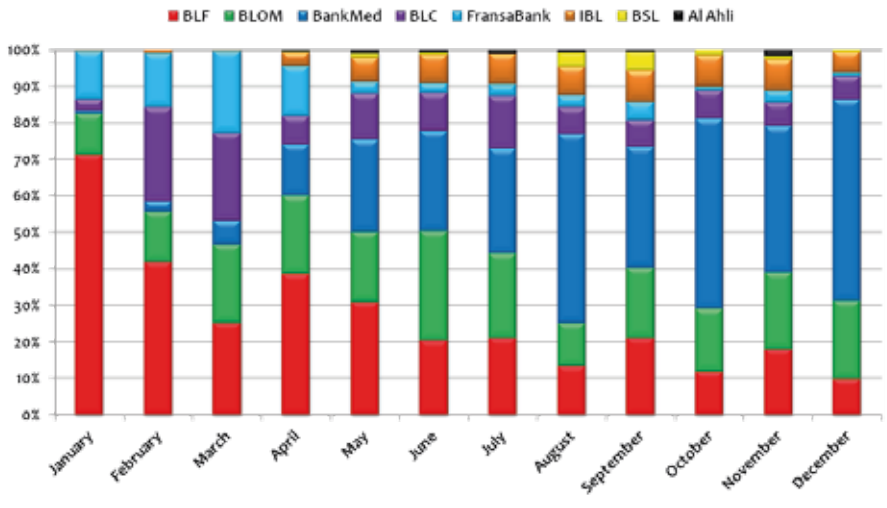


Figure 60: Shares of solar loan applications applied throughout 2011

CHAPTER 3

ECONOMIC AND ENVIRONMENTAL IMPACT

ECONOMIC AND ENVIRONMENTAL IMPACT

3.1 Electricity Savings

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. A study performed by the LCEC on a solar water heater with a storage capacity of 208 liters, installed in a typical residence in Marjeioun showed an annual saving of 1,776 kWh of electricity. This was based on real-time measurements monitored over a period of 12 months. This gives an estimated annual rate of saving of 8.54 kWh per liter.

During 2011, a total of 3,557 loans were given among which 1,717 systems were subsidized with a total subsidy value of 343,400 USD. This created a momentum in the market leading to the installation of 12,197 systems in total with a storage capacity of 3,313,427 liters. Table 1 summarizes the activities performed in 2011.

Table 1: Summary of installation activities in 2011

	Systems	Value	Sq.m	Liters
Solar Loan Applications	3,557	$ 5,287,583	11,695	945,225
Loan Applications with Subsidies	1,717	$ 343,400	6,520	448,540
Total Installation	12,197	$ 18,131,183	43,500	3,313,427

With the saving rate of 8.54 kWh per liter, the savings achieved are 8,071 MWh for all solar loan applications, out of which 3,823 MWh are from subsidized systems. As a result, a total of 28,292 MWh are saved at the national level. This has avoided the need for a capacity of 3.68 MW. Table 2 shows the electricity savings for the three categories.

Table 2: Summary of electricity demand reduction from SWH installation in 2011

	kWh	MW
Solar Loan Applications	8,070,767	1.05
Subsidized Systems	3,829,842	0.50
Total Installation	28,291,569	3.68

3.2 Greenhouse Gases Emissions Reductions

The electricity supply mix in Lebanon includes local thermal power plants running on fuel oil, natural gas, and diesel oil. In addition, hydro power plants share does not exceed 4% of the overall electricity supply. Add to that the electricity purchases from Syria that vary based on the availability from the supply side, and the need at the end use.

In 2011, the grid emissions factor estimated by EDL was 0.65 kg of CO_2 equivalent per kWh; this means total emissions of 650 tons of CO2 per GWh of electricity produced.

Based on this factor, the emissions reductions are estimated to be 5,246 tons of CO_2 equivalent for all solar loan applications, among which 2,489 tons from subsidized systems. As a result, a total of 18,390 tons of CO_2 equivalent are saved at the national level. In the CDM concept, this is equivalent to 18,390 CERs.

3.3 Financial Analysis

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, known to be having the biggest share of subsidies and causing unwanted pressure on the Lebanese economy.

During one year, the national financing mechanism for solar water heaters has facilitated the installation of 3,557 systems, saving around 8,071 MWh, and also moved the market to reach a total installation of 12,197 systems, saving around 28,292 MWh.

This leads to an economic saving of around 3,754,687 USD on the consumer level and around 145,254 USD on the EDL in the form of subsidies reduction. It is worth noting that the increase in oil prices affecting the production cost will be compensated for through an increase in electricity pricing that is expected to start taking place within the coming years as part of the national electricity sector reform plan.

In addition, the electricity deficit is negatively affecting the Lebanese economy, with an estimated Value of Lost Load (VOLL) of 700 USD per MWh on average. Accordingly, the total installed capacity of solar water heaters in Lebanese residences contributes to a total reduction of 19,804,098 USD in the value of lost loan for 2011.

A summary of monetary savings is presented in Table 3

Table 3: Summary of economic savings from SWH installation in 2011

	Electricity (for Consumer)	Electricity (for EDL)	VOLL
Solar Loan Applications	$1,071,104	$41,437	$5,649,537
Subsidized Systems	$508,274	$19,663	$2,680,889
Total Installation	$3,754,687	$145,254	$9,804,098

3.4 Economic Feasibility

The national financing mechanism for solar water heaters is composed of two supporting schemes, the first through offering interest-free loans, and the second through providing a subsidy of 200 USD per system.

The first scheme does not add any expenses to the government as the financing of these loans are done through releasing an equivalent amount required reserves, which in turn brings the commercial bank more profit. While the other scheme requires financing that accounted to a total of 343,400 USD in 2011.

This program has facilitated the installation of 3,557 systems, providing an initial annual saving of 41,437 USD. The savings are achieved annually during the lifetime of the system that is globally known to be around 15 years. After 10 years of operation, the efficiency of the system is expected to drop by 10%. Taking these assumptions into account, the program has shown to have a net present value of 45,427 USD at a discount rate of 6%. This leads to an IRR of 8%.

Net present value plotted versus the discount rate for the solar loan program is shown in Figure 60.

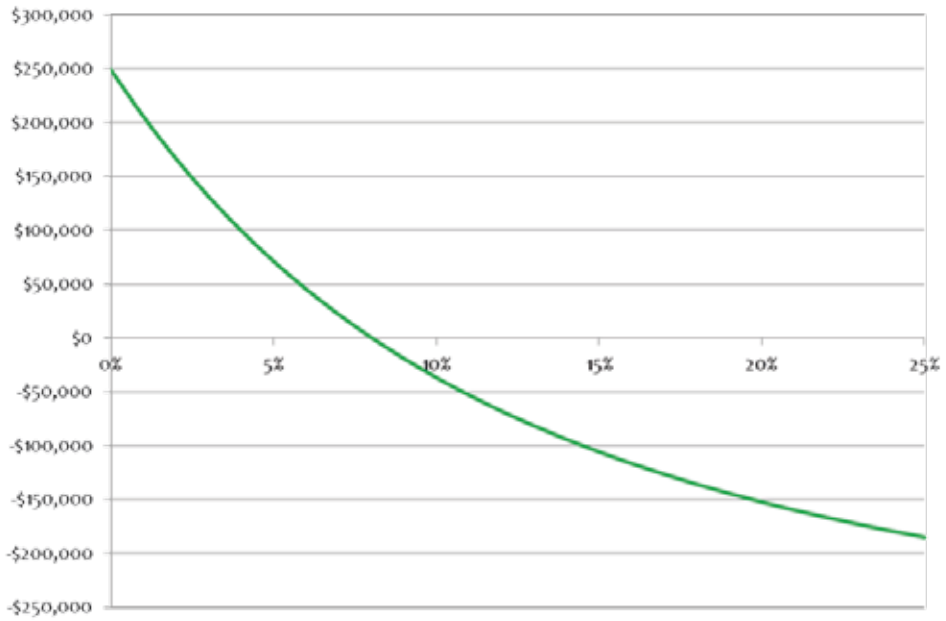


Figure 61: NPV versus discount rate for the solar loan program

In a business-as-usual scenario, an annual installation of 20,000 square meters of solar water heaters is fair, meaning that the actual mechanism contributed to the installation of an additional 23,500 square meters of solar systems. This has lead to a reduction of 78,470 USD in the subsidies paid by the Lebanese government per year with a total saving of 1,122,912 USD over the period of 15 years, having an internal rate of return of 22% and a net present value of 504,658 USD at a discount rate of 6%.

Net present value plotted versus the discount rate for the total systems installations done is shown in Figure 61.

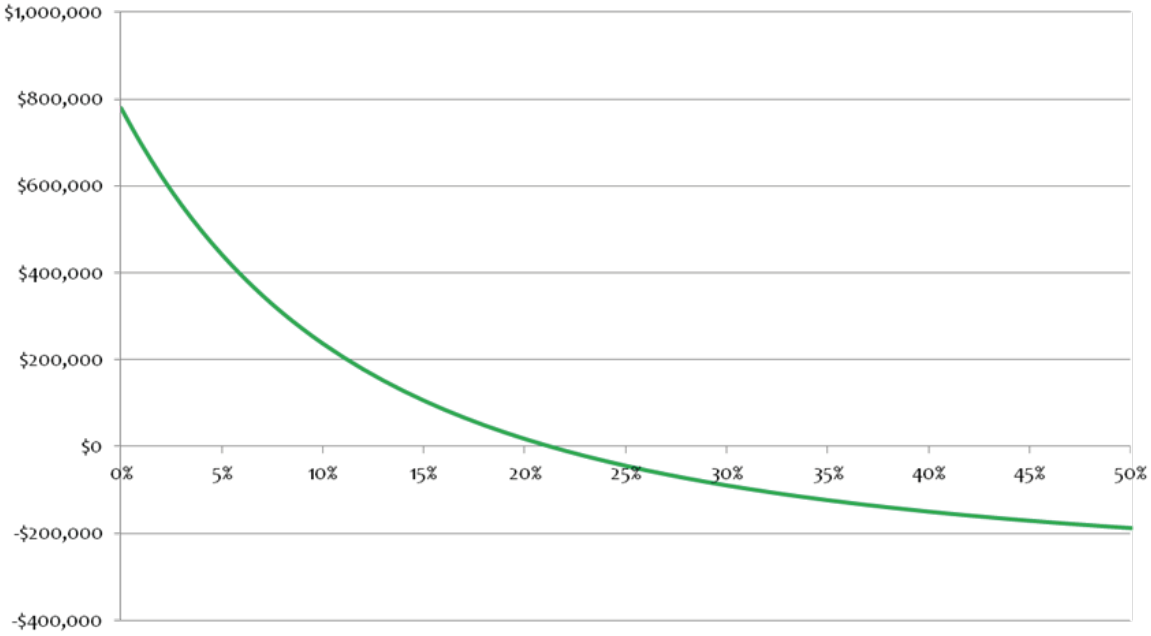


Figure 62: NPV versus discount rate compared to business as usual in 2011

CHAPTER 4

CONCLUSION AND RECOMMENDATIONS

CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

The solar thermal market has been witnessing some development during the first years of the past decade, but started to stagnate few years later to reach a point where the product became not of interest to consumers due to the lack of trust and absence of governmental support in the financial and technical aspects.

The national program initiated in 2010 was aiming at redefining the market and creating more trust through a sustainable financing scheme and reliable quality control over products as well as contracting activities. With around 23% of the allocated subsidy budget granted, 43,500 square meters of solar water heaters were installed in the residential sector in 2011, leading to an overall annual saving of 28.3 GWh.

If developing at the same pace, the subsidy budget is expected to remain applicable for the coming 4 or 5 years, and thus creating a market of more than 20 million USD annually, with the target to reach an overall installation capacity of 190,012 square meters. This would be leading to an annual electricity demand reduction of 123.6 GWh, thus avoiding an electrical power capacity of 16 MW.

The national financing mechanism can be considered a success and an important market mobilizer, creating a sustainable momentum towards the adoption of solar water heaters as a national necessity in Lebanese residences.

4.2 Recommendations

The national financing mechanism helped the solar water heaters market exceed the national target for the year 2011. However, during this first year of operation, several loopholes are discovered and these require corrective actions. The major recommendations to further improve this national initiative and ensure progressive development are as follows:

1. Raise more awareness at the public level and deliver clear messages to home owners and end users on the importance of solar water heaters and the reliability of the initiative supported by the MEW and BDL.
2. Provide more support to commercial banks involved in the initiative through capacity building and lectures on demand to the team working on facilitating the solar loans. This would avoid any delay or mistreatment of the files.
3. Reach more banks and try to have other banks involved in this initiative. This is an important issue to ensure coverage over all the Lebanese territories, and would also play a major role in facilitating the loan process for customers.
4. Facilitate the loan process and avoid requiring too many documents for the approval from the bank side. This can be dealt with through providing risk guarantees for low and middle income households.
5. Request the customers to submit the official invoice to the bank as part of the loan documents. A proforma invoice, a quotation, or an offer are not enough to ensure that the client has installed the solar water heater and not in the process of deciding to do so or not.
6. Provide the qualified products for each company in the same document that lists qualified companies. This is to help the client avoid being misled and ensure the subsidy is granted.

4.3 Impact on the Suppliers

The initiative has had a positive impact on the market as a whole with a direct impact on the dealers and suppliers of solar water heaters who have witnessed a remarkable increase in their sales.

One fact is that few companies -mainly dealing with products that were not qualified according to the national requirements- complained about the initiative reducing their sales volume. However, the majority of companies were satisfied with the initiative expressing their appreciation in constructive feedback and encouraging comments. Some testimonies are shown here below.

A TALK WITH…

Jean Paul Sfeir
GM, Solarnet

The loan introduction has energized the market. Some applicants did not apply for the loan but decided to install solar water heaters after hearing about such loan.

Elie Kanan
Kanaan Trading

The solar water heating market has risen significantly to become one of the leading markets in Lebanon. This initiative has proven to be a big step forward (…)

We applaud the LCEC for taking on an initiative of this magnitude, which included great advertising campaigns and a constructive relationship with the banking sector. It has allowed Lebanon to take a major green step towards a cleaner future for generations to come.

Jihad Ghorra
Manager, Solar Solutions

The solar loan was a real market mobilizer, also the campaign for the heaters was really good. During the year 2011 we had a growth of almost 35%

Toni Traboulsy
GM, The Green Pact

The solar loan by BDL was a key in the implementation of "The National CDM Project for Solar Energy" where the initial model created did include subsidizing the interest in order to make solar water heaters widely available for the people who most need it but can't afford buying it.

(…) We can inform you that our sales have more than quadrupled during the second half of 2011 and the individual systems sold through BDL solar loan. The subsidized interest loan was a main catalyst among the other benefits provided through the project for this increase.

Rabih Shehayeb
GM, Kodorat

The BDL loan did a major impact on the market.
(…) Although very few companies where only qualified for most of the year 2011, the cash sales has increased a lot, mostly for the low cost units ($600-$700). This was because of the rise of interest in people minds about solar energy, and also the increased credibility of its performance - "if BDL is supporting this then it must be a good solution".

Ziad Doumit
GM, RenMed Energies

The solar loan by BDL is without any doubt a market mobilizer.

APPENDICES

APPENDIX 1: LIST OF QUALIFIED COMPANIES BY LCEC (VERSION 6)

LIST OF QUALIFIED SOLAR WATER HEATERS SUPPLIERS/ INSTALLERS

VERSION 6, DATED FEBRUARY 24, 2012

General Notes and Comments:

• This list is issued by the Lebanese Center for Energy Conservation (LCEC) based on a set of criteria translated into a grading system.
• The list includes the qualified solar water heaters suppliers/ installers that are eligible to participate in the national financing mechanism launched by the Ministry of Energy and Water (MEW) offering 200 USD grant money for the first 7,500 installed solar water heater systems.

Ref.	Company Name	Contact Name	Phone	Address
1	Albina s.a.l	Mohamad Tabbara	03 127721 01 863311 06 443548	Beirut, Clemenceau, AXA ME bldg, 2nd Flr albina@albinagroup.com www.albinagroup.com
2	Aqua Pro	Tanios El Haibi	03 713797 04 925797	Cornet Chehwan, Main str. -Georges El Haibi bldg aquapro@terra.net.lb
3	Climapure	Issam Al Amil	03 448226 01 489201	Cornet Chehwan, Main str. -Georges El Haibi bldg aquapro@terra.net.lb
4	Contra International	Bassel Baaklini	01 381381 03 508108	Sami El Solh Avenue, Badaro, Beirut basselb@contraintl.com www.contraintl.com
5	CONTRAM-M. Jamal & Co.	Mohamad Al Jamal	03 640508 01 342701 01 807772	Beirut, Abdulaziz street, Hamra Bldg Awad, 4th floor info@supersolarheater.com
6	Dawtec	Wissam Daou	03 951460 01 288 688	Furn El-Chebback, Sagesse university str. dawtec@dawtec.com www.dawtec.com
7	DK Energy Systems	Elie Dany	03 698880 04 916232	Mtayleb main road, Noufaily Bldg. info@dkenergysystems.com www.dkenergysystems.com
8	Earth Technologies	Lara Fathalla	04 444 961 70 969 196	Antelias, CCL bldg, 4th floor info@earthtechnologies-me.com www.earthtechnologies-me.com
9	Electro Mechanics Establishment	Rafic Ezzeddine	03 580579 07 381456	South Lebanon, Deir Kanoun, El Naher ezzeddinefactory@hotmail.com
10	Elements (Sun & Wind)	Elias Abou Chedid	03 357599 01 492305	Horch Tabet, GGF Center Block A, 8th floor elias@elementssw.com www.elementssw.com
11	Emarts S.a.r.l	Francois Farage	03 748702 03 474 881	Zahle, St. Elie Street Bldg. Jean Zaatar ffarage@emarts.biz www.emarts.biz

Ref.	Company Name	Contact Name	Phone	Address
12	Enercom	Elie Aoun	01 687189 71 203080	Dikwaneh, Nafaa Str., Chalhoub Bldg ener.com@hotmail.com
13	Energy Efficiency Group/NEC	Ronald Diab	01 250840	Dora, Banking Center, 6th Floor ronald@nec-group.com www.mec-group.com
14	Est. Khalil Sleiman	Khalil Al-haj Suleiman	03 458991 08 910172	Bednayel, Bekaa eks@hotmail.ca
15	Est. Joseph Ziade	Alain Ziade	03 669221 09 830702	Jounieh, Old Harissa road, Naaman Bldg. ziade.alain@gmail.com
16	Falcon Win Trading	Asaad Slaiby	03 694005 08 910521	Zahle, Main Street f-w-t@hotmail.com www.falconenergy-lb.com
17	Fayez Abou El Sheikh (FASCO)	Khaled Abou El Sheikh	03 645406 07 755255	Saida, Saint place Street gm@fasco-lb.com
18	Ghaddar for Commerce & Construction	Zohour Ghaddar	03 422525 07 222656	Ghazieh, Main Road, Ghaddar Bldg zouhourg@hotmail.com
19	Ghaddar Trading & Industry	Sahar Ghaddar	07 221956 07 220512 03 277102	Saida, Main Road, Fouad Khalifeh Building, 1st Floor redaghad@inco.com.lb
20	Green Arms Lebanon s.a.l	Sandra Bou Madi	01 983399	Downtown Beirut, Foch Str., Venice Center info@greenarms.co.uk www.greenarms.co.uk
21	Green Pact	Toni Traboulsi	03 861051 01 999515	65 Rmeil, Rmeil Str. Beirut, Lebanon t_traboulsy@hotmail.com www.thegreenalliance.org
22	Houssam Rifai & Partners	Housam Rifai	71 193577 71 357721	Baalbeck, Douris main road, Rifai bldg hassanrifai2@gmail.com
23	Ismail Salloum	Ismail Salloum	03 707599	Nabatieh, Rweiss Street, Salloum Bldg, Main street salloum_general@hotmail.com
24	Itani Company for Industry & Trade	Khaled Itani	03 534797 05 481346	Aley, Tiro street, Itani.Boite bldg star20@inco.com.lb
25	JF Group	Joseph Faddoul	03 177348 04 916533	Ashrafyeh, Sassine, Trabolsy Bldg jfgrp@hotmail.com
26	Kanaan Establishment for Trading	Asaad Kinaan	03 303392 05 950607	Baabda, Hazmieh, Mar Takla street, Ali Nehme Bldg. info@solarpower-liban.com www.solarworld.com.lb
27	Kodorat	Rabih Shehayeb	03 515930	Aley, Main Street rabih@kodorat.com www.kodorat.com
28	Mawared & Construction Co. – Kypros	Hanna Akar	01 255755	Dora, Cebaco Building, Block A info@kyprossolar.com www.kyprossolar.com

Ref.	Company Name	Contact Name	Phone	Address
29	Mecha Basics Industries	Adel Zubaidi	05 272074 76 766002	Bchamoun, Zohour str., Zouri Bldg zadoco@gmail.com
30	MESMO Zreik	Walid Zreik	06 202566 70 109943	Tripoli, Meitein Street, Zamalek Building zreikw@inco.com.lb
31	Metacs sarl	Emile Azar	01 335929 01 200159	Ashrafieh, Tabaris, Azar bldg metacs@metacs.com www.metacs.com
32	Middle East Green Energy	Phillipe El Khoury	01 491 446 01 444 961	Sin El fil, Beirut hall, Hibri bldg www.me-greenenergy.com info@me-greenenergy.com
33	Mikael Yazbek	Mikael Yazbek	03 704227 06 416415	Al Samiria, Nakhle Bldg, Lina Center mikaelyazbek@hotmail.com
34	Nature Energie	Gilbert Zabbal	05 457968	Baabda, Rihanieh, St Charles Hospital Str gilbert@skyenergies.com www.skyenergies.com
35	Phoenix Group of Companies	Simon Gerges	09 855690	Safra, Kesrouan simon.gerges@phoenixlb.com www.phoenixlb.com
36	Renewable Med Energies	Ziad Doumit	03 302203 04 545230	Dbayeh Main street, facing Hotel le Royal ziad.doumit@rmenergies.com www.rmenergies.com
37	Saab International	Roger Saab	71 750505 01 879589	Zalka, Biakout main road, Jazra Bldg roger.saab@saab-intl.com www.saab-intl.com
38	Saadeddin General Trading	Elias Saadeddin	03 231258 06 250191	Kfarchlan, Danniyeh main road, Ahmad Osman Bldg specialheat@hotmail.com
39	Sawan Solar Systems	Elie Sawan	03 472528 01 681421	Zgarta, Akbeh street. sawan_est@hotmail.com
40	Sofaya	Michael Moussa	70 466129 06 953110	Cosba, Koura, Arz Highway michaelmoussa@hotmail.fr
41	Solar Power	Rabih El Hajj	03 250292 09 221449	Zouk Mosbeh, Elie Moukawam Bldg rawadhaj@hotmail.com
42	Solar Solutions	Jihad Ghorra	08 806778 03 961516	Zahle, Ksara, near LA TOUR restaurant jihadghorra@hotmail.com
43	Solarnet	Jean Paul Sfeir	03 309 885 04 532927 04 532937	Mansourieh, Old road, Yazbeck Bld info@solarnet-online.com www.solarnet-online.com
44	Sun Island	Ziad Daou	05 720473 03 580084 03 465922	Dmit, El Shouf, Main Road info@sunisland-lb.com www.sun-island-lb.com
45	Sun Power	Dani Akiki	04 444204 03 123685	Antelias, Bekfaya Road, Abi Karam Bldg dany@sunpowerlb.com www.sunpowerlb.com
46	Tabbara General Trading	Ziad Tabbara	03 701386 01 704444	Ahmad Takkiedine str, Colombia Center ziad@tabbara-general.com www.tabbara-general.com

Ref.	Company Name	Contact Name	Phone	Address
47	Takat General Trading	Deeb Youssef	03 750200 09 622574	Jbeil, Romane Street deeb_youssef@hotmail.com
48	TechniCorp	Amer Hafez	03 706543 01 884815	Dora, Street 75, Pink Bldg info@technicorp.net www.technicorp.net
49	Techno Mass	Khaled Tohme	03 706543 01 884815	Beit al Chaar, Michel Abood Bldg info@techno-mass.com www.techno-mass.com
50	Tfaily Solar Energy	Sami Tfaily	03 720129 07 530330	Dair Al Zazhrani Main Road sunshine_solar@hotmail.com
51	Universal Energy	Omar El Hassan	70 566200 01 839030	Hadath, Main Road, Center Cherfan energy_universal@yahoo.com
52	WEBCO	Walid El Baba	03 667492 01 850068 01 853711	Beirut, Zahia Salman, El Baba Bldg, 2nd flr webco@cyberia.net.lb www.webco-lb.com
53	White Water	Gaby Mrad	03 660847 06 417847	Sammrieh, Barad Chami, Yamouneh Bldg whitewater660@gmail.com

APPENDIX 2: LIST OF COMPANIES INVOLVED IN THE STUDY

A

Abdo Bros
ABH
Abi Rizk
Abi Tayeh
Acsco
Agrunor
Albina
Aqua Solar
AVS

C

Century
Chamaliya
Climapure
Contra
Contram

D

Dawtec
DK Energy

E

Earth Technology
EEG
Eiwan
EKS
El Zir
Elements
Emarts
Emec
Enercom
Ezzedine

F

Falcon
Fasco

G

Gabriel
Ghaddar
Green Arms
Greentech

H

Haddad
Hatoum
Helios
Hendi
Hijazi

I

Ismail Hamza

J

JFGroup

K

Kanaan
Kasr El Hanan
Khoueiry
Kodorat
Kypros

M

Maarawi
ME Green Energy
Mesmo
Mossaco

N

Nabbout
Nakouzi
Naturenergie

P

Phoenix

R

Rafale
RenMed
Rifai

S

Saab
Saadeddine
Salem
Salloum
Samir Mikael
Sawan
Skaff
Sofaya
Solar Power
Solar Solutions
Solarnet
Solartech
Soleil
Sun Island
Sun Power
Sunergie

T

Tabbara
Tabbouch
Technicorp
Technomass
Technosystems
Tfaily

U

Universal Energy

W

White Water

Y

Yazbek
Younes

Z

Ziad Saab
Ziade

APPENDIX 3: DISTRICTS AND GOVERNORATES NUMBER OF INHABITANTS

DISTRICT	INHABITANTS
Akkar	478,000
Aley	104,000
Baabda	585,000
Baalbeck	183,000
Batroun	38,000
Beirut	1,000,000
Bint Jbeil	58,300
Bsharre	13,000
Chouf	174,000
Minieh-Dinnieh	92,000
Hasbaya	30,000
Hermel	25,400
Jbeil	70,000
Jezzine	20,500
Keserwan	202,000
Koura	70,000
Marjeioun	45,300
Metn	487,000
Nabatieh	111,000
Rashaya	28,000
Saida	229,500
Sour	238,348
Tripoli	780,000
West Bekaa	53,500
Zahle	144,500
Zgharta	53,000

GOVERNORATES	INHABITANTS
Akkar	500,000
Baalbeck-Hermel	208,400
Beirut	1,000,000
Bekaa	226,000
Mount Lebanon	1,622,000
Nabatieh	244,600
North	1,024,000
South	488,348

ABOUT THE LCEC

L.C.E.C.
Lebanese Center for Energy Conservation
المركز اللبناني لحفظ الطاقة

The Lebanese Center for Energy Conservation (LCEC) is the national energy agency catering for energy efficiency and renewable energy in Lebanon, and performing as the technical arm to the Lebanese Ministry of Energy and Water in energy conservation issues at both technical and strategic levels.

LCEC started on a project basis financed by the Global Environment Facility (GEF) and the Ministry of Energy Water (MEW), in addition to other bilateral donors, under the direct management of the United Nations Development Programme (UNDP). Now, the center is legally registered at the Ministry of Interior, and is established as an independent technical national center although it continues to be supported by the UNDP, to ensure measurable and sustainable global benefits in terms of long-term greenhouse gas (GHG) emissions reductions, which in-turn contributes to the mitigation of climate change.

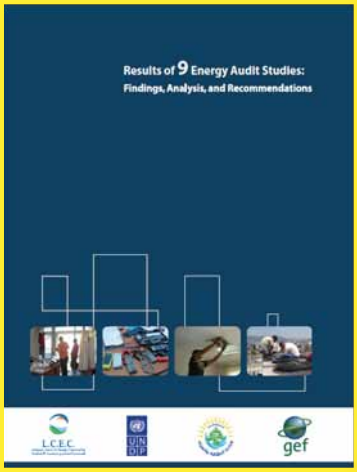
LCEC addresses end-use energy conservation and renewable energy at the national level, and supports the Government of Lebanon in developing and implementing national strategies that promote the development of efficient and rational uses of energy, in addition to the use of renewable energy at the end user level.

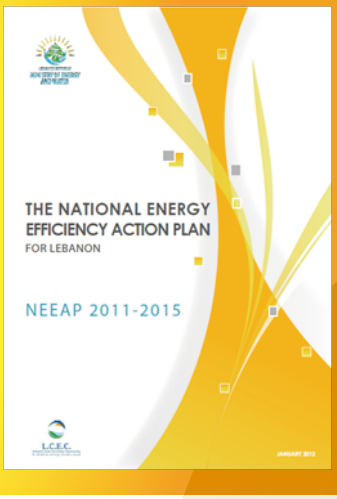
For the past few years, LCEC has developed energy efficiency standards and labels for major household appliances in cooperation with Libnor and IRI, helped in the creation of Energy Services Companies (ESCOs) to conduct more than 100 energy audit studies for companies and institutions, supervised and installed more than 4,000 square meters of solar water heaters.

In addition, LCEC supported the Ministry of Energy and Water in preparing the National Energy Efficiency Action Plan (NEEAP) for Lebanon, in distributing 3 Million energy efficient lights all over the country, and in applying for CDM revenues to offset a big share of the project cost.

At the international level, LCEC is a founding member representing Lebanon at the Regional Center for Renewable Energy and Energy Efficiency (RCREEE). LCEC is the national focal point for different EU-funded projects like MED-ENEC and MED-EMIP.

OTHER PUBLICATIONS BY UNDP - LCEC





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