



SOLAR WATER HEATERS' MARKET EVALUATION: CASE STUDY OF LEBANON 2015

Prepared for UNEP, Division of Technology,
Industry and Economics, Global Solar Water
Heating Initiative

November 2015

UNITED NATIONS ENVIRONMENT PROGRAMME



SOLAR WATER HEATERS' MARKET EVALUATION: CASE STUDY OF LEBANON 2015

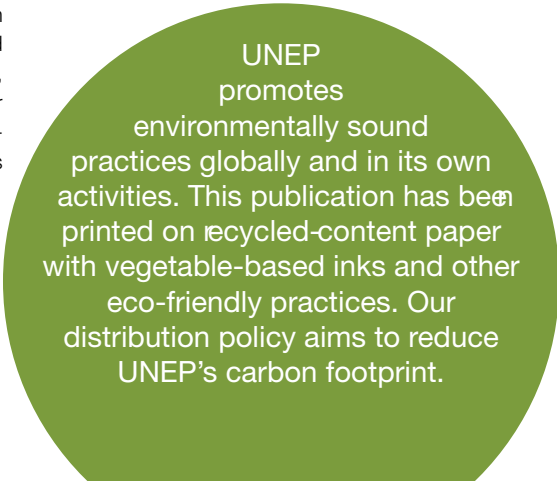
Copyright © United Nations Environment Programme, 2014

This publication may be reproduced in whole or in part and in any form for educational or non-profit purposes without special permission from the copyright holder, provided acknowledgement of the source is made. UNEP would appreciate receiving a copy of any publication that uses this publication as a source.

No use of this publication may be made for resale or for any other commercial purpose whatsoever without prior permission in writing from the United Nations Environment Programme.

Disclaimer

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the United Nations Environment Programme concerning the legal status of any country, territory, city or area or of its authorities, or concerning delimitation of its frontiers or boundaries. Moreover, the views expressed do not necessarily represent the decision or the stated policy of the United Nations Environment Programme, nor does citing of trade names or commercial processes constitute endorsement.



UNEP
promotes
environmentally sound
practices globally and in its own
activities. This publication has been
printed on recycled-content paper
with vegetable-based inks and other
eco-friendly practices. Our
distribution policy aims to reduce
UNEP's carbon footprint.

ABOUT THE UNEP DIVISION OF TECHNOLOGY, INDUSTRY AND ECONOMICS

ACKNOWLEDGEMENTS

SUPERVISION AND COORDINATION

Amr Abdelhai, Programme Officer, UNEP Division of Technology, Industry and Economics
Ashraf Kraidy, Senior Advisor to the Energy Department, League of Arab States

LEAD AUTHOR

Elie Abou Jaoudeh, Energy Consultant

REVIEWERS

Amr Abdelhai, Programme Officer, UNEP Division of Technology, Industry and Economics
Pierre El Khoury, General Director, Lebanese Center for Energy Conservation (LCEC)
Ziad El Zein, Head of PR and Finance, Lebanese Center for Energy Conservation (LCEC)
Nader Haj Shehadeh, Energy & Sustainability Consultant
Ana Rovzar, International Relations Specialist, Regional Center for Renewable Energy and Energy Efficiency (RCREEE)

*Designed by Karine Shraim, Communication Specialist and Graphic Designer for the Lebanese Center for Energy Conservation (LCEC)
Design update by Mostafa Attya, Senior Graphic Designer, Regional Center for Renewable Energy and Energy Efficiency (RCREEE)*

This report was prepared in its first version in 2015, and then reviewed and updated in October 2015 to include the latest updates on market development and emissions estimation. The review was essential to present latest market trends and provide update information on the impact of the GSWH initiative and its effect on the local SWH market.

The review was performed in coordination with the UNDP climate change team at the Ministry of Environment, as well as the Energy and Environment unit at the UNDP head office. The review also included feedback from the Lebanese Center for Energy Conservation to formulate a well-rounded report that presents the most recent data and observations about the Lebanese SWH Market.

The updates were undertaken based on desk-review of national data and verification against Lebanon's National SWH Market Survey conducted in 2014. The verification also covered calculations performed throughout the report but was limited to the data presented and available numbers. No verification beyond that was performed.

Copyright © United Nations Environment Programme, 2015

This publication may be reproduced in whole or in part and in any form for educational or non-profit purposes without special permission from the copyright holder, provided acknowledgement of the source is made. UNEP would appreciate receiving a copy of any publication that uses this publication as a source.

No use of this publication may be made for resale or for any other commercial purpose whatsoever without prior permission in writing from the United Nations Environment Programme.

Disclaimer

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the United Nations Environment Programme concerning the legal status of any country, territory, city or area or of its authorities, or concerning delimitation of its frontiers or boundaries.

Moreover, the views expressed do not necessarily represent the decision or the stated policy of the United Nations Environment Programme, nor does citing of trade names or commercial processes constitute endorsement.

EXECUTIVE SUMMARY

The Publication was developed under the Global Solar Water Heating (GSWH) Market Transformation and Strengthening Initiative (GSWH Project), a joint undertaking by the United Nations Environment Programme (UNEP) and the United Nations Development Programme (UNDP) and is funded by the Global Environment Facility (GEF), with co-financing by the International Copper Association (ICA).

The GSWH initiative supported Solar Water Heating (SWH) national market development in five countries including Lebanon. At that time, the market for solar water heaters in Lebanon was developing at a very slow pace due to many market barriers. This initiative has set a target of 190,000 m² of new solar thermal panel installations over a period of 5 years (2009-2014), but this target was already exceeded by the end of 2014. And now, Lebanon is considered among the top 10 markets for solar water heaters in the world, and this is according to the International Energy Agency (IEA) in its EA-SHC Solar Heat Worldwide Markets and Contributions to the Energy Supply 2012.

The different sections of this report offer a comparative analysis of the SWH market development in Lebanon for the past 5 years. Through an initiative launched by UNEP in close coordination with the Regional Center for Renewable Energy and Energy Efficiency (RCREEE), the purpose of this study is to analyze the impact of the GSWH initiative on the development of the solar water heaters market in Lebanon.

The report evaluates the solar water heaters market development in Lebanon using the UNEP's TechScope SWH Market Readiness Assessment systematic Methodology and Analysis Tool, and presents a comprehensive case study based on the successful implementation of a national initiative for SWH market development. Also, it provides the lessons learned and best practices in order to initiate the interest, of other developing countries and countries in the Arab region, to start implementing a similar SWH national initiative.

The GSWH was implemented between 2009 and 2014. It consists of two components as follows:

- Component 1 - Global Knowledge Management (KM) and Networking: Effective initiation and co-ordination of the country specific support needs and improved access of national experts to state of the art information, technical backstopping, training and international experiences and lessons learned.
- Component 2 - UNDP Country Programmes: Work in the country programmes revolves around addressing the most common barriers to solar water heating development: policy and regulations, finance, business skills, information, and technology.

The activities under the country national program (Component 2) in Lebanon was articulated around four main sub-components:

- Legal, regulatory, and institutional framework;
- Public awareness raising, marketing support, and capacity building;
- Financing mechanisms and new delivery models;
- Business skills barrier and product quality.

While analyzing these four main sub-components using a narrative approach, the report shows that back in 2009, the SWH market was not up to its real potential. The market was practically having a large number of weaknesses, some of the most important being shown here below:

- No public institution in place to actively promote sustainable market growth of SWH financing mechanisms and new delivery models;
- No specific building regulations, fiscal or public financial incentives in place to promote sustainable SWH market;
- No specific regulations for SWH standards, certification or quality control mechanisms, and no availability of a testing facility for solar water heaters;
- No specific financial or fiscal incentives to promote the SWH market;
- Lack of effective and focused public awareness efforts and initiatives;
- No specific facilitated financing and new delivery mechanisms offered and marketed for the SWH purchase.

Following the implementation of the national country program, the target for the year 2014 was achieved thanks to the role the GSWH initiative played in creating

a common platform in which the team of the GSWH initiative succeeded to bring together all national stakeholders and to align efforts towards one single national goal.

The GSWH initiative team has played a pivotal role in linking stakeholders together and in securing a smooth communication among the different parties, allowing each to play a significant role in moving towards a sustainable SWH market in Lebanon.

The different implemented activities by the GSWH initiative have led to a

remarkable growth in the SWH market. This growth as documented in a number of market reports and observations. The first national SWH survey of 2012 involving a number of installers, experts, and end-users Collected data about various of factors including their perception of the solar thermal market in Lebanon, The survey concluded that 76% of installers and 85% of experts and end-users agree that the market is growing.

In 2014, LCEC conducted a research to quantify the installed solar thermal systems in Lebanon as part of the Central Bank of Lebanon support mechanism, which resulted in the market growing faster than initially predicted at the start of the national SWH initiative. The initial target was set to reach 1 Million m² of installed collectors by the year 2020. According to the most recent growth trends, the target will be reached by 2018.

To evaluate this market growth in a quantifiable way, an analysis of the Lebanese SWH market was done using UNEP's SWH TechScope Market Readiness Assessment methodology. The analysis includes three different phases:

The first phase takes place before the start of the GSWH initiative (Pre-GSWH); the second phase is during the execution phase (Mid-term); while the final phase runs after the project's completion (Post-GSWH).

- 1. Pre-GSWH:** The first stage is considered to be the phase before the start of the GSWH project, in the year 2009. The main source of data for this milestone is face-to-face interviews with active stakeholders in the SWH market at the time.
- 2. Mid-Term GSWH Implementation:** The second phase is the time of data collection for the UNEP SWH TechScope Market Readiness Assessment report 2012. The grades for this section were not changed from what was initially conceived in the mentioned report.
- 3. Post-GSWH:** The final phase of the scoring considers the achievements of the GSWH project and the new decisions and actions taken by all the stakeholders in the SWH market.

According to the SWH Techscope Market Readiness Assessment, the total score for Lebanon was 2.31 out of 5.0 at the beginning of the GSWH project in 2009 (Pre-GSWH). The last section covers the impact of the GSWH project and analyzes its overall achievements. The GSWH project started with a budget of 3.16 Million USD, co-funded by the GEF and MEW and managed by UNDP.

The initiative had a clear impact in two main categories, changing drastically from the pre-GSWH phase to the post-GSWH phase. The scoring was a major indicator for this, with the support framework scoring 91.4% instead of 10.4% in the pre-GSWH stage. This achievement was mainly driven by the adoption of targets and by offering financial incentives and special loans for SWHs. With national conditions staying identical and only improving by 2.4% to become 67.1%, and the financing staying stable at 70%, the business climate improved from 29% to 56.2%. This improvement was also driven by the standards and certification efforts for systems and installers.

The three main impacts that the project had on the market can be summarized as:

- Direct financial injections: the GSWH successfully attracted 3.7 Million USD in form of funds or projects to boost the SWH market growth
- Indirect financial injections: the GSWH was able to increase the market growth through financial mechanisms and other forms of measures. The value of this impact is calculated to be 72.8 Million USD. This value indicates the investments that would not have been made if it weren't for the measures put in place by the GSWH in cooperation with several stakeholders.
- GHG Emissions: The project and its initiatives were able to prevent emissions of at least 123,346 tCO₂e between 2015 to 2020. This gives a value of 1tCO₂ saved for each 25.6 USD invested in the project. This emission reduction return on investment is more competitive than for replacing incandescent bulbs with high efficiency LEDs or using large scale wind turbines to replace fossil fuel electricity generation.

The GSWH initiative, and the structured national program have led to the rapid development and growth of the SWH market. Especially with the global and economically-feasible potential for increased use of solar thermal applications for hot water preparation comparable to any other form of energy efficiency or renewable energy. As demonstrated by the experiences in Lebanon, it is a technology that can provide cost-effective energy solutions also to poorer segments of the population and can become a mass product leading to permanent market shift at the national level for the benefit of both the end users and the environment.

CONTENTS

BACKGROUND AND METHODOLOGY	10
1.1 Background	10
1.2 Analysis and Structure of the Study	10
Development of the Lebanese SWH Market	14
2.1 Overview of the SWH Market	14
2.2 Legal, Regulatory, and Institutional Framework	19
2.3 Public Awareness Raising	23
2.4 Financing-Mechanisms	36
2.5 Business Skills Barrier and Product Quality	39
2.5.1 SHAMCI	43
2.6 Conclusion	45
Applying UNEP's SWH TechScope Assessment Methodology: Parameters Evaluation and Score Variation in 3 Phases of Implementation	50
3.1 Introduction and Scoring Methodology	50
3.2 Parameter I: Solar Water Heating Support Framework	53
3.2.1 SWH Targets	53
3.2.2 Financial Incentives for SWH system installation	53
3.2.3 SWH Loan Programs	53
3.2.4 Mandates	53
3.2.5 Outreach Campaigns	53
3.3 Parameter II: National Conditions	53
3.3.1 Insolation	53
3.3.2 SWH Market Penetration	54
3.3.3 Residential Energy Consumption Growth	55
3.3.4 SWH Market Growth	56
3.3.6 Competitiveness: Heat Fuel Subsidy	57
3.4 Parameter III: Financing	57
3.4.1 Country Credit Rating	57
3.4.2 Access to Finance	57
3.5 Parameter IV: Business Climate	58
3.5.1 Doing Business	58
3.5.2 Manufacturing Capacity	58
3.5.3 Product Standards and Certifications	59
3.5.4 Installer Certification	59
3.5.5 Industry Associations	59
3.6 Score Evolution over the three time-phases	61
3.7 Score by Parameter	61
National SWH Program Impact Analysis And Way Forward	64
4.1 Introduction	64
4.2 GSWH Impact Analysis	64
4.2.1 Impact of Soft Loans and Subsidies	64
4.2.2 SWH Key Figures	66
4.3 Non-Quantitative Impacts	68
4.3.1 Policy Setting	68
4.3.2 Building Mandates	69
4.3.3 Outreach Campaigns	69
4.3.4 Product Standards and Certifications	69

4.3.5	Installer Certifications	69
4.4	Quantitative Impacts	69
4.4.1	Financial Incentives	69
4.4.2	SWH loan Programs	70
4.4.3	NEEREA Loan Programs	70
4.4.4	Pilot Projects	70
4.4.5	Market Growth	71
4.5	The Way Forward	71
4.5.1	NAMAS	71
4.5.2	SWH Support Framework	72
4.5.3	National Conditions	72
4.5.4	Financing	72
4.5.5	Business Climate	72
4.5.6	SHAMCI Certification	73
4.5.7	Upgrade SWH Testing Laboratory	73
4.5.8	Action Points	73
4.6	Results	74
	Conclusion	78

LIST OF TABLES

TABLE 1	Achievements, Contributors, and initiatives (Stakeholders' perspective)	16
Table 2	The main solutions requested by stakeholders according to the Lebanese First National SWH and PV Market Survey and the solutions that were implemented through the GSWH project	21
Table 3	Expert report results for the completion of the testing facility at IRI	41
Table 4	Solutions and actions needed to improve the solar thermal market (Stakeholders' perspective)	47
Table 5	Overview of SWH Techscope Market Readiness Analysis Tool Weights for Parameters and Indicators	52
Table 6	Real Interest Rate and Domestic Credit Availability of Lebanon variations from 2008 until 2013, Source: World Bank	57
Table 7	MVA for Lebanon, 2008 until 2013. Source: World Bank	58
Table 8	Lebanon's indicators scoring over the 3 time periods	60
Table 9	Lebanon's parameter scores by time period	61
Table 10	Additional key data and figures for the Lebanese SWH market	68
Table 11	Summary of the impact of the GSWH Project	74

LIST OF FIGURES

FIGURE 1	Major Challenges Facing the SWH Market in the Past 5 Years, Stakeholders' Opinion	
FIGURE 2	Time flow of SWH Market Achievements	
FIGURE 3	Challenges faced by the SWH market according to the Lebanese First National SWH and PV Market Survey	
FIGURE 4	Laws and Regulations Building Blocks	
FIGURE 5	Lebanon's SWH Market Survey Results and Projections (2010)	
FIGURE 6	Building Mandates Approval Cycle for Lebanon	
FIGURE 7	Lebanon's Activities in Raising Public Awareness for SWH Technology	
FIGURE 8	Values for people who considered energy efficiency solutions	
FIGURE 9	People who are aware of SWH technology vs people who are actually using it	
FIGURE 10	Outreach campaign Direct Cash Injection from the National SWH Project and the Actual Value of the Campaign due to the Free Ads and Free Billboards that Were Given out by Some Agencies	
FIGURE 11	Picture from the Billboard Advertisement Campaign	
FIGURE 12	Picture from the Billboard Advertisement Campaign for SWH	
FIGURE 13	Solutions Brought Forth by the Involvement of International Experts in the Design Phase of Pilot Projects	
FIGURE 14	Methodology of Loan Interest Coverage	
18	FIGURE 15	38
	Flowchart of NEEREA SWH Loan Application and Subsidy Distribution	
19	FIGURE 16	38
	Subsidy Distribution by year	
20	FIGURE 17	38
	SWH Installations in Lebanon, Expected Installations from SWH Market Survey in 2010, Actual Installations due to NEEREA Files and National Survey in 2014	
21	FIGURE 18	39
	Perceived impact of the LCEC in running the 200USD subsidy program for SWHs (Stakeholders' perspective)	
22	FIGURE 19	40
	Doing Business Rankings for Lebanon. Source: World Bank	
23	FIGURE 20	40
	Imported vs locally manufactured SWH system sales in the market	
24	FIGURE 21	40
	Distribution of Dealers that Import All the SWH System and the Dealers that Use Some Locally Manufactured Parts	
24	FIGURE 22	42
	Solar System Certifications Available for Products used by Local Installers. Source: Lebanon's First Survey Study of the Solar Water Heaters Market, 2014.	
25	FIGURE 23	42
	Problems in the Operation of SWH Systems as Reported by End-Users	
25	FIGURE 24	43
	Process of the Inception of SHAMCI	
26	FIGURE 25	44
	Foreseeable SHAMCI Certification Path for Lebanon	
26	FIGURE 26	44
	SWH Market Size - Local Market - SHAMCI Region Market for 2015/2016	
36	FIGURE 27	45
	Market Conditions According to Local Installers and Stakeholders, 2012	
37	FIGURE 28	45
	Reasons for Market Growth As Seen From Installing Companies Perspective	

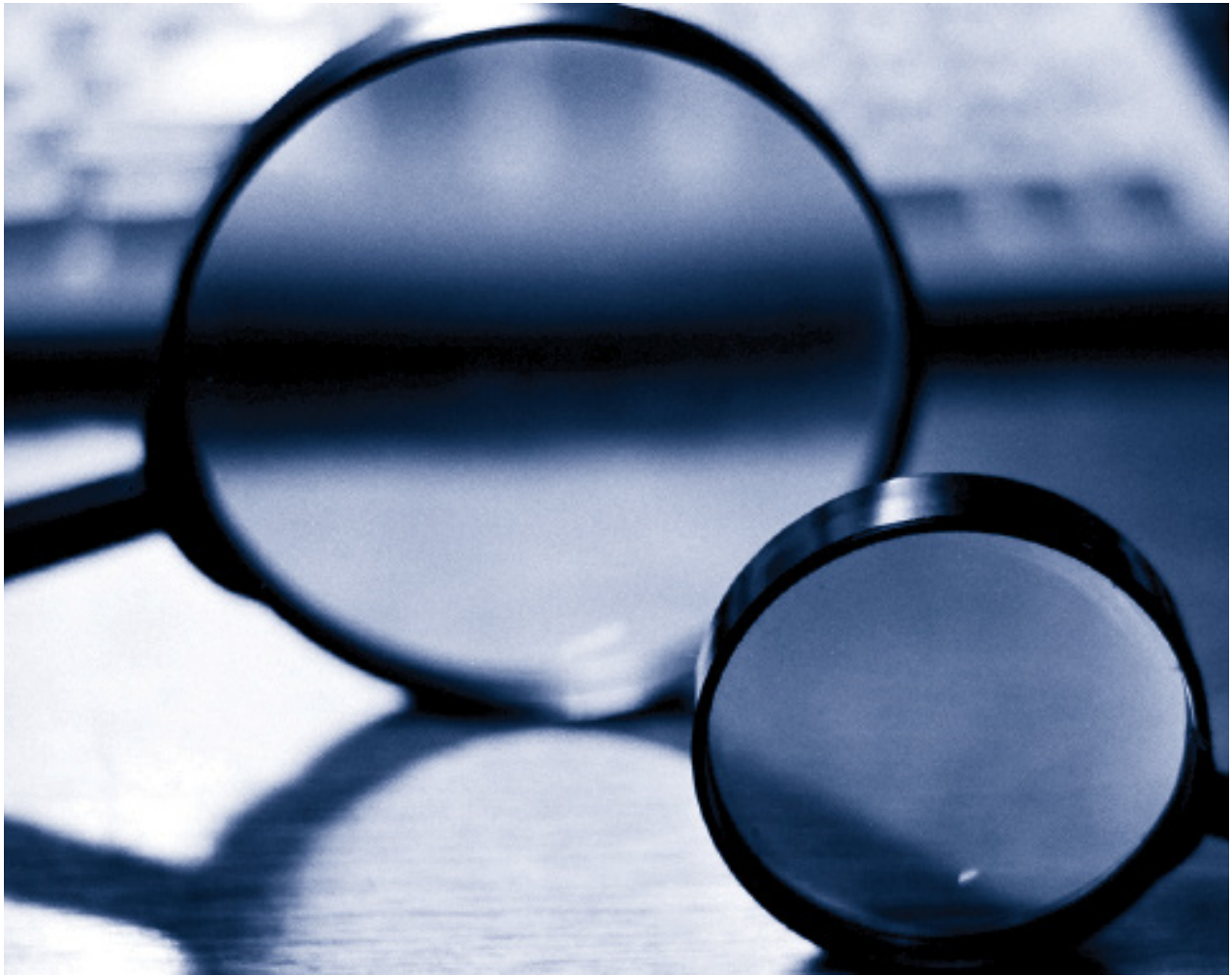
FIGURE 29 Share of SWH System Installation Split by End-Use Type	46	FIGURE 43 CO ₂ Savings by the SWH systems, yearly and cumulative	68
FIGURE 30 SWH Market Growth in Lebanon, projected vs surveyed	47	FIGURE 44 Impact of the Solar Water Heater Loans	70
FIGURE 31 Parameter Element Weights	51	FIGURE 45 GSWH Contribution to the SWH Market in M ² of collectors installed	71
FIGURE 32 Lebanon's insolation is shown on the right figure. The scoring for each insolation level figures in the table on the left.	54	FIGURE 46 The financial performance for different Energy Efficient and Renewable Energy Measures	75
FIGURE 33 Lebanon's SWH market growth. Light orange is for surveyed market at the start of the GSWH project. Medium Orange is for the projected growth at the time (2010). Dark orange is the projection based on the 2014 market survey	55		
FIGURE 34 Cost breakdown for the installation of a SWH system	56		
FIGURE 35 Imported vs locally manufactured SWH system sales in the market	58		
FIGURE 36 The Evolution of Lebanon's Market Score	60		
FIGURE 37 SWH sales distribution split into cash payments, NEEREA loans with subsidies, and NEEREA loans without subsidies	65		
FIGURE 38 Distribution of systems that benefited from NEEREA loans from 2010 until 2014 showing the number which benefited from Subsidies	65		
FIGURE 39 Employment in the Lebanese SWH market, Source: GSWH survey 2014	66		
FIGURE 40 Lebanon's Governorates	66		
FIGURE 41 The figure on the left shows the company headquarters distributed by Governorate. The figure on the right shows the coverage of companies per governorate	67		
FIGURE 42 Distribution of Domestic Water Heating Fuel, Source: Survey 2012	67		

LIST OF ACRONYMS

BDL	Central Bank of Lebanon
CDM	Clean Development Mechanism
CDR	Council for Development and Reconstruction
CEDRO	Country Energy Efficiency and Renewable Energy Demonstration Project for the Recovery of Lebanon
CER	Certified Emission Reduction
CFL	Compact Fluorescent lamps
CO₂	Carbon Dioxide
CO₂e	Carbon Dioxide Equivalent
CSP	Concentrated Solar Power
DNA	Designated National Authority
EC	European Commission
EDL	Electricité du Liban
EE	Energy Efficiency
EN	European Standard
ESCO	Energy Services Company
EU	European Union
GEF	Global Environment Facility
GHG	Greenhouse Gas
GSWH	Global Solar Water Heating Market Transformation and Strengthening
IEA	International Energy Agency
IPP	Independent Power Producers
IRI	Industrial Research Institute
ISO	International Standards Organization
KWh	Kilowatt-hour
KW_{th}	Kilowatt-hour Thermal
LAS	League of Arab States
LCEC	Lebanese Center for Energy Conservation
LED	Light Emitting Diode
LGBC	Lebanon Green Building Council
LIBNOR	Lebanese Standards Institution
LSES	Lebanese Solar Energy Society
m²	Square meters
MED-ENEC	Euro- Mediterranean Project on Energy Efficiency in the Construction Sector
MED-EMIP	Euro- Mediterranean Energy Market Integration Project
MEHE	Ministry of Education and Higher Education
MEW	Ministry of Energy and Water
MoE	Ministry of Environment
MOF	Ministry of Finance
MWh	Megawatt Hour
NEEAP	National Energy Efficiency Action Plan
NEEREA	National Energy Efficiency and Renewable Energy Action
PDD	Project Design Document
PIN	Project Idea Note
PMU	Project Management Unit
PV	Photovoltaic
RCREEE	Regional Center for Renewable Energy and Energy Efficiency
SHAMCI	Solar Heating Arab Mark and Certification Initiative
SWH	Solar Water Heater
tCO₂	Tonne Carbon Dioxide
TA	Technical Assistance
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
USD	United States Dollars
USAID	US Agency for International Development
WB	World Bank

SECTION 1

BACKGROUND & METHODOLOGY



BACKGROUND AND METHODOLOGY

1.1 BACKGROUND

Back in 2009, the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP) launched a joint programme entitled “Global Solar Water Heating Market Transformation and Strengthening Initiative” (hereafter referred to as GSWH initiative) funded by the Global Environment Facility (GEF) and the International Copper Association (ICA). The GSWH initiative covered 5 different countries worldwide including Lebanon.

At that time, the market for solar water heaters in Lebanon was developing at a very slow pace with a large number of problems facing the market development. The GSWH initiative was implemented by the Lebanese Center for Energy Conservation (LCEC) under the direct management of the Lebanese Ministry of Energy and Water (MEW), UNDP Lebanon, and UNEP. Through a well-structured approach focusing on four independent but inter-related axes (policy, financing, quality control, and capacity building), the initiative succeeded in giving a huge boost to the solar water heaters market in Lebanon. The GSWH initiative set a target of 190,000 m² of new installations over a period of 5 years (2009-2014) to reach 350,000 m² in 2014 starting with 160,000 m² in 2009. By the end of 2014, the actual implementations of solar water heaters exceeded the set target. Furthermore, **Lebanon is now considered among the top 10 markets for solar water heaters in the world according to the International Energy Agency (IEA).**¹

Following these results, UNEP, in close coordination with the Regional Center for Renewable Energy and Energy Efficiency (RCREEE) based in Cairo, Egypt, has initiated a study to analyze the development of the solar water heaters market in Lebanon following the implementation of the GSWH initiative. The analysis of the Lebanese market is done in cooperation with the Lebanese Center for Energy Conservation (LCEC) the latter being the implementing agency of the Ministry of Energy and Water.

This report is the output of the study funded by UNEP to analyze the current status of the solar water heaters market in Lebanon and the different stages of development of this market. This report also evaluates the solar water heaters market development in Lebanon using the UNEP SWH TechScope Market Readiness Assessment. The following sections will detail the approach used in the analysis.

In completing this study, UNEP and RCREEE aim to offer a real case study of the successful implementation of a national initiative for SWH market development. The objective is to use the Lebanese case study as a basis to generalize this experience and to implement successful initiative in other developing countries.

1.2 ANALYSIS AND STRUCTURE OF THE STUDY

This purpose of this report is to provide an analysis of the SWH market development in Lebanon while identifying the impact of the national GSWH initiative on the market. By doing so, the report assesses the Lebanese SWH market and offers a successful case study that could be generalized to other countries of similar conditions, especially Arab countries.

To offer a systematic and global coverage, the report addresses the solar water heaters market in Lebanon through a two-fold approach. First, the analysis will address the Lebanese solar water heating market from a narrative approach by studying the different market development stages and the impact of the national SWH programs on the market development. Secondly, the analysis will follow a more critical and quantifiable approach using UNEP’s SWH TechScope Market Readiness Assessment Tool.

¹ Mauthner, F.M., & Weiss, W.W. (2012). *Solar Heat Worldwide, Edition 2014*. Gleisdorf, Austria: SHC (Solar Heating & Cooling Programme)

The objective of the two different approaches is one: to measure the impact of the GSWH initiative and to draw a clear assessment of the results of its implementation; and most importantly to draw lessons learned and success stories that could be generalized elsewhere.

The following Section 2 of this report will present the narrative approach, analyzing the SWH market development in Lebanon with focus on the role of the national component of the GSWH initiative. Section 3 will present the measurable approach, applying UNEP's SWH Techscope Market Readiness Assessment Methodology and Tool on the Lebanese SWH Market in three different timelines. The results of the Lebanon's SWH Market Scoring will be presented in Section 4, while finally Section 5 offers an evaluation of the role of the GSWH project, detailing both direct and indirect impacts.

In more details, Section 2 of the report will follow the approach implemented by the national program of the GSWH initiative during the period 2009-2014. Specifically, Section 2 will be along four different lines:

- Legal, regulatory, and institutional framework;
- Public awareness raising, marketing support, and capacity building;
- Financing mechanisms and new delivery models;
- Business skills barrier and product quality.

As for Section 3 dealing with the application of the UNEP's Techscope Market Readiness Assessment Methodology and Tool, the analysis will follow a time-based approach. Specifically, the analysis will cover three different periods in the history of the market development of solar water heaters, divided as follows:

- Pre-GSWH Initiative: the first stage is considered to be the period before the start of the GSWH project, that is end of the year 2009;
- Mid-Term of the GSWH Initiative Implementation: this second stage coincides with the mid-term evaluation of the national GSWH initiative in Lebanon (done in 2012);
- Post-GSWH Initiative: the last stage of the scoring considers the achievements and impact of the GSWH initiative following its closure in 2014.

In the pre-GSWH initiative phase, the main source of data and analysis is the different face-to-face interviews done with key players and stakeholders at that time. For the mid-term of the GSWH initiative implementation phase, the analysis will be based on results of the "UNEP SWH TechScope Market Readiness Assessment" report produced by UNEP in 2012. The last phase will be analyzed in details as per the achievements of the GSWH initiative and the action plans taken by Lebanon for the future of the SWH market. The picture below shows the 3 different phases.



A comparison of the scores of the three different phases will be presented in a tabulated format in Section 4. Finally, Section 5 will cover the impact of the GSWH initiative implementation and its positive direct achievements on the Lebanese SWH market. In doing so, the analysis will tackle three different aspects in terms of impact:

- Direct financial investments in the SWH market thanks to the GSWH through the different activities implemented throughout the life of the project;
- Indirect financial investments in the SWH market due to the GSWH through other channels working in parallel to the GSWH initiative;
- CO₂ savings resulting from both the direct and indirect impact of the GSWH.

SECTION 2

DEVELOPMENT OF THE LEBANESE SWH MARKET



DEVELOPMENT OF THE LEBANESE SWH MARKET

This section offers a comprehensive coverage of the development of the solar water heaters market in Lebanon using a narrative approach, with the purpose to measure the impact of the implementation of the national GSWH. Most importantly, this section will shed the light on the success stories achieved thanks to the GSWH, and will present lessons learned for replication elsewhere.

Knowing that the GSWH initiative was implemented between 2009 and 2014, the analysis in this section will focus on that period. At first, a holistic and comprehensive overview of the SWH market development will be presented. The following paragraphs will present the overall objectives of the GSWH initiative, the different players involved, and the overall situation of the SWH market.

Second, the analysis will follow the four major phases of implementation of the GSWH initiative as shown here below (as described in the project document of the GSWH initiative):

- Legal, regulatory, and institutional framework;
- Public awareness raising, marketing support, and capacity building;
- Financing mechanisms and new delivery models;
- Business skills barrier and product quality.

It is important to note that these mentioned phases are based on international experience and on the in-country consultations conducted in Lebanon as a part of the GSWH initiative preparation phase. Accordingly, these four specific national components can be further tailored and fine-tuned to the specific needs of other developing countries.

2.1 OVERVIEW OF THE SWH MARKET

Back in 2009, the SWH market in Lebanon witnessed number of difficulties. Lebanon was clearly lagging behind countries with similar climatic, geographic, and demographic conditions. The SWH penetration rate was estimated only 26 m² of SWH per 1,000 inhabitants in 2005 (around 106,817 m² of total installed collectors among which 16,000 m² installed during 2005).

By 2009, the installed capacity reached 160,000 m², indicating an average annual growth of 10.63%. In principle, this growth is an indication of a promising market but with significant risks of being unable to sustain continued and steady growth. The market was facing a large number of weaknesses that could be summarized as follows:

- No public institution in place to actively promote sustainable market growth of SWH Financing mechanisms and new delivery models;
- No specific building regulations, fiscal or public financial incentives in place to promote sustainable SWH market;
- No specific regulations for SWH standards, certification or quality control mechanisms, and no availability of a testing facility for solar water heaters;
- SLack of effective and focused public awareness efforts and initiatives;
- No specific facilitated financing and new delivery mechanisms offered and marketed for the SWH purchase;
- Lack of capacity of the supply side to offer equipment and associated services at the required level to sustain the market growth;

- Lack of local capacity in the SWH market;
- No certification and training system in place for SWH systems installers;
- No results and experiences documented and disseminated.

The previous points summarize the situation of the SWH market in Lebanon in 2009. The national component of the GSWH initiative had set a number of objectives to overcome these barriers and create a solid SWH market in the country.

More specifically, the overall objective of the Global SWH Market Transformation and Strengthening Initiative was to accelerate and sustain the solar water heating market in Lebanon. The GSWH has clearly stated three main objectives to be completed during the implementation period between 2009 and 2014. The three main objectives could be summarized as follows:

- To achieve at least 190,000 m² of new installed collector area during the period 2009-2014 and an annual sale of 50,000 m² reached by the end of the project with expected continuing growth to reach the set target of 1,050,000 m² of installed SWH capacity by 2020;
- To reach 75 m² per 1,000 inhabitants with a steady, average growth rate of 15-20 % and continuation until the expected saturation point of 75 m² per 1,000 inhabitants, all by the end of the project and to reach an additional 200-225 m² per 1,000 inhabitants by 2020;
- To achieve a positive experience by over 80% of clients who purchased a SWH system based on problem-free good quality products and after-sales services.

The GSWH initiative has succeeded in achieving most of the set targets to date. In fact, the initiative has helped the SWH market exceed the set target of 190,000 m² as well as the other objectives.

One main reason of this success was the ability of the GSWH initiative to serve as a common platform where all involved players could interact and push for a national action plan. In fact, the team of the GSWH initiative succeeded to bring together all national stakeholders and to align efforts towards one single national goal.

"ALIGNING EFFORTS" IS ONE SECRET RECIPE TOWARDS SUCCESS

In Lebanon, the GSWH initiative succeeded in establishing itself as a common platform where all stakeholders join efforts and work on implementing a successful SWH market development.

The GSWH initiative team has played a pivotal role in linking all players together and in ensuring a smooth communication among all parties. Each institution was then able to play a significant role in creating a sustainable SWH market in Lebanon.

The involved parties are the following: Ministry of Energy and Water (MEW); The Lebanese Center for Energy Conservation Project (LCEC); Banque Du Liban (BDL); United Nations Development Programme (UNDP); Lebanon Green Building Council (LGBC); Community Energy Efficiency and Renewable Energy Demonstration Project for the Recovery of Lebanon (UNDP-CEDRO Project); Industrial Research Institute (IRI); Lebanese Standards Institution (Libnor); and Ministry of Education and Higher Education (MEHE).

Table 1 Achievements, Contributors, and initiatives (Stakeholders' perspective)

ACHIEVEMENT	CONTRIBUTORS	INITIATIVES
INCREASING AWARENESS	PRIMARY ROLE	· Awareness campaigns · Publicities · Financing research and studies
	LCEC	
	MEW	
	MoE	
	Private Dealers	
	SUPPORTING ROLE	
	LGBC	
	Green Line	
	UNDP	
	Italian Cooperation	
INCREASE IN DEMAND	PRIMARY ROLE	· Financial facilitations: interest free loans · Subsidy Program · LGBC's assessment system
	LCEC	
	MEW	
	BDL	
	Green Arms Lebanon	
	Municipalities	
	SUPPORTING ROLE	
	UNDP	
	Banks	
	Dealers	
	LGBC	
LARGE-SCALE INSTALLATIONS	PRIMARY ROLE	· SWH Donations from China · Large-scale projects for hospitals (CEDRO) · Projects for public institutions (UNDP)
	UNDP (Greece, Spain)	
	CEDRO	
	China	
	SUPPORTING ROLE	
	Municipalities	
	Banks	
	Green Arms Lebanon	
QUALITY CONTROL SCHEME	PRIMARY ROLE	· Establish testing facility at IRI
	UNDP (Greece)	
	IRI	
	Libnor	
	LCEC	

ACHIEVEMENT	CONTRIBUTORS	INITIATIVES
FINANCIAL SOLUTIONS	PRIMARY ROLE	· Offering soft loans · The national SWH subsidy program · National initiative for the activation of RE
	LCEC	
	MEW	
	Banks	
	Private Companies	
	SUPPORTING ROLE	
	European Union	
	Municipalities	
	BDL	
STANDARDIZATION	PRIMARY ROLE	· Setting norms at national level · Perform training on the standards
	LCEC	
	IRI	
	Libnor	
	MEW	
LARGE-SCALE ACTIVITIES	MEW	· Distribution of economic lamps
PRACTICAL TOOLS	LGBC	· Rating System
SPREADING KNOWLEDGE	LCEC	· Energy forums
INSTALLER CERTIFICATION	UNDP	· Creation of a SWH curriculum to be instated in Lebanon's vocational training. · Certification based on the available curriculum for installers who did not achieve vocational education
	LCEC	
	MEHE	
CAPACITY BUILDING	PRIMARY ROLE	· Training workshops with technical schools and vocational training centers · Manufacturing trainings sessions with LSES and IRI · Capacity building and other training activities
	LCEC	
	MEW	
	LSES	
	IRI	
	SUPPORTING ROLE	
	UNDP	
	Italian Cooperation	
	ESCWA	

Furthermore, throughout its lifetime, the GSWH was characterized by the fact that it was developed according to the needs of the market. In fact, UNDP and LCEC conducted a number of market surveys targeting SWH installers, engineers, and end users. The purpose of these surveys is to understand the market dynamics and try to direct the implementation of the initiative towards the most needed areas.

CONTINUOUS MONITORING FOR A USEFUL INTERVENTION

At different phases of the SWH market development, continuous monitoring was done to ensure that applied measures were leading the market towards a healthy and positive growth.

The two figures here below show the results of two conducted surveys during the GSWH initiative implementation phase. The surveys were conducted in 2009 and 2012, through which stakeholders were consulted on the major difficulties and barriers hindering the development of the market. The results of these surveys were an essential feedback in the development of the market.

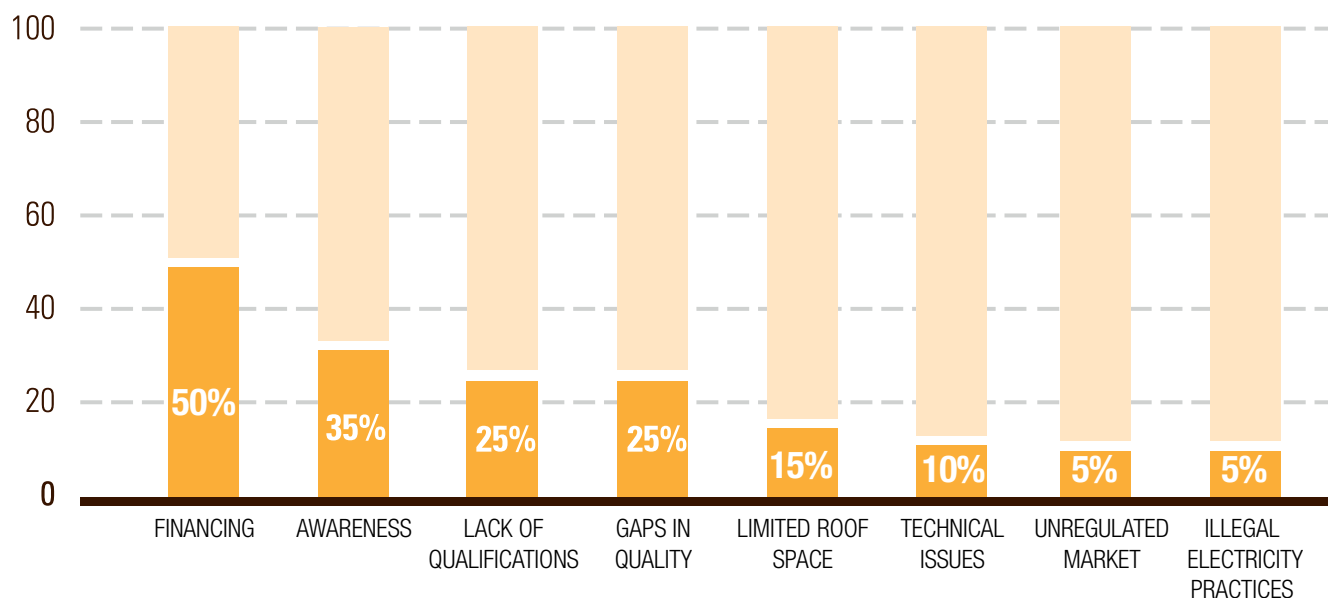
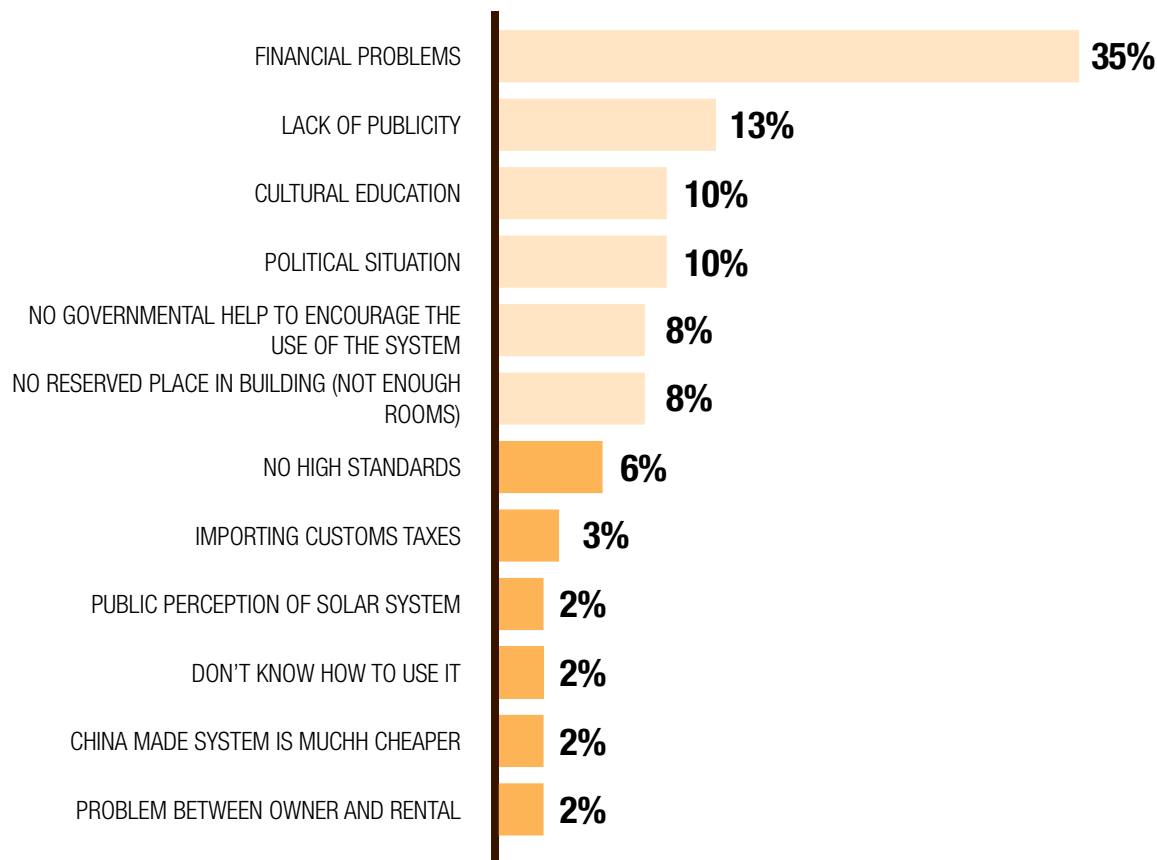


Figure 1 Major Challenges Facing the SWH Market in the Past 5 Years, Stakeholders' Opinion



Whereas understanding the actual market situation is key to proposing solutions, the implementations of the solutions and measures need to be well orchestrated. Another successful aspect of the GSWH was the ability to have a homogeneous implementation of activities. Figure 2 here below shows a timeline of the implementation of activities between 2009 and 2014 including activities by other stakeholders like CEDRO.

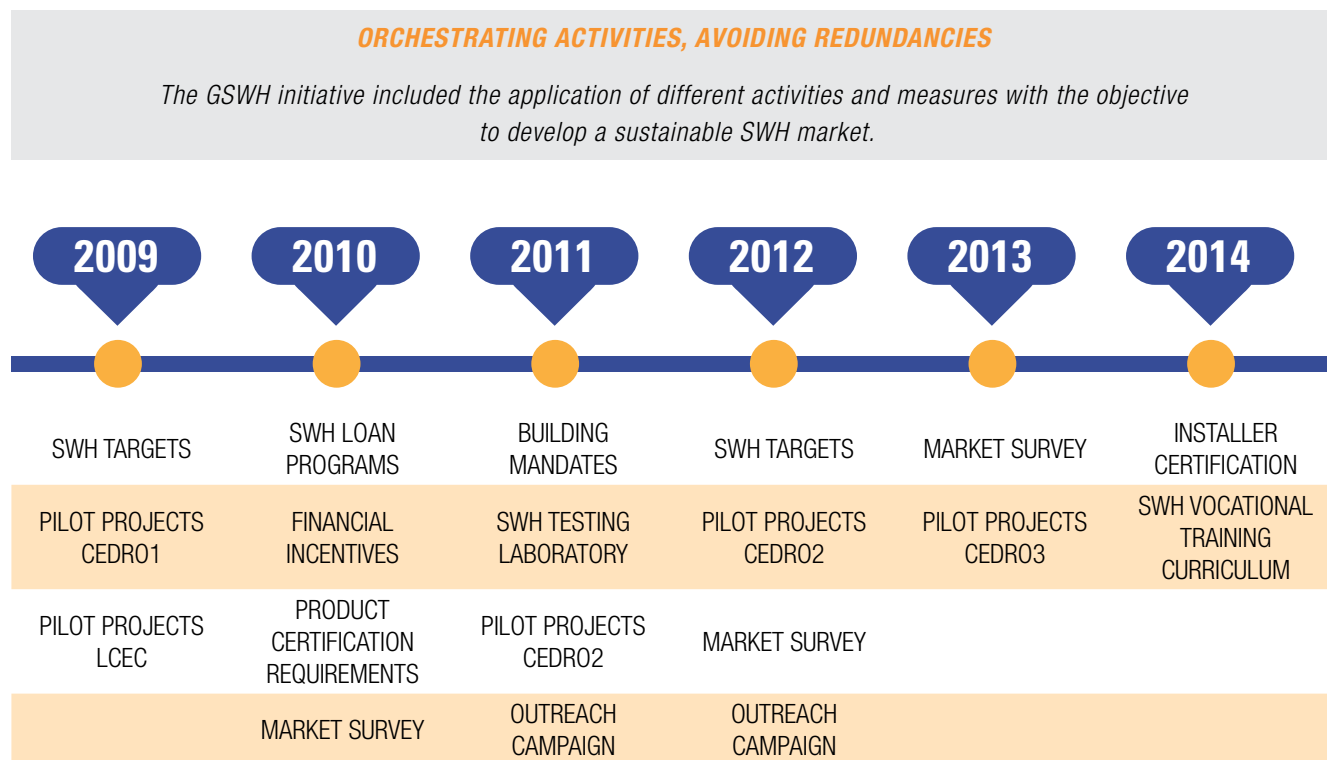


Figure 2 Time flow of SWH Market Achievements

The following sections will detail even more the mentioned activities as well as the other activities of the GSWH initiative according to the four axes of work.

2.2 LEGAL, REGULATORY, AND INSTITUTIONAL FRAMEWORK

To create a healthy SWH market with sustainable growth, several components have to come together. Even though subsidies and financial support can create large market growth, sustainability of such measures will only endure as long as the support endures. On the other hand, legislations and regulations that encourage SWH installations ensure a longer and more sustainable market growth. This is because of the nature of such measures, which are usually implemented on a long term basis.

LAWS AND REGULATIONS

Laws and Regulations are one of the most sustainable ways to grow a market, but require adequate planning because of their long-term effects.

It should be noted though, that not all legislations can create a healthy market, some can create negative impacts if not planned adequately and tailor made for the market in question. A much-used financial support system is usually tax exemption on imports. But for a market with local manufacturing, a reduction of tax on competing imports will harm local manufacturing capability. This will have a negative effect on local employment and manufacturing ability. Accordingly, the first phase of legislation or regulation should

start with a market study and be followed with expert reports and plans. This will help the country set targets for the measures in place and be able to plan the kind of regulations and legislations that will help the market grow in a sustainable and natural fashion.

Another challenge facing similar issues are the multilateral components. Legislations and regulations need several stakeholders to collaborate and work conjointly to come to a final result. Ministries, directorates, legislative and regulatory bodies, local businesses, among others are required to collaborate and create a legislation that fits the requirements of all bodies involved. The First National Survey of the SWH and PV Markets in Lebanon² in 2012 showed the main components that installers believe to be the challenges faced by the market (Figure 43). The solutions proposed by the installers are shown in Table 32. As can be noted in Figure 4 3 and Table 32, most challenges could be overcome through legal and regulatory actions.



Figure 3 Challenges faced by the SWH market according to the Lebanese First National SWH and PV Market Survey

²http://solarthermalworld.org/sites/gstec/files/story/2014-11-19/lebanons_first_national_swh_study_report_2014.pdf

MARKET CHALLENGE	SOLUTIONS REQUIRED ACCORDING TO NATIONAL SURVEY	ACTION AND MEASURES TAKEN
Construction Barriers	· Implement Building Code · Support from Municipalities	· Building Code Updated and waiting approval
Unregulated Market	· Setting Specifications · Law promoting local manufacturing	· Ministry set specifications through subsidy and loan programs
Taxation/Customs	· Exempt solar goods from taxes	· Not implemented for protecting local manufacturing
Unfair Competition	· Strict control on imported products · Educational Campaigns	· Imported products require testing certificates according to international standards. Overseen by IRI · Several workshops and seminars related to raising awareness on SWH technology
Lack of Qualified Labor	· More guidance and training · Improve educational material	· Vocational training curriculum developed and awaiting final approval · Certification for installers will be implemented in the near future following the mentioned curriculum
Lack of Awareness	· More awareness raising campaigns · Lectures and seminars at universities	· Awareness campaigns have been conducted periodically to promote SWH technology · Lectures and seminars at universities under their request

Table 2 The main solutions requested by stakeholders according to the Lebanese First National SWH and PV Market Survey and the solutions that were implemented through the GSWH project

In developing the SWH market, it is important pinpoint the fact that Lebanon faces particular difficulty in passing new legislations and regulations due to the difficult political situation and bureaucracy. The first step towards legislation is studying the market and setting up targets. This step was started when Lebanon set renewable energy in 2009 in the United Nations Climate Change Conference in Copenhagen and then confirmed in the official governmental declaration of 2010 and the MEW policy paper, where energy efficiency commitment was also introduced for the first time in Lebanon. Prior to the GSWH project initiation, the Lebanese government had made a commitment for reaching a 12% renewable energy in the production mix by 2020.

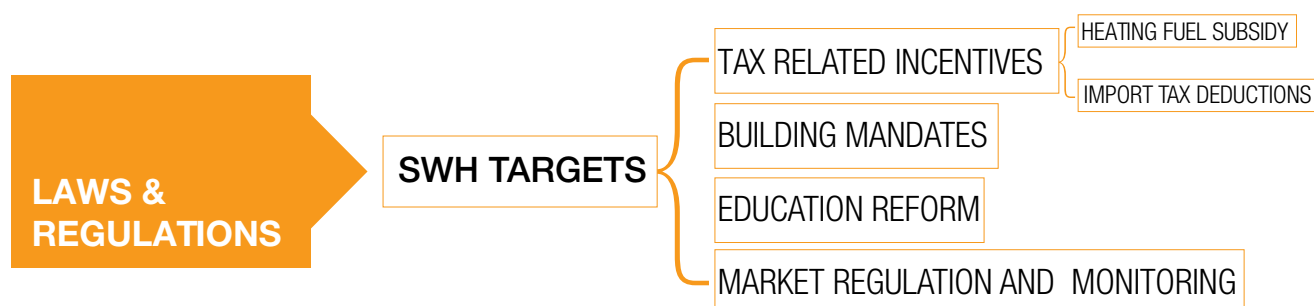


Figure 4 Laws and Regulations Building Blocks

A detailed energy plan in 2010 was laid out by the Ministry of Energy and Water including actions related to SWH in its targets. The MEW highlighted the importance of increasing the penetration of Solar Water Heaters and devise innovative financing schemes in collaboration with the banking sector to achieve the slogan “A solar water heater for each household”. LCEC in conjunction with the GSWH project started the build-up for the actual planning on how to increase SWH market penetration. The start of the process was through a market survey that assessed the SWH market and its growth potential.

According to the market survey that was carried out by LCEC and the GSWH, a target market installation of 1 million m² of collectors was set to be reached by 2020. figure 6.

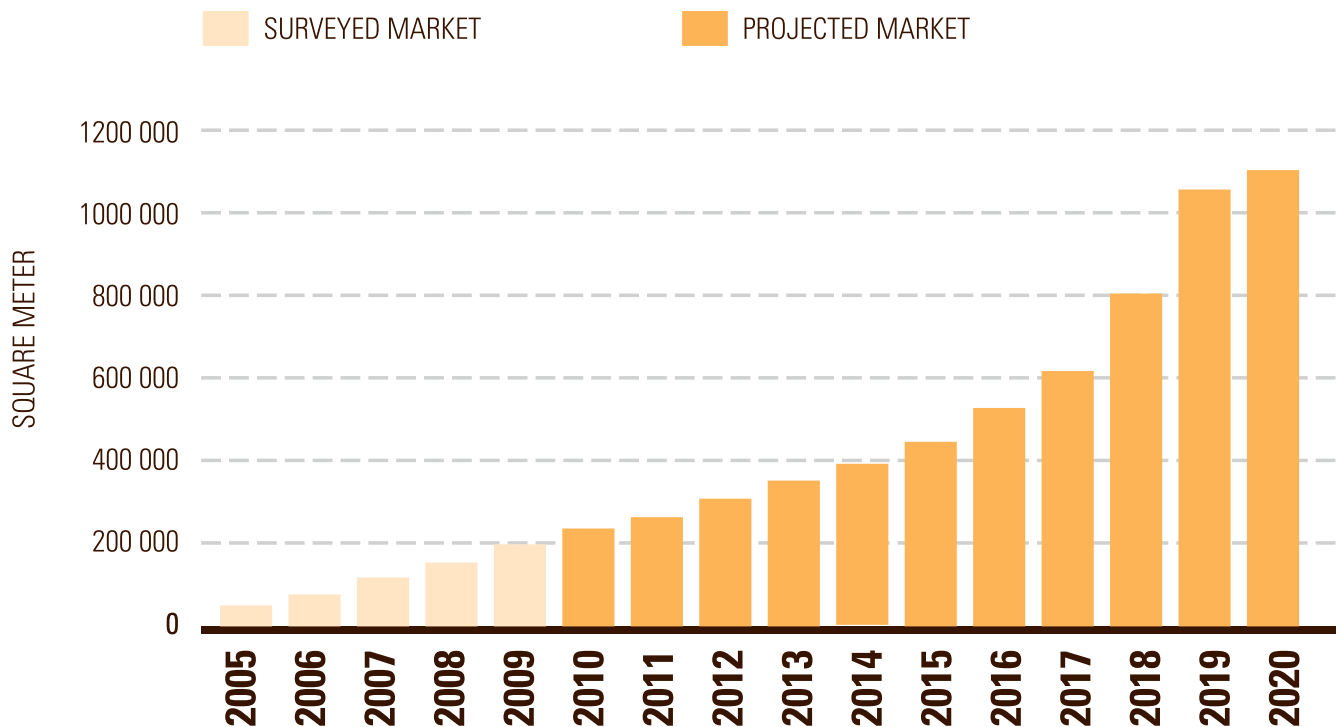


Figure 5 Lebanon’s SWH Market Survey Results and Projections (2010)

Having laid out the targets, work began on the procedures needed to reach them. The achievements will be covered throughout this report.

A. BUILDING MANDATES

The GSWH project and LCEC worked together to highlight the importance of including SWH in Lebanese building mandates. The letter was sent by the MEW to the Ministry of Public Works and Transport in order to add the building mandates to the agenda of the Higher Council of Urban Planning. In 2015, the Higher Council of Urban Planning has planned to invite stakeholders in the SWH market including the Order of Engineers and Architects, the Industrial Research Institute, Libnor, and LCEC. The implementation of the new building code will lead to the inclusion of SWH in the plans of any new construction.

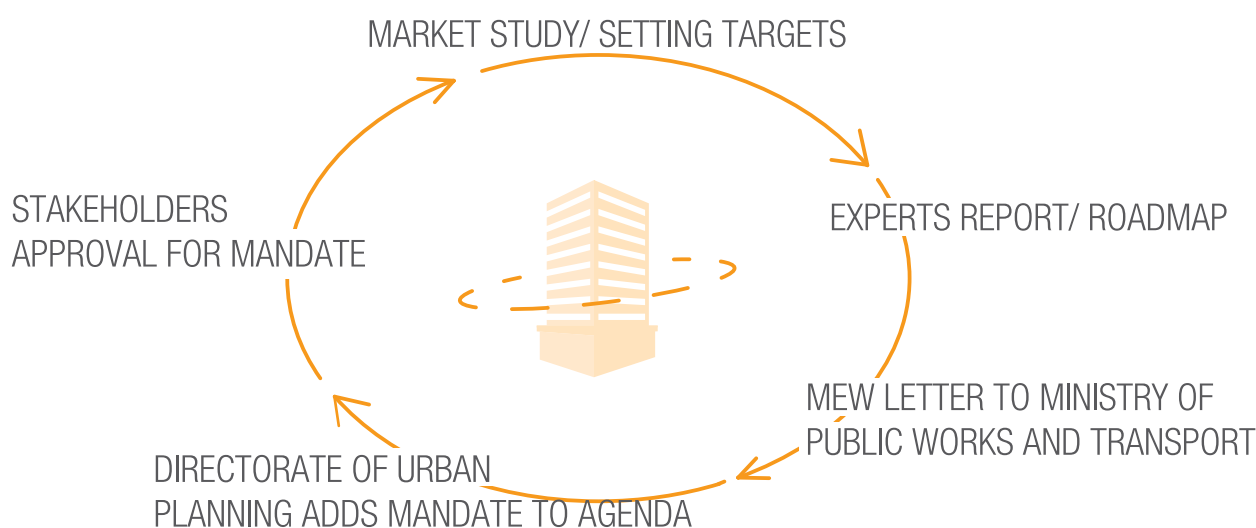


Figure 6 Building mandates approval cycle for Lebanon

B. HEATING FUEL SUBSIDY

According to the First National SWH Study Report, 2014, 93% of domestic water heating in Lebanon is through electrical heaters. The average cost of generating electricity in Lebanon is between 0.20 USD and 0.22 USD/kWh, and electricity is substantially subsidized at an average sale price of 0.1 USD/kWh. SWH systems that offset electricity reduce this subsidy and therefore reduce the strain on utility finances. This is a significant benefit because the current need to support energy subsidies puts pressure on the credit worthiness of the electricity utility (MVV Decon et al., 2011). The subsidy makes solar heating less competitive against electricity. Yet, the intermittency of the grid and the partial dependency on diesel generators does give solar water heating an advantage. Since generator electricity is usually distributed with limited availability in terms of peak power, some residents face difficulty in heating water during grid blackout.

C. FISCAL INCENTIVES

No tax incentives have been placed for aiding people to buy solar water heaters, but subsidies and soft loans have been provided. Tax discounts have not been provided for importing SWHs either due to the existence of local manufacturing. Such incentives might lead to job losses in the manufacturing industry and the loss of manufacturing ability that usually contribute more to local economies.

Following the overview of the legal and regulatory framework, the following paragraphs will detail the efforts invested in terms of public awareness raising.

2.3 PUBLIC AWARENESS RAISING

Raising public awareness in a market is linked to several interrelated components. Direct marketing in forms of advertising is the most straightforward method. But indirect methods such as capacity building, industrial associations, and demonstration projects can play a significant role in promoting the SWH technology. The GSWH initiative worked on all aspects of raising public awareness to develop the SWH market in Lebanon.



Figure 7 Lebanon's Activities in Raising Public Awareness for SWH Technology

A. OUTREACH CAMPAIGNS

One of the biggest challenges facing the solar water heating market is lack of awareness. Lebanon faced a problem at the start of the SWH introduction to the market with negative advertisement. The negative reputation came from the failure of some SWH installations to deliver to their promise due to the lack of experience of the installers and the poor quality of the SWHs. In 2006 an advertisement campaign was launched by LCEC-UNDP project and the Ministry of Energy and Water. The campaign was successful in raising interest in the technology³. The first campaign saw the rise of the number of solar water heating companies from 20 to 35 (source: LCEC). By the time the campaign was repeated in 2011 and 2012, the number of companies operating in the SWH market rose above 100. The initial campaign was supported with approximately 40,000 USD from GEF and an equivalent of 150,000 USD from the MEW. The second round of advertising was allocated an additional 100,000 USD from the MEW. The total cost of the advertisement is valued at above 3Million USD due to the fact that some advertisement agencies and media decided to run the ads for free for a certain period of time.

The outreach campaigns used several available dissemination methods such as TV, radio, and illboards.
The TV advertising campaigns used famous actors to act the commercials.

The success of the campaign can be seen from a survey of common households that was held 2012 and published in 2014. 69% of the households in Lebanon that considered energy efficiency measures gave priority to SWHs, yet they didn't install solar systems due to other considerations and barriers they claim to have faced. Only 10% considered energy efficient lighting (10%) and 21% considered other types of energy efficiency.

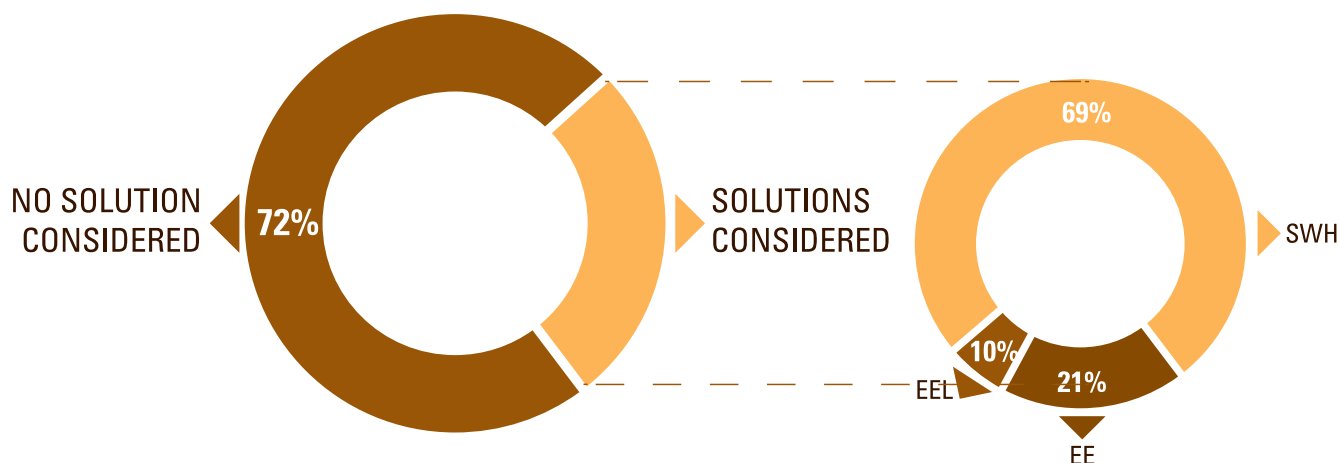


Figure 8 Values for people who considered energy efficiency solutions

³ Some of the campaigns can be found online on the LCEC Youtube page: http://www.youtube.com/watch?v=_M3VqYne5XY <https://www.youtube.com/watch?v=Y0iLygXHVVQ>

Out of all interviewees, 94% claimed to be familiar with SWH technologies, but only 15% of the interviewees were using these technologies at the time of the interview. The highest percentage of people not using SWH technologies mentioned SWHs were not a priority and that they did not want the additional financial burden. It should be mentioned that among commercial and industrial hot water users the values of awareness and SWH usage are lower. Targeting such clients might be a future objective for the outreach campaigns to work on. Advertising for commercial and industrial customers would be different from campaigns for residential users:

- The advertisements must be specific to large-scale implementations
- The advertisement will probably be based on experiences taken from pilot project implementations
- These advertisements should also contain economic information, specifically related to savings and return on investment

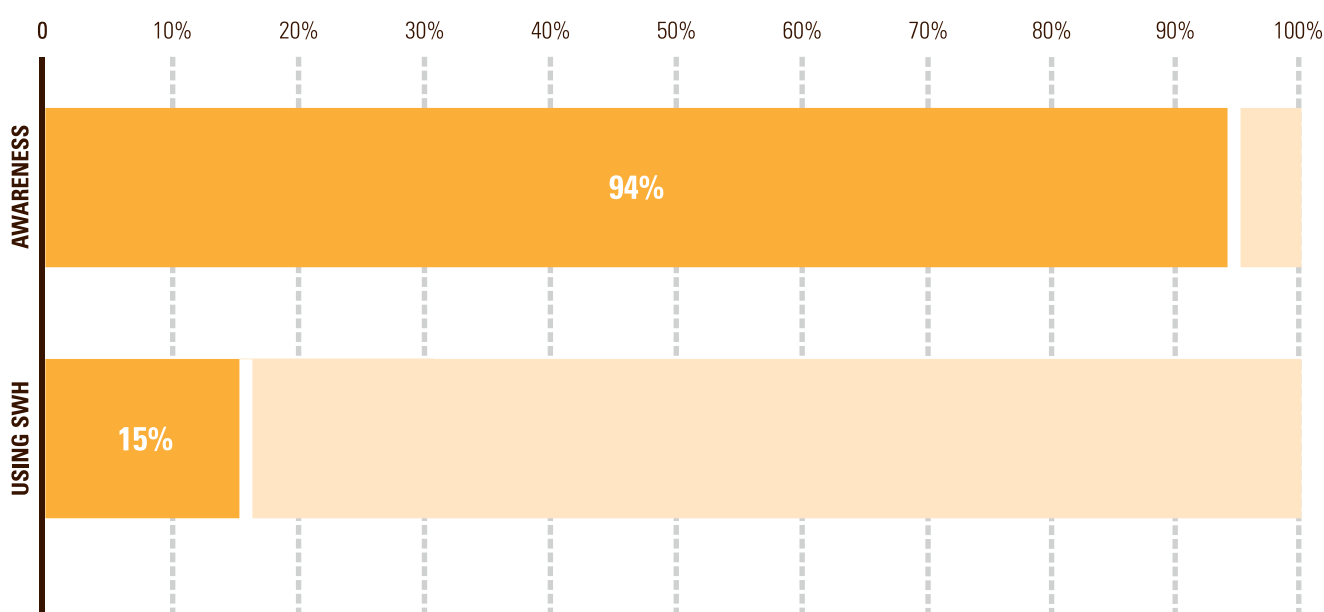


Figure 9 People who are aware of SWH technology vs people who are actually using it

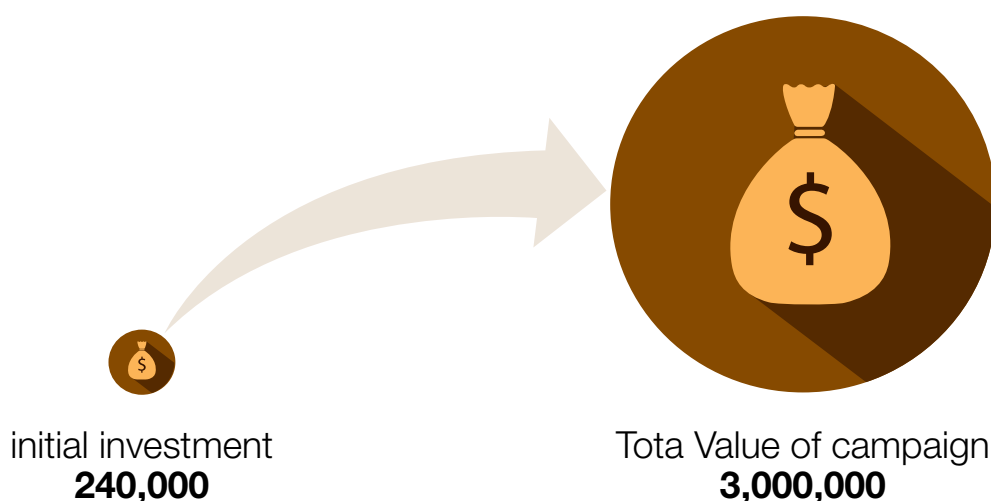


Figure 10 Outreach campaign Direct Cash Injection from the National SWH Project and the actual value of the campaign due to the free ads and free billboards that were given out by some agencies

SEED MONEY CAN YIELD HUGE IMPACT

*The GSWH initiative used seed money to lay the ground for large awareness raising campaigns.
A well-designed campaign attracts a lot of in-kind contributions.*



Figure 12 Picture from the Billboard Advertisement Campaign for SWH



Figure 11 Picture from the Billboard Advertisement Campaign

Public awareness covers a wide range of activities. The team of the GSWH initiative has strived to use all available tools to push for a sustainable SWH market. The following is a quick overview of the different activities related to this aspect.

1. IN AL JAZEERA.NET

Published in 2011, LCEC made an appearance on Al Jazeera's official website. In its article, LCEC mentioned several projects that are being worked on including the project that supports the market of solar water heaters in Lebanon based on the initiative "Solar Water Heaters for Buildings and Institutions".

The article specified the total area of solar water heaters that is estimated to be installed during the period of 2009-2014 and in 2020, the total amount of electricity saved through the use of SWHs and the expected amount of GHG emissions reduction. Following this, the article highlighted the activities and results of the project accomplished such as promoting the market development of solar water heaters in Lebanon at the level of policy-making and funding mechanisms and encouraging communication and media campaigns that focus on the marketing advantages of solar water heaters.

Moreover, the Ministry of Energy and Water received broad institutional supports aimed at strengthening the solar heater market in Lebanon; the specification standards for energy-saving devices set by LIBNOR (the official institution responsible for setting Lebanese standard); the funding mechanism for energy efficiency in cooperation with the Central Bank of Lebanon supporting the project “as Solar Water Heater for Each Household”; awareness campaigns; the completion of the initial draft of the energy conservation and finally and most importantly the National Plan for Energy Efficiency Directive NEEAP; all contributed to the expansion of the solar water heaters in the Lebanese market.

2. DAILY STAR

The article entitled “12% Renewable Energy by 2020: Mission Possible” was published by the director of LCEC, Mr. Pierre El Khoury, in April 2012 and discusses the efforts by the Ministry of Energy and Water and UNDP Lebanon through funding by the Global Environment Facility (GEF) to come up with a national initiative to develop the solar water heating market in Lebanon. The initiative has an objective of installing 1,050,000 m² of solar systems by 2020 that will be directly supported by the Central Bank of Lebanon and is expected to replace 120 MW of production capacity.

I. MAGAZINE

REAL MAGAZINE

Mr. Pierre El Khoury, Director of LCEC, has also covered the topic of solar water heaters in several articles such as “Guest Editor” that was issued on 30 November, 2010 in REAL Magazine. Throughout the article, Mr. El Khoury emphasized the positive outcomes that the project “The Setup of a National Financing Mechanism for the Promotion of Residential Solar Water Heaters” will bring for small and large scale communities.

In the article, Mr. El Khoury also mentioned the financing mechanism for the promotion of solar water heaters that has facilitated the realization of the project. NEEREA was created by BDL but the cooperation among BDL, EU, UNDP, and the Ministry of Energy and Water has given NEEREA the weight it deserves.

Mr. El Khoury stressed the importance of the NEEAP that covers 14 national initiatives in the fields of energy including the initiative “Solar Water Heaters for Buildings and Institutions” that targets the installation of 1,050,000 m² of solar systems and aims towards the achievement of the strategic objective set by the Lebanese Government: to reach 12% of renewable energy by 2020.

II. BROCHURES

1. THE NATIONAL INITIATIVE TOWARDS DEVELOPING THE SOLAR WATER HEATERS MARKET IN LEBANON

In this brochure, LCEC represented the national 5-year initiative “Developing Solar Water Heaters Market in Lebanon”. The initiative is under the management of the Lebanese Ministry of Energy and Water and UNDP and aims to stimulate the growth of the market as part of the GSWH initiative. The brochure started with a graph showing the expected increase in SWH installed capacity from 160,000 m² in 2009 through the installation of an additional 190,000 m² in the period 2009-2014 and in the long-term reaching an overall installation capacity of 1,050,000 m² by 2020. Moreover, the use of solar water heaters will contribute to an estimated cumulative GHG emissions reduction potential of over 3 million additional tonnes of CO₂ equivalent by the end of 2020.

In addition to the previously mentioned partners in this brochure, other regional partners also contributed to the success of the initiative such as In this brochure, the regional partners, that also contributed to the success of the initiative in addition to the previously mentioned partners are listed: such as Regional Center for Renewable Energy and Energy Efficiency (RCREEE), League of Arab States (LAS), EU-funded MED-

EMIP Project, EU-funded MED-ENEC Project and EU-funded Paving the Way for the MSP (Mediterranean Solar Plan) Project.

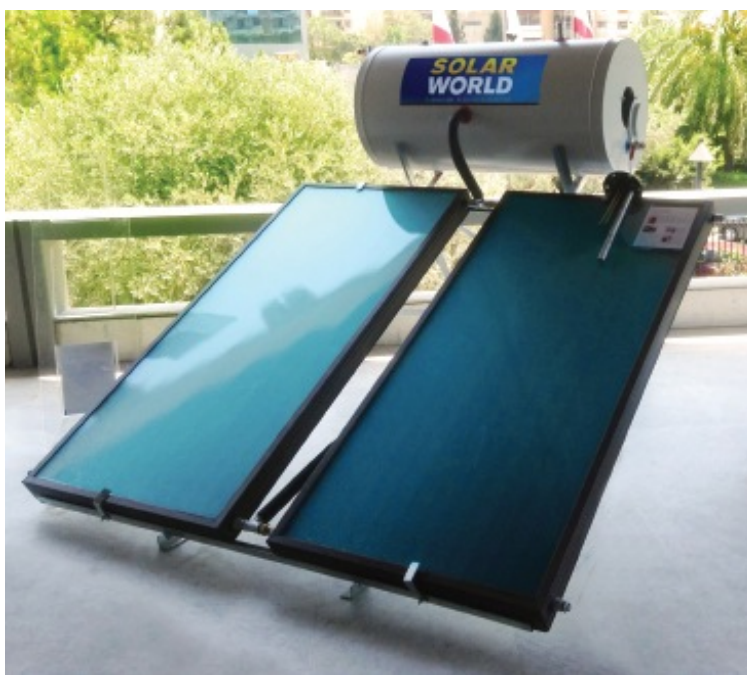
The initiative development was presented to be along four major themes to create an enabling environment that facilitates the development of the SWH market in Lebanon, strengthening the awareness among the public, establishing and implementing technical and pilot projects and finally institutionalizing the management and lessons learned. The current status of the Lebanese SWH market, challenges and opportunities were also present in this brochure. At the end of the material, the awareness advertisements made by the MEW and LCEC promoted the interest-free financing mechanism over a 5 year period with a grant of 200 USD and raising awareness about the financial savings that a user would make by using SWHs through real-life examples and statistics. A copy of the brochure can be found in the appendix of this report.

2. HOUSEHOLD ENERGY EFFICIENCY MEASURES

This small instructive brochure provides energy conservation measures that can be achieved at the domestic level. The 2-page brochure spreads awareness on the possible and simple steps that can be accomplished in order to save energy. The suggested measures concern turning off the lights when not needed, switching to energy-saving light, and unplugging equipment when not in use. This brochure is within the framework of the Greek Grant project entitled “Renewable Energy and Energy Saving Applications in the affected Regions of Lebanon, via the installation of: Solar Collectors, Lamps of Low Consumption, Testing and Measurements Facility of Solar Collectors with Simultaneous Transfer Know-How”.

3. “A SOLAR WATER HEATER FOR EVERY ENGINEER”

This brochure gives proper guidance for engineers and architects interested in installing and benefiting from the loan to get a SWH. “A Solar Water Heater for Every Engineer” is a joint initiative between the Orders of Engineers and Architects of Beirut (OEA) and UNDP aiming at the installation of residential solar water heaters for engineers and architects. The benefits of this initiative were listed in order to motivate and encourage all interested professionals. The applicant can choose the SWH from any of the two preselected companies and get the loan from any of two preselected commercial banks. The companies were selected in a public competitive bid process. The addresses of the 2 SWH companies are indicated to facilitate the communication between the beneficiary and the company.



III. ENERGY SAVING

LCEC issues a regular newsletter in which a number of activities and awareness material are present. The newsletter was published twice a year, distributed in printed copies with more than 2,000 print in English and 2,000 prints in Arabic.

1. 4TH ISSUE “A PRIMER ON SOLAR THERMAL ENERGY”

Issued in October 2009, the 4th publication of LCEC's SAVING ENERGY newsletter during the month of January 2009 included a section on the training course held on 25-26 July 2008, at Don Bosco Technical School.

Solar energy experts from LCEC and Ökoinstitut Südtirol, a nonprofit Italian association with the aim to promote sustainable development, conducted a training session targeting experts in the field of renewable energy and energy efficiency. It thus represented a major step in the process of training the trainers, who are key players in disseminating knowledge and creating awareness about solar energy as a crucial factor of the development of the country.

The training session was a successful first step of a national plan aiming at the promotion of valuable knowledge in solar thermal energy, the strengthening of skills in assessing and designing solar systems, and in the stimulation of the exchange of know-how among different parties working in the field of solar and renewable energies.

2. 6TH ISSUE “190,000m² OF SOLAR HEATERS BY 2014 A NEW MEW, GEF AND UNDP INITIATIVE”

This publication describes the launching of a new GSWH initiative referred to as ‘Developing the Solar Water Heaters Market in Lebanon’ by LCEC and UNDP. The target of the initiative and its implementation axes were presented and disseminated in the 6th issue of LCEC's ENERGY SAVING newsletter reaching a large number of individuals and institutions.

3. 7TH ISSUE “SINO-LEBANESE COOPERATION: THE CHINESE EMBASSY AND LCEC PROVIDE TRAINING ON SOLAR WATER HEATING”

In the 7th newsletter issue in June 2010, facts were published on the growing market of the SWH in Lebanon. In addition, the newsletter included a presentation of the training cooperation between LCEC and Chinese experts in a number of training sessions in universities and technical schools.

4. IN THE 8TH ISSUE, “MANDATORY STANDARDS OF COM PACT FLUORESCENT LAMPS AND SOLAR WATER HEATERS”

The article, issued on February 2011, explained the standards set by LIBNOR that aims at controlling all imported SWH systems to Lebanon to ensure compliance with Lebanese national standards.

5. IN THE 11TH ISSUE “43,500 m² OF RESIDENTIAL SOLAR WATER HEATERS IN 2011”

On the front page of the 11th Issue, this article gave a comprehensive look at the success of installing 43,500 m² of residential solar water heater back in 2011. The article presented the results of the national statistical investigation of installed solar water heaters, which was very close to the target set by the MEW.

The article, in fact, summarized the report “The Residential Solar Water Heaters Market in Lebanon 2011: How Can Sound Governmental Policies Boost a Green Economy” by stating the number of total SWHs installed, and the number that benefited from the interest-free loans offered as part of the national financing mechanism jointly developed and implemented with BDL and the detailed loan application process.

IV. GOOD TO KNOW

One of LCEC's major outreach actions is the weekly Good-To-Know email reaching more than 5000 recipients through which it makes announcements such as accomplishments, updates and other useful information. Around 26 of these Good To Know news items are dedicated to announcements regarding solar water heaters.

The following 15 Good-to-Know news items were sent during the project implementation period:

1. 16 January 2014 - Join the "National Guide of Solar Water Heaters Installers" that talks about solar water heater companies' obligation to fill out the questionnaire as a pre-requisite for qualification procedure that will be launched soon.
2. 5 December 2013—"OEA Energy Conference 18-19 December // GEF-UNDP Vocational Course on Solar Water Heaters" announces the development of a new vocational course on solar water heaters installation by GEF and UNDP.
3. Friday, August 30, 2013 – "A New Publication by LCEC // Skeleton Agenda of the BEF 2013 Now Available". In this Good-To-Know LCEC stated the publication of a new report that focuses on the solar water heating testing facility installed at the premises of the Industrial Research Institute (IRI).
4. Tuesday, August 20, 2013 – "Looking for a SWH National Consultant // Looking for a SWH International Consultant".
5. Friday, July 26, 2013—"New Solar Pilot Projects by UNDP // Vote for Your Energy Ambassador"
6. Friday, January 18, 2013– "3 New Bids Announced // LCEC Article in RenewableEnergyWorld.com"
7. Friday, January 04, 2013– "A New National Bid.. // Renewables Training in UAE and Japan"
8. Wednesday, November 14, 2012 – "SPECIA NEWS ***** New Bid for 1,000 Flat Plate Solar Water Heaters *****"
9. Thursday, October 04, 2012 – "Download BEF 2012 Presentations // Collect Your Copy of the SWH Report"
10. Tuesday, July 24, 2012 –"Solar PV Street Lighting Bid on the Move // Best Banks and Best Solar Water Heaters Companies"
11. Tuesday, July 03, 2012—"Book 13-14 September 2012 // 50,000 sqm of SWH Installed in 2011"
12. Monday, May 14, 2012 CEDRO Training on Microwind and Geothermal // Arab SWH Certification Program
13. Wednesday, April 18, 2012 Beirut Hosts UNEP-OME Regional Workshop on Solar // 280 Municipalities Receive 1,470 Photocells
14. Friday, July 29, 2011 – "National Micro-Hydro Study // 1,200 Applications for Solar Water Heaters"
15. Thursday, May 12, 2011—"Testing Facility for Solar Water Heaters // Training Sessions on the NEEREA"

B. CAPACITY BUILDING

Another factor in fixing the support of the SWH market reputation is to organize capacity building training sessions and seminars. The GSWH project, LCEC, and UNDP together with several other institutions carried out several a number of training sessions and workshops. The trainings aimed at raising the level of knowledge targeting engineers, company owners, and installers. Capacity building raised the level of knowledge and increased the sharing of knowledge between local installers and international experts. The trainings covered:

- Trainings by international experts sharing knowledge from experience in countries that were ahead of Lebanon in SWH development. Several trainings were carried out by CEDRO backstopping consultancy firm TTA during their visits to the pilot project implementations by the project.
- Guiding and training materials were also provided by the online knowledge tool of the GSWH project that serves as a source of solar thermal knowledge sharing platform: www.solarthermalworld.com
- Sharing of local knowledge and lessons learned in the Lebanese market provided by LCEC, GSWH project, and CEDRO project teams.
- “How To” and “Best Practices” in SWH installation

The training sessions and workshops were attended by solar thermal company owners, engineers, engineering students, technical staff, vocational training instructors, installers, government institutions’ representatives and others. In the following paragraphs, a more detailed description of the major trainings and workshops is presented.

LCEC contributed to the second solar thermal applications training course held at Don Bosco Technique at Fidar, together with the Italian Cooperation of the Italian embassy in Beirut and the Italian non-governmental organization VIS (Volontariato Internazionale per lo Sviluppo).

This second phase was held from the beginning of February till the end of April 2009. The training included a theoretical course and a practical course given by Nader Hajj Shehadeh from LCEC and Jean-Claude Kosseifi from Don Bosco Technique.

A total of 15 participants completed the training course and got certificates in Heating with a specialty of Solar Thermal Systems during a ceremony held at Don Bosco Technique in the presence of representatives of the Italian embassy, LCEC and VIS.



1. SOLAR WATER HEATER TESTING FACILITY

In August 2009, UNDP and the Industrial Research Institution (IRI) signed a Memorandum of Understanding (MoU) specifying that IRI is in charge of operating and running the testing facility while ensuring financial sustainability of the IRI unit that will be testing the SWHs and the UNDP-LCEC unit that will be issuing the certification cooperatively with IRI. The MoU also stated UNDP-LCEC's responsibility in ensuring the good delivery of the SWHs testing facility and the setup of the related standards. As such, a location at IRI was identified where pre-fabricated labs were installed on site. As for the installation of the testing facility, CRES assigned IZES, the institute for future energy systems, to do the requested task at the IRI.



The installation process took four days. On March 2011, IRI introduced its staff members to the different equipment on site and started training them on the chief elements of the testing procedures. After the SWHs standards became mandatory and the testing facility was installed, the UNDP-LCEC decided to have a workshop for the SWH companies in Lebanon to order to introduce them to the standards, their importance in this new market and the role of UNDP-LCEC in transforming and strengthening the market.



2. CHINESE TRAINING

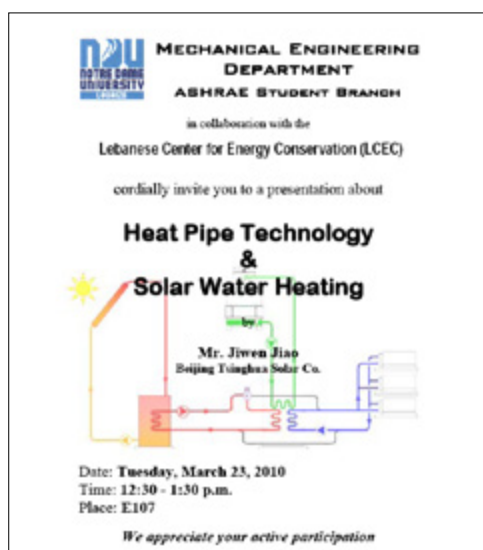
Following the contract sign under the items of the Agreement on Economic and Technological Cooperation between the Government of Lebanon and the Government of the People's Republic of China on December 15th 2003, China National Corporation for Overseas Economic Cooperation contributed with, 500 solar thermal units in 2006 to the Lebanese Government under aid account # 1 for 2003. The donated solar thermal units were installed at residences in South Lebanon. Following the war in July 2006, the Chinese government donated 600 more systems and 2,500 evacuated solar tubes in 2010 to compensate for the damages occurred.

As part of the donation, the Chinese government sent experts to Lebanon to share the expertise and educate the Lebanese engineers and technicians on installation and operation of the donated solar water-heating units.

The expert conducted site visits to previously installed units. They also gave multiple workshops in different Lebanese areas about Solar Water Heating.

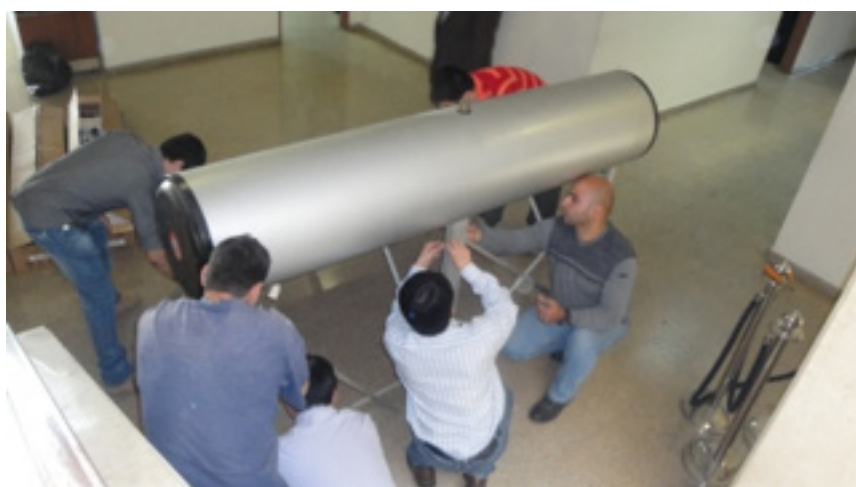
a. Workshop at Notre Dame University

A workshop was held in Notre Dame University on 23 March 2010 where almost 40 engineering students and professors attended. The main objectives of the workshop were to discuss Solar Water Heating and Evacuated Tube Systems and technical and industrial issues related to heat pipe technology to the Thermo-Fluid lab students.



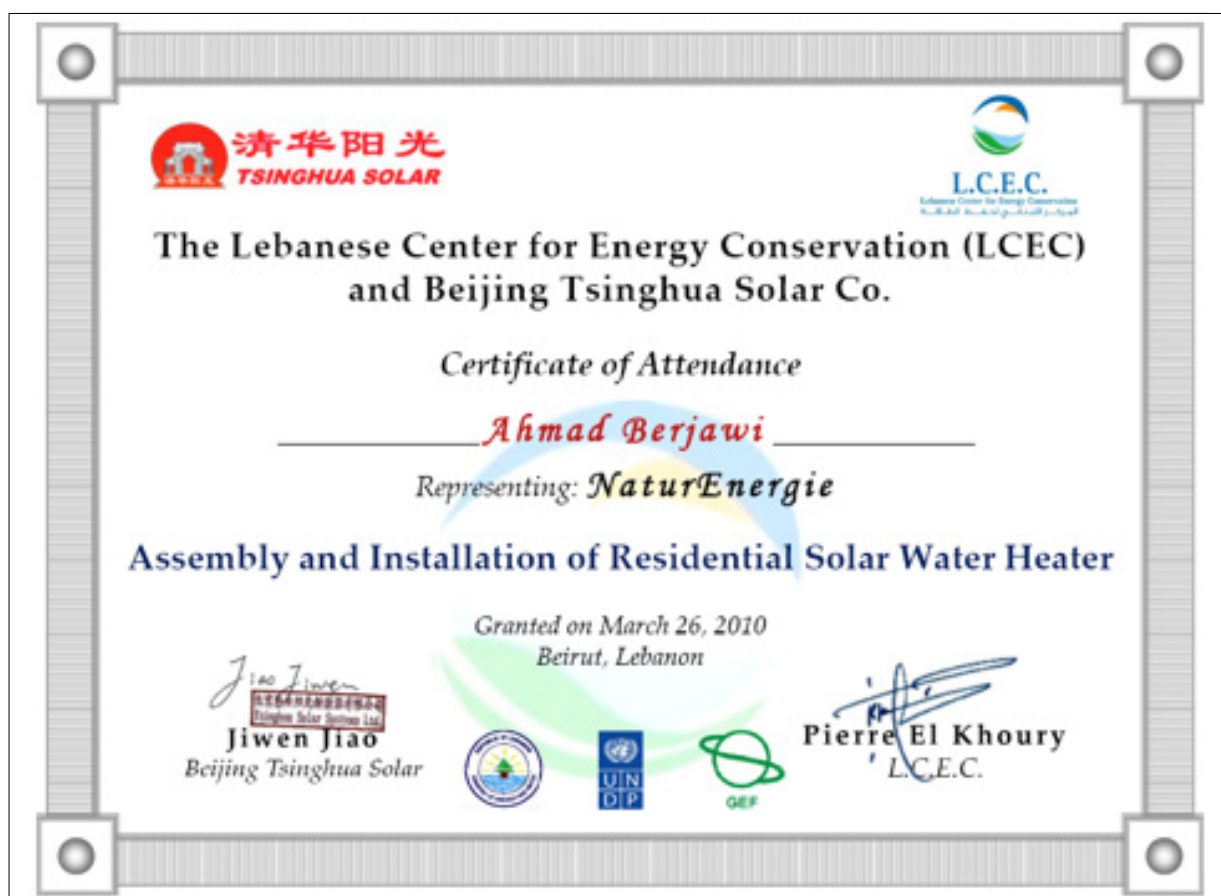
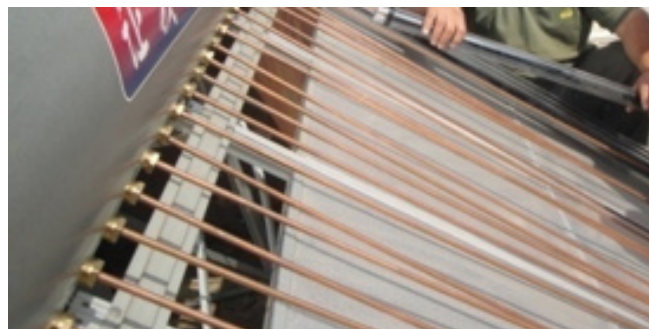
b. Workshop at Dikwane Technical School

Held on 24 March 2010, heating technical students and teachers attended a full day workshop on how to assemble and install the solar water heater and on the operation of the heat pipe solar water heater.



c. Installation Workshop in Khiyam

The Chinese experts conducted the last workshop at Zreik Residence, Khiyam South Lebanon on 26 March 2010. It targeted technicians and Engineers from Solar Companies. The 27 technicians and engineers gained practical experience on the installation and operation of a residential 208-liters solar water heating system. The participants assembled the unit, connected it to the home network and put it in operation.



3. REGIONAL TRAINING OF TRAINERS ON ENERGY MANAGEMENT SYSTEMS AND ISO50001- TUNIS

Dr. Jawad Abi Akl from Lebanese Norms Institute (LIBNOR) and Energy Engineer Rani Al Achkar from Lebanese Center for Energy Conservation (LCEC) took part in this workshop as representatives of Lebanon in 24-26 September 2012 in Tunis. They gave an overview on energy efficiency in Lebanon within the context of ISO 50001. The 14 initiatives of NEEAP were clearly explained to the audience, including the initiative 4 of Solar Water Heaters for Buildings and Institutions. As such both professionals were able to give a clear image of the Lebanese solar water heater market's milestones, accomplishments and

limitations.

4. LIBNOR /ISO NATIONAL SEMINAR ON ENERGY MANAGEMENT AND ISO 50001 -12 DECEMBER 2012, BEIRUT- LEBANON.

The purpose of this seminar was to raise awareness and understanding among authorities and industry in Lebanon about energy management and energy efficiency standards, business opportunities, existing best practices, implications and possible impact of the ISO 50001 Energy Management standard, to inform about the requirements of the ISO 50001 standard and to provide a platform for specialists from industry, government and academia in the region to share experiences and discuss issues related to the implementation of energy management and the ISO 50001 standard. The positive impacts of solar water heaters were also discussed as they are a part of energy management system.

C. PILOT PROJECTS

One of the quickest ways to promote a technology is to start by introducing the technology through NGO's. LCEC started by introducing collective solar water heating technologies in several institutions. UNDP followed by installing collective solar water heating systems for several public institutions' buildings under the project CEDRO ("Country Energy Efficiency and Renewable Energy Demonstration Project for the Recovery of Lebanon" financed by the Government of Spain through the Lebanon Recovery Fund). The first projects relied on local experiences and know how. The subsequent projects included a team of international experts. While the pilot projects proved to be a success, the international experts brought added value to the market. Some of these additional SWH technologies included those not previously

Involving international experts in the design phases of pilot projects resulted in new system types in the market.

considered by Lebanese companies in order to overcome some specific technical issues related to the climatic-zone and water characteristics of Lebanon, such as:

- Drain-back systems: Overheating and freezing of the heating liquid are common problems in Lebanon for solar water heaters. The drain back systems were an easily implemented solution for such problems.
- Anti-Calcification Measures: Lebanese water has a high content of calcium residues, a solid that condenses on solar water heater components and diminishes their efficiency, sometimes even completely clogging the systems.

The pilot projects also availed several lessons to the market, which were shared throughout workshops with SWH companies and installers. In short, SWH pilot projects are a very quick and efficient way to learn and teach stakeholders about the weaknesses and strengths of new technologies introduced to the market. Some of the lessons to be taken from the pilot projects experience are:

- Involve the Ministries early on, especially since they would need to allocate budgets for maintenance of the SWH systems and they need to assess their savings as well;
- Since the facilities were receiving the systems for free, it is important to enforce a maintenance agreement, where the beneficiary has the responsibility of repairing any damage or failure in the systems;
- Ensure the facility's maintenance staff is qualified for keeping the systems fault free and operational;
- Data logging is a very important parameter, because the data collected from such sites will serve as the building blocks of the sharing of experiences;



Figure 13 Solutions Brought Forth by the Involvement of International Experts in the Design Phase of Pilot Projects

2.4 FINANCING-MECHANISMS

Lebanon is a country with no natural fossil fuel resources, until the recent talks of offshore natural gas potential, and that suffers from electricity shortages related to the deficit in production capability and the inefficient use and transmission of its electricity. This puts the country under economic, social, and development stress. The population had little motivation to invest in RE and EE technologies due to the high subsidization of electricity and heating fuels and due to the fact that the purchasing power of the population is limited. Accordingly, it was necessary for the growth of the RE and EE sector to have a well-established financing mechanism for such investments.

Lebanon's solution came in the form of NEEREA, National Energy Efficiency and Renewable Energy Action. The NEEREA is a soft loan mechanism that allows loans with a yearly interest of less than 1% spread over a period of 10 years. The scheme was approved under the Council of Ministers Decision No.59 of 2010. Additionally, through NEEREA, SMEs can benefit from 5-15% cash back on their investment in RE and EE immediately after the measures have been implemented. This cash back is covered with an aid from the EU. The application process for the NEEREA loans could be considered complicated due to the requirements of highly professional reports and technical studies. But since SWH technology is a well established and widely applied technology, a simplified NEEREA process was designed for residential SWH. This special scheme allows a direct submission to the NEEREA scheme for any residential SWH and allows a loan with 0% interest to be repaid over a period of 5 years.

The Ministry of Finance allocates the funds for NEEREA through the same process it funds the housing loans

At the time when the Market Readiness Assessment report was launched in early 2013, 3,500 customers had already benefited from the SWH loan program. By December 2014, this number had risen to 7,815 with a total loan value of 11.75 Million USD.

NEEREA was conceived with the participation of several stakeholders:

- **MEW:** sets the strategic guidance and priority in EE and RE;
- **BDL:** as the national financing institution, BDL sets the operational framework and offers benefits to the banks;
- **MoF:** defines the subsidies and interest rates for the different sectors of the economy;
- **EU:** has offered BDL a grant of 12 Million EUR to encourage SMEs in applying for NEEREA;
- **UNDP:** partnered with BDL to offer technical support, training, marketing, and awareness raising activities;
- **LCEC:** acts as the technical consultant to BDL, reviewing loan applications, and setting quality control criteria.

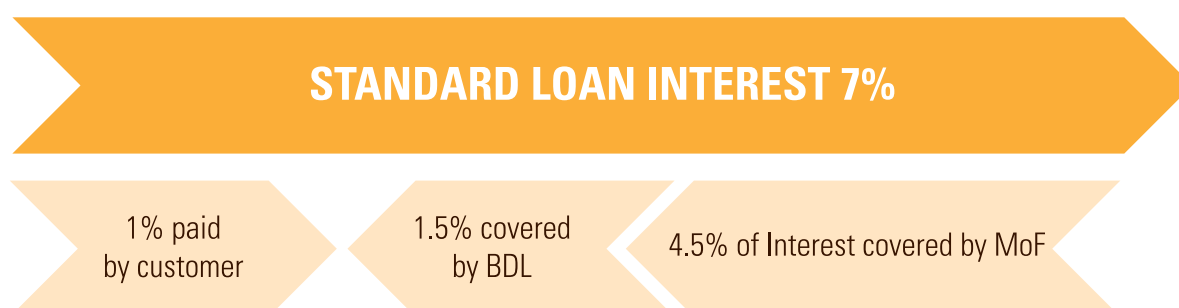


Figure 14 Methodology of Loan Interest Coverage

As shown in figure 14, the standard loan interest in Lebanon is around 7% per year. To reduce the interest, the Ministry of Finance allocated a yearly budget that covers 4.5% of the interest rate. The other 1.5%-2.5% interest is covered by the Lebanese National Bank. In total, 18 Million USD in loans have been provided for SWH and it is anticipated that an additional 30 Million USD will be made available to support SWH in 2014. The solar loans will be augmented by a new 65 Million USD credit line, established by the European Investment Bank (EIB) and the French Development Agency (Agence Française de Développement, or “AFD”) for the National Energy Efficiency and Renewable Energy Actions (NEEREA) initiative. Banks have an incentive to participate in the loan program because BDL allows them to lower the amount of reserves they must hold for each low-interest loan they give out. In other words, this mechanism allows banks the commercial use of this otherwise frozen money in the reserve. In addition to the SWH program, a separate loan program under NEEREA is available for a wider range of EE and RE systems.

In addition to the financing scheme, Lebanon has allocated a 200 USD that is distributed to residents who install SWH systems through the NEEREA loan. The total amount available for distribution is 1.5 Million USD. The general conditions governing the processing of the subsidy are:

- The resident applied for the SWH system through a NEEREA loan;
- The installer company is qualified by LCEC;
- Maximum 2 loans/subsidies per person;
- The maximum allowed loan amount is 5000 USD.

Diesel fuel in Lebanon was subsidized over a period of 3 months in the winter. This subsidy was removed in 2010, but the budget was still allocated by the MoF. Accordingly, it was agreed to divert the available 1.5 Million USD to subsidize SWHs instead.



Figure 15 Flowchart of NEEREA SWH loan application and subsidy distribution

By the time of the inception of this report, 825,000 USD has been distributed as subsidies. 2011 had the largest impact on the subsidy scheme because it was the first year of the program. After that, the conditions of applications became more difficult especially with the implementation of harsher qualification rules for installing companies to make sure that only good installations benefit from the loan scheme.

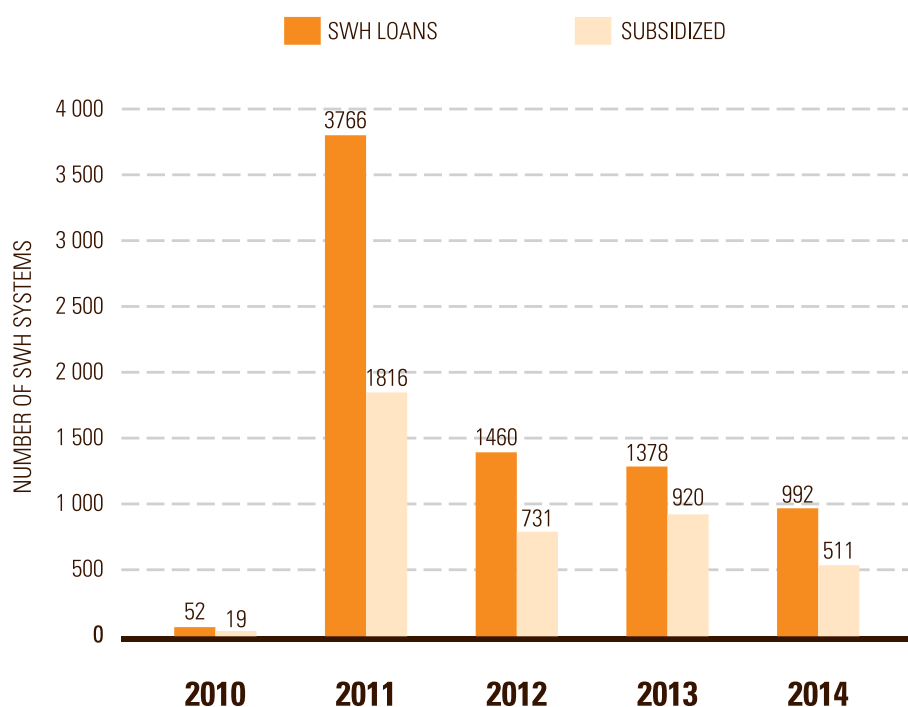


Figure 16 SWH loans granted and subsidy provided distribution by year

Lebanon is considered to be advanced in terms of financing mechanisms and SWH subsidies. NEEREA proved very successful and sparked interest in technologies that are otherwise very difficult for normal middle and lower class to purchase, such as solar photovoltaics.

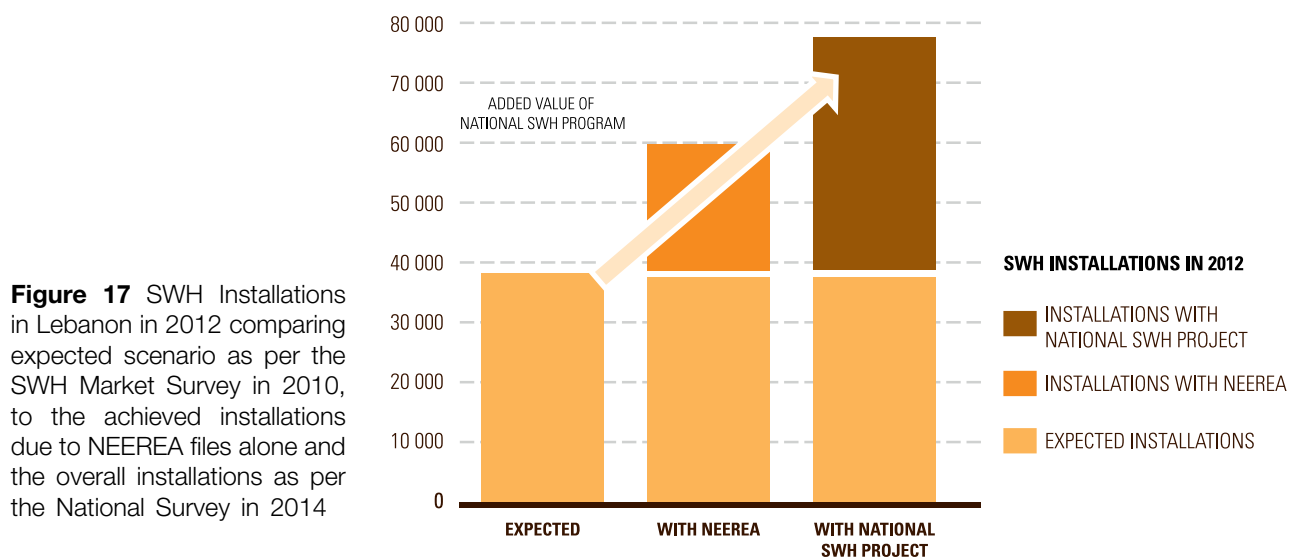


Figure 17 SWH Installations in Lebanon in 2012 comparing expected scenario as per the SWH Market Survey in 2010, to the achieved installations due to NEEREA files alone and the overall installations as per the National Survey in 2014

The roles of National SWH Programs are diverse and range well beyond their direct impact on the market. Measuring the success of such programs entails a measure of sustainability. Sustainability can be maintained through different methods, the most dominant of which usually can be characterized as legislations and laws and/or empowerment of local institutions and actors.

In Lebanon, LCEC played an instrumental part in developing the RE and EE sectors. In the Lebanese SWH Program, LCEC capacities and roles were shaped and empowered to be able to strongly affect the local market. After the end of the official mandate of the SWH Program, LCEC has taken over the role of the national authority in the SWH Market. One of the several influential files that LCEC currently manages is the subsidy distribution program for the installation of SWHs. In the Lebanese First National SWH Market Survey, 56% of the interviewed stakeholders pointed out that the program was encouraging demand, while others had minor comments on the way the system was working or the amount of money being distributed, as illustrated in figure 18.

It should be noted that after the survey, LCEC took several actions to further develop and advance the subsidy program; the process is now faster, clearer, and more organized. The latest advertisement campaign that was run by the MEW also included the loan and subsidy programs to increase their visibility to the public.

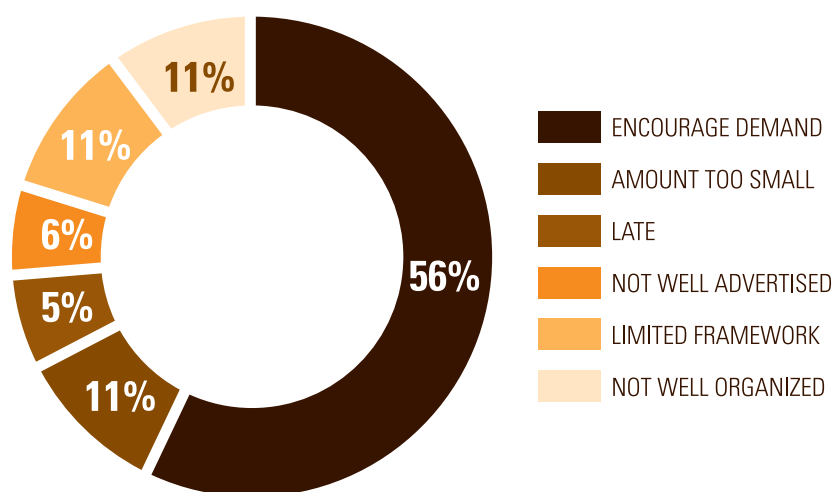


Figure 18 Perceived impact of the LCEC in running the 200 USD subsidy program for SWHs (Stakeholders' perspective)

2.5 BUSINESS SKILLS BARRIER AND PRODUCT QUALITY

A. DOING BUSINESS

The Doing Business Project is a World Bank Initiative whose objective is to provide objective measures of business regulations and their enforcement across 189 economies and selected cities at the subnational and regional level. The project, which was launched in 2002, looks at domestic small and medium size companies and measures the regulations applying to them through their life cycle⁴.

According to the Doing Business report, Lebanon was in the 113th position in 2010, but then moved up to 102nd in 2013. Before the end of 2014, Lebanon was in the 104th position. one of the factors that played a positive part in Lebanon's ranking is the fact that it is easy to start a new company to manufacture or sell/ trade. Also, getting an electrical connection is easy and paying taxes is well organized. On the other hand, issues such as obtaining construction permits and resolving issues remain a bottleneck for Lebanon's businesses. It should be noted that local businessmen can overcome bottlenecks faster than international businesses.

⁴ <http://www.doingbusiness.org/>

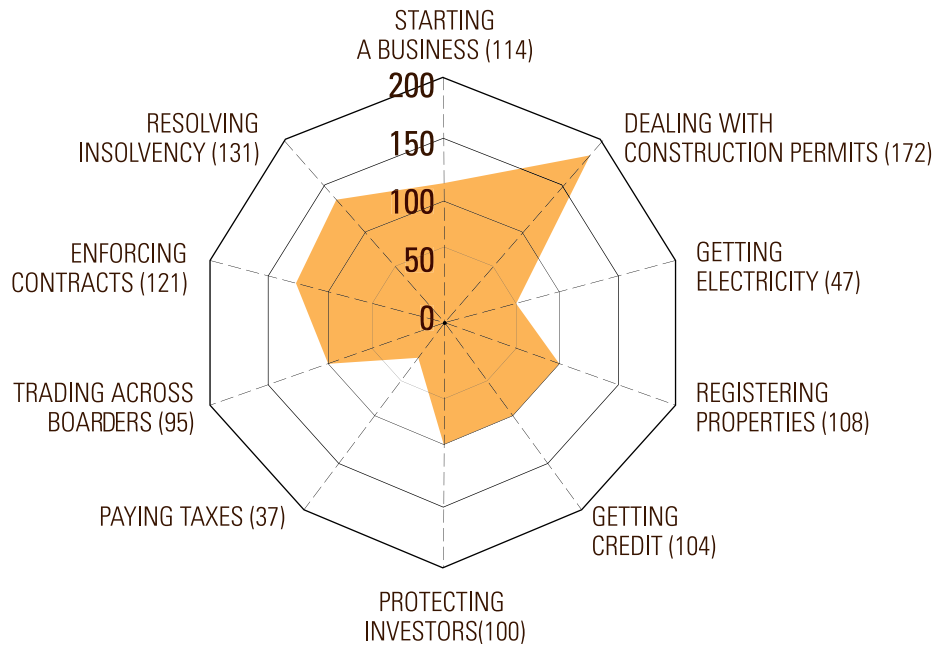


Figure 19 Doing Business Rankings for Lebanon. Source: World Bank

B. DOMESTIC MANUFACTURING

Domestic manufacturing also enjoys a strong role in the Lebanese SWH sector. Even though most local manufacturers do not produce the collector, they still play a role in manufacturing the components of the SWH such as tanks and support structures. Lebanon has one flat plate manufacturing facility and several other tank manufacturers that use imported vacuum tubes.

In 2011, 13% of the products supplied to the market came from a Lebanese assembly line. According to the solar survey of 2014, the installation figures from 2012 and 2013 showed an increase in the market share of local manufacturers from 21.7% to 29%.

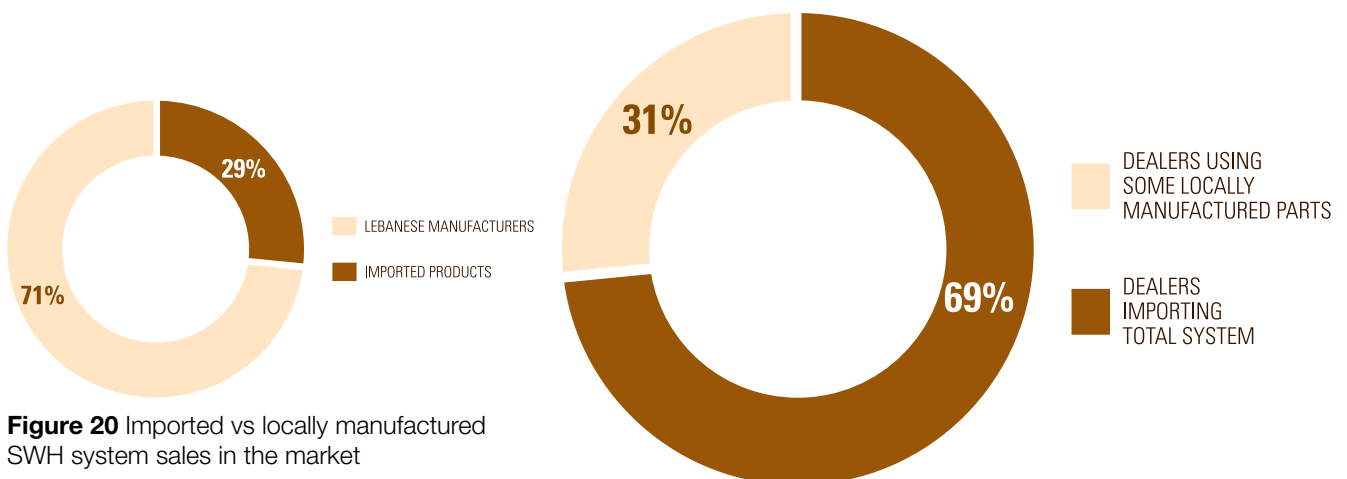


Figure 20 Imported vs locally manufactured SWH system sales in the market

Figure 21 Distribution of Dealers that Import All the SWH System and the Dealers that Use Some Locally Manufactured Parts

The growth of the Lebanese manufacturers' market share can be attributed to two events that coincided in nearly the same period. Event 1: Enforcement of the EN12975/6/7 certification on imported products diminished the number of cheap imported products. Event 2: The start of the subsidies program which coincided with the publishing of a list of qualified companies by LCEC. This list included local manufacturers but filtered out some importers with unqualified products.

One of the direct impacts of the adoption of EN12975 was a shift of several companies to the use of new certified products, especially when applying for the LCEC national SWH company qualification that was performed to shortlist SWH companies and allow their customers to benefit from the SWH subsidy program. More than five companies applying for LCEC SWH company qualification changed their products and switched to EN12975 certified systems.

*he adoption of EN12975 lead to a shift of several companies to the use of certified products.
A number of companies changed their products to meet the standards requirements.*

C. PRODUCT QUALITY

Having noted the relative ease of doing business in the SWH sector in Lebanon, focus turned to guarantying the quality of the installations and products. Thus, it was necessary to start building a standards and certification infrastructure. This started with a decree that made it mandatory for all imported solar water heaters to have been tested according to the EN12975/6/7 norm. This was followed with an effort by the IRI, GSWH, LCEC, and UNDP that led to the building of the first solar water heater collector testing facility. The facility was financed through a donation from Greek and was able to test collectors according to the EN12975 norm. Through the GSWH project, an international expert was assigned with evaluating the existing facility and assessing the cost of items needed for it to be completely able to complete all the tests related to the ISO 9806 standard. The projected cost of the additional items is USD 249,000.

ITEM	DESCRIPTION	COST (USD)
Independent Assessment for setting up the laboratory	Expert evaluation for the required testing and aligning them with the additions that need to be made on the existing laboratory	25,000
Hardware Requirements	Funding for purchasing and constructing the testing laboratory	96,000
Specialized Work	Programming software, testing runs, calibration certifications	9,0000
Training and Capacity Building	Training for local staff on the testing methodology and how to run the facility. Training and technology transfer for experts selected by SHAMCI affiliated countries	38,000
TOTAL		249,000

Table 3 Expert report results for the completion of the testing facility at IRI

Lebanon is an active member of the Solar Heaters Arab Mark and Certification Initiative (SHAMCI), which is an effort to develop a certification system appropriate for the region (Kraidy, 2013). IRI is also working to ensure that its SWH testing laboratory will be SHAMCI compliant.

The other part of product qualification came through an effort from the GSWH and LCEC. A periodical evaluation of installing companies has been conceived. Its aim is to qualify company products in 3 different categories: 3-Star, Qualified, and Passing.

- 3-Star Company products comprise of high quality products installed by experienced and well-established companies. Those installations benefit from the USD 200 subsidy.
- Qualified Company Products are usually high quality products that are being installed by companies who have yet to establish themselves. Those products also benefit from the USD 200 subsidy

- Passing Company Products are usually non-certified products or certified products that are installed by new and start-up companies. Their inclusion on the list is a form of encouragement and support until the companies are able to establish themselves in the market. Those products do not benefit from the subsidy.

It should be noted that it is possible for companies to have 2 different products and thus may be in two different tiers in the same time. This would lead them to get subsidies on their products that are in the top tiers, but not for those products in the third tier. This qualification scheme is public and is disseminated to banks every time it is updated. This led to an improvement in installation quality and serves as a guideline for people who are interested in the technology. After the completion of the GSWH project, LCEC is still updating the evaluation process and keeping companies in check.

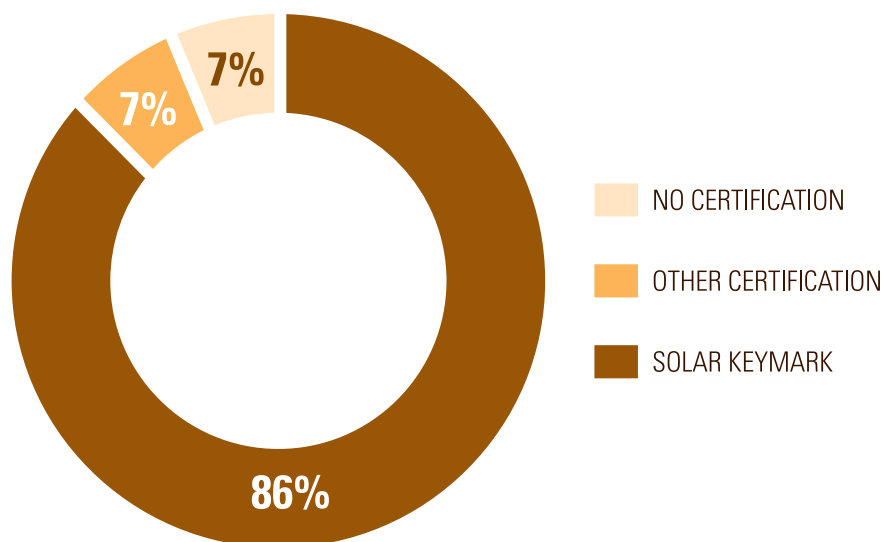


Figure 22 Solar System Certifications Available for Products used by Local Installers. Source: Lebanon's First Survey Study of the Solar Water Heaters Market, 2014.

D. INSTALLER CERTIFICATIONS

According to the Lebanese First National SWH Market Survey, companies highlighted the problems that end-users often report about the systems. As can be seen in figure 23, the dominant identified problem is overheating of the systems followed closely by leakages. Such malfunctions can be avoided if the installing workforce is better trained and qualified for the job.

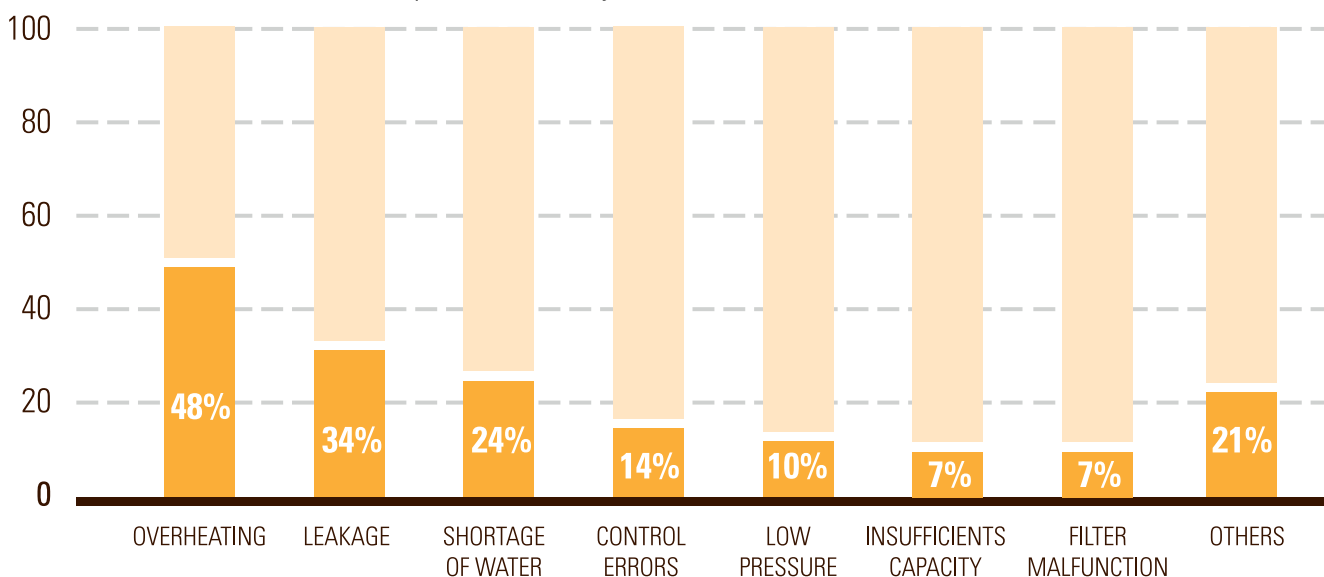


Figure 23 Problems in the Operation of SWH Systems as Reported by End-Users

In the beginning of 2014, the GSWH project worked closely with the Directorate of Fine Arts and Vocational Training in the Lebanese Ministry of Education and Higher Education to prepare a vocational training curriculum that includes solar water heating. The study was carried out by an international expert in collaboration with the mentioned stakeholders and local installing companies. The final result was a complete curriculum for solar water heating for the 3 vocational levels in Lebanon.

The curriculum is set for official adoption by the educational year of 2015/2016. The study also included a guidebook with the course references so that teachers will find it easier to choose the material for each level. A training of trainers was carried out by the end of the program and it was attended by representatives from all the vocational institutes. The institutes will also include an afternoon certification class aimed at training installers that have not completed a formal education program.



The Solar Heating Arab Mark
and Certification Initiative

2.5.1 SHAMCI

The Solar Heating Arab Mark and Certification Initiative (SHAMCI) is a quality certification scheme for solar thermal products and services in the Arab region. The project provides a regional industrial and regulatory compliance framework for policy makers, industrial sector, and end-consumers. The project promotes adopting standard quality measures, accreditation systems, and quality labels across the Arab region. It is the first Arab certification scheme for solar thermal products. It is built around specific characteristics and needs of Arab states in the Middle East and North Africa. SHAMCI is inspired by the Solar Keymark, the European certification scheme. SHAMCI was initiated by RCREEE with the support of the Arabian Industrial Development and Mining Organization (AIDMO) based on the Arab Ministerial Council of Electricity (AMCE) and at the request of the League of Arab States. AMCE endorsed the establishment of the network and initially accepted SHAMCI certification rules. Four countries (Jordan, Tunisia, Egypt, and Lebanon) have shown interests to implement SHAMCI certification rules at national level. The SHAMCI certification will create new opportunities to open up Arab SWH markets and encourage trade between countries. It will also help increase product quality in their respective markets, since it will be difficult if not impossible to import products that are not SHAMCI certified.



Figure 24 Process of the Inception of SHAMCI

Lebanon has ratified the SHAMCI certification protocol and has moved forward in its implementation. Even though the roles have not yet been fully distributed between the local stakeholders, it is foreseen that the structure would most likely be on the following lines, with LCEC playing the role of the central coordinator and the accredited body to issue certificates. IRI shall also be accredited by SHAMCI as well as the testing laboratory according to the set requirements

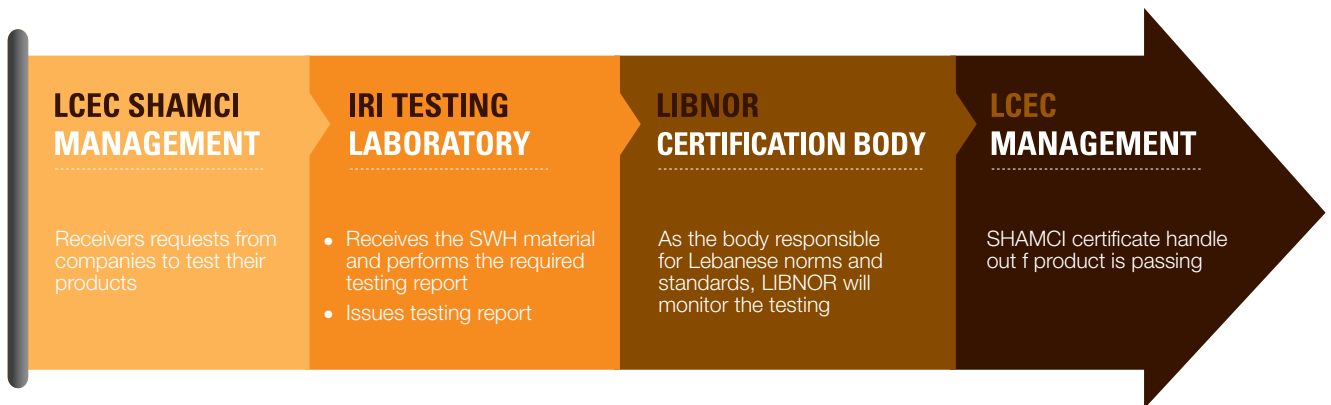


Figure 25 Foreseeable SHAMCI Certification Path for Lebanon

Figure 25 shows the possible path that the certification might take. But this will only be finalized once all stakeholders come to the final agreement. Lebanon still needs to achieve some final steps to adopt SHAMCI:

- Lebanon has a SWH testing laboratory that can perform testing according to EN12975. This laboratory should be upgraded to be able to perform all the tests in the upgraded ISO9806 standard;
- LIBNOR will need to update the Lebanese standards that require that imported SWH should have EN12975/6/7 testing. The standards should be upgraded to the new ISO9806 for SWH testing;
- Finalize the certification path;

Lebanon is aiming to be able to complete the above targets in the year 2015.

SHAMCI's ultimate goal is to open up the member countries' markets to each other thus increasing economies of scale for local manufacturers. Lebanon's projected market for the year 2015 is about 615,000 m², but the projected combined SHAMCI market size can reach 1 Million m² (Chanar, 2015). This would provide more opportunities for local manufacturers and can lower production costs to reach lower income customers.

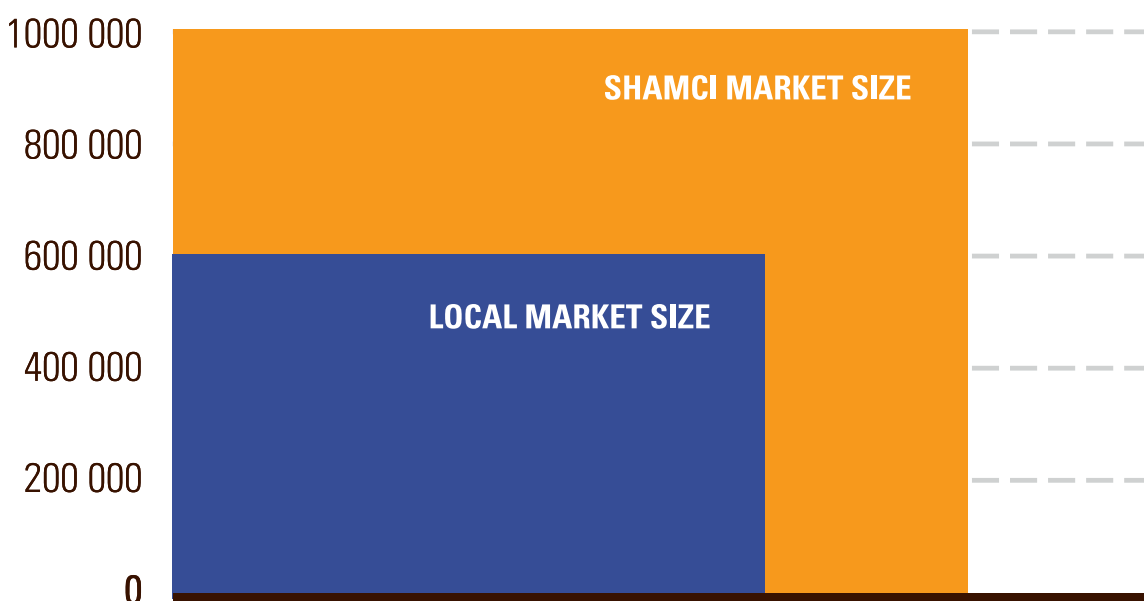


Figure 26 SWH Market Size - Local Market - SHAMCI Region Market for 2015/2016

2.6 CONCLUSION

Following the presentation of the different activities undertaken by the GSWH initiative in Lebanon and the successes achieved, this last sub-section will offer a wrap-up of the results achieved in this sector as well as a presentation of the challenges still ahead.

Firstly, it is important to note that due to the implementation of the National GSWH initiative, the SWH market witnessed a remarkable increase; the market growth was steady and visible. The first national SWH survey (completed in 2012) included interviews with several installers, experts, and end-users. As shown in figure 27, both installers (76%) and experts/ end-users (85%) agree that the market is growing.

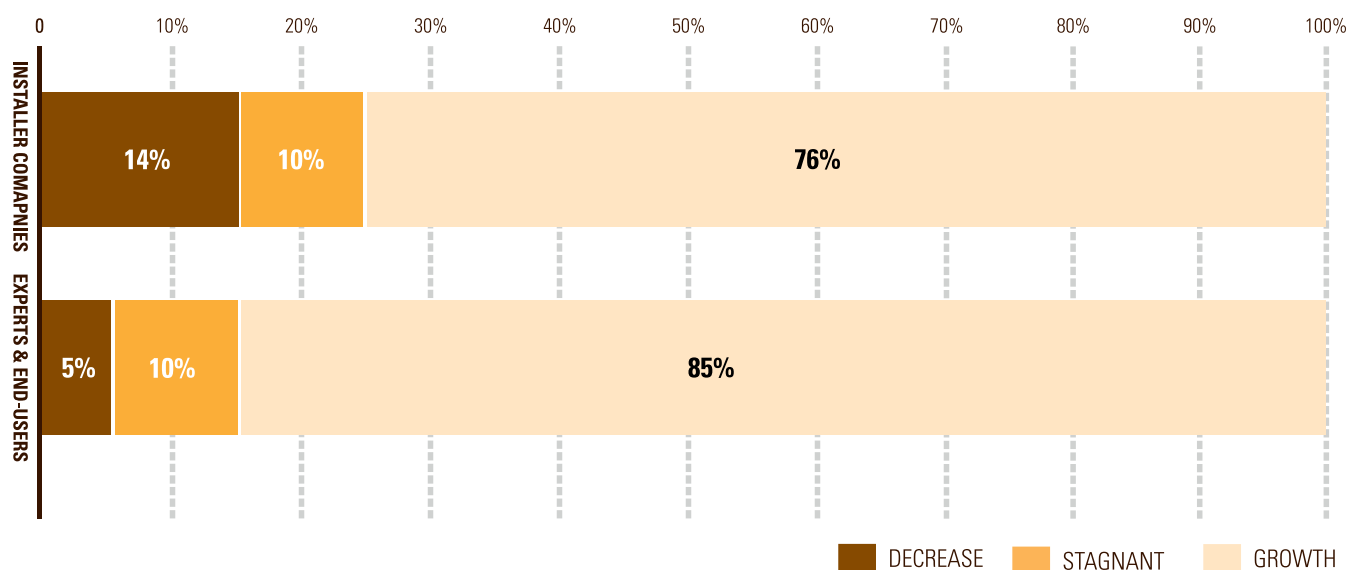


Figure 27 Market Conditions According to Local Installers and Stakeholders, 2012

Most companies agree that the main reason behind for this growth is a direct result of the initiatives undertaken by the Ministry of Energy and Water and LCEC, as can be seen in figure 28. The majority of local SWH dealers stated that their business grew between 10% and 50% as a result of LCEC's initiatives.

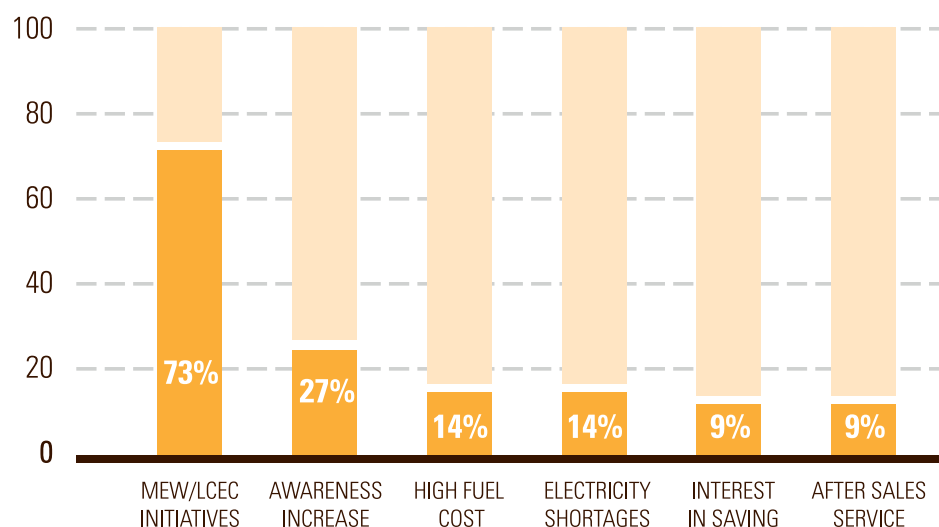


Figure 28 Reasons for Market Growth As Seen From Installing Companies Perspective

That same survey shows that much of the market growth was attributed to the increase in demand of the residential sector although the applied financing mechanism is open to all sectors of the economy. It should be also noted that the initiatives that were undertaken by the national SWH initiative were not strictly related to only encouraging residential users. Figure 29 shows that the SWH market is lagging in the industrial sector where only 4% of the total installed capacity in Lebanon is related to this sector. As a first conclusion, it is clear that there is an untapped potential for the SWH market in the industrial sector of Lebanon.

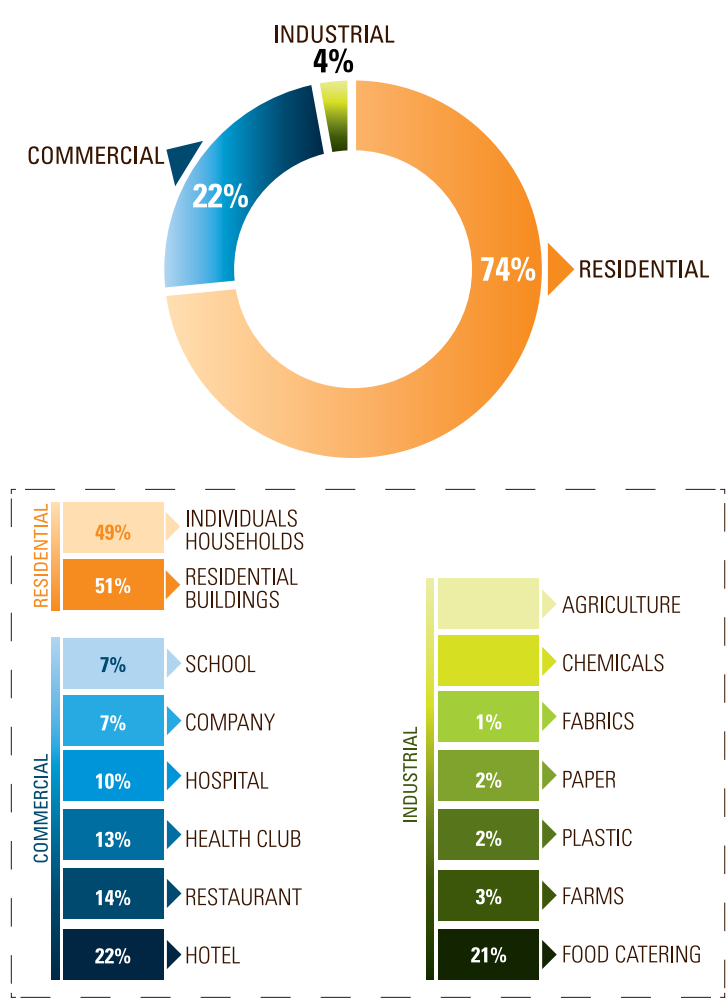


Figure 29 Share of SWH System Installation Split by End-Use Type

Most data collected in Lebanon show that the Lebanese SWH market is growing steadily. The last survey conducted in 2014 shows that the market is growing faster than initially predicted at the start of the national SWH initiative. The initial target was set to reach 1 Million m² of installed collectors by the year 2020. According to the most recent growth trends, the target will be reached in the year 2018, two years earlier than predicted as it can be seen in figure 30.

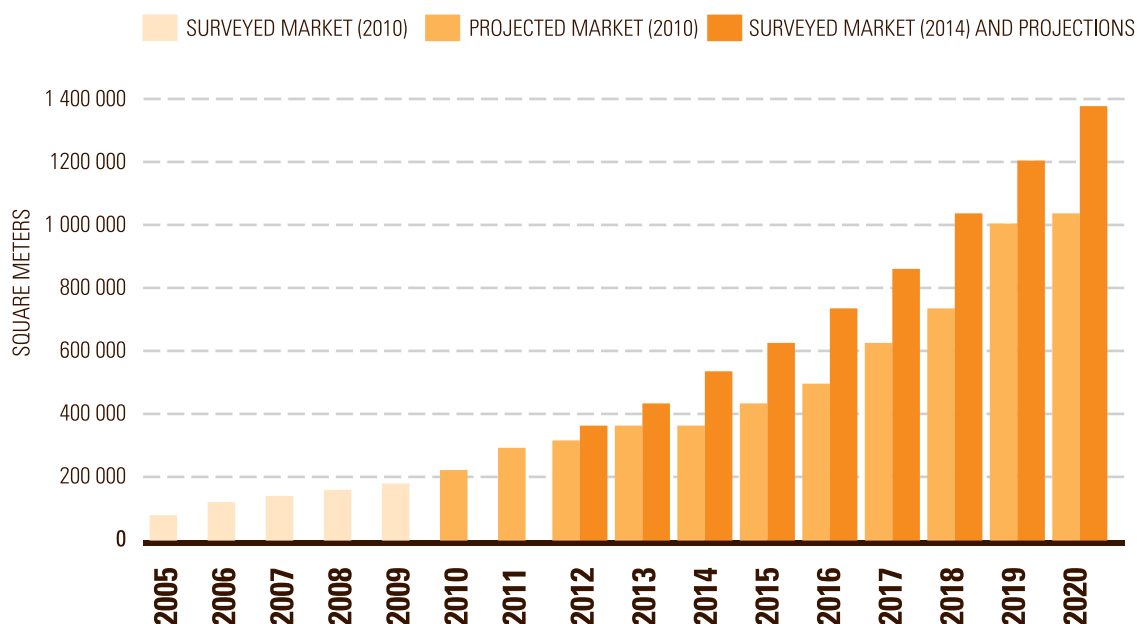


Figure 30 SWH Market Growth in Lebanon, projected vs surveyed

Despite the successes the SWH market witnessed, several challenges still need to be overcome. For instance, Lebanon needs to work on implementing the new building code, completing the testing laboratories for SWH, and most importantly implementing SHAMCI. Table 4 below summarizes the actions that should still be taken for a better and healthier SWH market in Lebanon.

CHALLENGE	Actions Needed
FINANCIAL CONSTRAINTS	· More initiatives · Installment with long settlement periods · Installment embedded in electricity bill
LIMITED ROOF-SPACE	· Find innovative technologies · Install common collectors · Organize roof-space · Make installations mandatory for new construction permits
LACK OF AWARENESS	· More awareness campaigns · Target academic milieu
TECHNICAL CONSTRAINTS	· Apply the set specifications · Explain more to customers about the quality/types of products · Offer training programs
UNREGULATED MARKET	· Regulate and control the market by implementing the set quality specifications · Compliment the quality specifications with sanctions in case of non-compliance
MANUFACTURING ISSUES	· Large-scale training programs about manufacturing techniques and technologies · Financial Support: Facilitate the granting of loans for manufacturing purposes, tax exemptions or reductions
HIGH COST	· Tax exemption · Reduction of VAT or customs · Support: Subsidy program
INSUFFICIENT INFORMATION	· Spread awareness on different products through the media

Table 4 Solutions and actions needed to improve the solar thermal market (Stakeholders' perspective)

Developing the SWH market is a continuous process, and Lebanon needs to keep up the efforts to maintain the momentum in the market. While this section shows how the different activities of the national GSWH initiative have resulted in numerous achievements, the following section will try to apply a quantitative analysis on the Lebanese SWH market.

SECTION 3

APPLYING UNEP'S SWH TECHSCOPE ASSESSMENT METHODOLOGY:

PARAMETERS EVALUATION AND SCORE VARIATION IN 3 PHASES OF
IMPLEMENTATION



APPLYING UNEP'S SWH TECHSCOPE ASSESSMENT METHODOLOGY: PARAMETERS EVALUATION AND SCORE VARIATION IN 3 PHASES OF IMPLEMENTATION

3.1 INTRODUCTION AND SCORING METHODOLOGY

Following the description of the different activities of the GSWH initiative, this section deals with the application of the UNEP's Techscope Market Readiness Assessment Methodology and Tool in order to measure the Lebanese SWH market. The analysis follows a time-based approach. As mentioned previously, the analysis covers three different periods in the history of the market development of solar water heaters, divided as follows:

- Pre-GSWH Initiative: the first stage is considered to be the period before the start of the GSWH project, that is end of the year 2009;
- Mid-Term of the GSWH Initiative Implementation: this second stage coincides with the mid-term evaluation of the national GSWH initiative in Lebanon (done in 2012);
- Post-GSWH Initiative: the last stage of the scoring considers the achievements and impact of the GSWH initiative following its closure in 2014.

To start with, it is important to describe the Techscope scoring methodology, noting that the full UNEP SWH TechScope Market Readiness Assessment methodology is comprehensively described in the "UNEP SWH TechScope Market Readiness Assessment" published by UNEP in 2014.

The scoring of the Techscope methodology relates to the situation of the SWH and assesses its weaknesses and strengths. The same scoring parameters and indicators of the UNEP SWH TechScope Market Readiness Assessment Report were used.

The scoring has 4 interrelated parameters:

- SWH Support Framework, includes government policies, regulations, and outreach efforts. Comprises 29% of the total score;
- National Conditions, includes climatic and market factors, Comprises 30% of the total score.
- Financing considers, access to capital and macroeconomic conditions. This parameter takes 20% of the total score;
- Business Climate, takes into account the ease of doing business and SWH business infrastructure. Business climate represents 21% of the total score.

These four parameters are composed of 18 indicators that reflect different elements of the enabling environment for SWH for a given country. Each of the indicators is scored on a scale from 0 to 5. These indicators are then weighted to develop an overall score for the country - again based on a scale from 0 to 5.

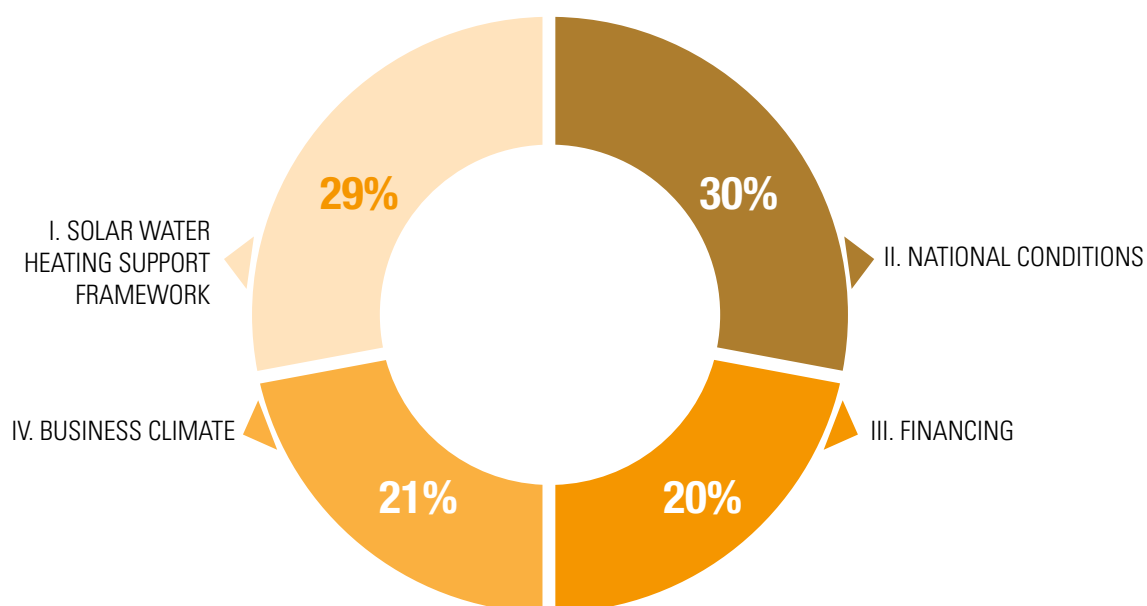


Figure 31 Parameter Element Weights

The assessed country receives a score for the different indicators that is multiplied by its individual weights and summed to provide the score for the different parameters. The parameters scores are then summed to provide the overall score for the specific country. Table 5 summarizes the relative weights of each parameter and the weights of each indicator.

The different indicators are scored using one of the following approaches:

- **Indexing:** In this case, the index is based entirely on a 0-5 scoring system, with 5 representing the highest possible score. Using the indexing approach, for example, a country with the maximum value for a given indicator would receive the highest score in the index (5). All other countries' outputs would be mapped relative to the maximum score. This approach is employed for quantitative indicators such as SWH installed capacity.
- **Tiering:** In this case, country indicator scores are tiered into predefined quintiles. For example, tiering may be used to place the "policy and regulation" indicators in different quintiles depending on the number of policies that are in place. This methodology is better suited than indexing for qualitative assessments. It may also be used when quantitative outputs are based on limited data.
- **Binary:** Binary scoring results in either a 0 or a 5 score. For instance, binary counting may be appropriate to determine whether a country has a quality certification for SWH installers or not. If they do, they receive a 5 score. If not, they receive a 0 score.

PARAMETER	PARAMETER WEIGHT OF TOTAL SCORE	INDICATOR	INDICATOR WEIGHT OF TOTAL SCORE (%)
I. SWH SUPPORT FRAMEWORK	29%	SWH Targets	5%
		Financial Incentives for System Installation	8%
		SWH Loan Programs	7%
		Building Mandates	5%
		Outreach Campaigns	4%
		SUBTOTAL	29%
II. NATIONAL CONDITIONS	30%	Insolation	5%
		SWH Market Penetration	4%
		Residential Energy Consumption Growth	5%
		SWH Market Growth	4%
		Competitiveness: Payback Period	7%
		Competitiveness: Heating Fuel and EDL Subsidy	5%
		Subtotal	30%
III. FINANCING	20%	Country Credit Rating	5%
		Access to Finance	15%
		SUBTOTAL	20%
IV. BUSINESS CLIMATE	21%	Doing Business	5%
		Manufacturing Capacity	3%
		Product Standards and Certification	5%
		Installer Certification	4%
		Industry Association	4%
		SUBTOTAL	21%
TOTAL	100%		100%

Table 5 Overview of SWH Techscope Market Readiness Analysis Tool Weights for Parameters and Indicators

The above parameters are scored from 0-5 according to the interpretation below:

- **Score 0-2:** SWH enabling environment is “emerging” and could likely benefit from additional support to accelerate SWH market growth.
- **Score 2-3:** SWH enabling environment is “good” with a SWH market positioned for increased growth.
- **Score 3-4:** SWH enabling environments are to be considered “strong” and are likely ready to attract investments.
- **Score 4-5:** SWH market conditions are “very strong” – policy, market, financial, and business conditions are aligned to support SWH and market growth is likely to be rapid.



Notes: It should be noted that the “score” used in this methodology is not intended as a judgment on the comparative quality of a given country’s enabling environment for solar heating. Different countries have markedly different conditions that need to be considered in detail on a case-by-case basis. Instead, the scoring is intended to serve as a tool for focusing market and policy discussions on specific issues and providing a starting point for comparisons - rather than serving as a stand-alone comparison on its own.

3.2 PARAMETER I: SOLAR WATER HEATING SUPPORT FRAMEWORK

In the following analysis, the indicators that fall under parameter I will be analyzed and evaluated.

3.2.1 SWH TARGETS

As mentioned in section 2.2, and as a result of the GSWH initiative and the growth targets it has set, Lebanon did set SWH targets and is still working on meeting them. Lebanon’s score is (2.5) for the period before the GSWH project, and (5) afterwards.

3.2.2 FINANCIAL INCENTIVES FOR SWH SYSTEM INSTALLATION

During the period of the initiative implementation, Lebanon has set up a subsidy program for supporting SWH system installations since 2011, section 2.4. Lebanon’s score is (5) after 2010.

3.2.3 SWH LOAN PROGRAMS

Lebanon has a fully functional SWH loan program since 2011, section 2.4. Lebanon’s score is (5) after 2010.

3.2.4 MANDATES

As mentioned in Section 2.2, Lebanon did initiate work on building mandates, but they are set for completion in 2015. Lebanon’s score is (2.5) from 2011 onwards.

3.2.5 OUTREACH CAMPAIGNS

Due to the ministry being active in promoting SWH system installation, Lebanon’s score for 2011 onwards is a (5), Section 2.3.

3.3 PARAMETER II: NATIONAL CONDITIONS

Under this section, all indicators falling under the parameter “National Conditions” will be analyzed.

3.3.1 INSOLATION

SWH systems use sunlight as fuel. Insolation is a primary driver for determining how much energy a SWH system will capture and produce. Insolation can be measured in terms of the kilowatt-hours of energy that strike each square meter of land area per day (kWh/m²/day). Insolation varies widely from country to country, and there can also be significant variation within a specific country. In order to assign a scoring system for insolation at the country level, the Market Readiness Assessment utilizes the Clean Energy Solutions Center’s Global RE Opportunity Tool. As can be seen in figure 32 below, the Global RE Opportunity Tool provides average insolation by country in sixteen tiers.

AVERAGE INSOLATION (KWH/m ² /DAY)	COLOR	TIER
2.5-3.0		1
3.0-3.5		2
3.5-4.0		3
4.0-4.5		4
4.5-5.0		5
5.0-5.5		6
5.5-6.0		7
6.0-6.5		8
6.5-7.0		9

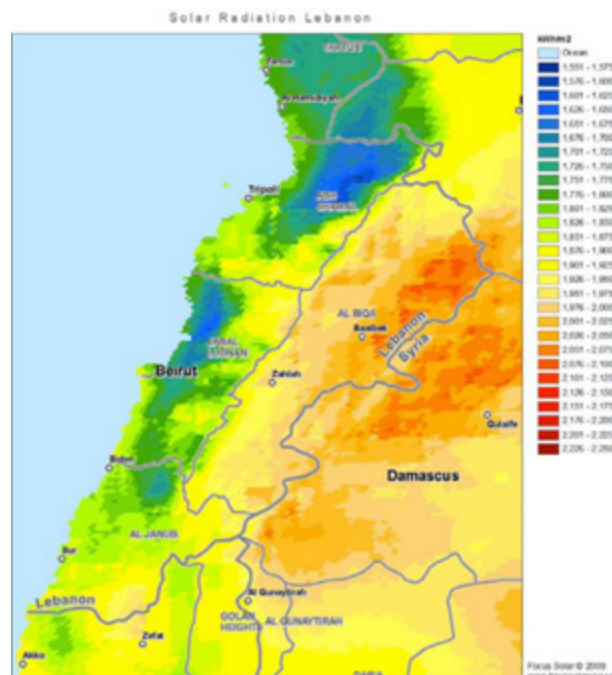


Figure 32 Lebanon's insolation is shown on the right. The scoring for each insolation level figures in the table on the top.

In order to score insolation, each tier is assigned a number, as can be seen in Figure 32 above. The upper and lower bounds represent the highest and lowest average values recorded for inhabited countries. The lower bound corresponds to average insolation in Nordic countries as Norway, Sweden, and Iceland, whereas the upper bound corresponds to countries such as Libya, Niger, Saudi Arabia, and Sudan.

As can be seen in figure 32, insolation levels in Lebanon vary from 1500 kWh/m²/year in the northern parts of the country to over 2000 kWh/m²/year in the eastern parts next to the Syrian border. On average, Lebanon has an insolation of 1947 kWh/m²/year and a daily insolation of 5.34 kWh/m²/day, placing it in tier 6.

To calculate the score the below methodology is used:

- **Step 1:** Lebanon has 5.34kWh/m²/day insolation, thus it is in Tier 6.
- **Step 2:** Lebanon's score is calculated according to the equation
- **Score**=(Tier/9)*5=3.3 from a possible 5.

3.3.2 SWH MARKET PENETRATION

Solar water heating penetration refers to the amount of solar systems that has been installed per capita in a certain country. Countries with higher penetration levels are more likely to have well-established solar heating industries with functional sales, distribution, installation, and service providers, whereas countries with lower penetration levels may have less established solar thermal industries and markets. The indicator was developed based on market data collection through the GSWH initiative. The data is collected as m² of collector area installed and converted to MW_{th}. For consistency purposes the penetration level is measured on a per capita basis. The scoring for SWH penetration used the global per capita rankings of major markets reported by the IEA Solar Heating and Cooling Programme (IEA SHC) as a benchmark. For the sake of this report, the used market data is taken from the Lebanese market surveys carried out by the GSWH project. For international data, the same IEA study was used. The data is compared to Greece as part of a calculation equation, since Greece is considered as a "mature market" but that is still growing, as compared to Cyprus or Austria, which are in a saturation phase.

The equation for calculating the score of Lebanon is given below:

COUNTRY X	UPPER BOUND (GREECE)	SCORE	INDICATOR WEIGHT (TOTAL % OF SCORE)
X kWth/1000	268.2 kWth	$(X/268.2)*5$	4%

The Lebanese market survey results are shown in figure 33. The light orange columns represent the market growth at the start of the GSWH project. The medium orange columns represent the projection given for the market growth until the market reached the 1 Million m² of collectors installed in 2020. The dark orange columns represent the actual growth after a survey of the market installation in the years 2012 and 2013. According to the recent survey, the market is set to reach the million target in the year 2018. It should be noted that the conversion factor used is 0.7 kW_{th}/m².

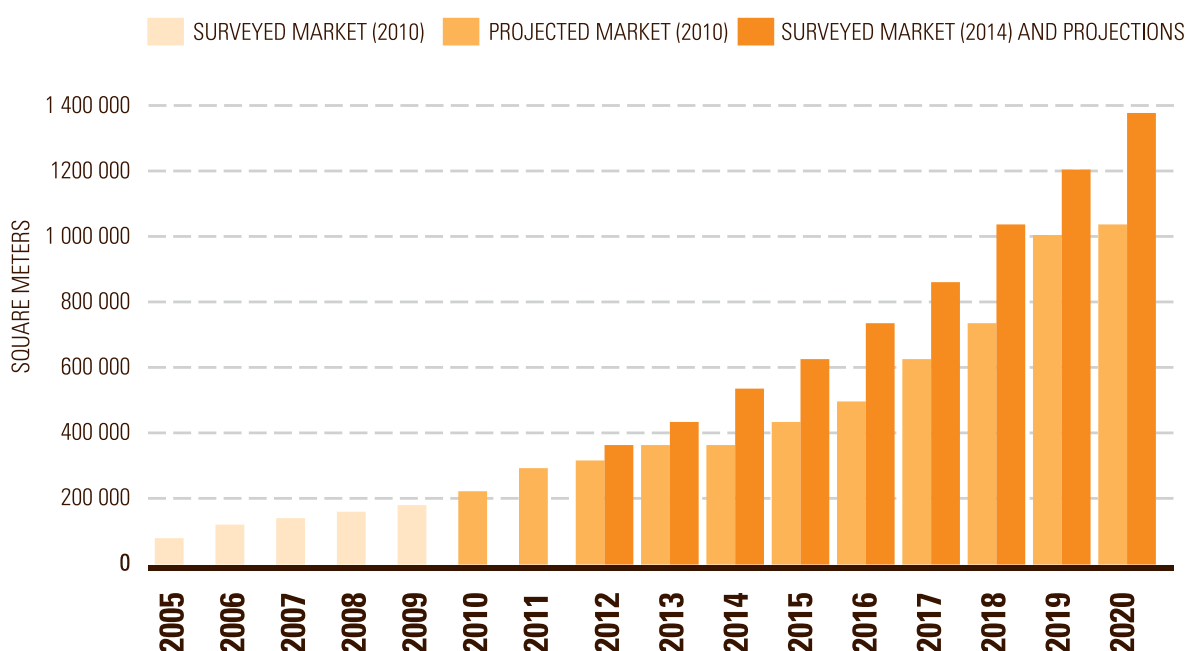


Figure 33 Lebanon's SWH market growth. Light orange is for surveyed market at the start of the GSWH project. Medium Orange is for the projected growth at the time (2010). Dark orange is the projection based on the 2014 market survey

Using the equation in conjunction with the results from the table, give Lebanon the following scores:

- **Pre-GSWH Project:** 35 kW_{th} per 1000 inhabitants with a score of 0.65
- **Mid-Term GSWH Project:** 65.35 kW_{th} per 1000 inhabitants with a score of 1.22.
- **Post GSWH Project:** 82.51 kW_{th} per 1000 inhabitants with a score of 1.54

3.3.3 RESIDENTIAL ENERGY CONSUMPTION GROWTH

Residential energy consumption in Lebanon has been dynamic during the past five years according to IEA statistics, with large increases and decreases from year to year. Overall, residential energy usage has grown significantly by an average of 11% during 2006-2011. Recent statistics by the Ministry of Energy and Water show that the pattern is unchanged mostly due to the unchanged status of electrical capacity shortages that limit growth patterns.

Lebanon experienced a steady growth of its SWH market, starting from about 10% in 2006 and moving to above 26% in 2012 and 2013.

Due to this high growth, Lebanon receives a 5 in this category.

3.3.4 SWH MARKET GROWTH

The market growth from year to year is evaluated in terms of % capacity each year. The scoring methodology used a 5 years average for market growth. The five-year average for the period prior to GSWH start (2006-2010) gives a growth of 15.4%, which has a score of 5. The two other periods under consideration, (2008-2012) and (2009-2013), show a growth of 20% and 22% respectively, thus keeping Lebanon's score as a 5.

3.3.5 COMPETITIVENESS: PAYBACK PERIOD

SWH systems costs; evacuated tube systems account for approximately 65% of the residential SWH market in Lebanon, with glazed flat plate systems account for the remaining 35% (Shehadeh, 2012). According to data gathered by Techscope Market Readiness Assessment, the typical collector surface is 3.6 m² and the typical size is 200 liters. The average system cost is 1300 USD. figure 34 below shows the contribution of major system components to total system cost.

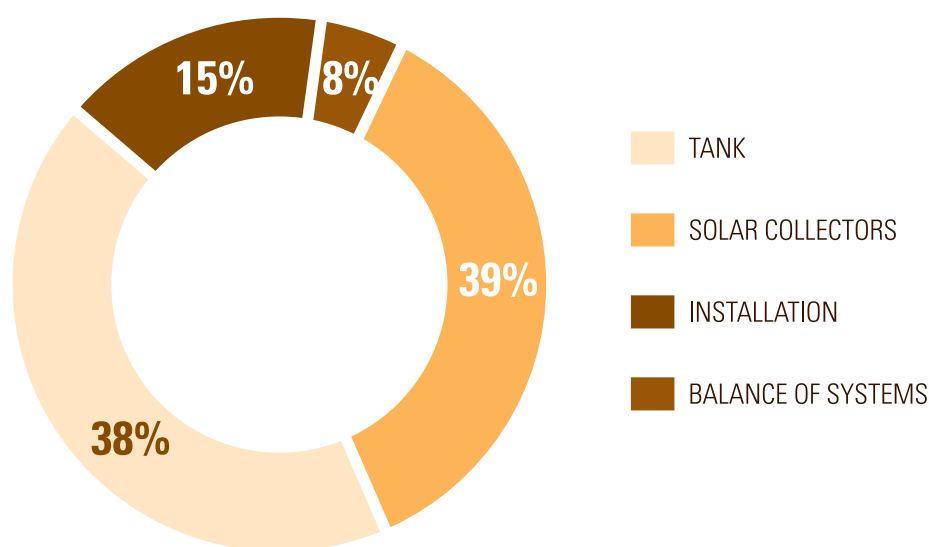


Figure 34 Cost breakdown for the installation of a SWH system

Retail Energy Price: a series of studies have concluded that electricity is the predominant fuel used for water heating in Lebanon, accounting for 60-80% of demand for energy to heat water in the residential sector (Stop et Al., 2011). The residential retail electricity rates charged in Lebanon increase based on the amount of electricity consumed and vary from 0.023 USD/kWh to 0.133 USD/kWh with an average of 0.10 USD/kWh. For the purpose of this analysis, it is assumed that the average retail electricity rate against which solar heating must compete is 0.10 USD/kWh.

Based on RETScreen analysis carried out for this report for a typical residential system, SWH in Lebanon has a payback period of 3.3 years, which receives a score of 4. It should also be noted, however, that Lebanon faces challenges with electricity supply disruptions. Solar water heating systems have emerged as a low-cost alternative for back-up generators for heating water during electricity shortages. When compared against the cost of back power, SWH may be viewed as more competitive. The analysis in this section could therefore be considered conservative.

3.3.6 COMPETITIVENESS: HEAT FUEL SUBSIDY

The cost of generating electricity in Lebanon is 0.171 USD/kWh, and electricity is substantially subsidized. SWH systems that offset electricity reduce this subsidy and therefore reduce the strain on utility financials. This is a significant benefit because the current need to support energy subsidies puts pressure on the creditworthiness of the electricity utility (MVV decon et al., 2011). The solar heating market does not capture this benefit, however. Instead, the subsidies serve to make solar heat less competitive against electricity. Due to these electricity subsidies, Lebanon gets a score of 0.

3.4 PARAMETER III: FINANCING

Two indicators fall under the Financing parameter. These are presented here below.

3.4.1 COUNTRY CREDIT RATING

Lebanon has experienced relatively high GDP growth in recent years, and its credit rating has improved over time. According to the rating agencies, Lebanon has a strong domestic banking sector, but the country has a comparatively high debt burden. The rating from Moody's and S&P are B1 and B, respectively. Based on these ratings, Lebanon receives 0.5 points for this section.

3.4.2 ACCESS TO FINANCE

The access to finance score was derived from two measures with equal weight: the real interest rate which serves as a proxy for the price of loans that accounts for inflation, and the amount of domestic credit provided by the banking sector (as percent of GDP), which serves as a proxy for the availability of in-country loans. The calculation methodology specifies that the data be collected over a period of 3 years and averaged. According to the World Bank, Table 6 shows the data for Lebanon.

WORLD BANK DATA	2008	2009	2010	2011	2012	2013
REAL INTEREST RATES	2.3	-0.8	8.2	4	1.7	5.5
DOMESTIC CREDIT AVAILABILITY (% OF GDP)	175.5	162.1	168.7	173.8	175.3	187.6

Table 6 Real Interest Rate and Domestic Credit Availability of Lebanon variations from 2008 until 2013, Source: World Bank

Lebanon's score for Real Interest Rates is unchanged during the 3-averaged periods, since all of them fall in the range between 1% and 5% with the same score of 4. The same applies for the Domestic Credit Availability as % of GDP, since all the data shows that Lebanon's data are above the 125% threshold. According to the scoring methodology, Lebanon's score is a 5 for all 3 periods. This parameter was counted as part of the variables, since even though the score didn't change, the data did.

3.5 PARAMETER IV: BUSINESS CLIMATE

3.5.1 DOING BUSINESS

Lebanon's rating has improved in several areas since 2010, Section (2.5). Thus the score for 2011 is 2, and (3) for the period that followed.

3.5.2 MANUFACTURING CAPACITY

A strong and healthy manufacturing sector is important for the growth of national SWH markets.

WORLD BANK DATA	2010	2011	2012	2013
MVA AS PERCENT OF GDP	8	8	9	9

Table 7 MVA for Lebanon, 2008 until 2013. Source: World Bank

Even if a country does not manufacture solar collectors, domestic manufacturers can still play a role in manufacturing components such as storage tanks. The combination of an existing domestic manufacturing and technical personnel can provide a strong foundation for developing a SWH market. The evaluation method uses the Manufacturing Value Added (MVA) as a percent of GDP. The UN Industrial Development Organization (UNIDO) provides statistics for major indicators of industrial performance of 208 jurisdictions around the world, including the MVA.

The growth of the Lebanese manufacturers' market share can be attributed to two events, which coincided in nearly the same period.

Event 1: Enforcement of the EN12975/6/7 certification on imported products diminished the number of cheap imported products.

Event 2: The start of the subsidies program which coincided with the publishing of a list of qualified companies by the LCEC. This list included local manufacturers but filtered out some importers with unqualified products.

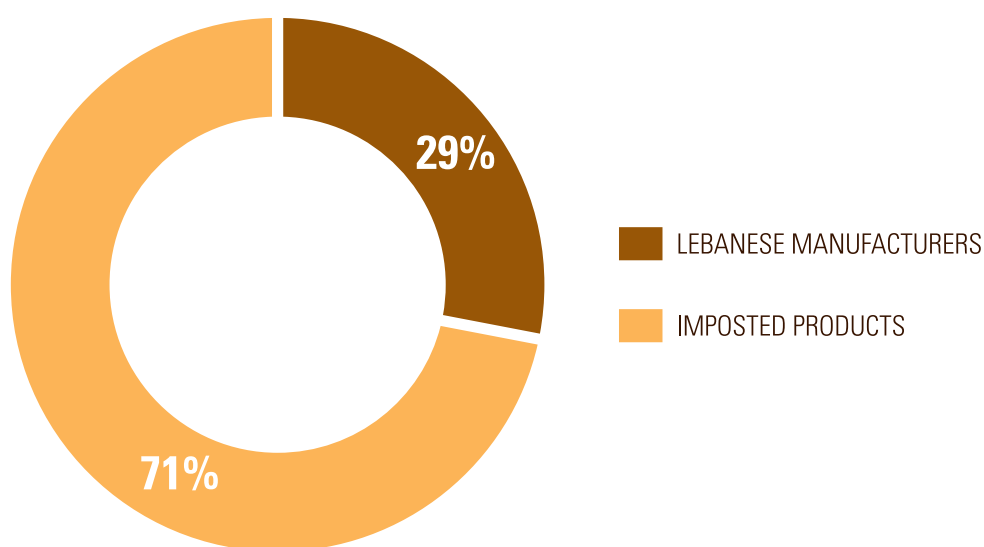


Figure 35 Imported vs locally manufactured SWH system sales in the market

According to the UNEP SWH TechScope Market Readiness Assessment methodology, an MVA of 8 produces a score of 2 whereas a score of 9 gives a score of 3. In Lebanon, most industrial activity focuses on assembly of parts that are usually imported. Lebanon has one flat plate assembly factory and several vacuum tubes assembly factories. Usually, most assembly factories manufacture the tanks locally. In 2011, 13% of the products supplied to the market came from a Lebanese assembly line. According to the GSWH project of 2014, the installations from 2012 and 2013 showed an increase in the market share of local manufacturers to 21.7% and 28% respectively.

3.5.3 PRODUCT STANDARDS AND CERTIFICATIONS

As mentioned in Section 2.5, Lebanon has a well-established certification scheme and a partially complete testing laboratory for SWHs. Lebanon also ratified the agreement with the SHAMCI certification mark. This gives Lebanon a score of (5) for the period after 2010 and a (3) for the period before 2010.

3.5.4 INSTALLER CERTIFICATION

Section 2.5 also covered the installer certification and accreditation on the vocational level. Lebanon gets a score of (2.5) for the period after 2014. Lebanon will get a full score once the curriculum is set officially on all vocational levels.

3.5.5 INDUSTRY ASSOCIATIONS

As mentioned in section 2.3, Lebanon currently does not have an active industrial association, thus scores a zero (0) on this section.

INDICATOR	PARAMETER	PRE-GSWH	MID-TERM GSWH	POST-GSWH
2.1.1 Insolation (5%)	II. National Conditions	Fixed Parameter		
		3.3		
2.1.2 Residential Energy Consumption Growth (5%)	II. National Conditions	Fixed Parameter		
		5		
2.1.3 Competitiveness: Payback Period (7%)	II. National Conditions	Fixed Parameter		
		4		
2.1.4 Competitiveness: Heat Fuel Subsidy (5%)	II. National Conditions	Fixed Parameter		
		0		
2.1.5 Country Credit Rating (5%)	III. Financing	Fixed Parameter		
		0.5		
2.1.6 Industry Association (4%)	IV. Business Climate	Fixed Parameter		
		0		
2.2.1 SWH Targets (5%)	I. Support Framework	Before 2009 Lebanon had general targets for RE, but after 2010 the targets included SWH in specific		
		2.5	5	5
2.2.2 Financial Incentives (8%)	I. Support Framework	After 2010, a subsidy program was instated		
		0	5	5
2.2.3 SWH Loan Programs (7%)	I. Support Framework	NEEREA soft loans program was started in 2010		
		0	5	5

INDICATOR	PARAMETER	PRE-GSWH	MID-TERM GSWH	POST-GSWH
2.2.4 Building Mandates (5%)	I. Support Framework	No national law, but some municipalities adopted mandates for SWH after 2012		
		0	2.5	2.5
2.2.5 Outreach Campaigns (4%)	I. Support Framework	Major campaigns in 2012 and 2014		
		5	5	5
2.3.1 SWH Market Penetration (4%)	II. National Conditions	Steady Growth Market		
		0.65	1.22	1.54
2.3.2 SWH Market Growth (5%)	II. National Conditions	Market growth above 15% since 2005		
		5	5	5
2.3.3 Access to Finance (15%)	III. Financing	Average score over 3 years kept the scores fixed even though yearly, Lebanon had strong variations		
		4.5	4.5	4.5
2.3.4 Doing Business (5%)	IV. Business Climate	Prior to 2013 Lebanon ranked lower than 110th, but the position improved to 102 then 104 in 2012 and 2013		
		2	3	3
2.3.5 Domestic Manufacturing (MVA) (3%)	IV. Business Climate	Even though market share of Lebanese manufacturers increased, but the Lebanese MVA as a percentage of GDP changed slightly between 2011 and 2012.		
		2	3	3
2.3.6 Product Standards and Certifications (5%)	IV. Business Climate	Adoption of EN12975/6/7 as mandatory for SWH imports in 2010. Flat plate laboratory built in 2012.		
		3	5	5
2.3.7 Installer Certification (4%)	IV. Business Climate	Initiated vocational training courses in 2014, but not officially adopted		
		0	0	2.5
TOTAL WEIGHTED SCORE		2.31	3.51	3.62

Table 8 Lebanon's indicators scoring over the 3 time periods

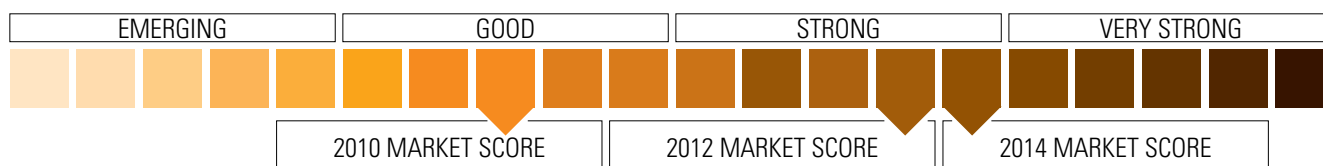


Figure 36 The Evolution of Lebanon's Market Score

3.6 SCORE EVOLUTION OVER THE THREE TIME-PHASES

Table 8 provides a compilation of Lebanon's indicator scores. The fixed parameters, which didn't change with the implementation of the GSWH and NSWHS projects are listed first and then followed with the indicators that progressed. The results show that Lebanon moved from a score of 2.31 in 2010 to 3.51 and 3.62 for 2012 and 2014 respectively.

3.7 SCORE BY PARAMETER

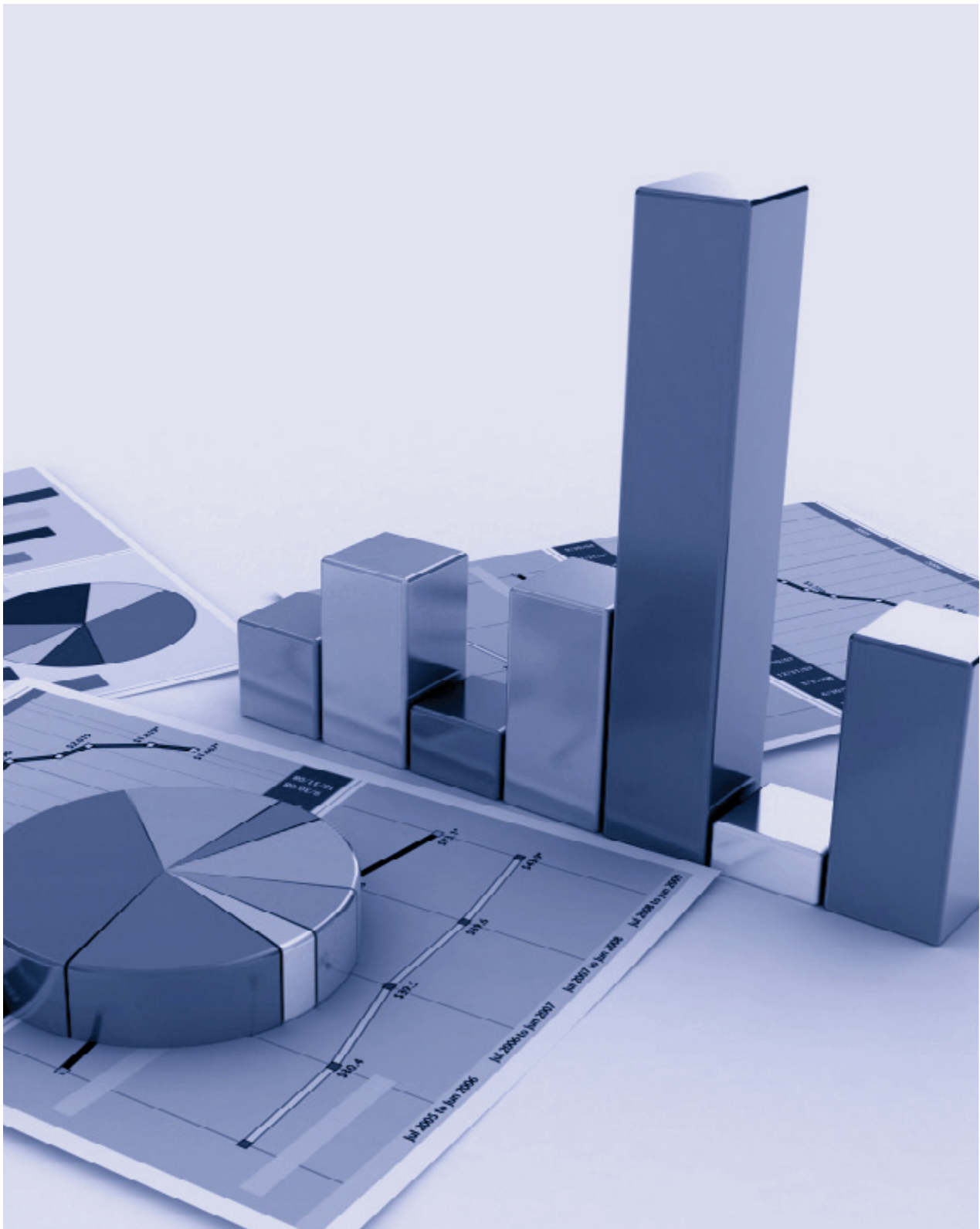
Table 9 shows the indicator scoring after they are weighed for their respective contribution of the final score. The % of total indicates Lebanon's score as part of the total achievable score for each parameter.

PARAMETER	PRE-GSWH		MID-TERM GSWH		POST GSWH	
	SCORE	% OF TOTAL	SCORE	% OF TOTAL	SCORE	% OF TOTAL
I. Support Framework	0.151	10.4	1.325	91.4	1.325	91.4
II. National Conditions	0.971	64.7	0.994	66.3	1.007	67.1
III. Financing	0.7	70	0.7	70	0.7	70
IV. Business Climate	0.31	29	0.49	46.7	0.59	56.2
TOTAL SCORE	2.31	46.2	3.509	70.2	3.622	72.4

Table 9 Lebanon's parameter scores by time period

SECTION 4

NATIONAL SWH PROGRAM IMPACT ANALYSIS AND WAY FORWARD



NATIONAL SWH PROGRAM IMPACT ANALYSIS AND WAY FORWARD

4.1 INTRODUCTION

As can be seen from the previous chapters, the GSWH project impacted the Lebanese SWH market on many fronts. Prior to the project there were no measures or plans that focused on increasing the market penetration of SWHs, and the market was completely self-dependent except for a few initiatives by LCEC and UNDP. The GSWH project played an important role on several political and financial fronts and awareness raising. Due to the GSWH project, the Lebanese market moved from a 2.26 score to a 3.62 score in just 5 years. It should be noted that the 2.26 score was mostly achieved due to the natural conditions in Lebanon and the business climate that already existed. It was only at the start of the GSWH project that measures targeting the SWH market started taking form.

This section is split into four main parts:

- Summary of the impacts of the GSWH project on Lebanon's SWH market development
- Non-quantitative assessment of the GSWH project impact
- Quantitative assessment of the GSWH project impact
- Analysis of the way to move forward and further improve the Lebanese SWH market

4.2 GSWH IMPACT ANALYSIS

Tables 8 and 9 of the previous section clearly show how the score of Lebanon improved dramatically after the start and take off of the GSWH project. According to the Market Readiness Assessment methodology, Lebanon's initial score is at 2.26. This means that Lebanon has a "good" enabling environment with a SWH market positioned for increased growth. At the implementation of the GSWH project, Lebanon moved to a higher level and showed signs that the enabling environment for SWH market growth is at the "strong" level and ready to attract investments.

One of the major factors in that growth is the development of the support framework, which moved from a score near zero to an almost complete score. This happened mainly due to the direct involvement of the government bodies and national agencies. This involvement and cooperation resulted in financing mechanisms, subsidies, adoption of building mandates, and outreach campaigns.

4.2.1 IMPACT OF SOFT LOANS AND SUBSIDIES

As mentioned previously, Lebanon implemented the NEEREA scheme, which enables people who want to install a SWH to benefit from a 5 year, interest-free, loan. Even though, the loan is available to any company, several banks use LCEC list of qualified companies to decide approval or rejection of loan application. The subsidies distribution is decided by LCEC depending on the qualification list. According to different market surveys, only 25% of the sales are going through the loan program, whereas most of the customers prefer to pay by cash or by splitting their payments to the company in a mutual agreement deal.

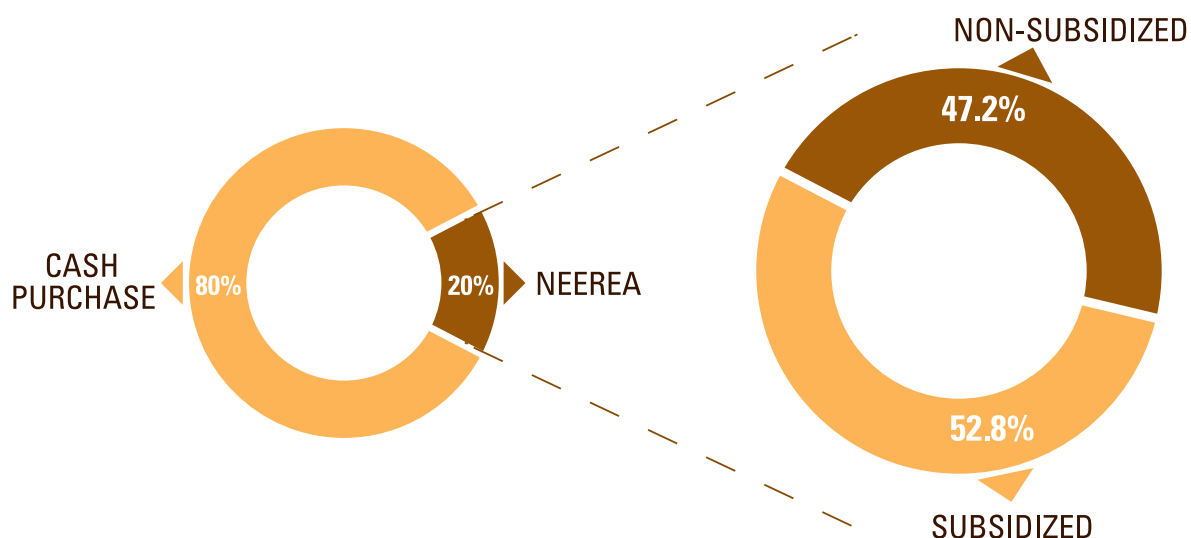


Figure 37 SWH sales distribution split into cash payments, NEEREA loans with subsidies, and NEEREA loans without subsidies

According to the interviewed companies, the SWH NEEREA program increased the interest in SWH installation and the outreach that this technology has. The graph below shows the evolution of the SWH NEEREA loans and the number of loans that benefited from the subsidies. It should be noted that the loans receive the subsidy as the loan period approaches its end, which explains why the year 2011 has a larger number of loans received than the remaining years. The 2011 subsidy data will only be completed after 5 years, which is the maximum allowable loan period for the SWH loans.

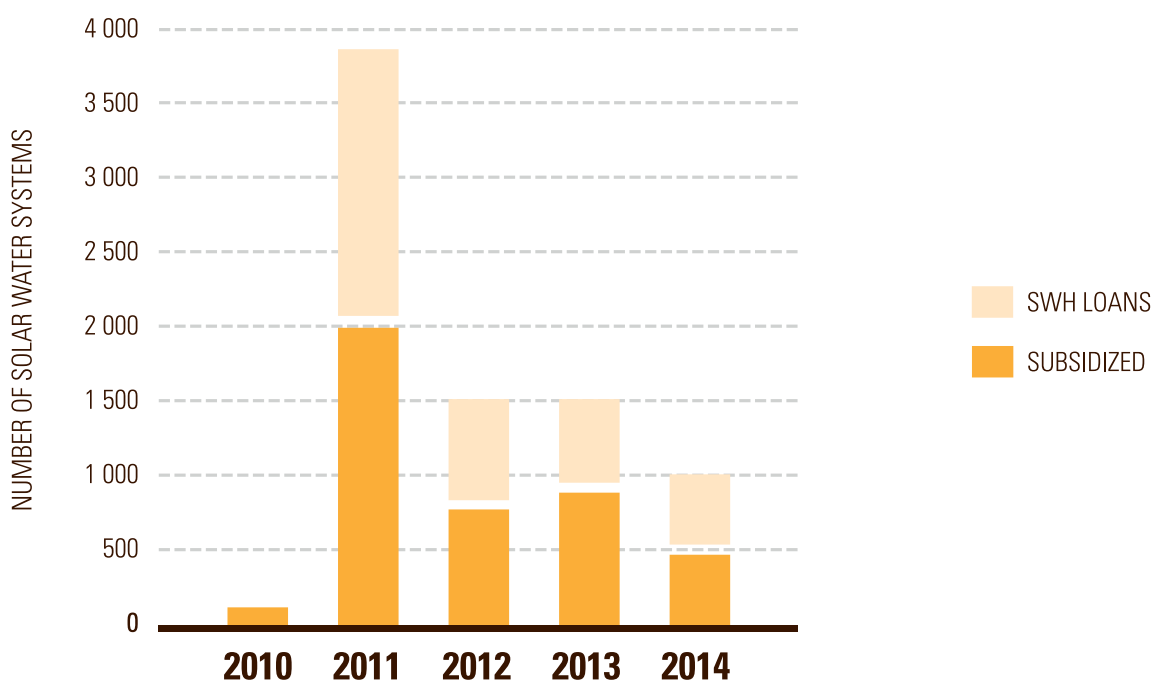


Figure 38 Distribution of systems that benefited from NEEREA loans from 2010 until 2014 showing the number that benefited from Subsidies

4.2.2 SWH KEY FIGURES

Lebanon has been a steadily growing market, as can be reflected in the scoring. The growth in the market does not only show in the installed capacity growth but that growth was accompanied with the number of companies in the sector. This also increased the number of employment in the SWH field and the number of banks interested in giving out NEEREA SWH loans. In 2013, the Lebanese SWH market had around 1,400 employees between engineers, technicians, installers, directors and owners.

A. EMPLOYMENT

The Lebanese SWH market had around 1,400 employees including engineers, technicians and installers, and administrative positions including directors and owners.

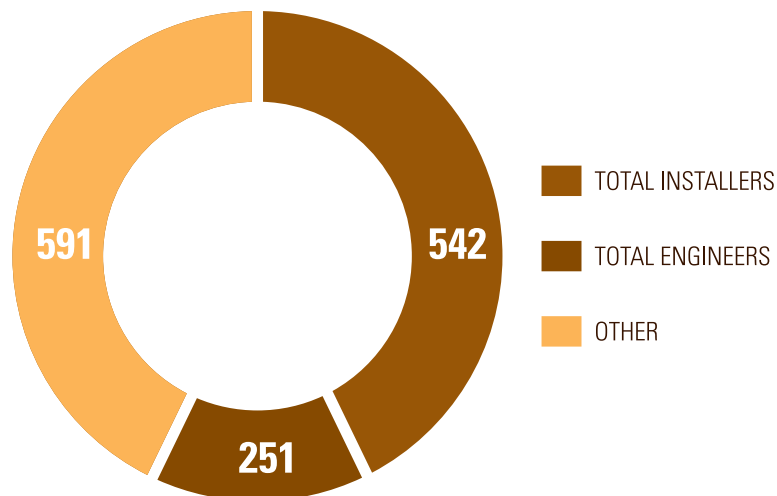


Figure 39 Employment in the Lebanese SWH market, Source: GSWH survey 2014

B. GEOGRAPHICAL DISTRIBUTION OF COMPANIES

With a surface area of 10,452 km², Lebanon is considered to be a very small country, ranking 166th in terms of size. Thus the coverage area of companies is usually very wide and a company based anywhere in the country would have the ability to install systems over the total area of the country. Lebanon is divided into 6 main governorates as shown in figure 40.



Figure 40 Lebanon's Governorates

The distribution of the main branches of companies is shown in figure 41 on the left and the surface coverage over Lebanon is shown on the right column chart.

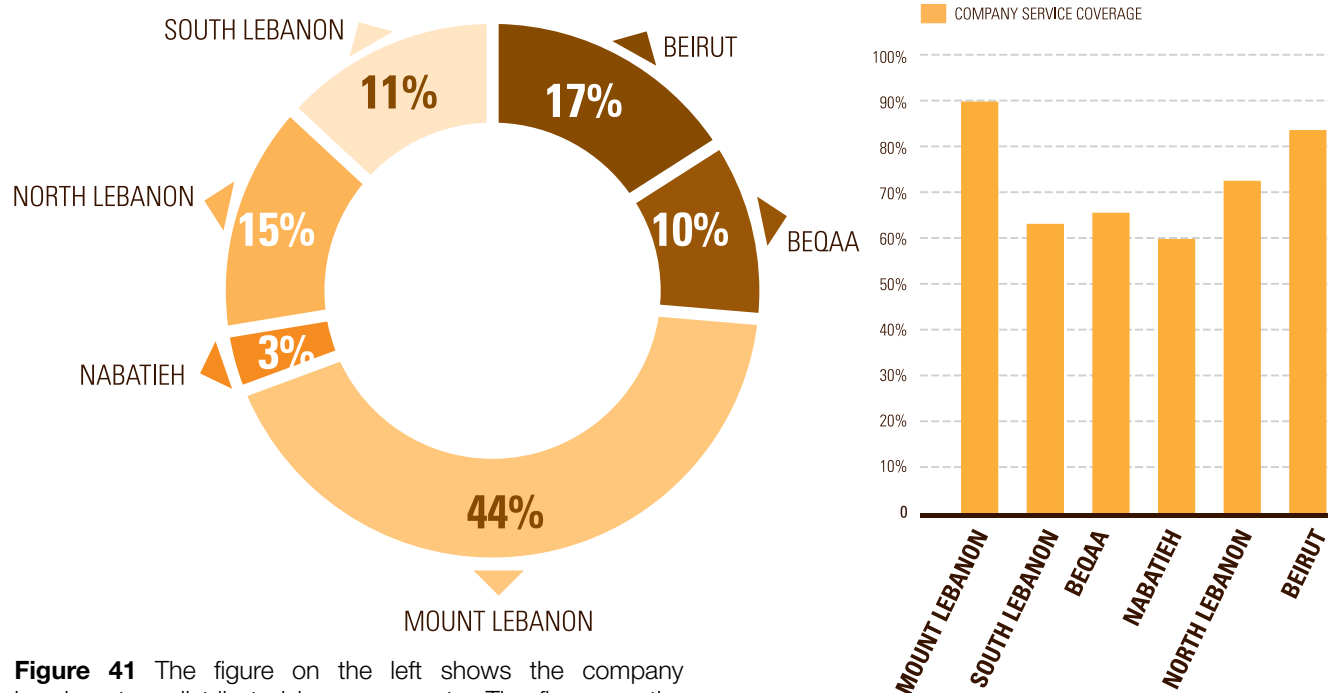


Figure 41 The figure on the left shows the company headquarters distributed by governorate. The figure on the right shows the coverage of companies per governorate

C. ENVIRONMENTAL IMPACT

According to the First National SWH Study Report, of 2014, the main method of domestic water heating in Lebanon was through electrical heaters. By 2014, 13% of water heating was done by Solar thermal. But to calculate the CO₂ savings from installing SWHs the baseline calculation will be based on electrical heater replacement since it represents 93% of the market. The savings are based on a RETscreen simulation where 6 m² of panels solar collectors were placed applied to represent a supply of a family of 5 persons. Using an average emission factor of 0.688 kg CO₂e per kWh produced from the combination of EDL and private generator in Lebanon as provided by the climate change unit at the Ministry of Environment, According and according to the analysis the 6m² of collectors will be saving about 3.2 tCO₂ of emissions annually, thus the factor of GHG emission saving is 0.53 tCO₂e/m²/year.

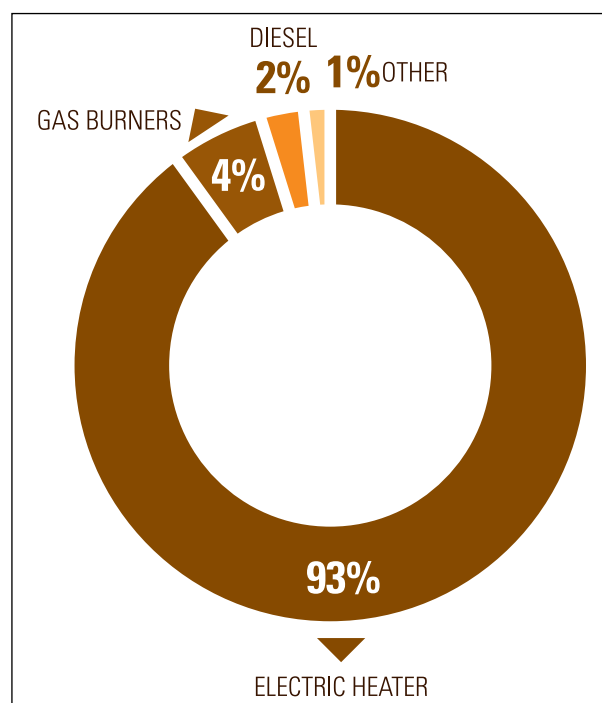


Figure 42 Distribution of domestic water heating fuel. Source: Survey 201

Following this analysis, the savings projected from the installed systems per year is shown as the bars in figure 43. The cumulative saving until 2020 is projected to be as high as 4.15 MtCO₂. The additional installations from the year 2009 to 2012 are estimated at 3 MtCO₂.

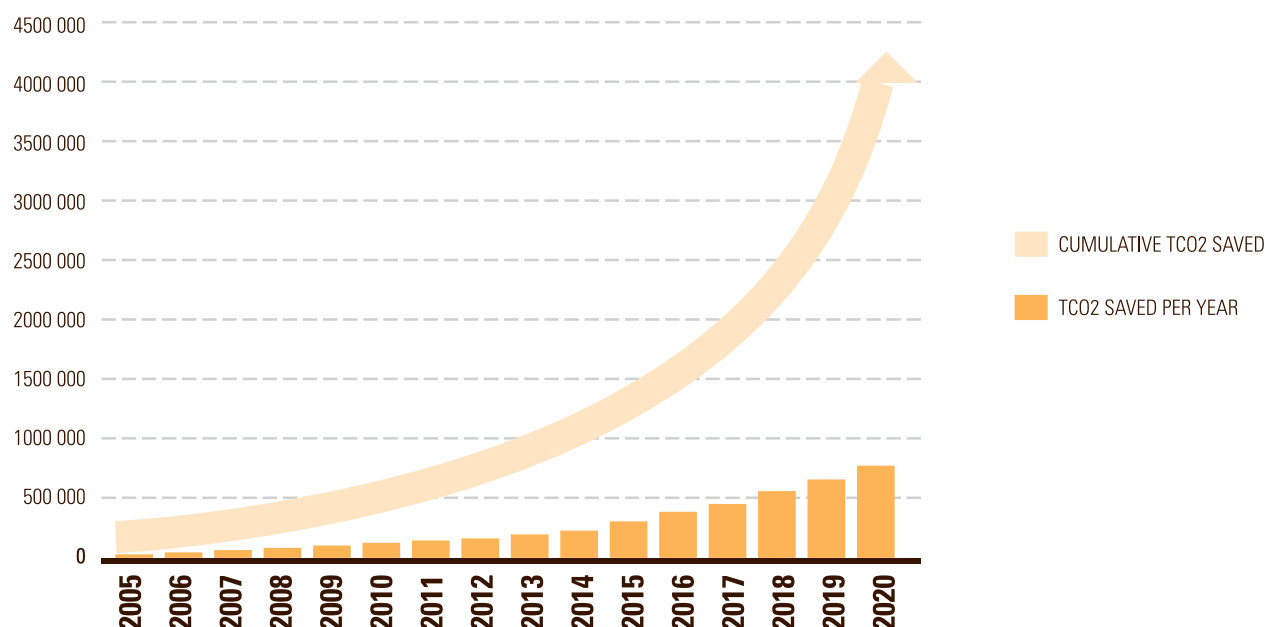


Figure 43 CO₂ Savings by the SWH systems, yearly and cumulative

D. ADDITIONAL KEY DATA AND FIGURES

COST PER SQUARE METER OF SWH SYSTEM	USD 370	COST PER LITER OF SWH SUPPLIED	USD 5.59
LITERS PER SQUARE METER	65.5	AVERAGE SYSTEM PRICE	USD 1,503
AVERAGE SYSTEM SIZE	270 liters	TOTAL LOANS SUBMITTED	7,815
TOTAL LOAN VALUES	USD 11,748,375	TOTAL SUBSIDIES DISTRIBUTED	USD 825,200

Table 10 Additional key data and figures for the Lebanese SWH market

4.3 NON-QUANTITATIVE IMPACTS

This section includes the measures and actions taken by the GSWH project whose impact is difficult to quantify in real terms. It should be noted that some of the measures needed financial injection to be achieved. This financial injection will be included in the final analysis as an added value of the project, but the impact of those injections is much higher than their dollar value since they carry a long-term value for the SWH market.

4.3.1 POLICY SETTING

Setting targets is the first part of creating a healthy policy to target a specific market aspect. This could only be achieved with a clear understanding of the market in place and how different initiatives will impact it. The presence of the GSWH project and its staff gave the opportunity to survey the market and understand how it works and what can be done to improve it. The surveys helped in assessing the size of the Lebanese SWH market and facilitated the setting of objectives to be met in the future.

The SWH targets might, not have had a significant impact on their own, but the resulting work plans and measures taken did largely impact the market and created a more sustainable growth.

4.3.2 BUILDING MANDATES

Although they have not been implemented yet, the fact that they have been created will facilitate their implementation in the future. The creation of such mandates needs a qualified full time staff, and this was provided by the GSWH project.

4.3.3 OUTREACH CAMPAIGNS

Prior to the GSWH project, SWHs in Lebanon did not have a very positive reputation due to the lack of reliable products and qualified installers in the market. It was necessary to create a positive image for SWHs in order to open up opportunities for the SWH market.

The GSWH project worked on financing the first phase of advertisement campaigns which had a large impact on the market which can be seen through the many phone calls received by the project center from people asking about the technology and its benefits. The project involvement also led to the government financing a second phase of advertisements in 2014.

4.3.4 PRODUCT STANDARDS AND CERTIFICATIONS

In order to increase trust in the market, the GSWH worked on introducing SWH standards and certifications to the Lebanese market. Accordingly, this decreased the availability of low quality products in the market which caused the negative publicity for SWHs. The development of a Company Qualification by the project and LCEC increased the trust in the market and augmented the interest of companies in higher quality products. Also, the GSWH project obtained a Greek donation for a solar water heating testing facility under the EN12975 norm. The final cost of the laboratory with installation and commissioning was 110,000 USD.

4.3.5 INSTALLER CERTIFICATIONS

Even though this has only recently been achieved and has yet to be adopted by the Directorate responsible for vocational trainings. it is a major step that will have a high impact on the market in the future, as it will lead to the availability of highly skilled and trained professionals responsible for SWH installations. This personnel will not only lead to better quality installations, but will have an awareness raising and marketing impact on the market.

4.4 QUANTITATIVE IMPACTS

This type of impacts can be quantified in terms of dollar value and CO₂ emissions reduction. Some of them also carried a financial injection value for the Lebanese SWH market and this will also be added to their long-term benefits.

4.4.1 FINANCIAL INCENTIVES

The benefits of financial subsidies for SWH systems have a multilateral impact on the market. It encouraged companies to apply for the SWH Company Qualification process, which needed good quality products. This also helped in allowing lesser income owners to be able to afford SWHs. To evaluate this measure, the loans that benefited from the subsidy will be accounted for and calculated for their value and their GHG emission savings.

The government made available 1.5 Million USD for the subsidy program. This will be included as the injection to the SWH market. The financial and GHG emissions impacts of this measure will account for the total amount of purchases that benefited from this subsidy. Accordingly, and up to the end of

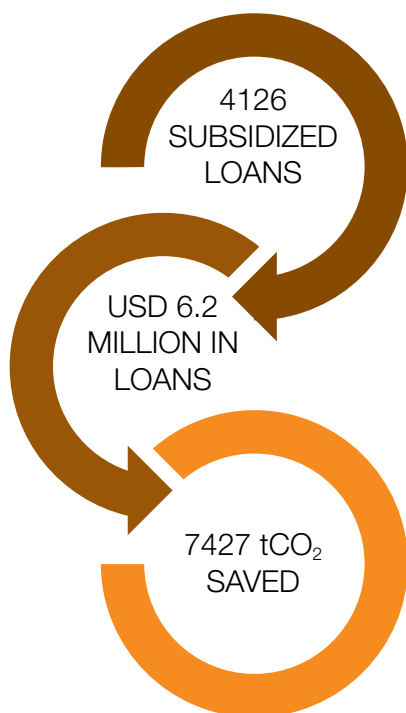


Figure 44 Impact of the Solar Water Heater loans

2014, 4,126 subsidized systems were purchased with an average system price of 1,503 USD. Thus the invested amount in SWHs due to the subsidy is 6.20 Million USD with a GHG emission savings of 8,966 tCO₂e per year, adding up to around 134,487 tCO₂e over the average lifetime of measure, estimated at 15 years. This leads to an average of 46.1 USD/tCO₂e. This is done disregarding O&M expenses and NPV.

4.4.2 SWH LOAN PROGRAMS

SWH loans gave an opportunity for the SWH market to reach a wider range of people with different income levels. These facilitated loans also reached a part of the market which would otherwise not have been interested in paying the investment sum in cash. The evaluation for the impact of this measure is done similar to the previous, but it evaluated the loans that did not receive the subsidy, which total 3,689. The value of those loans is approximately 5.54 Million USD and contributes to saving 8,016 tCO₂e per year, adding up to around 120,243 tCO₂e over the average lifetime of the measure, estimated at 15 years. This leads to an average of 36.7 USD/tCO₂e. This is done disregarding O&M expenses and NPV.

4.4.3 NEEREA LOAN PROGRAMS

Even though the SWH loan programs that were included before are also a part of the NEEREA scheme in this section the large scale SWH systems are covered. The total SWH investment through the NEEREA amounts to 948,000 USD with 490 tCO₂e saved per year, adding up to around 9,800 tCO₂e over the lifetime of the measure, estimated at 20 years. This leads to an average of 96.7 USD/tCO₂e. This is done disregarding O&M expenses and NPV.

4.4.4 PILOT PROJECTS

The GSWH started opening up the market by installing several SWH systems in order to increase trust in the technology and raise awareness to its benefits.

LCEC Projects: The first phase of the SWH projects were implemented by LCEC and the GSWH jointly. Ten large scale SWH systems installed in several buildings such as hospitals and community centers. The total cost of the implementation was 307,000 USD and will save 166.6 tCO₂e per year.

CEDRO Projects: The second phase of the projects went through the CEDRO – UNDP project. Those projects, sixteen in total, were focused on governmental institutions such as hospitals and army barracks with a budget of 1.8 Million USD. Those implementations will save 524 tCO₂e per year.

4.4.5 MARKET GROWTH

Prior to the GSWH project the Lebanese market was still in a growth pattern but this growth increased with the implementation of all the measures listed throughout this report. To account for the increased growth, the projects that would have not been implemented without the GSWH project will be calculated. In other words, the projected market value for 2012 was 287,978 m² of collectors whilst the amount that was installed was 326,766, thus the GSWH project contribution is approximately 38,788 m² of collectors.

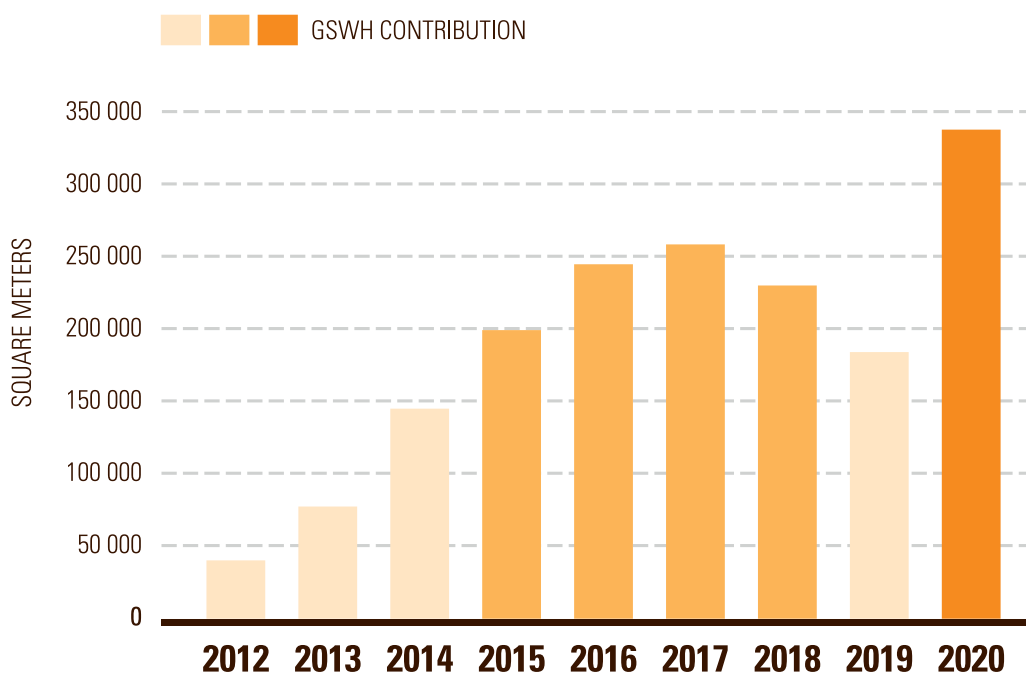


Figure 45 GSWH contribution to the SWH Market in square meters of collectors installed

The project's total contribution by 2020 to reach 320,000 m² of collectors installed. For simplifying the calculation and to linearize it with the rest of the methodology, only the contribution of 2012 until 2014 will be considered. In order to remove the potential for duplication, the contributions of the NEEREA, 1,412 m², SWH Loans and Subsidies, 28,134 m², should be subtracted from the values. This will leave the remaining contribution of 114,000 m² of collectors resulting in the reduction of emissions by 57,000 tCO₂e per year in 2014. The estimated value of the installations is at 60.1 Million USD. Considering an average lifetime of 20 years, the overall investment rate would be 52.7 USD/tCO₂e. This is done disregarding O&M expenses and NPV.

4.5 THE WAY FORWARD

This report showed the many points of strength of the Lebanese solar water heating market and the improvements it had made in the past few years. The difference in grading between 2010 and 2012 is immense and several areas that affect the SWH market had been improved. The Lebanese financing schemes and subsidies have played a major role in this market. But in order to achieve a stronger market and better sustainability, there remain a few points to tackle.

4.5.1 NAMAS

Nationally Appropriate Mitigation Actions (NAMAs) present a new opportunity for developing countries to seek finance, technology and capacity building support for the implementation of actions to mitigate climate change.

Lebanon is currently developing NAMAs in three different sectors, namely transport, waste, and forestry.

The first two are being developed under the UNDP climate change unit at the DNE (Designated National Entity) which is the Ministry of Environment, and the third developed by the Ministry of Agriculture in coordination with the climate change unit.

No NAMA in the Energy sector has yet been developed, but discussions of a NAMA for scaling up the use of Renewable Energy and Energy Efficiency in the Lebanese building sector took place, with initiation meetings held between the national stakeholders including5:

- **CCCU/MEW:** Climate Change Coordination Unit at the Ministry of Environment
- **MEW:** Ministry of Energy and Water
- **LCEC:** Lebanese Center for Energy Conservation
- Representatives from the private sector
- In addition to other representative from the civil society

4.5.2 SWH SUPPORT FRAMEWORK

According to the summary of results, section 3.2, Lebanon's SWH support framework has obtained 91.4% of the score. The country looks like it will be able to keep this score for the coming years, especially since the SWH loans program has been prolonged with additional funds continuously being added to the program. Advertising also looks to be secured for the future, though not from the government itself. Currently, advertising campaigns are being launched by the companies operating in Lebanon, especially when it comes to promote their status of benefactors of the 200 USD subsidy provided by the Ministry of Energy and Water as a quality and trust mark. The future of the subsidy should be discussed soon, but the funds will be enough for the coming 4-5 years. Lebanon main point to tackle is the building mandates forcing buildings to be designed with SWH installation provisions.

4.5.3 NATIONAL CONDITIONS

National Conditions parameters are tied, as the name indicates, to national parameters that are not only related to SWH. But as the market improves in SWH and financial parameters, the national condition score will improve. The most pressing point from this parameter is the financial subsidy provided on the price of electricity. But this subsidy is projected to be removed in steps as the supply hours of electricity are increased. Though no work has begun on this point yet, the policy plan of the Ministry of Energy and Water has placed the targets for this move.

4.5.4 FINANCING

This parameter is completely independent of the SWH market when it comes to direct impact from the SWH measures on the score. The Country Credit Rating is affected by national conditions and security as well as measures implemented by the Ministry of Finance and private banks among other stakeholders. The bulk of the score though is dependent on the ease of access to finance, which Lebanon scored very high on.

4.5.5 BUSINESS CLIMATE

To improve the score in this parameter Lebanon needs to encourage the reinstatement of a SWH industry association and to enforce the new vocational training curriculum and certifications as planned for 2015/2016. As far as doing business and local manufacturing, those parameters fare well for Lebanon and are projected to increase in the future as the government is playing a bigger role in the field of decreasing corruption and increasing trust in local manufacturing. The implementation of the SHAMCI certification might also play a decisive role in this front.

4.5.6 SHAMCI CERTIFICATION

The Solar Heating Arab Mark and Certification Initiative (SHAMCI) is a quality certification scheme for the solar thermal products and services in the Arab region. SHAMCI is an Arab certification scheme similar to the Solar Keymark in Europe. It aims at unifying the requirements of solar water heaters before they enter into Arab markets. While sub-section 2.4.1 gives a clear description about SHAMCI, it is important at this stage to mention that SHAMCI promotes adopting standard quality measures, accreditation systems, and quality labels across the Arab region. Accordingly, Lebanon could definitely benefit from the application of SHAMCI to open the door for SWH manufacturers to export their products to the different countries of the Arab World.

The SHAMCI scheme is set to be launched officially in 2015 in Lebanon. To be on the right path, Lebanon's action plan for the implementation of SHAMCI needs to implement the following steps:

- Complete the SWH testing facility;
- Update the certification and testing schemes for ISO 9806, which replaces the already existing EN12975/6/7 norms;
- Complete adoption of SHAMCI.

4.5.7 UPGRADE SWH TESTING LABORATORY

As mentioned previously, Lebanon's SWH testing laboratory, located at the IRI premises, is only capable of testing collectors according to EN12975. Lebanon's target for the coming year is to upgrade the laboratory to enable it to run all the required tests in compliance with the new ISO9806 standard. LCEC, LIBNOR, and IRI are currently working on drawing multilateral funding for completing the laboratory including a submission to the CTCN Network for providing the technical backstopping needed to set up a structure testing facility. The CTCN Network stands for Climate Technology Centre and Network and is the operational arm of the United Nations Framework Convention on Climate Change (UNFCCC) and is hosted and managed by UNEP in collaboration with United Nations Industrial Development Organization (UNIDO) and 11 centers of excellence. The center's main objective is to stimulate technology cooperation and enhance the development and transfer of technologies to developing countries.

4.5.8 ACTION POINTS

The action plans are split into two parts; the first one being the points that can be tackled by the stakeholders in the SWH market directly. The second part presents the parameters that affect the market as a whole and are not only related to SWHs. Thus they need to be part of a bigger plan by the government

PART 1:

- Implement SWH related building mandates;
- Help in the reinstatement of a SWH industry association and help it play a larger role in the sector;
- Implementation of the SHAMCI Certification to increase trust in local manufacturing and produce opportunities for exports.

PART 2:

- Removing subsidies on non-renewable energy source, namely electricity;
- Improving Lebanon's Country Credit is achieved by increased transparency and stronger security and thus requires the government to increase interventions on this area;
- Increasing the role of local manufacturing and encouraging local companies to expand.

⁵ <http://www.med-enec.com/news/developing-building-sector-nama-lebanon>

4.6 RESULTS

The impact amounts would be evaluated under 3 main indicators: Direct Financial Injections, Indirect Financial Injections, and GHG emissions reduced.

INDICATOR	DIRECT FINANCIAL INJECTION	INDIRECT FINANCIAL IMPACT	GHG EMISSION REDUCTION
	USD	USD	TCO ₂ e
OUTREACH CAMPAIGN	240,000	3,000,000	
TESTING LABORATORY	110,000		
FINANCIAL INCENTIVES	1,500,000	6,200,000	8,966
SWH LOANS		5,500,000	8,016
NEEREA		948,000	490
PILOT PROJECTS	2,107,000		690.6
MARKET GROWTH		60,100,000	57,000
TOTAL	3,957,000	75,748,000	75,162.60

Table 11 Summary of the impact of the GSWH Project

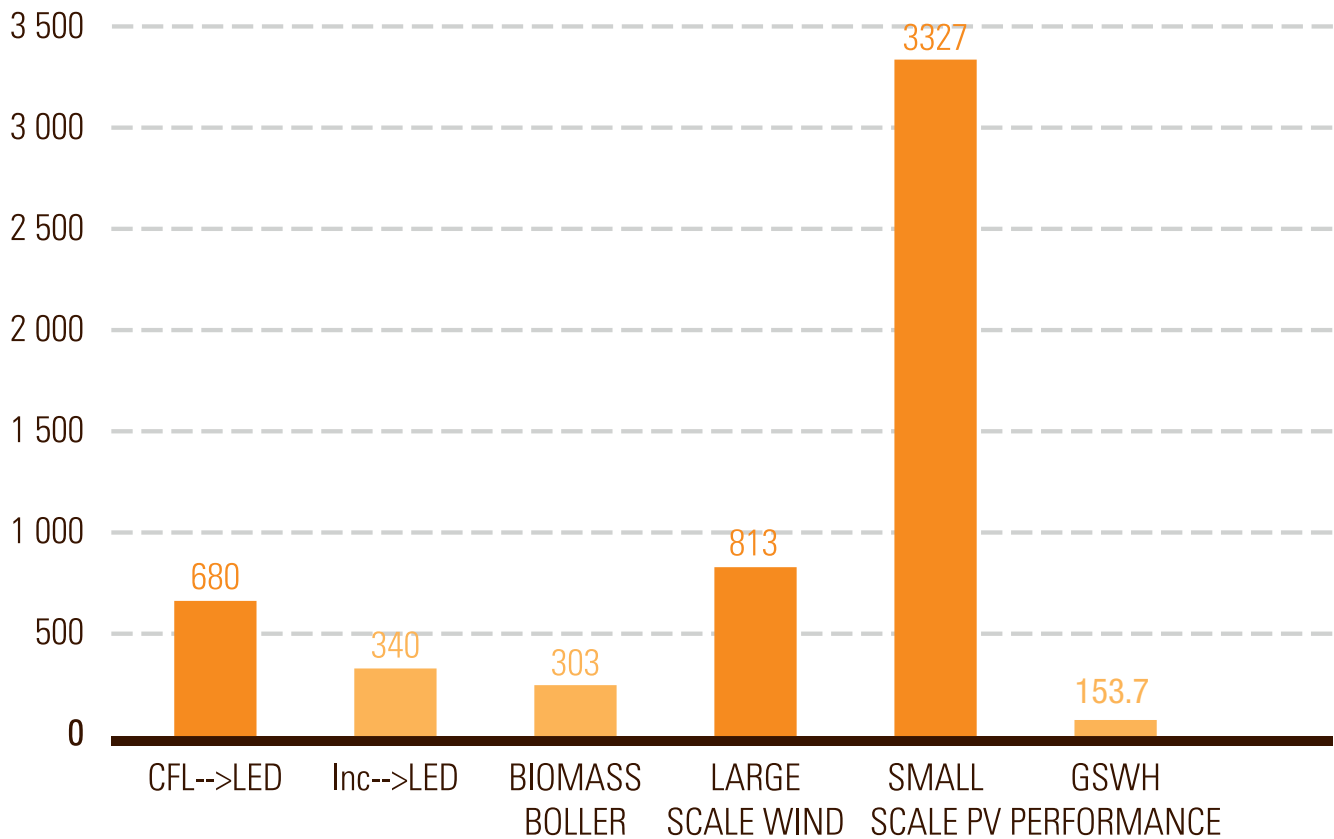
It should be noted that the GSWH project was launched with a budget of 3.16 Million USD in 2009 spread over 5 years. The GSWH project proved to be very successful in increasing the SWH market growth and laying the foundations for that increase to be sustainable. This small investment in the project was able to attract direct investments in the Lebanese SWH market of 3.6 Million USD and an indirect investment of 75.8 Million USD during the period of its implementation. Those values are set to grow at an incremental rate as the market grows and improves.

The overall impact of the SWH installations is a reduction of emissions by a yearly value of more than 75,000 tCO₂e. In order to evaluate the direct impact of the GSWH initiative, the direct impact of the additional installation of 37,788 m² is considered. With the project budget of 3.16 Million USD, the average investment rate per tCO₂e is 153.7 USD/tCO₂e saved per year.

To put this into perspective, to save 1 tCO₂e by replacing CFLs with LED lighting will need an investment of 680 USD, which is approximately the price of 30 LED bulbs. The same analysis will show that replacing a diesel boiler for house heating with a biomass boiler has a ratio of 300 USD per tCO₂e saved. The sources of those values are the NEEREA studies that were submitted to LCEC. The GSWH project had a ratio of 42.04 USD for each tCO₂e saved. It should be noted that the values don't consider the pay back periods of the different technologies.

Investment Cost per Measure to Save 1 tCO₂

USD/TCO₂



EE and RE Measures

Figure 46 The financial performance for different Energy Efficient and Renewable Energy Measures

To put things into perspective, 75,ktCO₂e is what is absorbed by 17,455 acres of forests per year; this is 70.6 km² or 0.65% of Lebanon's surface area.

SECTION 5

CONCLUSION



CONCLUSION

Lebanon has started targeting the expansion of the SWH market since the creation of LCEC project as a partnership between UNDP and MEW financed by GEF. The project targeted several RE and EE measures and worked on several initiatives. The SWH outreach campaign that started in 2006 was one of the fruits of the work done by LCEC and UNDP and it successfully started raising awareness about the usefulness of the SWH technology. The report summarizes how Lebanon overcame the challenges in growing its SWH market over 3 different parts.

The first part summarizes the actions taken by the national SWH project in order to share the lessons learned and best practices that the project encountered during its implementation. The project started by raising awareness through several forms of advertising. Work also was done in creating pilot projects to promote technology visibility, over 27 projects, worth in excess of US\$ 2 Million USD. But to ensure sustainable growth the project focused on ensuring product quality and market maturity. Norms for importing SWHs were adopted and a testing laboratory was built. The testing laboratory has a complete facility for testing flat plate collectors, and LCEC is currently in search of funding to complete the testing facility so it can accommodate for all types of collectors.

It is with no doubt that the GSWH initiative was a game changer in the SWH market in Lebanon. The actions taken by and throughout the initiative has led to a major rise in the market, quantified according to the UNEP SWH Techscope tool by a rise from 2.31/5 to 3.62/5. This rise has put the market among the top 10 attractive solar water heaters market in the world.

The success of the GSWH initiative was a result of a collaborative approach brining in together the different stakeholders and decision makers and making them part of the solution to boost the market. The flow that this initiative took with close stakeholders' involvement was key. From barrier identification, to strategic planning, to lessons learned dissemination, this all played a vital role in achieving the targets and moving towards as sustainable market growth.

By the end of the project life, and according to the end-of-project market assessment research performed, the current growth values indicate that the market will be able to reach that target 2 years ahead of the set year.

To build up on this impressive experience, the following key lessons are to be noted:

■ **Lesson 1: Market Assessment is Essential**

Start with a market assessment, evaluate with another, and end with the last one. Each market is unique and has its specific conditions, which makes it essential to have something concrete to build a strategy on. The market assessment needs to be thoroughly done to involve different types of users, stakeholders, and decision makers. This is the foundation of the market development plan.

■ **Lesson 2: Collaborative Approach is Key**

Involving the different stakeholders from the beginning is a major step towards effective planning, but what is more important is properly allocating the stakeholders and identifying them properly. A stakeholder is any entity, body, or individual who is affected by the market development you are targeting whether directly or indirectly. These are the key players who will later decide on the success or failure of your initiative.

■ **Lesson 3: A Pilot Project is Worth a Thousand Words**

Pilot projects are an essential point to start with. They have a number of benefits and serve the market in different means. Pilot projects play a critical role in building local capacity and creating a pool of technically capable experts and companies that are soon to become key players in the project development.

Pilot projects also are your best marketing tool, success stories travel fastest, and trust in the local market is only built when real life experiences are witnessed.

Lesson 4: Proper Outreach Makes the Difference

Spread it, don't hide it. Everyone should know about SWH and what it has to offer. Innovative methods helped in achieving a better outreach and affect a larger number of audience. This is where the government and the public authorities could play a major role through securing marketing platforms and methods that reach highest number of public.

It is essential to note here that marketing without establishing quality assurance tools and methods could lead to market deterioration. That is a point that should be properly tackled.

Lesson 5: Set the Ground Rules before Unleashing the Dogs

As the market grows, companies will start to pop up, and products will start to massively flow in the country. With no proper quality control scheme, it would become difficult to maintain a stable growth and keep up a good reputation.

It is essential that the planning authority, and before offering any attractive financing schemes or rebate programs, that it achieves clear and reasonable quality control scheme. This is mainly but not only related to products, there is more into this than that. Installers' certification and quality assurance are also vital.

Lesson 6: If You Don't Have SHAMCI, Create One

Be it SHAMCI, SolarKeymark, or any other similarly established quality control scheme, the role it plays in maintaining a sustainable market and building a robust quality control strategy. The role SHAMCI is expected to play in Lebanon is very critical in achieving a common, implementable, and reliable platform for quality assurance.

Being market-tailored and specially designed to the region, SHAMCI will avoid market pull-downs caused by applying other international standards to a market that doesn't share the same conditions and specifications as the mother region.

Lesson 7: Value the Impact of This Market

To be able to convince the public with the value of a SWH, the government has to know it for itself. It is essential to have a thorough valuation of the market and its impact on the national economy as well as the public benefit. Policy makers need to see the numbers, witness the impact, and believe in the cause. Nation-wide assessment of such an initiative helps creating acceptance and belief among policy and decision makers.

Lesson 8: Integrated Approach or Segregated Results

An integrated approach means designing the action plan with all actions to work together. It is senseless to design actions separately and think of one target group or scope of work separately. The approach has to integrate the various sectors, target groups, needs, and market gaps in a set of actions plan that work together and separately for a sustainably growing market.

These lessons are being shared to build upon in designing strategies, action plans, and market development roadmaps. With every new experience there are lessons learned, and every success was reached through obstacles. Courage, patience, and openness are doubtlessly key factors for the success and attainment of targets.

SWH TECHSCOPE THREE PHASES REPORTS GENERATED BY THE SWH TECHSCOPE ANALYSIS TOOL

The addendum contains Lebanon's score using the template developed by UNEP in the SWH Market Readiness Assessment. It should be noted that the slight difference in the total score between the template and the one reached in the case study is due to some parameters that cannot be modified. Those parameters are listed below:

PRE-GSWH PHASE

1a SWH Targets: the template only allows Yes/No answers. For Lebanon, the case study considered a half result, since Lebanon had by 2010 set renewable energy targets, but the detailed planning and execution started after 2011.

2d SWH Market Growth: the data source is based on LCEC and GSWH project market surveys

3b Access to Finance: the score of Lebanon did not change throughout the different periods under consideration in the report. The parameter values did change slightly, but the template values were not changed. The actual values for each period are shown in the report in Section 3.4.3.

4c Product Standards and Certification: a well-established infrastructure for product certification and standard adoption exists in Lebanon. The SWH laboratory was completed in 2010, and was the only missing part of this parameter. Lebanon's score was considered as 3 even though in the template it is fixed as 2.

Overall, the case study gives Lebanon a score of 2.26 while the template gives 2.33. The slight difference does not change Lebanon's market status.

MID-TERM

No change

POST GSWH

2d SWH Market Growth: the data source is based on LCEC and GSWH project market surveys

4d Installer Certification: Lebanon has developed an installer certification program and a vocational training course for SWH installers. The official adoption of the program is foreseen to occur for the next educational year. Accordingly, Lebanon's score was considered at 2.5, half of the score selected in the template that only allows Yes (5 points) or No (0 points) scenarios.

ADDENDUM I

TECHSCOPE TEMPLATE - PRE GSWH PROJECT

1 Parameter I: Solar Water Heating Support Framework

1a SWH Targets

Has the country established a solar thermal target?

1b Financial Incentives for System Installation

Does the country offer financial or fiscal incentives for SWH system installation? These may include, for example, direct cash payments (e.g. grants, rebates, performance-based incentives, and feed-in tariffs) or tax incentives (e.g. tax credits, income tax deductions, etc.)

1c SWH Loan Programs

Does the country offer loan policies or programs supporting SWH system installation, such as low-interest loan programs, interest rate buy-down programs, and loan loss reserves?

1d Building Mandates

Does the country require that solar heating (or renewable heating more broadly) be integrated into new construction and/or major renovations of buildings?

1e Outreach Campaigns

Are there any government-led or government-supported campaigns to raise awareness about solar heating in place?

2 Parameter II: National Conditions

2a Insolation

Data Description	Data Source	Unit	Value	Tier
Solar Insolation	Clean Energy Solutions Center's Global SE Opportunity Tool	Average Solar Resource (kWh/m ² /day)	5.0-5.5	6

Note: Enter data for most recent year available.

2b SWH Market Penetration

Data Description	Data Source	Unit	Value
SWH Market penetration per 1000 people	IEA Solar Heating & Cooling Programme Annual Report	kWh/1000 people	35.00

Note: Enter data for most recent year available.

2c Residential Energy Consumption Growth

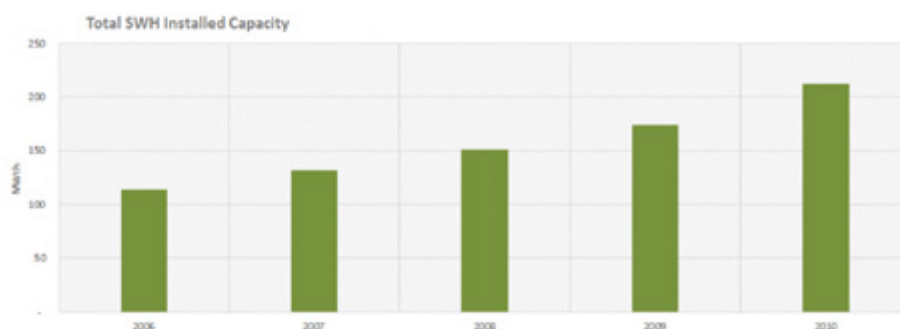
Data Description	Data Source	Unit	Value
Residential Energy Consumption Growth	(Calculated from "Country Data", Section 2a).	%/year	11.3%

Note: Based on data entered on "Country Data" sheet.

2d SWH Market Growth

Note: Data for the year of interest is published two years after the fact (e.g. 2007 data is in the 2009 report)

SWH installed capacity	Data Source	Unit	2005	2006	2007	2008	2009	2010
Total	IEA Solar Heating & Cooling Programme Annual Reports (2007-2013)	MWh	104	114	132	151	174	212
Annual market growth	(Calculated)	%		9.6%	15.8%	14.4%	15.2%	21.8%



Average Annual Market Growth
15%

2e SWH Competitiveness: Payback Period

Data Description	Data Source	Unit	Value
Payback period	(Calculated using RETScreen v4 and country-specific data)	Years	3.3

For RETScreen Input "Fuel Rate", use the following value:

\$ 0.10 Note: Data entry required on "Country Data" sheet, section 2b.

2f SWH Competitiveness: Heating Fuel Subsidies

Are subsidies available which reduce the price of conventional residential heating? ☒ Yes

3 Parameter III: Financing

3a Country Credit Rating

Data Description	Data Source	Value	Score
Moody's Credit Rating	Trading Economics	B, B1, B2, B3	0.5
S&P Credit Rating	Trading Economics	B, B-, CCC+	0.5
Average			0.5

3b Access to Finance

Data Description	Data Source	2010	2011	2012	Score
Domestic Credit Provided by the Banking Sector (% of GDP)	World Bank	173%	174%	176%	5
Real Interest Rate (%)	World Bank	8%	3%	2%	4
Average					4.5

4 Parameter IV: Business Climate

4a Doing Business Index

Data Description	Data Source	Ranking	Percentile
Doing Business Index	World Bank	113	38.9%

Note: Enter data for most recent year available.

4b Manufacturing Capacity

Data Description	Data Source	Value
MVA as percentage of GDP at constant 2005 prices in US\$	UNIDO	>4-8%

Note: Enter data for most recent year available.

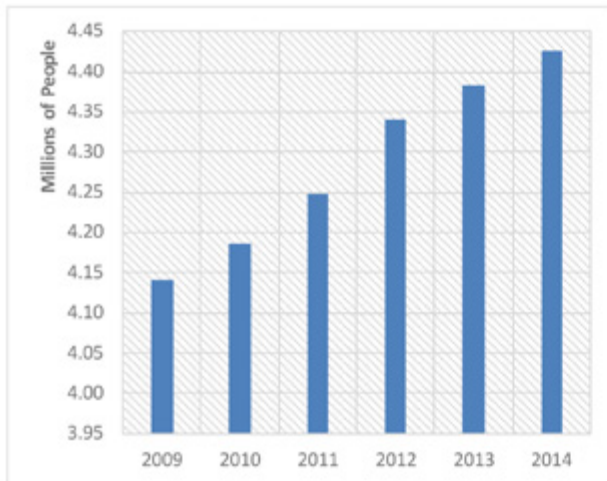
Parameter Weight	Indicator Weight	Indicator	Raw Score	Weighted Score
29%	5%	SWH Targets	5.0	0.25
	8%	Financial Incentives for System Installation	0.0	0.00
	7%	SWH Loan Programs	0.0	0.00
	5%	Building Mandates	0.0	0.00
	4%	Outreach Campaigns	5.0	0.20
30%	5%	Insolation	3.3	0.17
	4%	SWH Market Penetration	0.7	0.03
	5%	Residential Energy Consumption Growth	5.0	0.25
	4%	SWH Market Growth	5.0	0.20
	7%	SWH Competitiveness: Payback Period	4.0	0.28
	5%	SWH Competitiveness: Heating Fuel Subsidy	0.0	0.00
20%	5%	Country Credit Rating	0.5	0.03
	15%	Access to Finance	4.5	0.68
21%	5%	Doing Business Index	2.0	0.10
	3%	Manufacturing Capacity	2.0	0.06
	5%	Product Standards and Certification	2.0	0.10
	4%	Installer Certification	0.0	0.00
	4%	Industry Association	0.0	0.00

Overall
Score

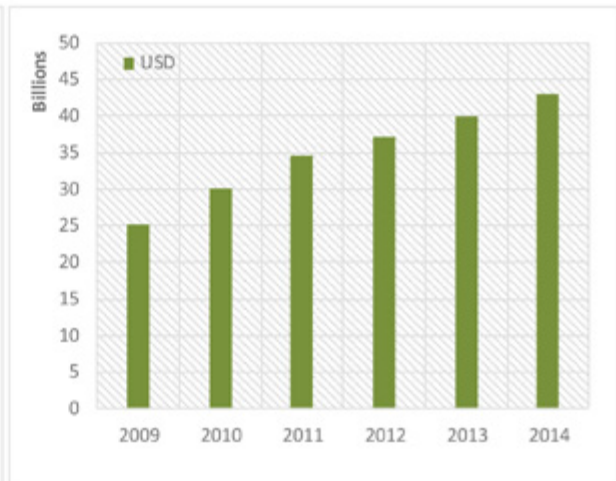
2.33

COUNTRY TRENDS

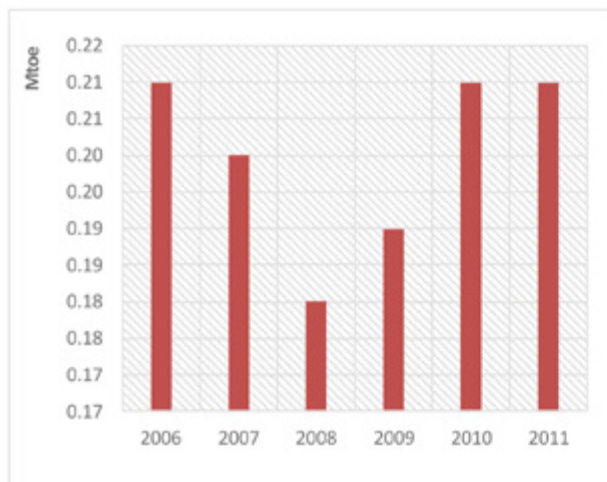
POPULATION



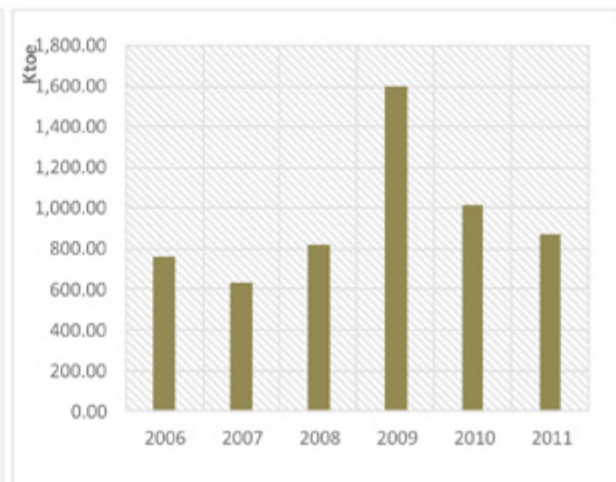
GDP



ENERGY PRODUCTION



RESIDENTIAL ENERGY CONSUMPTION



PRIMARY FUELS FOR RESIDENTIAL HEATING

SOLAR HOT WATER MARKET DATA

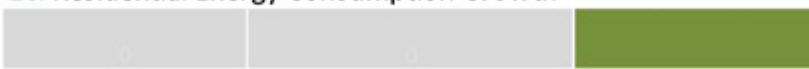
Parameter I: Solar Water Heating Support Framework

Score

☒	1a. SWH targets	5.0
☒	1b. Financial incentives for system installation	0.0
☒	1c. SWH loan programs for system installation	0.0
☒	1d. Required SWH for new construction and renovations	0.0
☒	1e. Government-sponsored awareness campaigns	5.0

Parameter II: National Conditions

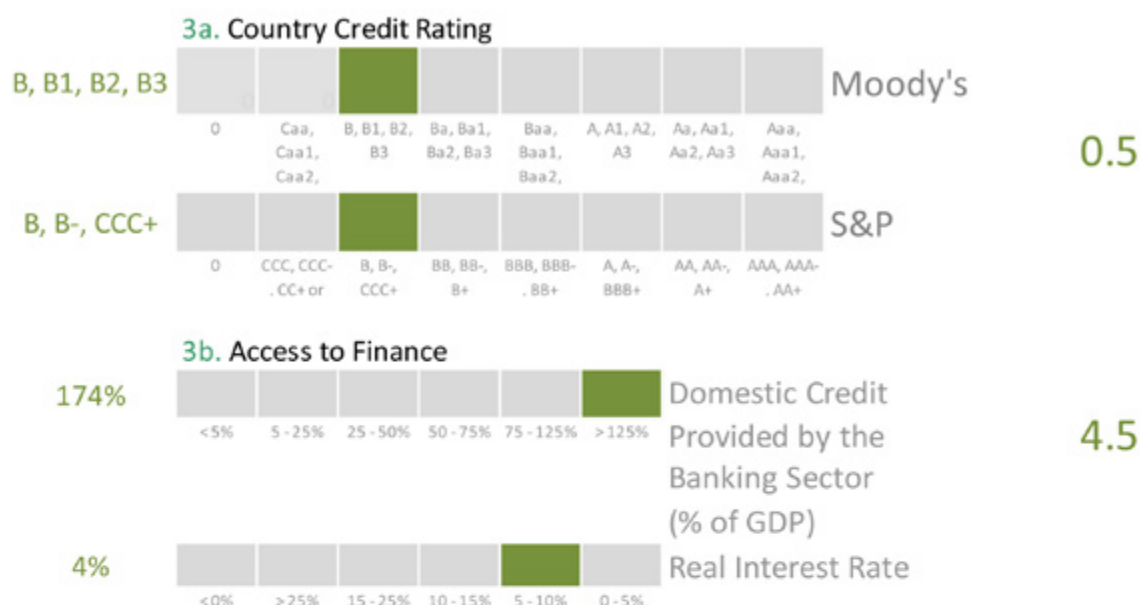
Score

2a. Insolation		
5.0-5.5		3.3
2b. SWH Market Penetration		
35		0.7
2c. Residential Energy Consumption Growth		
11.3%		5.0
2d. SWH Market Growth		
15.4%		5.0
2e. SWH Competitiveness: Payback Period		
3.3		4.0
☒	2f. SWH Competitiveness: Heating Fuel Subsidy	0.0

SOLAR HOT WATER MARKET DATA

Parameter III: Financing

Score



Parameter IV: Business Climate

Score



Assessment of Overall Strength of Market



Explanation of Scores

Score of 0-2: SWH enabling environment is “emerging” and could likely benefit from additional support to accelerate SWH market growth.

Score of 2-3: SWH enabling environment is “good” with a SWH market positioned for increased growth.

Score of 3-4: SWH enabling environments are considered to be “strong” and are likely ready to attract investment.

Score of 4-5: SWH conditions are “very strong” – policy, market, financial, business conditions are aligned to support SWH and market growth is likely to be rapid.

ADDENDUM II

TECHSCOPE TEMPLATE - MID-TERM GSWH PROJECT

1 Parameter I: Solar Water Heating Support Framework

1a SWH Targets

Has the country established a solar thermal target?

Yes

1b Financial Incentives for System Installation

Does the country offer financial or fiscal incentives for SWH system installation? These may include, for example, direct cash payments (e.g. grants, rebates, performance-based incentives, and feed-in tariffs) or tax incentives (e.g. tax credits, income tax deductions, etc.)

Yes

1c SWH Loan Programs

Does the country offer loan policies or programs supporting SWH system installation, such as low-interest loan programs, interest rate buy-down programs, and loan loss reserves?

Yes

1d Building Mandates

Does the country require that solar heating (or renewable heating more broadly) be integrated into new construction and/or major renovations of buildings?

Subnational

1e Outreach Campaigns

Are there any government-led or government-supported campaigns to raise awareness about solar heating in place?

Yes

2 Parameter II: National Conditions

2a Insolation

Data Description	Data Source	Unit	Value	Tier
Solar Insolation	Clean Energy Solutions Center's Global BE Opportunity Tool	Average Solar Resource (kWh/m ² /day)	5.0-5.5	6

Note: Enter data for most recent year available.

2b SWH Market Penetration

Data Description	Data Source	Unit	Value
SWH Market penetration per 1000 people	IEA Solar Heating & Cooling Programme Annual Report	kWh/1000 people	65.35

Note: Enter data for most recent year available.

2c Residential Energy Consumption Growth

Data Description	Data Source	Unit	Value
Residential Energy Consumption Growth	(Calculated from "Country Data", Section 2a)	%/year	11.3%

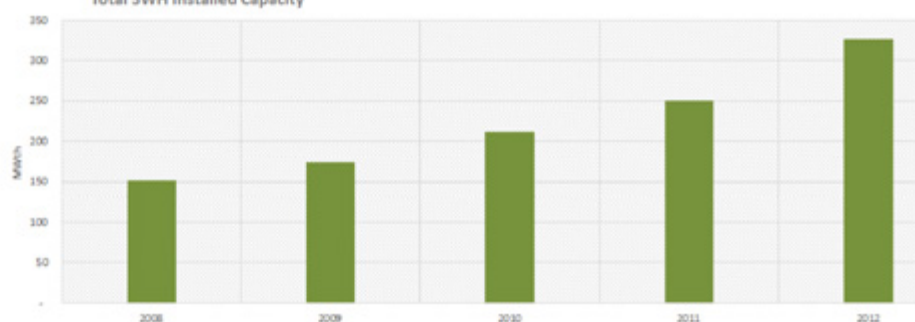
Note: Based on data entered on "Country Data" sheet.

2d SWH Market Growth

Note: Data for the year of interest is published two years after the fact (e.g. 2007 data is in the 2009 report)

SWH installed capacity	Data Source	Unit	2007	2008	2009	2010	2011	2012
Total	IEA Solar Heating & Cooling Programme Annual Reports (2007-2013)	MWth	132	151	174	212	250	327
Annual market growth	(Calculated)	%		14.4%	15.2%	21.8%	17.9%	30.8%

Total SWH Installed Capacity

Average Annual
Market Growth

20%

2e SWH Competitiveness: Payback Period

Data Description	Data Source	Unit	Value
Payback period	(Calculated using RETScreen v5 and country-specific data)	Years	3.3

For RETScreen Input "Fuel Rate", use the following value:

\$ 0.10 Note: Data entry required on "Country Data" sheet, section 2b.

2f SWH Competitiveness: Heating Fuel Subsidies

Are subsidies available which reduce the price of conventional residential heating? Yes

3 Parameter III: Financing

3a Country Credit Rating

Data Description	Data Source	Value	Score
Moody's Credit Rating	Trading Economics	B, B1, B2, B3	0.5
S&P Credit Rating	Trading Economics	B, B-, CCC+	0.5
Average			0.5

3b Access to Finance

4 Parameter IV: Business Climate

4a Doing Business Index

Data Description	Data Source	Ranking	Percentile
Doing Business Index	World Bank	102	44.9%

Note: Enter data for most recent year available.

4b Manufacturing Capacity

Data Description	Data Source	Value
MVA as percentage of GDP at constant 2005 prices in US\$	UNIDO	>8-12%

Note: Enter data for most recent year available.

4c Product Standards and Certification

What standards or certification infrastructure are currently in place? Please check all that apply.

- ☒ Existence of a national standards entity
- ☒ Solar thermal equipment standards exist
- ☒ Domestic solar thermal testing facilities are available
- ☒ Solar thermal product national certification has been introduced
- ☒ Solar thermal products regional or international certification is introduced

4d Installer Certification

Is there a national certification system in place for either individual installers or installation companies? No

4e Industry Association

Is there a solar thermal industry association? For the purpose of this analysis, we define an "active" industry association as one that represents a significant share of the solar thermal industry and is pursuing industry-defined objectives such as policy lobbying, capacity building and/or training. An active industry association could also include a renewable energy association that represents multiple renewable energy technologies.

No

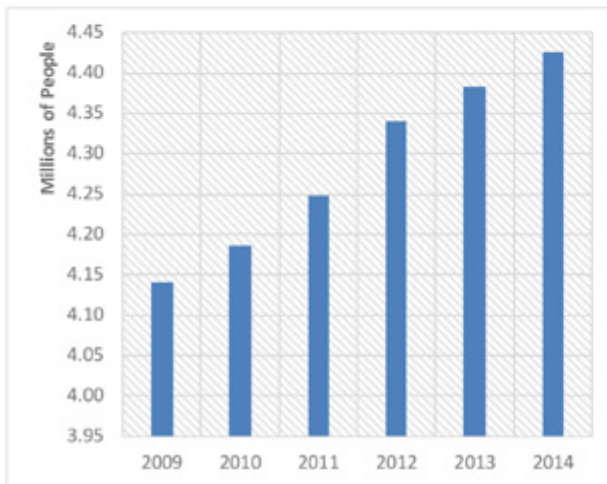
Parameter Weight	Indicator Weight	Indicator	Raw Score	Weighted Score
29%	5%	SWH Targets	5.0	0.25
	8%	Financial Incentives for System Installation	5.0	0.40
	7%	SWH Loan Programs	5.0	0.35
	5%	Building Mandates	2.5	0.13
	4%	Outreach Campaigns	5.0	0.20
30%	5%	Insolation	3.3	0.17
	4%	SWH Market Penetration	1.2	0.05
	5%	Residential Energy Consumption Growth	5.0	0.25
	4%	SWH Market Growth	5.0	0.20
	7%	SWH Competitiveness: Payback Period	4.0	0.28
	5%	SWH Competitiveness: Heating Fuel Subsidy	0.0	0.00
20%	5%	Country Credit Rating	0.5	0.03
	15%	Access to Finance	4.5	0.68
21%	5%	Doing Business Index	3.0	0.15
	3%	Manufacturing Capacity	3.0	0.09
	5%	Product Standards and Certification	5.0	0.25
	4%	Installer Certification	0.0	0.00
	4%	Industry Association	0.0	0.00

Overall
Score

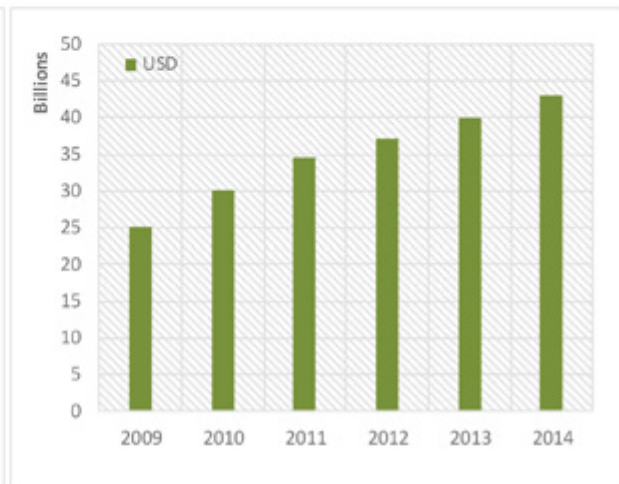
3.46

COUNTRY TRENDS

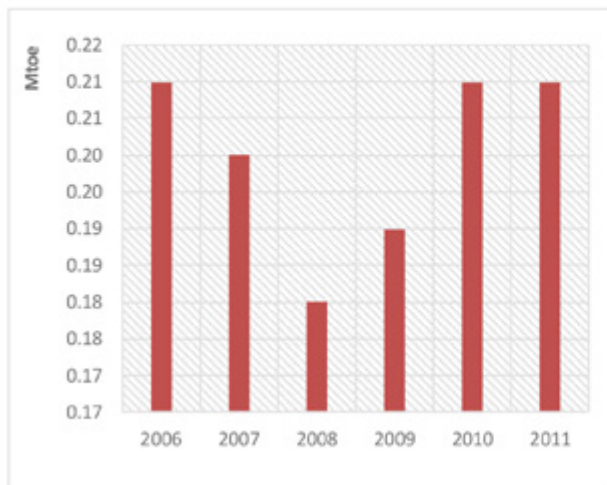
POPULATION



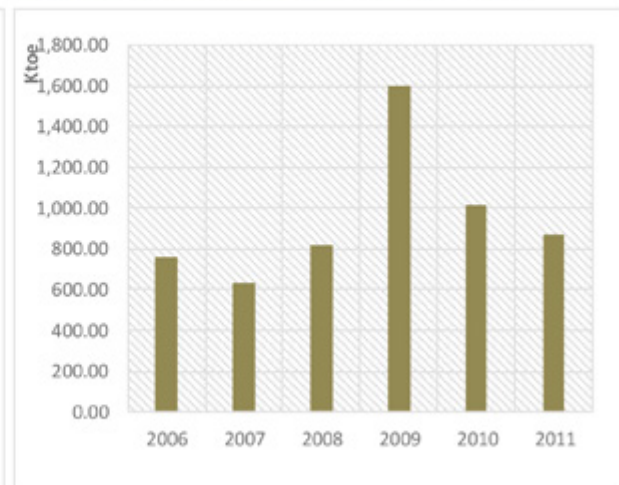
GDP



ENERGY PRODUCTION



RESIDENTIAL ENERGY CONSUMPTION



SUMMARY FIELD FOR RESIDENTIAL HEATING

SOLAR HOT WATER MARKET DATA

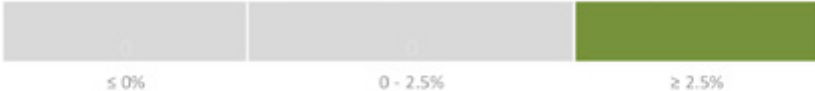
Parameter I: Solar Water Heating Support Framework

Score

☒	1a. SWH targets	5.0
☒	1b. Financial incentives for system installation	5.0
☒	1c. SWH loan programs for system installation	5.0
☒	1d. Required SWH for new construction and renovations	2.5
☒	1e. Government-sponsored awareness campaigns	5.0

Parameter II: National Conditions

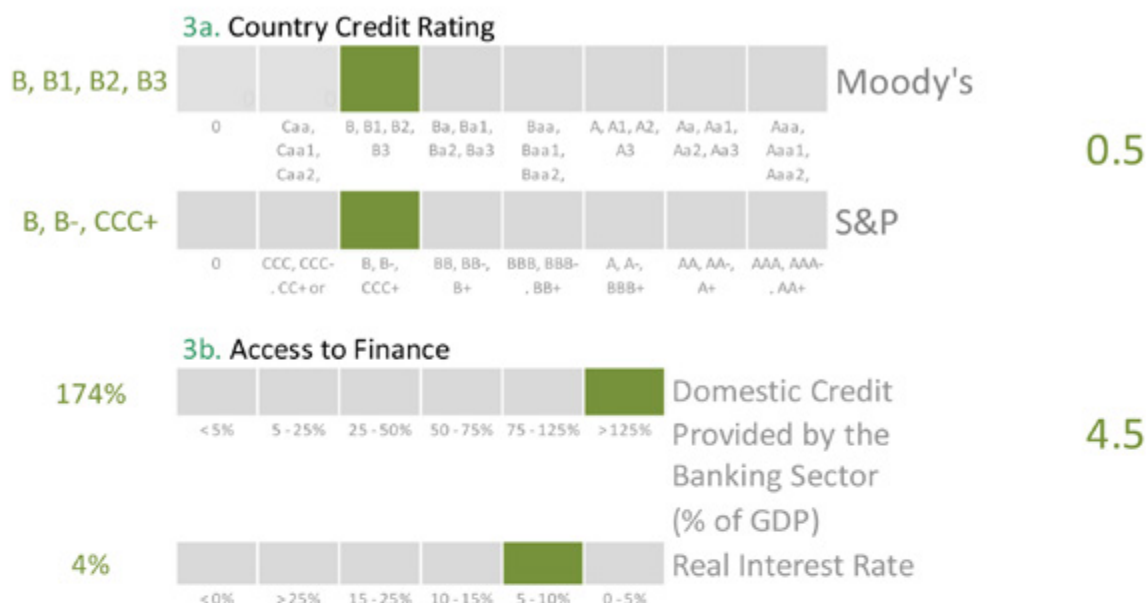
Score

2a. Insolation		
5.0-5.5		3.3
2b. SWH Market Penetration		
65		1.2
2c. Residential Energy Consumption Growth		
11.3%		5.0
2d. SWH Market Growth		
20.0%		5.0
2e. SWH Competitiveness: Payback Period		
3.3		4.0
☒	2f. SWH Competitiveness: Heating Fuel Subsidy	0.0

SOLAR HOT WATER MARKET DATA

Parameter III: Financing

Score



Parameter IV: Business Climate

Score



Assessment of Overall Strength of Market



Explanation of Scores

Score of 0-2: SWH enabling environment is “emerging” and could likely benefit from additional support to accelerate SWH market growth.

Score of 2-3: SWH enabling environment is “good” with a SWH market positioned for increased growth.

Score of 3-4: SWH enabling environments are considered to be “strong” and are likely ready to attract investment.

Score of 4-5: SWH conditions are “very strong” – policy, market, financial, business conditions are aligned to support SWH and market growth is likely to be rapid.

ADDENDUM III

TECHSCOPE TEMPLATE - POST GSWH PROJECT

1 Parameter I: Solar Water Heating Support Framework

1a SWH Targets

Has the country established a solar thermal target?

Yes

1b Financial Incentives for System Installation

Does the country offer financial or fiscal incentives for SWH system installation? These may include, for example, direct cash payments (e.g. grants, rebates, performance-based incentives, and feed-in tariffs) or tax incentives (e.g. tax credits, income tax deductions, etc.)

Yes

1c SWH Loan Programs

Does the country offer loan policies or programs supporting SWH system installation, such as low-interest loan programs, interest rate buy-down programs, and loan loss reserves?

Yes

1d Building Mandates

Does the country require that solar heating (or renewable heating more broadly) be integrated into new construction and/or major renovations of buildings?

Subnational

1e Outreach Campaigns

Are there any government-led or government-supported campaigns to raise awareness about solar heating in place?

Yes

2 Parameter II: National Conditions

2a Insolation

Data Description	Data Source	Unit	Value	Tier
Solar insolation	Clean Energy Solutions Center's Global RE Opportunity Tool	Average Solar Resource (kWh/m ² /day)	5.0-5.5	6

Note: Enter data for most recent year available.

2b SWH Market Penetration

Data Description	Data Source	Unit	Value
SWH Market penetration per 1000 people	IEA Solar Heating & Cooling Programme Annual Report	kWh/1000 people	65.55

Note: Enter data for most recent year available.

2c Residential Energy Consumption Growth

Data Description	Data Source	Unit	Value
Residential Energy Consumption Growth	(Calculated from "Country Data", Section 2a)	%/year	11.3%

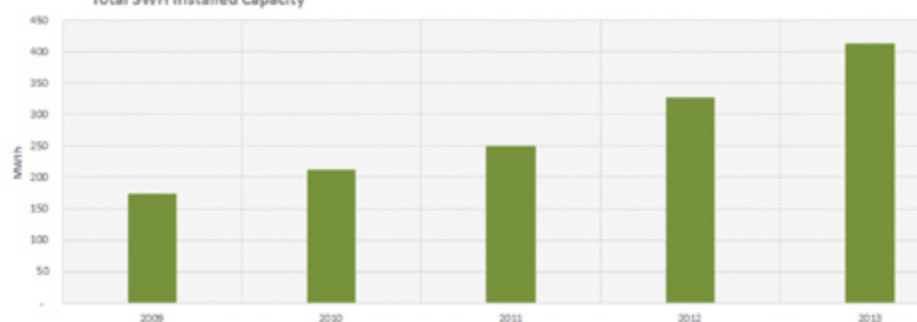
Note: Based on data entered on "Country Data" sheet.

2d SWH Market Growth

Note: Data for the year of interest is published two years after the fact (e.g. 2007 data is in the 2009 report)

SWH installed capacity	Data Source	Unit	2006	2009	2010	2011	2012	2013
Total	IEA Solar Heating & Cooling Programme Annual Reports (2007-2013)	MWth	151	174	212	250	327	415
Annual market								

Total SWH Installed Capacity

Average Annual
Market Growth

22%

2e SWH Competitiveness: Payback Period

Data Description	Data Source	Unit	Value
Payback period	(Calculated using RETScreen v4 and country-specific data)	Years	3.3

For RETScreen input "Fuel Rate", use the following value:

\$ 0.10 Note: Data entry required on "Country Data" sheet, section 2b.

2f SWH Competitiveness: Heating Fuel Subsidies

Are subsidies available which reduce the price of conventional residential heating? ☒ Yes

3 Parameter III: Financing

3a Country Credit Rating

Data Description	Data Source	Value	Score
Moody's Credit Rating	Trading Economics	B, B1, B2, B3	0.5
S&P Credit Rating	Trading Economics	B, B-, CCC+	0.5
Average			0.5

3b Access to Finance

Data Description	Data Source	2010	2011	2012	Score
Domestic Credit Provided by the Banking Sector (% of GDP)	World Bank	173%	174%	176%	5
Real Interest Rate (%)	World Bank	8%	3%	2%	4
Average					4.5

4 Parameter IV: Business Climate

4a Doing Business Index

Data Description	Data Source	Ranking	Percentile
Doing Business Index	World Bank	102	44.9%

Note: Enter data for most recent year available.

4b Manufacturing Capacity

Data Description	Data Source	Value
MVA as percentage of GDP at constant 2005 prices in US\$	UNIDO	>8-12%

Note: Enter data for most recent year available.

4c Product Standards and Certification

What standards or certification infrastructure are currently in place? Please check all that apply.

- ☒ Existence of a national standards entity
- ☒ Solar thermal equipment standards exist
- ☒ Domestic solar thermal testing facilities are available
- ☒ Solar thermal product national certification has been introduced
- ☒ Solar thermal products regional or international certification is introduced

4d Installer Certification

Is there a national certification system in place for either individual installers or installation companies? ☒ Yes

4e Industry Association

Is there a solar thermal industry association? For the purpose of this analysis, we define an "active" industry association as one that represents a significant share of the solar thermal industry and is pursuing industry-defined objectives such as policy lobbying, capacity building and/or training. An active industry association could also include a renewable energy association that represents multiple renewable energy technologies.

☐ No

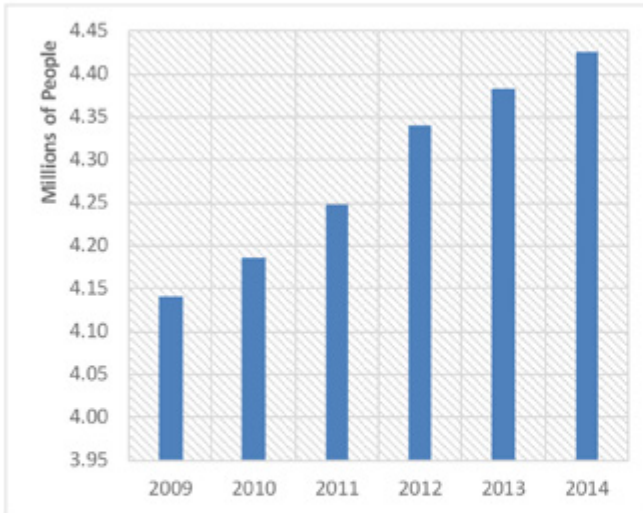
Parameter Weight	Indicator Weight	Indicator	Raw Score	Weighted Score
29%	5%	SWH Targets	5.0	0.25
	8%	Financial Incentives for System Installation	5.0	0.40
	7%	SWH Loan Programs	5.0	0.35
	5%	Building Mandates	2.5	0.13
	4%	Outreach Campaigns	5.0	0.20
30%	5%	Insolation	3.3	0.17
	4%	SWH Market Penetration	1.2	0.05
	5%	Residential Energy Consumption Growth	5.0	0.25
	4%	SWH Market Growth	5.0	0.20
	7%	SWH Competitiveness: Payback Period	4.0	0.28
	5%	SWH Competitiveness: Heating Fuel Subsidy	0.0	0.00
20%	5%	Country Credit Rating	0.5	0.03
	15%	Access to Finance	4.5	0.68
21%	5%	Doing Business Index	3.0	0.15
	3%	Manufacturing Capacity	3.0	0.09
	5%	Product Standards and Certification	5.0	0.25
	4%	Installer Certification	5.0	0.20
	4%	Industry Association	0.0	0.00

Overall
Score

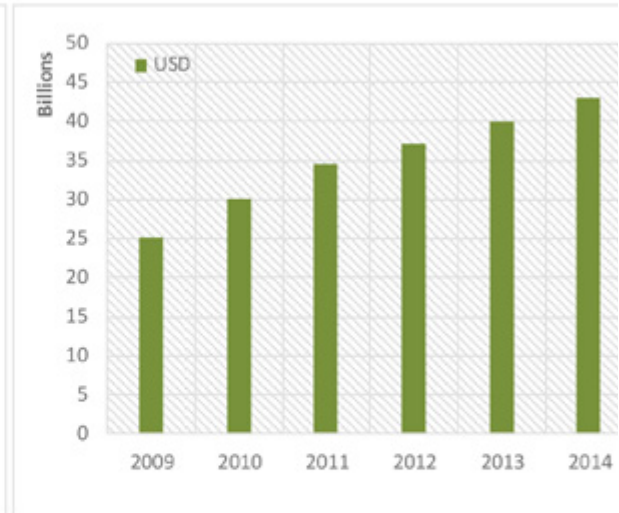
3.66

COUNTRY TRENDS

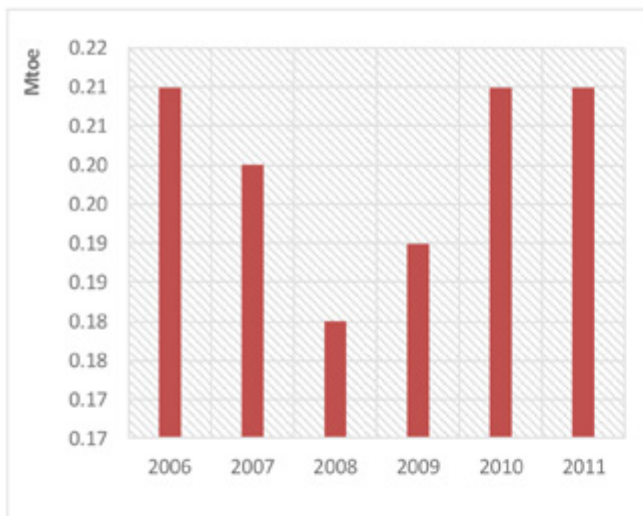
POPULATION



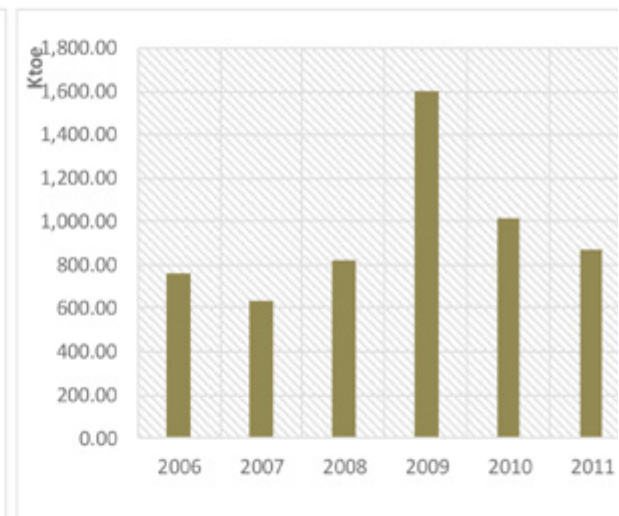
GDP



ENERGY PRODUCTION



RESIDENTIAL ENERGY CONSUMPTION



PRIMARY FUELS FOR RESIDENTIAL HEATING

Fuel	% of total	% of total	Average Retail Price (\$/kW)
Oil	0%		
Natural Gas	0%		
Electricity	0%		
Wood	0%		
Other	0%		

SOLAR HOT WATER MARKET DATA

Parameter I: Solar Water Heating Support Framework

Score

☒	1a. SWH targets	5.0
☒	1b. Financial incentives for system installation	5.0
☒	1c. SWH loan programs for system installation	5.0
☒	1d. Required SWH for new construction and renovations	2.5
☒	1e. Government-sponsored awareness campaigns	5.0

Parameter II: National Conditions

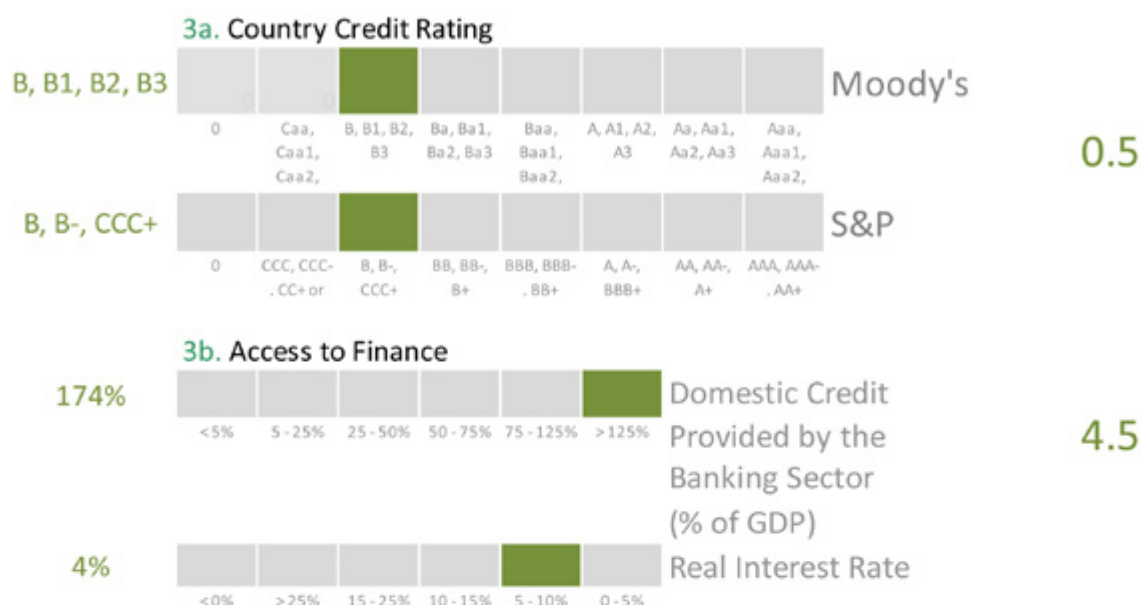
Score

2a. Insolation		
5.0-5.5	kWh/m²/day <2.5 2.5-3.0 3.0-3.5 3.5-4.0 4.0-4.5 4.5-5.0 5.0-5.5 5.5-6.0 6.0-6.5 6.5+	3.3
2b. SWH Market Penetration		
65	kWh/1000 people 0 100 200 300 400 500 600 Early Stage Mature Market Saturated Market	1.2
2c. Residential Energy Consumption Growth		
11.3%	%/yr ≤ 0% 0 - 2.5% ≥ 2.5%	5.0
2d. SWH Market Growth		
22.4%	%/yr < 0% 0 - 3% 3 - 6% 6 - 10% 10 - 15% ≥ 15%	5.0
2e. SWH Competitiveness: Payback Period		
3.3	Years ≤ 10 8 - 10 5 - 8 2 - 5 < 2	4.0
☒	2f. SWH Competitiveness: Heating Fuel Subsidy	0.0

SOLAR HOT WATER MARKET DATA

Parameter III: Financing

Score



Parameter IV: Business Climate

Score



Assessment of Overall Strength of Market



Explanation of Scores

Score of 0-2: SWH enabling environment is “emerging” and could likely benefit from additional support to accelerate SWH market growth.

Score of 2-3: SWH enabling environment is “good” with a SWH market positioned for increased growth.

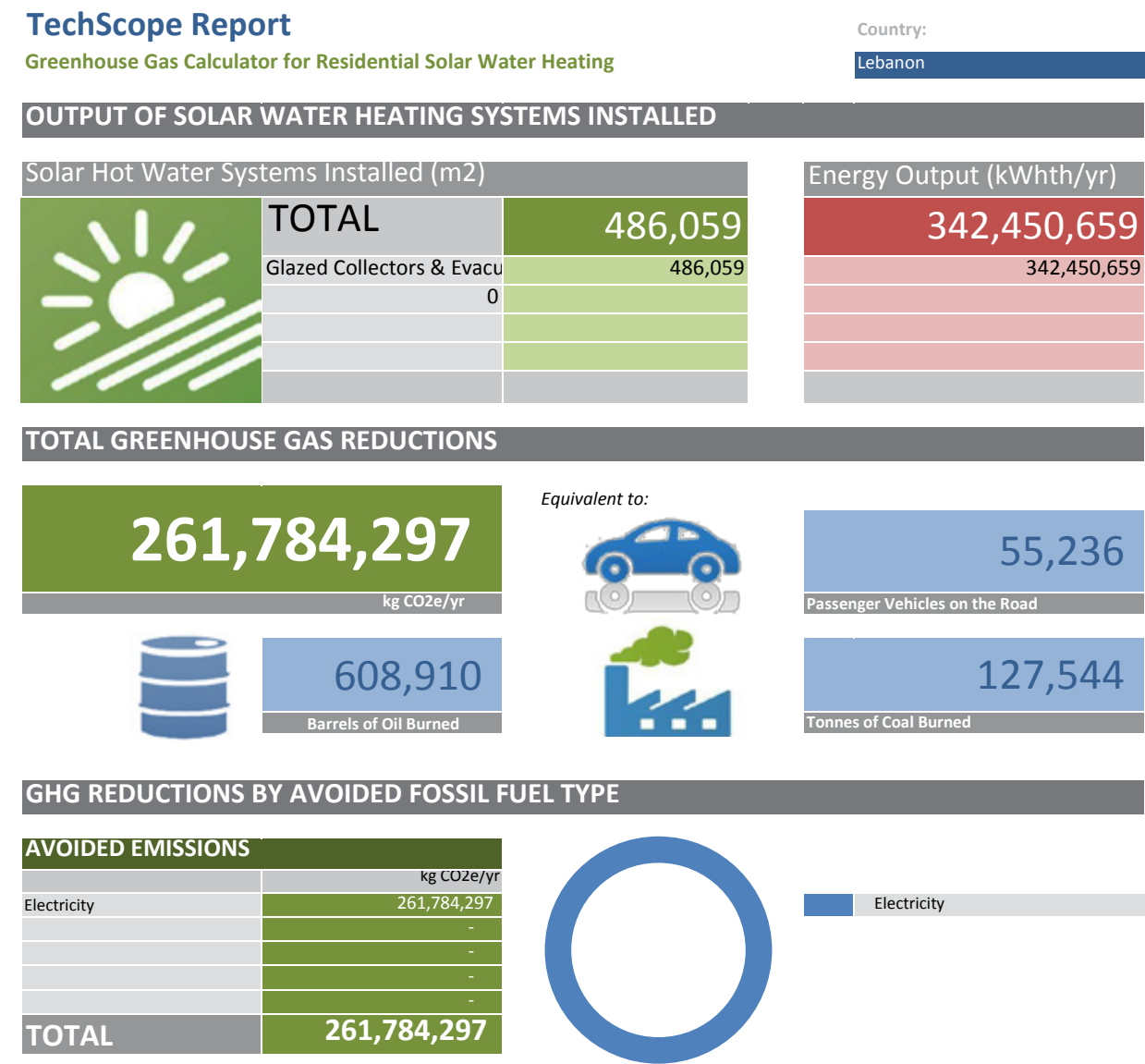
Score of 3-4: SWH enabling environments are considered to be “strong” and are likely ready to attract investment.

Score of 4-5: SWH conditions are “very strong” – policy, market, financial, business conditions are aligned to support SWH and market growth is likely to be rapid.

ADDENDUM VI

GHG AVOIDED DUE TO SWHS INSTALLATIONS

Business as usual 2020



Targeted 2020

TechScope Report

Greenhouse Gas Calculator for Residential Solar Water Heating

Country:

Lebanon

OUTPUT OF SOLAR WATER HEATING SYSTEMS INSTALLED

Solar Hot Water Systems Installed (m2)

	TOTAL	1,022,000
	Glazed Collectors & Evacu	1,022,000
	0	

Energy Output (kWhth/yr)

720,045,455
720,045,455

TOTAL GREENHOUSE GAS REDUCTIONS

550,434,312
kg CO2e/yr

Equivalent to:



116,142
Passenger Vehicles on the Road



1,280,310
Barrels of Oil Burned

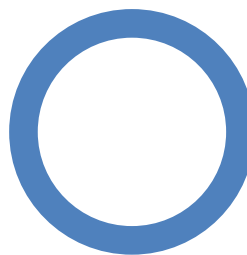


268,177
Tonnes of Coal Burned

GHG REDUCTIONS BY AVOIDED FOSSIL FUEL TYPE

AVOIDED EMISSIONS

	kg CO2e/yr
Electricity	550,434,312
	-
	-
	-
	-
TOTAL	550,434,312



Electricity

Achieved 2020

TechScope Report

Greenhouse Gas Calculator for Residential Solar Water Heating

Country:

Lebanon

OUTPUT OF SOLAR WATER HEATING SYSTEMS INSTALLED

Solar Hot Water Systems Installed (m2)

	TOTAL	1,366,000
	Glazed Collectors & Evacu	1,366,000
	0	

Energy Output (kWhth/yr)

962,409,091
962,409,091

TOTAL GREENHOUSE GAS REDUCTIONS

735,707,700
kg CO2e/yr

Equivalent to:



155,234
Passenger Vehicles on the Road



1,711,256
Barrels of Oil Burned

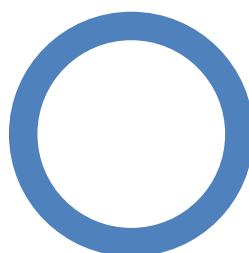


358,444
Tonnes of Coal Burned

GHG REDUCTIONS BY AVOIDED FOSSIL FUEL TYPE

AVOIDED EMISSIONS

	kg CO2e/yr
Electricity	735,707,700
	-
	-
	-
	-
TOTAL	735,707,700



Electricity

Business as usual 2014

TechScope Report

Greenhouse Gas Calculator for Residential Solar Water Heating

Country:

Lebanon

OUTPUT OF SOLAR WATER HEATING SYSTEMS INSTALLED

Solar Hot Water Systems Installed (m2)

	TOTAL	265,135
	Glazed Collectors & Evacu	265,135
	0	

Energy Output (kWhth/yr)

186,799,659
186,799,659

TOTAL GREENHOUSE GAS REDUCTIONS

142,797,849
kg CO2e/yr

Equivalent to:



30,130
Passenger Vehicles on the Road



332,148
Barrels of Oil Burned

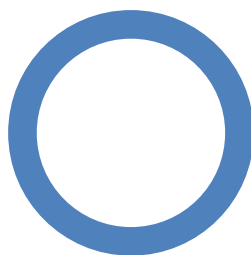


69,572
Tonnes of Coal Burned

GHG REDUCTIONS BY AVOIDED FOSSIL FUEL TYPE

AVOIDED EMISSIONS

	kg CO2e/yr
Electricity	142,797,849
	-
	-
	-
TOTAL	142,797,849



Electricity

Targeted 2014

TechScope Report

Greenhouse Gas Calculator for Residential Solar Water Heating

Country:

Lebanon

OUTPUT OF SOLAR WATER HEATING SYSTEMS INSTALLED

Solar Hot Water Systems Installed (m2)

	TOTAL	350,000
	Glazed Collectors & Evacu	350,000
	0	

Energy Output (kWhth/yr)

246,590,909
246,590,909

TOTAL GREENHOUSE GAS REDUCTIONS

188,504,901
kg CO2e/yr

Equivalent to:



39,775
Passenger Vehicles on the Road



438,462
Barrels of Oil Burned

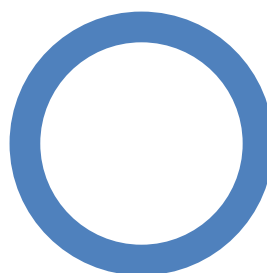


91,841
Tonnes of Coal Burned

GHG REDUCTIONS BY AVOIDED FOSSIL FUEL TYPE

AVOIDED EMISSIONS

	kg CO2e/yr
Electricity	188,504,901
	-
	-
	-
	-
TOTAL	188,504,901



Electricity

Achieved 2014

TechScope Report

Greenhouse Gas Calculator for Residential Solar Water Heating

Country:

Lebanon

OUTPUT OF SOLAR WATER HEATING SYSTEMS INSTALLED

Solar Hot Water Systems Installed (m2)

	TOTAL	533,000
	Glazed Collectors & Evacu	533,000
	0	

Energy Output (kWhth/yr)

375,522,727
375,522,727

TOTAL GREENHOUSE GAS REDUCTIONS

287,066,035
kg CO2e/yr

Equivalent to:



60,571
Passenger Vehicles on the Road



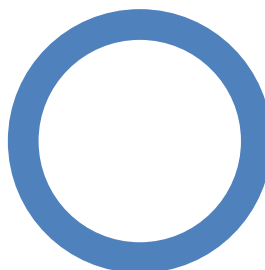
667,716
Barrels of Oil Burned

139,861
Tonnes of Coal Burned

GHG REDUCTIONS BY AVOIDED FOSSIL FUEL TYPE

AVOIDED EMISSIONS

	kg CO2e/yr
Electricity	287,066,035
	-
	-
	-
	-
TOTAL	287,066,035



Electricity

TechScope Report

Greenhouse Gas Calculator for Residential Solar Water Heating

Country:

Lebanon

OUTPUT OF SOLAR WATER HEATING SYSTEMS INSTALLED

Solar Hot Water Systems Installed (m2)

	TOTAL	160,000
	Glazed Collectors & Evacu	160,000
	0	

Energy Output (kWhth/yr)

112,727,273
112,727,273

TOTAL GREENHOUSE GAS REDUCTIONS

86,173,669
kg CO2e/yr

Equivalent to:



18,183
Passenger Vehicles on the Road



200,440
Barrels of Oil Burned

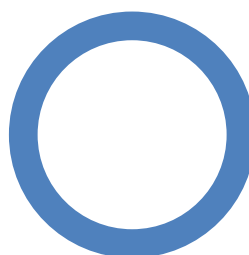


41,985
Tonnes of Coal Burned

GHG REDUCTIONS BY AVOIDED FOSSIL FUEL TYPE

AVOIDED EMISSIONS

	kg CO2e/yr
Electricity	86,173,669
	-
	-
	-
	-
TOTAL	86,173,669

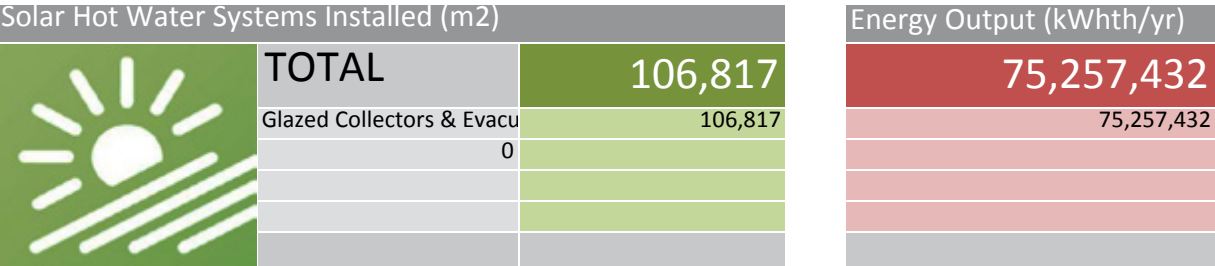


Electricity

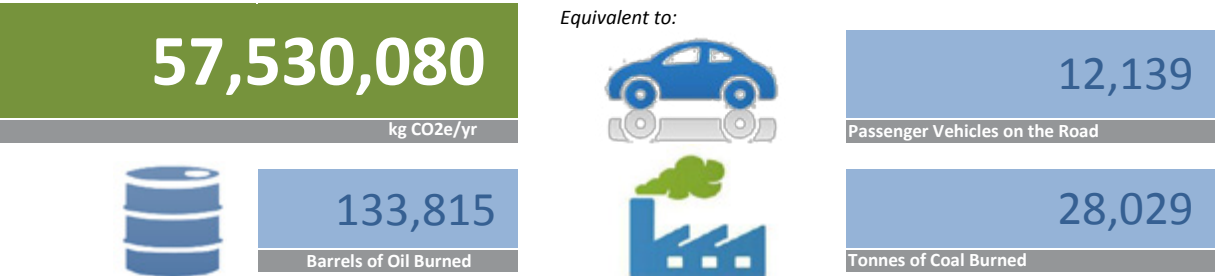
TechScope Report
Greenhouse Gas Calculator for Residential Solar Water Heating

Country:
Lebanon

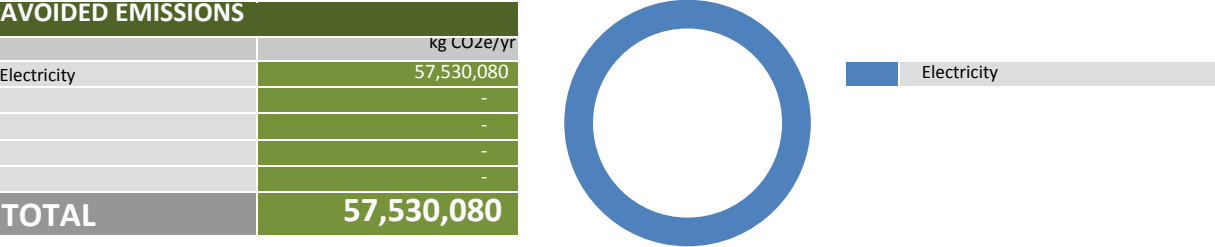
OUTPUT OF SOLAR WATER HEATING SYSTEMS INSTALLED



TOTAL GREENHOUSE GAS REDUCTIONS



GHG REDUCTIONS BY AVOIDED FOSSIL FUEL TYPE



Energy Branch

**Division of Technology, Industry and
Economics**

**United Nations Environment
Programme**

15, rue de Milan
F-75441 . Paris CEDEX 09, France
Tel.: +33 1 44 37 14 50
Fax: +33 1 44 37 14 74
Email: unep.tie@unep.org
www.unep.org/energy

www.unep.org

United Nations Environment Programme
P.O. Box 30552 Nairobi, Kenya
Tel.: ++254-(0)20-62 1234
Fax: ++254-(0)20-62 3927
E-mail: cpinfo@unep.org



Back in 2009, the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP) launched a joint programme entitled “Global Solar Water Heating Market Transformation and Strengthening Initiative” (GSWH) with funding from the Global Environment Facility (GEF).

The GSWH initiative supported Solar Water Heating (SWH) national market development in five countries including Lebanon. At that time, the market for solar water heaters in Lebanon was developing at a very slow pace due to many market barriers.

This initiative has set a target of 190,000 square meters of new solar panels installations over a period of 5 years (2009-2014), but this target was already exceeded by the end of 2014. And now, Lebanon is considered among the top 10 markets for solar water heaters in the world, and this is according to the International Energy Agency (IEA).

This report, which was prepared in its first version in February 2015 and then reviewed and updated in October 2015, evaluates the solar water heaters market development and emissions estimation in Lebanon using the UNEP’s TechScope SWH Market Readiness Assessment systematic Methodology and Analysis Tool, and presents a comprehensive case study based on the successful implementation of a national initiative for SWH market development. Also, it provides the lessons learnt and best practices in order to initiate the interest, of other developing countries and countries in the Arab region, to start implementing a similar SWH national initiative.