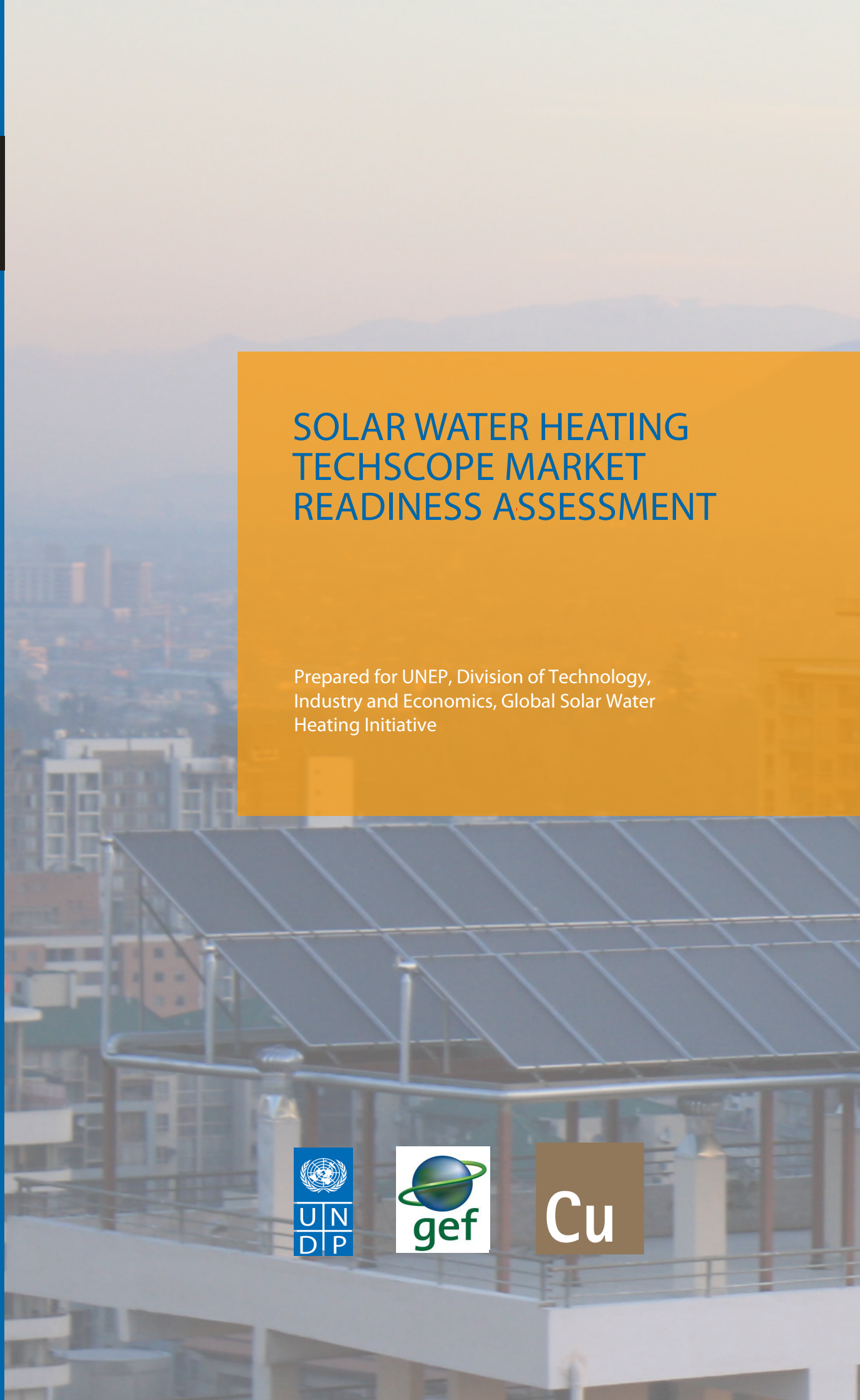

UNEP

SOLAR WATER HEATING TECHSCOPE MARKET READINESS ASSESSMENT

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

UNDP

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United Nations Environment Programme

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ACKNOWLEDGEMENTS

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EXECUTIVE SUMMARY

This report presents a replicable and public methodology to evaluate the solar water heating policy, finance and investment, business, and quality control infrastructure across countries: the *SWH TechScope Market Readiness Assessment methodology*. This report is intended by be used in concert with an Excel-based evaluation tool, the *SWH TechScope Market Readiness Analysis Tool*, which can be used to benchmark and evaluate different SWH markets. The SWH TechScope was developed as part of the Global Solar Water Heating (GSWH) Market Transformation and Strengthening Initiative.

The SWH TechScope Market Readiness Assessment methodology uses a system of weighted indicators to develop a score for national SWH enabling environments. The indicator system development was supported by a network of international SWH and renewable energy experts. The scoring system consists of four interrelated parameters:

- SWH Support Framework, which includes government policies, regulations, and outreach efforts
- National Conditions, which include climactic and market factors
- Financing, which considers access to capital and macroeconomic conditions
- Business Climate, which takes into account the ease of doing business and SWH business infrastructure.

These four parameters are composed of 18 indicators that reflect different elements of the enabling environment for SWH in a given country. Each of the indicators is scored based on a scale of 0 to 5. These indicators are then weighted to develop an overall score for the country – again based on a scale of 0 to 5. The overall national scores can be interpreted as follows:

- 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, and business conditions are aligned to support SWH and market growth is likely to be rapid.

A summary of each of the parameters and indicators, and their respective weights can be found in Table 1 of this report. The methodology for each of the indicators is explained in detail in this report and is mirrored in the Market Readiness Analysis Tool. The GSWH initiative supported SWH development in five countries: Albania, Chile, India, Lebanon and Mexico. The report contains an analysis of each of these countries' SWH enabling environment using the Market Readiness Assessment methodology.

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BACKGROUND ON THE SWH TECHSCOPE MARKET READINESS ASSESSMENT

1.1 INTRODUCTION

The Global Solar Water Heating (GSWH) Market Transformation and Strengthening Initiative ("the GSWH project") is a joint initiative undertaking by the United Nations Environment Programme (UNEP) and the United Nations development Programme (UNDP) and is funded by the Global Environmental Facility (GEF). The objective of the GSWH project is to develop, strengthen and accelerate the growth of the solar water heating (SWH) sector. UNEP's Division of Technology, Industry and Economics is leading the knowledge management component of the project, while UNDP is the main implementing agency. A detailed description of the GSWH project and its components, as well as experiences with the five GSWH project countries, can be found in Annex II of this report.

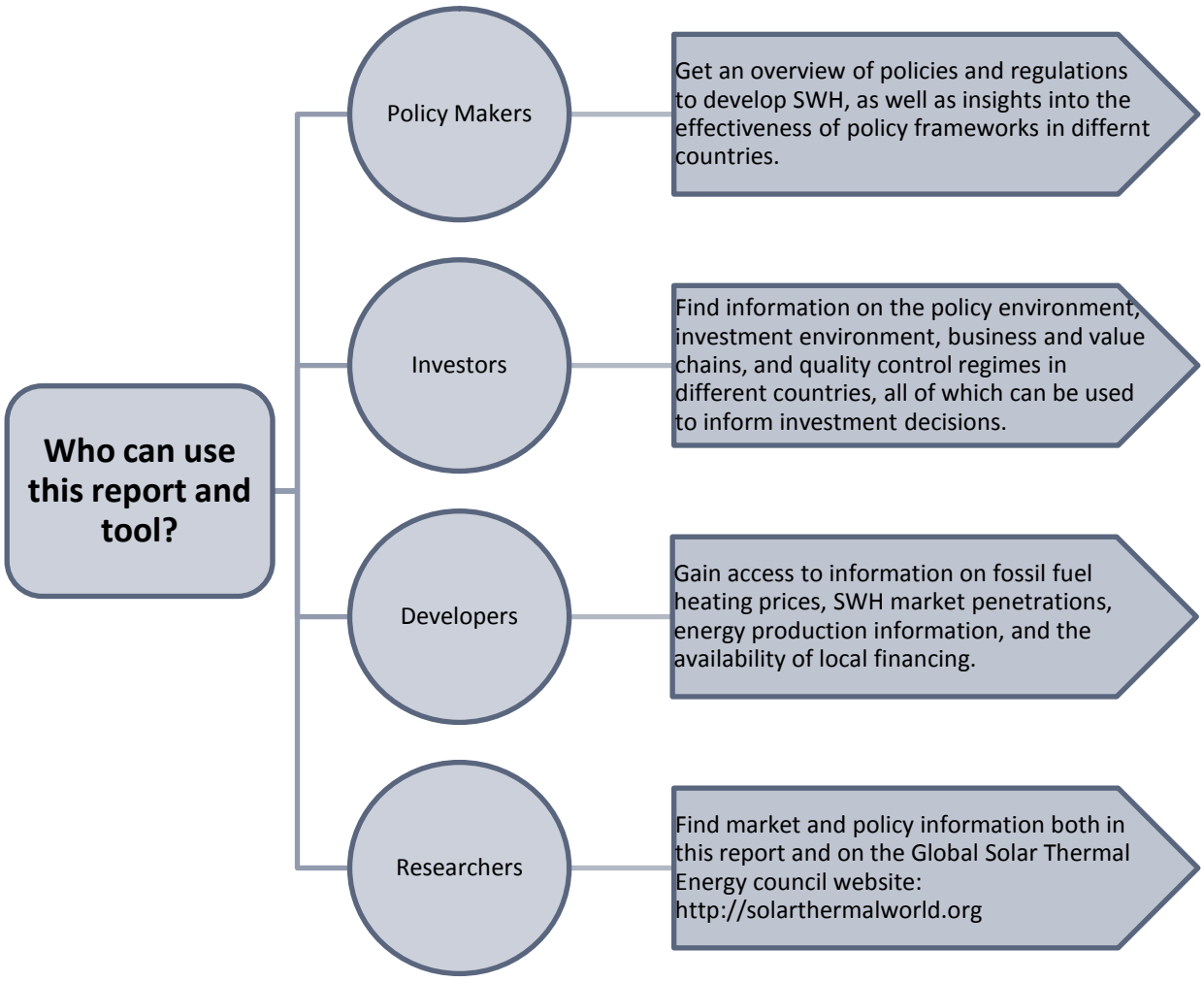
Together with a network of global and regional partners, UNEP's knowledge management initiative facilitates timely, coordinated and professional backstopping for country-specific SWH activities by analyzing and disseminating information on the lessons learnt and best practices to encourage SWH market transformation across countries globally. In support of this initiative, UNEP has identified a need for a replicable and public methodology to evaluate the SWH policy, finance and investment, business, and quality control infrastructure across countries. While several methodologies are available that analyze renewable energy markets or specific SWH market segments, no methodologies are publicly available that provide a high-level evaluation of national market development opportunities for SWH. The SWH TechScope seeks to fill this gap by providing stakeholders with a ***Market Readiness Assessment*** methodology (contained in this report) and a ***Market Readiness Analysis Tool***, which can be used to benchmark and evaluate different SWH markets.

The SWH TechScope Market Readiness Assessment Report and Analysis Tool aim to improve the understanding of the opportunities and challenges related to developing vibrant SWH markets. Policy makers can use the SWH TechScope to benchmark current county achievements against specific objectives, compare achievements against other countries, and set future SWH market and policy goals.

The SWH TechScope Market Readiness Assessment provides a detailed explanation of the assessment methodology, and serves as the instruction manual for the Market Readiness Analysis Tool. The associated Tool allows interested user to input the relevant data for a specific country and receive a score. In order to demonstrate how assessments can be conducted, this report also profiles five countries that received support under the GSWH project ("the five GSWH project countries") —Albania, Chile, Lebanon, India and Mexico—and summarizes their experiences in establishing and growing a vibrant SWH market. The experiences and the best practices that emerge can be used to support decision-makers' efforts to create nationally appropriate policies to scale up SWH markets.

1.2 HOW IS THE SOLAR WATER HEATING TECHSCOPE REPORT AND ANAYSIS TOOL RELEVANT TO YOU?

The SWH TechScope Report and Analysis Tool are intended to be useful to a range of different stakeholders as depicted in the graphic below:



The Analysis Tool can be used to benchmark the current status of different countries' SWH markets in a standard manner. The Analysis Tool can also be used to evaluate SWH support programs by comparing the scores from both before and after program implementation.

1.3 OVERVIEW OF THE SWH TECHSCOPE MARKET READINESS ASSESSMENT METHODOLOGY

The assessment methodology presented in this section was designed based on in-depth research on international solar thermal markets and policy development, as well as a review of the experiences and outcomes of the five GSWH project countries. The methodology was also guided by resources such as the OECD *Handbook on Constructing Composite Indicators* (Hoffman et al., 2008) and was benchmarked against the methodologies used in other recent sustainable energy indicator analyses (Bloomberg New Energy Finance, 2012; Mani, 2012; Myrsalieva & Samborsky, 2013; Samborsky et al., 2013). The assessment methodology was reviewed and informed by an Advisory Committee that consists of international solar heating industry and policy experts. It should be noted that the Market Readiness Assessment focuses on domestic SWH systems, which comprise the vast majority of installed solar heating and cooling capacity.

The TechScope methodology focuses on four interrelated parameters:

I SWH Support Framework: Government policies, regulations, and engagement programs have played an important role in scaling up many of the world's leading solar heating markets. For the purposes of developing the score, the support framework includes SWH targets, financial incentives, loan programs, building mandates, and outreach campaigns.

II National Conditions: The relevant national conditions include the incoming solar radiation (i.e. insolation), SWH penetration and market growth, energy demand trends, and the competitiveness of SWH compared to other heating fuels.

III Financing: Financing takes into account national macroeconomic conditions, as well as data on access to loans and the cost of financing.

IV Business Climate: The business climate is assessed by examining the ease of doing business, the existence of SWH quality standards, and the presence of associations that support SWH.

These four parameters are composed of 18 indicators that reflect different elements of the enabling environment for SWH in a given country (Table 1). Figure 1 shows the weighting of the parameters.

Figure 1: Parameter Elements

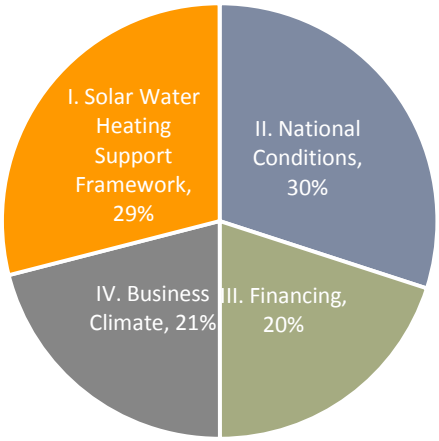


Table 1: Overview of SWH TechScope Market Readiness Analysis Tool Weights for Parameters and Indicators

Parameter	Parameter Weight of Total Score	Indicator	Indicator Weight (as a %) 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 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%

The indicators selected for the Readiness Assessment draw primarily from publicly available datasets that include data for a wide range of countries. However, there may be cases when data is unavailable for a particular country. In these situations, users of the Analysis Tool *may use alternative or proxy data sources. The primary data sources for each indicator are detailed in the Section 2 of this report. Hyperlinks to the data sources for each indicator are also embedded in* the Analysis Tool.

1.3.1 SCORING

Together, these indicators and their corresponding parameters can be used to construct a "snapshot" of a particular country's SWH market. Based on this assessment, each country is provided an overall score on a scale of 0 to 5. A higher score reflects the fact that there is significant policy, financial, and industry infrastructure in place within the country to support and enable SWH deployment. A lower score reflects the fact that some of the "building blocks" for a robust solar heating market may not be in place. It is important to note that the score is static and does not capture progress that a country has made in strengthening its enabling environment. Ideally, the Analysis Tool could be used to assess a country both before and after a significant effort to strengthen a country's SWH enabling environment in order to track improvement.

The SWH TechScope Market Readiness Analysis Tool assigns the following broad labels for 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 the 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, and business conditions are aligned to support SWH and market growth is likely to be rapid.

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 definitive and stand-alone comparison on its own.

Each country receives a score for the different indicators, which are then multiplied by their individual weights and summed to provide the score for the different parameters. The parameter scores are then summed to provide the overall score for the specific country. Table 1 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.

1.3.2 PARAMETER AND INDICATOR WEIGHT

The parameters and Indicators were weighted using the following process:

The parameters and indicators were weighted using the *budget allocation process* outlined in the *OECD Handbook on Constructing Composite Indicators*. A network of international experts was asked to provide input on the relative weights that should be assigned to each parameter and each indicator.

The *budget allocation process* was conducted in three-steps. First, the international experts were asked to assign weights to the four parameters, using a budget of 100 points. The parameters were weighted, based on the experts' judgment, according to their relative importance to enabling environment for SWH. Second, the experts weighted the individual indicators. Third, the experts' assessment of indicators and parameters were analyzed in aggregate order to inform the development of the final weights.

1.4 SWH TECHSCOPE MARKET READINESS ASSESSMENT REPORT STRUCTURE

This remainder of this report is structured as follows:

- Section 2 provides a detailed description of the Market Readiness Assessment methodology and serves as a technical guide for the accompanying Analytical Tool. Section 2 summarizes each parameter and indicator, and describes the formula used to calculate the scores.
- Section 3 applies the Market Readiness Assessment to the five GSWH project countries. The section summarizes the SWH market in each country, as well as the factors that contribute to score.
- Section 4 contains a brief conclusion.
- Annex I summarizes the scores for the five GSWH project countries.
- Annex II summarizes experiences to date from UNDP-GEF efforts in the five GSWH project countries.

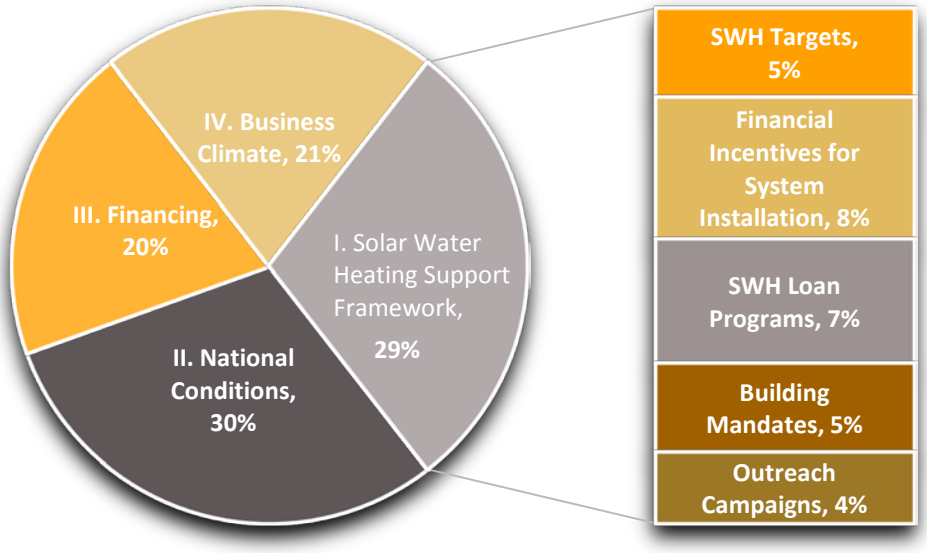
SECTION 2
SWH TECHSCOPE MARKET READINESS ASSESSMENT METHODOLOGY

2.1 INTRODUCTION

This Section introduces the SWH TechScope Market Readiness Assessment methodology and provides a detailed overview of each parameter and indicator. This Section serves as the guidance document for the SWH TechScope Market Readiness Analysis Tool and should be read in parallel with the corresponding spreadsheets within the Analysis Tool in order to provide context. Additional instructions for operating the Analysis Tool (e.g. what to put in each cell and where to find datasets) are embedded in the Analysis Tool itself.

2.2 PARAMETER I: SWH SUPPORT FRAMEWORK

Figure 2: Parameter I Elements



The SWH Support Framework parameter has a weight of 29% (Table 2) and is based on five indicators as can be seen in the graphic above. This is one of the highest weights given to a parameter in the Market Readiness Assessment methodology, which reflects the importance of targeted policy, regulations, and programs in supporting the development of the SWH market.

Government policies, regulations, and outreach programs have played an important role in scaling up national solar heating and cooling markets. The broad range of policy types currently in use, however, can make categorization and evaluation challenging. In order to develop a scoring system for the SWH support framework, a survey of global solar heating and cooling policies, regulations, and other supporting programs was conducted and benchmarked against the findings of recent studies (Egger et al., 2010; Epp, 2013; ESTIF, 2012c; Langniss et al., 2007).[1] The support frameworks of the five GSWH project countries were also researched in detail and compared with international practice. Policies and programs were then grouped into broad and representative categories which formed the basis for the scoring system (Table 2).

[1] The GSWH project supported guidelines for SWH policy and framework conditions, which can be found online at: http://solarthermalworld.org/sites/gstec/files/policy_framework.pdf

Table 2: Scoring Formula for Parameter I

Parameter I	Parameter Weight (as a %) of Total Score	Indicator	Indicator Weight (as a %) of Total Score
Solar Water Heating Support Framework	29%	SWH Targets	5%
		Financial Incentives for System Installation	8%
		SWH Loans Programs	7%
		Building Mandates	5%
		Outreach Campaigns	4%

It is important to note that it is difficult to define universal "best practices" since what is best will vary from country to country based on national policy objectives and national conditions. What may be considered a best practice for a high-income country with low heating fuel costs, for example may vary from what would be considered a best practice for a low-income country with high heating fuel costs.

It is also important to acknowledge that the support framework score is not intended to capture or reflect the potential complexity and nuance of policy design. The scoring methodology is intentionally basic and does not take into account factors such as specific policy design, policy duration, or policy interaction. There are several criteria which can be used to conduct more specific analyses of renewable energy support frameworks (e.g. the Deutsche Bank TLC framework), but which are beyond the scope of this study (DBCCA, 2009; Hamilton, 2009; Osborn et al., 2005).

As discussed in Section 1.2, a low score should not be viewed as a value judgment. Instead, the score is meant to reveal a snapshot of the key elements of the support framework and highlight how they operate in parallel with other market and economic factors.

For the purposes of developing the score, five support framework indicators were selected and weighted (described below). In order to score the supportive framework, a binary approach is used. Each support framework element is scored individually. As can be seen in Table 3 below, a score of 0 indicates that the support framework element is not in place at the national level, whereas a score of five indicates that the support element is in place. The exception to this rule is that countries with subnational (e.g. state- or province-level) building mandates receive 2.5 points (e.g. half of the full score). This partial scoring reflects the fact that building code implementation may reside at the state, rather than the federal level, in some countries.

The support framework indicators include:

- SWH targets. The number of countries with quantitative targets for renewable energy has expanded dramatically around the world during the past several years (REN21, 2013). Quantitative targets can help unify government policy and can also increase investor certainty (DBCCA, 2011). For the Market Readiness Assessment, there must be a quantitative target specific to SWH that is formally adopted by the national government. India's target to install 20,000,000 m^2 of solar thermal by 2022, for example, scores a 5 (Section 3.3.1.1).
- Financial incentives for system installation. Financial and fiscal incentives for SWH are designed to improve the economic performance of systems by reducing system cost. Incentives are defined

here as direct cash payments (e.g. grants, rebates, performance-based incentives, and feed-in tariffs[2]) or tax incentives such as tax credits, income tax deductions, etc. Chile's tax credit for SWH installations, for example, scores a 5 (Section 3.2.1.2).[3]

- Solar loan programs. Government-supported loan programs can be designed to reduce the cost of capital for financing SWH systems, and to expand access to and availability of solar loans. Examples can include low-interest loan programs, interest rate buy-down programs, and loan loss reserves. Lebanon's SWH loan programs for residential and for commercial buildings, for example, score a 5 (Section 3.4.1.3).
- Building mandates. Building mandates require that solar heating (or renewable heating more broadly) be integrated into new construction and/or major renovations of buildings. Israel was the first country to introduce mandates at the national level. Several GSWH countries having building mandates at the national level (or will soon introduce building mandates). Several states in India and Mexico have building mandates that require installation of SWH systems in certain new and existing building types (Sections 3.3.1.4 and 3.5.1.4, respectively). In addition, with Albania's adoption of Law No. 138/2013 on Renewable Energy Sources, the county will be introducing a national level building mandates over the next 6 to 12 months (Section 3.1.1.4).
- Outreach campaigns. Government-led or government-supported campaigns to raise awareness about SWH can be an important complement to policies and regulations. Outreach and education campaigns can be designed to target a broad range of different constituencies and utilize different tools (e.g. social media) to encourage the purchase of SWH systems (ESTIF, 2012a).[4] Lebanon's innovative and government-supported SWH outreach campaign, for example, scores a 5 (Section 3.4.1.5).

Although these support framework elements are not inclusive of all policy, regulations, and programs, they were identified as the "cornerstone" support framework elements by the network of international experts that advised the SWH TechScope Market Readiness Assessment.

Table 3: Solar Heating Support Framework Parameter Score Rating

Indicator	Rating	Score
SWH Targets	Not in place	0
	In place at the national level	5
Financial Incentives for System Installation	Not in place	0
	In place at the national level	5
SWH Loan Programs	Not in place	0
	In place at the national level	5
Building Mandates	Not in place	0
	In place at the subnational level	2.5
	In place at the national level	5
Outreach Campaigns	Not in place	0
	In place at the national level	5

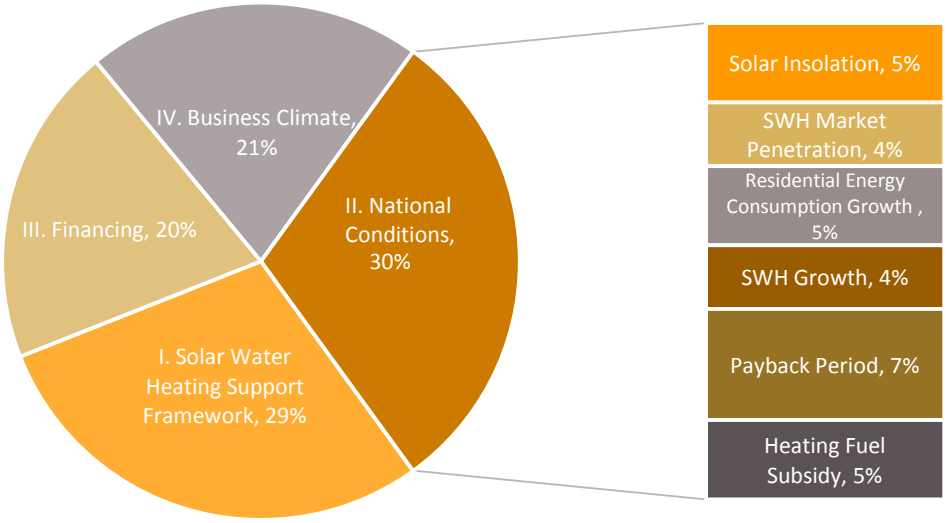
[2] Although feed-in tariffs are typically associated with electricity, some studies have characterized policies such as the UK's Renewable Heat Incentive as a feed-in tariff (FIT) for thermal energy, or have explored the development of renewable thermal FITs more generally (e.g. Nast et al., 2007).

[3] Policies that remove taxes imposed on solar heating systems by government (e.g. sales tax, excise tax, import duties, property tax, etc.) can be useful complementary measures, but typically do not have a significant impact on market development on their own and do not receive a score.

[4] The GSWH project supported the development of a guide for SWH awareness raising campaigns, which can be found online at: http://solarthermalworld.org/sites/gstec/files/awareness_raising.pdf

2.3 PARAMETER II: NATIONAL CONDITIONS

Figure 3: Parameter II Elements



Parameter II has a weight of 40% (**Table 4**) to reflect the fact the national conditions significantly impact SWH markets. Parameter II consists of six indicators as can be seen in the graphic above: national insolation, SWH penetration, energy consumption trends, SWH market trends, the competitiveness of SWH compared to other heating fuels, and the presence of energy subsidies.

Table 4: Parameter II – National Conditions

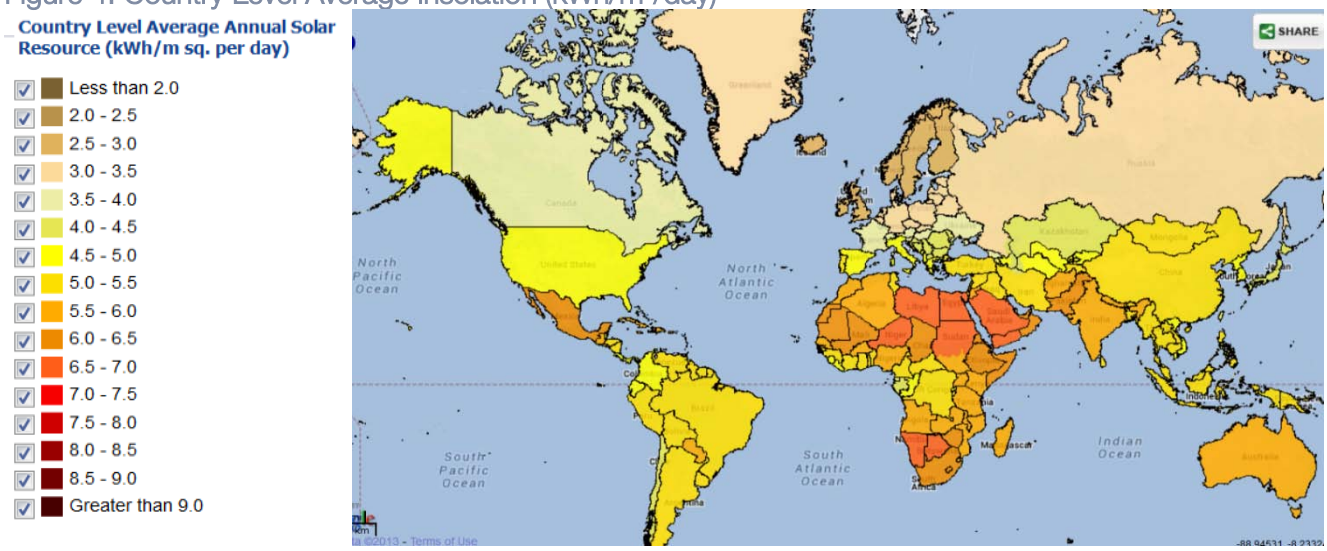
Parameter II	Parameter Weight (as a %) of Total Score	Indicator	Indicator Weight (as a %) of Total Score
National Conditions	30%	Insolation	5%
		SWH Market Penetration	4%
		Energy Consumption Growth	5%
		SWH Market Growth	4%
		Competitiveness: Payback Period	7%
		Competitiveness: Heating Fuel Subsidy	5%

2.3.1 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/m^2/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 1 below, the Global RE Opportunity Tool provides average insolation by country in sixteen tiers, for example, 3.5-4.0 kWh/m^2/day.

Figure 4: Country Level Average Insolation (kWh/m^2/day)



Source: Clean Energy Solutions Center (2014)

In order to score insolation, each tier is assigned a number, as can be seen in Table 5 below. 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 such as Norway, Sweden, and Iceland, whereas the upper bound corresponds to countries such as Libya, Niger, Saudi Arabia, and Sudan.

It should be noted that in some countries with high insolation (e.g. Persian Gulf states, Africa), climactic conditions, architecture, and energy use patterns may combine to heat the water supply even without solar thermal systems. Under such circumstances, other forms for solar thermal applications can be much more useful primarily in larger installations (e.g. commercial (hotels/guest houses, restaurants), institutional (hospitals, places of worship), and industry (process heat)) rather than in residential installations. The TechScope scoring system does not take the possibility of naturally overheated water into account but analysts should be cognizant of this possibility.

Table 5: Insolation Scoring

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

The score was then calculated based on a five point scale, with Tier 9 as an upper bound per the formula below. Using this scoring system, for example, Mexico would receive a score of 4.4 with its Tier 7 average insolation whereas Chile would receive a score of 2.2 based on its Tier 4 average insolation.

This indicator has a weight of 5% (Table 6).

Table 6: Solar Resource Indicator Score Rating and Weight

Solar Resource Tier for Country X	Score	Weight
Average solar resource X = Tier 1 to 9 per Table 5	(Tier X/9)*5	5%

2.3.2 SWH PENETRATION

Solar water penetration refers to the amount of solar systems that have been installed per capita. Countries with higher penetration levels are more likely to have well-established and structured solar heating industries with functional sales, distribution, installation, and service providers, whereas countries with lower penetration levels may have less established solar thermal industries. In order to develop the SWH penetration indicator:

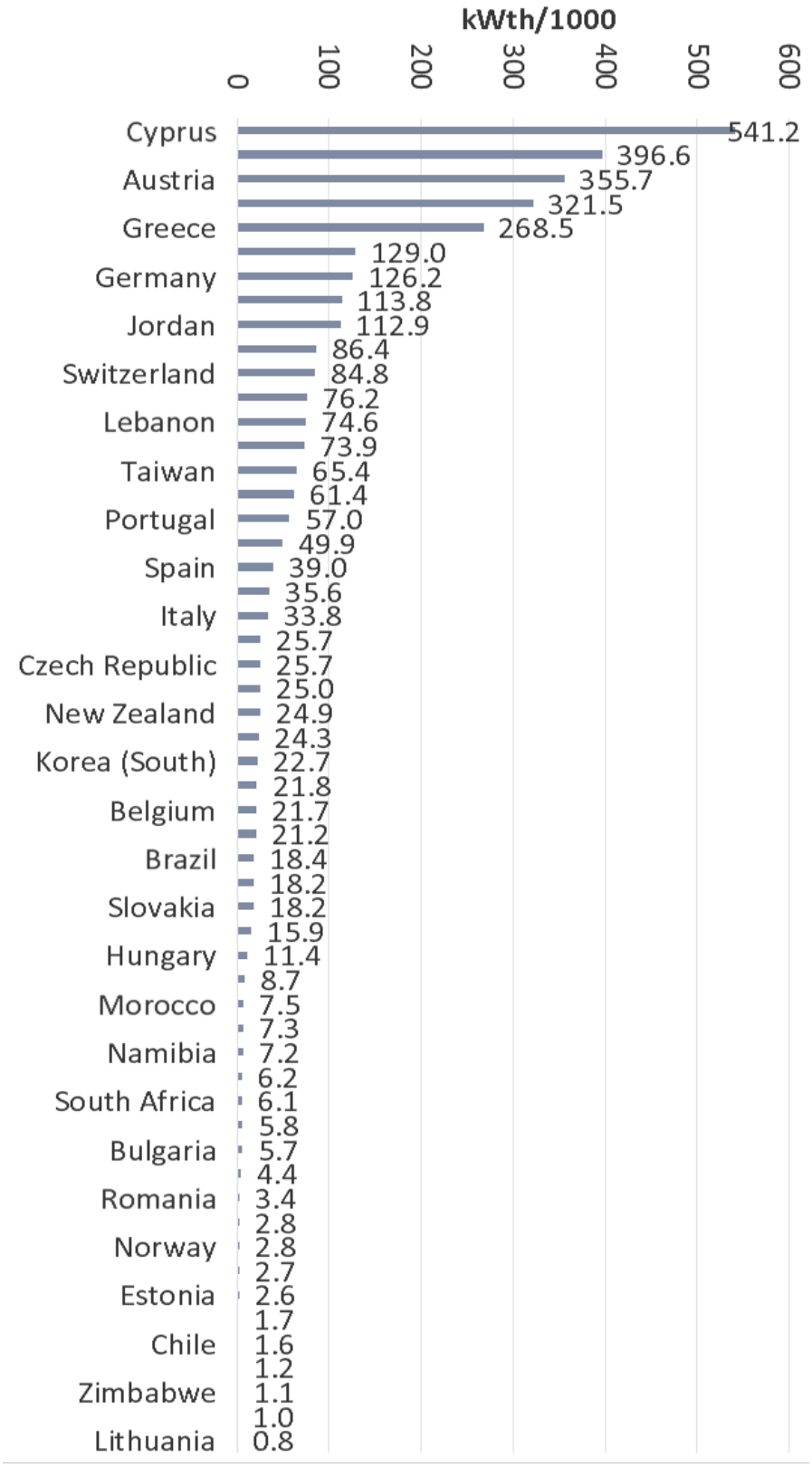
- National data from each of the GSWH project countries was gathered in terms of megawatts of installed thermal capacity (MW_{th}) as well as total m^2 of collector area. In order to be consistent with industry standards[5], installed capacity is reported in terms of MW_{th} and penetration is measured on a per capita basis.
- The scoring for SWH penetration uses the *global per capita rankings* of major markets as reported by the *IEA Solar Heating & Cooling Programme* (IEA SHC) (Figure 2) as a benchmark *(Weiss & Mauthner, 2013*). The upper end of the index is set to the penetration rate achieved by Greece. Although some countries have higher per capita levels than Greece, recent indices have classified Greece as a "mature" but growing market, whereas countries with higher penetrations such as Austria and Cyprus have begun to reach a point of saturation at which market growth is beginning to slow (Epp, 2011). Countries that would technically score above 5 in this category (e.g. Israel and Barbados) are scored as a five in the Market Readiness Assessment.
- This indicator has a weight of 4% (Table 7).

Table 7: SWH Market Penetration Indicator Scoring Methodology (MWth/1000 people)

Country X	Upper Bound (Greece)	Score	Indicator Weight (as a %) of Total Score
X kW_{th}/1000	268.2 kW_{th}	(x/268.2)*5	4%

[5] The International Energy Agency Solar Heating & Cooling Programme Task 43 has recommended that installed capacity be recorded in terms MW_{th}, rather than in square meters.

Figure 5: Total Capacity of Glazed Flat Plate and Evacuate Tube Collectors in Operation per 1,000 inhabitants by the end of 2011



2.3.3 ENERGY TRENDS

The market for solar water heating can be defined using a range of different indicators. For the purposes of the Market Readiness Assessment, two different indicators were selected: residential energy consumption growth and SWH market growth. Residential energy consumption trends were drawn from data contained on the IEA Statistics website.[6] Unless otherwise noted, SWH data was drawn from International Energy Agency Solar Heating & Cooling Programme reports. Table 8 contains the weights for these two indicators.

Table 8: Energy Trends Indicator Weight

Parameter II	Indicator	Indicator Weight (as a %) of Total Score
National Conditions	Residential energy consumption growth	5%
	SWH market growth	4%

2.3.3.1 Residential Energy Consumption Growth

Energy consumption can be viewed as both a negative or positive indicator, depending on stakeholder perspective. Increasing energy consumption in countries or regions that rely heavily on fossil fuels, for example, increases greenhouse gas emissions and air pollution. For the purposes of this study, however, energy consumption is viewed as a positive indicator for SWH development. From the perspective of solar water heating developers and industry stakeholders, expanding energy consumption can indicate a larger addressable market for SWH. For policymakers, expanding energy consumption may create additional motivation to build an enabling environment that is supportive of energy conservation measures to install additional square meters of SWH panels through national SWH programs.

- A range of different statistics from multiple sources was considered for energy consumption. These included historical and projected statistics for energy consumption overall (primary and final), by end user (e.g. residential, commercial and industrial), by country category (e.g. OECD and non-OECD), and historical and by fuel type (e.g. demand for "modern" energy vs. "traditional" biomass), etc. Ultimately, the IEA's statistics for residential energy consumption were selected as the basis for the indicator since SWH market growth tends to be heavily concentrated in the residential sector and because water and space heating comprise a large share of residential energy consumption in many countries where there are vibrant SWH markets.[7]
- To calculate a score, average residential energy consumption growth for the five year period from 2007-2011 is calculated for each country and benchmarked against international statistics (IEA, 2013c). During the past five years, residential energy consumption has grown at approximately 1.25% worldwide.[8] National growth rates vary widely, however, by country and by region. Some countries have experienced growth close to 0% whereas others have experienced growth at 5% or above. Looking ahead, it is projected that global residential consumption will grow at a rate of

[6] *See* http://www.iea.org/statistics/

[7] It is important to note that this indicator does not take into account factors such as energy access, energy poverty, etc. These factors are considered by indices such as the IEA's Energy Development Index (EDI) (IEA, 2013d), but are not explicitly taken into account as part of the TechScope.

[8] This rate includes biofuels and waste. The growth rate for "modern" fuels only (e.g. natural gas, electricity, and oil) is 1.22% and is not significantly different.

1.5% each year through 2040. Residential consumption in OECD countries is projected to grow only 0.4%, while consumption in non-OECD countries is projected to grow at a rate of 2.5% (US EIA, 2013). As can be seen in **Table 9**, a score of 5 is awarded to countries with residential energy consumption growth of 2.5% or above. Growth rate scores between 0% and 2.5% are calculated on a 5-point scale with 1.25% as the mid-point. Chile's 5-year average residential energy consumption growth of 2.4%, for example, would score 4.8.

- This indicator has a weight of **5%.**

Table 9: Growth in Residential Energy Consumption Score Rating

Formula	Growth in residential energy consumption	Score
(%Growth/2.5)*5	0% or below	0
	0%-2.5%	Scored on 5-point scale
	2.5% and above	5

Table 10: Growth in Residential Energy Consumption Score and Weight

Parameter II	Indicator	Indicator Weight (as a %) of Total Score
National Conditions	Solar Thermal Growth: Residential Energy Consumption Growth	5%

2.3.3.2 SWH Market Growth

During the past five years, the global SWH market (i.e. glazed and evacuated tube collectors) has grown at an average of 16% annually.[9] Five-year average growth is highly variable by country. Some established markets such as China and India have sustained high growth rates over the past five years (19% and 24%, respectively), despite having comparatively large markets. Other countries have seen comparatively slow growth. The SWH market in the US, for example, has only grown at an average of only 2% per year over the past five years.

The SWH growth score is based on the average growth rate of installed SWH capacity during the most recent five year period for which data is available (e.g. 2007-2011). **Table 12** details the tiering system that is used to score SWH growth. Albania's SWH 5-year average SWH market growth rate of 17%, for example, scores a 5. For many countries, annual SWH capacity data can be found in reports published by the IEA SHC.[10] In countries that are not covered by the IEA SHC, data may be gathered from industry associations or government entities (e.g. energy ministries or statistical agencies).

This indicator has a weigh of 4%.

[9] Global solar heating and cooling market growth, including glazed, unglazed, and evacuated water heating systems, as well as air heating systems, was only 13% during the same period.
[10] See, e.g. (Weiss et al., 2008; Weiss et al., 2009; Weiss & Mauthner, 2010, 2011, 2012, 2013)

Table 11: SWH Market Growth Indicator Score Rating

Parameter II	Indicator	Indicator Weight (as a %) of Total Score
National Conditions	Growth in SWH Market	4%

Table 12: Solar Water Heating Market Score Rating

Growth Rate	Score
-% to 0%	0
1% to 3%	1
4% to 6%	2
7% to 10%	3
11% to 14%	4
15% or greater	5

2.3.4 SOLAR THERMAL COMPETITIVENESS

Even if a country has not created a strong enabling environment for solar heating through policy, regulation, and outreach, it may still be possible for there to be strong SWH market growth if the economics are compelling (e.g. if the cost of heating fuel is high). For the purposes of the Market Readiness Assessment, solar heating competitiveness is measured based on (i) the payback of a typical SWH system offsetting the predominant heating fuel and (ii) the presence of energy subsidies, particularly heating energy subsidies (**Table 13**).

Table 13: Solar Thermal Competitiveness Indicator Weight

Parameter II	Indicator	Indicator Weight (as a %) of Total Score
National Conditions	Competitiveness: Payback Period	7%
	Competitiveness: Heating Fuel Subsidy	5%

2.3.4.1 SWH Competitiveness: Payback Period

High heating costs can be a positive factor for the development of SWH because they make solar water heating systems a more compelling investment. Several recent studies have concluded that SWH systems in some parts of the world can have levelized costs of energy (LCOEs)[11] that are an order of magnitude higher than the LCOEs in other parts of the world (e.g. 2-3 cents US¢/kWh vs. 20-30 US¢/kWh (Beerepoot, 2012; REN21, 2011). "Typical" SWH economic performance can be difficult to establish globally, and even within a specific country. It can also be difficult to identify what the "typical" fuel used for water heating is in a given country since energy end uses are sometimes not tracked at this level of granularity. For the sake of simplicity, the Market Readiness Assessment score is based on system payback – although there are tradeoffs between using payback and of other metrics, such as LCOE or internal rate of return (Gifford et al., 2011).

[11] LCOE is the constant unit cost (per kWh or MWh) of a payment stream that has the same present value as the total cost of building and operating a generating plant over its life.

When calculating competitiveness, analysts will likely also face a range of choices when defining the fuel against which SWH competes. Considerations may include:

- Different fuels. Countries may have markets for different heating fuels in different regions that will have different price points (e.g. countries with oil, electricity, and gas).
- Reliability concerns. Countries may have unreliable energy sources that drive consumers to install expensive back-up systems. In such cases, SWH could be analyzed as competing against the cost of running and maintaining a back-up system, instead of competing against the market price of fuel.
- Energy access. In some countries, the price of marketed fuels is a less relevant point of comparison for SWH because large portions of the population may lack basic energy access as a result of economic and/or infrastructure issues. In these circumstances, analysts will likely need to consider how to value non-marketed fuels (e.g. traditional biomass) and determine whether or not energy for hot water is considered a priority in areas without other energy services.

- Since a range of input data and assumptions for what is "typical" for a given country could be considered reasonable, this indicator has greater room for interpretation than other indicators.
- For the sake of illustration, the national examples in this report assume that SWH competes against the retail price of the predominant heating fuel, where such data is readily available. Where data on the specific heating fuel is not available, the retail price of the predominant fuel consumed at the residential level is used as a proxy. SWH cost data and heating fuel data were gathered for each country using published data, where available, supplemented by interviews with national experts.
- The data are then entered into the RETScreen 4 software suite in order to calculate simple payback. RETScreen 4 includes solar water heating analysis modules, as well as related case studies and training materials.[12]
- A tiered method is used for scoring the payback (Table 14). A simple payback above 12 years is scored with 0, whereas a simple payback of 2 years and below receives a score of 5. India's payback of 4.1 years, for example, scores a 4 (Section 3.3.2.5).

- This indicator has a weight of 7%.

Table 14: Payback Period Scoring Methodology

Payback	Score
> 12 years	0
10-12 years	1
8-10 years	2
5-8 years	3
2-5 years	4
<2 years	5

Table 15: Payback Period Indicator Weight

Parameter II	Indicator	Indicator Weight (as a %) of Total Score
National Conditions	Payback Period	7%

[12] *See,* http://www.retscreen.net/ang/g_solarw.php

2.3.4.2 SWH Competitiveness: Heating Fuel Subsidies

Many countries have some form of fossil fuel subsidies in place (Morgan, 2008). The IEA projects that fossil fuel subsidies could grow from $409 billion in 2010 to $660 billion by 2020 if reforms are not implemented (IEA, 2011).

- The issue of energy subsidies is closely related to the competitiveness of solar heating. Energy subsidies that suppress fuel prices (e.g. diesel fuel or electricity) are a negative factor for SWH development because there is less incentive for energy consumers to adopt solar.
- This study considers producer subsidies and consumer subsidies. On the producer side, subsidies include direct payments made by the government to energy producers. On the consumer side, subsidies are defined as broad based subsidies that all households receive regardless of fuel price fluctuations, income level, or energy consumption.[13]
- A binary method is used for scoring. If subsidies reduce the retail price of residential heating, then this receives a score of 0 (**Table 16**). When governments require utilities to sell electricity at rates below what it costs the utilities to generate and supply the electricity, for example, this would considered a subsidy. If the energy price is unsubsidized, then a score of 5 is awarded. In Lebanon, for example, the retail electricity rate is kept artificially below utilities costs and this subsidy results in a score of 0b (Section 3.5.2.6).
- This indicator has a weight of **5%.**

Table 16: Heating Fuel Subsidies Score Ranking

Heating Fuel Prices	Score
Subsidized	0
Unsubsidized	5

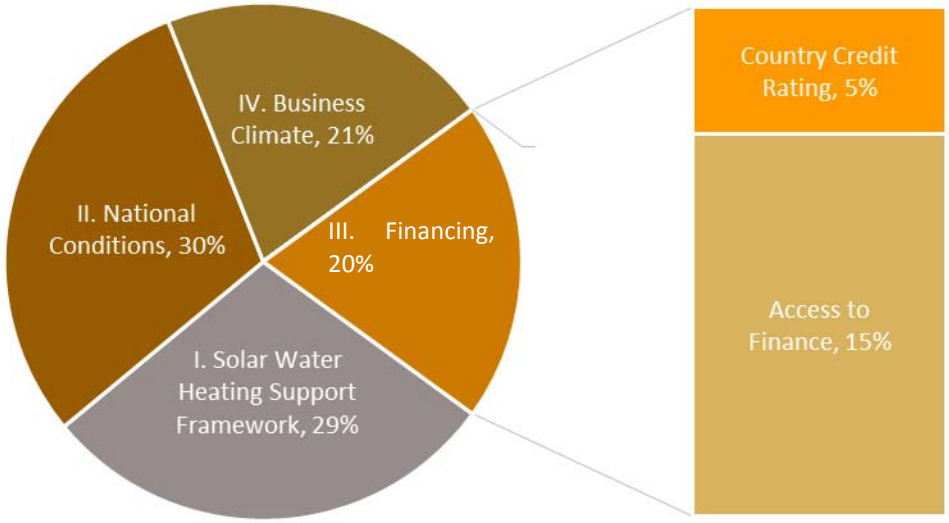
Table 17: Heating Fuel Subsidy Indicator Weight

Parameter II	Indicator	Indicator Weight (as a %) of Total Score
National Conditions	Heating Fuel Subsidy	5%

[13] The Market Readiness Assessment does not consider subsidies designed to protect low income groups from energy price increases as subsidies for the purposes for scoring, although the performance of such subsidies internationally has been mixed.

2.4 PARAMETER III: FINANCING

Figure 6: Parameter III Elements



The availability of financing and the cost of financing are important to the development of SWH markets in many countries. Since the Market Readiness Assessment methodology focuses on the domestic SWH market, Parameter III emphasizes financing at the residential/ household level rather than at the institutional, commercial and industrial levels. However, the methodology does incorporate national credit scores published by ratings agencies such as *Standards & Poor's* and *Moody's*. Parameter III has a weight of 20% towards the overall Market Readiness Assessment score (Table 18) and consists of two indicators as can be seen in the graphic above.

Table 18: Scoring Formula for Parameter III

Parameter III	Parameter Weight (as ha %) of Total Score	Indicator	Indicator Weight (as a %) of Total Score
Financing	20%	Country Credit Rating	5%
		Access to Finance	15%

2.4.1 COUNTRY CREDIT RATING

Credit ratings are an evaluation of the creditworthiness of an entity, such as a government or a corporation. The credit rating, which is assigned by credit rating agencies, reflects the ability of the entity to pay back debt and the likelihood that a loan will be defaulted on. Countries with lower scores may face restricted capital flows, which may constrain the ability of domestic banks to make loans.

- Table 19 provides a summary of the different credit ratings issued by Standard & Poor's (S&P) and Moody's, as well as their scoring.
- To calculate a score, a tiering approach is used. Each country received a score from 0-5 based on the credit rating. Higher credit ratings receive higher scores. Chile's AA- rating from Standard & Poor's and AA3 from Moody's, for example, scores a 4.
- The Country Credit Rating Indicator has a weight of 5% (Table 20).

Table 19: Moody's Ratings & Standard & Poor's Long-Term Debt Equivalents

Grade	Moody's	Standard & Poor's	Score
Investment Grade			
	Aaa, Aaa1, Aaa2, Aaa3	AAA, AAA-, AA+	5
	Aa, Aa1, Aa2, Aa3	AA, AA-, A+	4
	A, A1, A2, A3	A, A-, BBB+	3
	Baa, Baa1, Baa2, Baa3	BBB, BBB-, BB+	2
Speculative Grade			
	Ba, Ba1, Ba2, Ba3	BB, BB-, B+	1
	B, B1, B2, B3	B, B-, CCC+	0.5
	Caa, Caa1, Caa2, Caa3, or below	CCC, CCC-, CC+, or below	0

Table 20: Country Credit Rating Indicator Weight

Parameter III	Indicator	Indicator Weight (as a %) of Total Score
Financing	Country Credit Rating	5%

2.4.2 ACCESS TO FINANCE

The upfront cost of SWH systems may serve as a barrier to market growth in many countries. At the same time, the size of loans required by SWH systems may be too small to interest commercial lenders (i.e.: banks). From a financing perspective, access to consumer loans (i.e. small loans typically used for household purposes) can be a useful indicator for access to loan products that can be used to finance SWH systems. Measuring household access to finance across countries is challenging, however, due to differences not only in the relative availability of consumer loans, but also the relative "price" of credit. The *World Bank Development Indicators* include a number of factors which can be combined to create a proxy for consumer credit access.

For the purposes of the Market Readiness Assessment, credit access is estimated in two equally weighted dimensions: *availability of loans* and the *real interest rate* associated with banking sector borrowing. These two variables are closely interrelated. Low interest rates, for example, are less relevant if loans are unavailable. Similarly, availability of finance is less meaningful if the interest rates are prohibitively expensive.

2.4.2.1 Availability of Loans

For the SWH Market Readiness Assessment, availability of loans is measured by the World Bank indicator for *domestic credit provided by the banking sector within a country as a percentage of gross domestic product (GDP)*.[14] This indicator is a measure of banking sector depth and financial

[14] *See* http://data.worldbank.org/indicator/FS.AST.DOMS.GD.ZS. Domestic credit provided by the banking sector includes all credit to various sectors on a gross basis, with the exception of credit to the central government, which is net. The banking sector includes monetary authorities and deposit money banks, as well as other banking institutions where data are available (including institutions that do not accept transferable

sector development in terms of size. Expressing credit provision as a function of GDP scales the availability metric to expanding or contracting economic scenarios. The methodology assumes that, as the domestic credit provided by the banking sector as a percentage of gross domestic product (GDP) increases, so does the availability of loans. It is important to note that this measure also includes government and business loans and may therefore overstate credit availability to households.

2.4.2.2 Cost of Financing

In addition to loan availability, the relative pricing of loan products also contributes to the ability of consumers to finance assets. As a measure of the cost of financing, the SWH Market Readiness Assessment methodology utilizes the data set associated with the World Bank Development Indicator Real Interest Rate.[15] This data set adjusts nominal loan rates by the GDP deflator. The resulting values are a reasonable proxy for real pricing of loans in local terms. The methodology assumes a high interest rate would prevent individuals from accessing domestic loans.

2.4.2.3 Data Gathering and Calculation

The data gathering methodology is identical for the two measures. Each country must have consecutive data for the three most recent years (e.g. 2010-2012). The three year data for each country is then averaged. The data was then rank ordered and divided into deciles to facilitate comparison on a relative basis. The deciles are then scored from 0 to 5. In the case of loan availability, a 0 indicates low availability, while a 5 indicates high availability. For real interest rates, a 0 indicates a high interest rate and a 5 indicates a low interest rate. The scoring methods are shown below.

Table 21: Domestic Credit

Domestic Credit Provided by the Banking Sector as a Percentage of GDP	Score
<5%	0
5-25%	1
25-50%	2
50-75%	3
75-125%	4
>125%	5

Table 22: Real Interest Rates

Real Interest Rate (%)	Score
>25%	0
25-15%	1
15-10%	2
10-5%	3
5-1%	4
0%	5

To calculate a single score for this indicator, the domestic credit score and the real interest rate score are then averaged.

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deposits but do incur such liabilities as time and savings deposits). Examples of other banking institutions are savings and mortgage loan institutions and building and loan associations.

[15] *See* http://data.worldbank.org/indicator/FR.INR.RINR

Access to Finance	Score
Domestic Credit Provided by the Banking Sector as a Percentage of GDP	
174.28 %	5
Real Interest Rate (%)	
4.09 %	4

- Take the Average of the scores: (5+4)/2 = 4.5
- Total Score = 4.5

To illustrate the methodology and calculation an example is provided below using data from Lebanon.

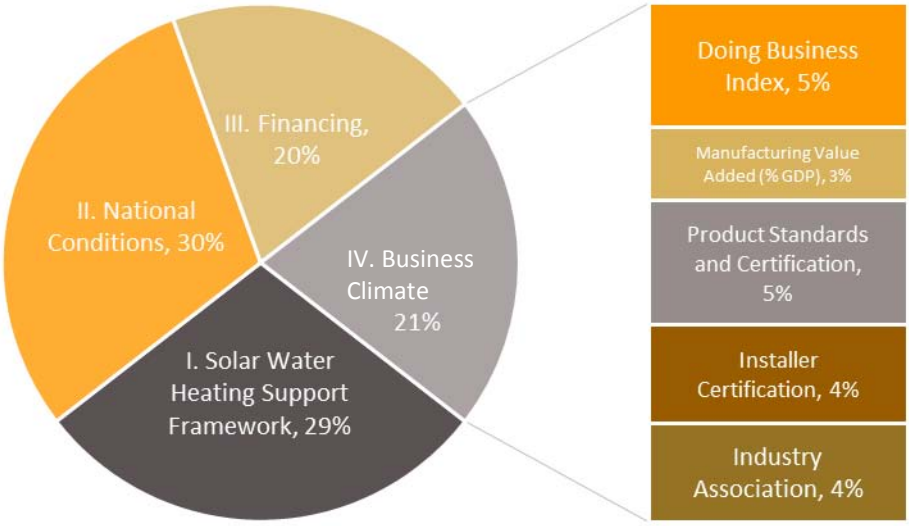
This indicator is 15% of the total Market Readiness Assessment score, as displayed in **Table 23** below.

Table 23: Consumer Loan Interest Rate Weight

Parameter III	Indicator	Indicator Weight (as a %) of Total Score
Financing	Access to Finance	15%

2.5 PARAMETER IV: BUSINESS CLIMATE

Figure 7: Parameter 4 Elements



The ease of doing business in a country is important for the development of a SWH market. The quality and reliability of SWH equipment is important for maintaining a positive reputation for SWH technology. Regional or national quality control standards, such as equipment certification or installer certification, can reduce the vulnerability of the SWH market to low quality products and in turn, a lack of trust in the technology among consumers. The presence of institutions that support the SWH market can also have an important impact on the growth of SWH by providing a voice for the SWH industry, providing training, supporting standards, etc.

Understanding the business climate of a specific country is important for stakeholders that are considering making an investment, developing a project, or starting a business. The business climate in a given country can be evaluated using a range of different indicators, such as the ease of starting up a business, protections for investors, enforcement of contracts, and the process of dealing with construction permits. These indicators are relevant to activities across the SWH value chain, ranging from starting up new solar manufacturing plants to installing systems on customer rooftops. Parameter IV consists of five indicators as can be seen in the graphic above and represents 21% of the overall SWH Market Readiness Assessment score (Table 24).

Table 24: Scoring Formula for Parameter IV

Parameter IV	Parameter Weight (as a %) of Total Score	Indicator	Indicator Weight (as a %) of Total Score
Business Climate	21%	Doing Business Index	5%
		Domestic Manufacturing	3%
		Product Certification	5%
		Installer Certification	4%
		Industry Association	4%

2.5.1 DOING BUSINESS INDEX

For the purposes of this study, the global rank from the World Bank and International Finance Corporation's *Doing Business Index* is used as a proxy for the business climate (World Bank and IFC, 2013), and transposed from the 185-country scale to a percentile score between 0 (worst) and 100 (best). To generate a TechScope score, the percentile is ranked on a 5-tiered scale ranging from a score of 1 (lowest quintile) to 5 (highest quintile) (**Table 25**). Mexico's rank of 48 out of 185, for example, is in the 74th percentile and hence scores a 4. This indicator has a weight of 5% (**Table 26**).

Table 25: Business Climate Ranking Formula

Formula to Calculate Percentile	Percentile	Score
1 - (Ranking of Country X / 185)	80-100%	5
	60-80%	4
	40-60%	3
	20-40%	2
	0-20%	1

Table 26: Business Climate Scoring Methodology and Weight

Parameter IV	Indicator	Indicator Weight (as a %) of Total Score
Business Climate	Doing Business Index	5%

2.5.2 MANUFACTURING CAPACITY

A strong and healthy manufacturing sector is important for the growth of national SWH markets. Even if a country does not manufacture solar collectors, domestic manufacturers can still play a role in manufacturing components (e.g. storage tanks) and in system assembly. An active manufacturing sector often requires personnel with technical skills and capabilities to produce the materials and component parts and build and maintain the systems. The combination of an existing Domestic Manufacturing with technical personnel can provide a strong foundation for developing a SWH market.

The economic measurement, ***manufacturing value added (MVA)*** *(as a percent of GDP)* can be a useful indicator in understanding the level of manufacturing in a country and the manufacturing sector's contribution to an economy. The UN Industrial Development Organization (UNIDO) provides statistics for major indicators of industrial performance for 208 jurisdictions around the world, including MVA.[16] The value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. The country data are given in comparison with figures for the geographical region, development group it belongs to, and global average.

In 2012, the average global MVA (as percentage of GDP at constant 2005 prices in US$) was ~17%. The Market Readiness Assessment methodology uses the average MVA (as percentage of GDP at constant 2005 prices in US$) for the world as the upper bound. It is assumed that if a country's MVA is above the world MVA, the country likely has a considerable manufacturing sector that could be mobilized to produce SWH systems. However, if a country's MVA is below the world's average it

[16] See http://www.unido.org/en/resources/statistics/statistical-country-briefs.html

could indicate that the sector is less competitively positioned to manufacture SWH systems or components. The methodology used is displayed in **Table 27.** Mexico's MVA as a percentage of GDP in 2012 was approximately 18%, for example, which scores a 5.

The weight for this indicator is 3% **(Table 28)**.

Table 27: Manufacturing Capacity Scoring Methodology

MVA as percentage of GDP at constant 2005 prices in US$	Score
0-2%	0
>2-4%	1
>4-8%	2
>8-12%	3
>12-17%	4
>17%	5

Table 28: Manufacturing Capacity Indicator Weight

Parameter IV	Indicator	Indicator Weight (as a %) of Total Score
Business Climate	Domestic Manufacturing	3%

2.5.3 PRODUCT STANDARDS AND CERTIFICATION

Quality standards and certifications for solar thermal equipment are important for SWH markets. Standards and certifications can help ensure solar system performance, durability, reliability and safety and can support consumer confidence in solar water heating technology.

A wide range of national and international SWH standards has been developed for solar collectors and systems (Kraidy, 2013). These include the Solar Keymark in Europe and the Solar Rating and Certification Corporation (SRCC) system in the US. These standards primarily specify how solar thermal systems should be tested, e.g. for thermal performance, impact resistance, rain penetration, etc. In order to support solar thermal standards, countries may introduce domestic testing facilities to ensure that local manufacturers can meet national standards. In addition, countries may introduce certification bodies to create and issue product quality labels (Drück, 2011). Brazil, China, India, and South Africa, for example, have each developed their own product quality labels.

It is important to note that the introduction of standards and certification infrastructure will likely need to be balanced with the level of industry maturity. Testing facilities, for example, may not be sustainable if the market is not sufficiently large. Similarly, requirements that SWH systems achieve specific certifications in order to participate in the market may impede market development if introduced too early (ESTIF, 2012b).[17]

The tiered scoring system introduced here attempts to recognize the "building blocks" of a functional standards and certification system without being overly prescriptive. The score for each tier is predicated on the previous tiers also being fulfilled. Lebanon, for example, has a national standards

[17] The GSWH project supported the development of a guide on SWH quality assurance, which provides an overview of quality standards worldwide. The guide can be found online at: http://solarthermalworld.org/sites/gstec/files/standardisation.pdf

entity, solar thermal equipment standards, domestic solar thermal testing facilities, and national certification tied to an international certification system. It therefore scores a five.

The following scoring methodology was developed for product certification:

Table 29: Product Certification Scoring

Description	Score
No standards or certification infrastructure.	0
Existence of a national standards entity. Some countries do not have a national body responsible for standards. The existence of a standards body can be an important building block for the solar thermal market, even if specific solar water heating standards are not yet adopted.	1
Solar thermal equipment standards exist.	2
Domestic solar thermal testing facilities are available	3
Solar thermal product national certification has been introduced	4
Solar thermal products regional or international certification is introduced.	5

This indicator has a weight of 5% (**Table 30**).

Table 30: Product Certification Weight

Parameter IV	Indicator	Indicator Weight (as a %) of Total Score
Business Climate	Product Certification	5%

2.5.4 INSTALLER CERTIFICATION

In addition to product certification, certification and licensing schemes can also be developed for solar installers in order to ensure installation quality. There is a wide range of different certification schemes internationally (e.g. NABCEP in North America).[18]

For installer certification, a binary approach was used. A country receives a score of 0 if there is no installer certification in place and a 5 if there is a certification system for **either individual installers or installation companies** (**Table 31**). Lebanon, for example, currently has no installer certification system and therefore scores a 0.

The presence of a certification system for installers is scored accordingly:

Table 31: Installer Certification Scoring

Certification	Score
No certification for either individual installers or installation companies is available	0
A certification for either individual installers or installation companies is available	5

This indicator has a weight of 4% (**Table 32**).

[18] *See, e.g.,* http://www.nabcep.org/certification/solar-thermal-installer-certification

Table 32: Installer Certification Weight

Parameter IV	Indicator	Indicator Weight (as a % of Total Score)
Business Climate	Installer certification	4%

2.5.5 INDUSTRY ASSOCIATION

The presence of a solar thermal industry association can provide an "industry voice" in the policy and political arena and can promote industry coordination and exchange. A tiered score is used for this indicator. Countries without an industry association receive a 0. Countries with an active industry association that specifically supports SWH receive a 5 (**Table 33**). For the purpose of this analysis, we an "active" industry association is defined 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.[19] Chile, for example, has an active solar association that represents a significant share of the solar thermal industry and therefore scores a 5.

Table 33: Industry Associations Score Rating

Association	Score
No Industrial Association	0
Active Solar Thermal or Renewable Energy Industrial Association	5

This indicator has a weight of 4% (**Table 34**).

Table 34: Industry Associations Indicator Rating

Parameter IV	Indicator	Indicator Weight (as a %) of Total Score
Business Climate	Industry Associations	4%

[19] An active industry association could also include a renewable energy association that represents multiple renewable energy technologies, including solar thermal technology.

SECTION 3

SWH TECHSCOPE MARKET READINESS ASSESSMENTS FOR THE FIVE GSWH PROJECT COUNTRIES

3.1 INTRODUCTION

In 2009, the Global Solar Water Heating (GSWH) Market Transformation and Strengthening Initiative was launched to develop, strengthen and accelerate the growth of the solar water heating (SWH) sector with a specific focus in Albania, Chile, India, Lebanon, and Mexico. The GSWH project is a joint undertaking of UNEP and UNDP and funded by the GEF. UNDP is the lead implementing agency, while UNEP is responsible for global knowledge management.

The GSWH project seeks to achieve four major goals in each GSWH project country:

1. Facilitate the development of an institutional, legal, and regulatory framework to enable a sustainable SWH market
2. Enhance the awareness and capacity of end users and building sector professionals to integrate SWH systems into the built environment
3. Contribute to the development of financing mechanisms that increase demand for SWH systems
4. Assist in improving national level SWH certification and quality control schemes

The SWH TechScope Market Readiness Assessment methodology and Analysis Tool was applied on each project country during the implementation of their national SWH programs to evaluate and bench mark other non-project countries and SWH markets in developing countries.. It should be noted that the GSWH project has been completed in India, but is ongoing in the other countries. Since the outcomes of the GSWH projects are not final, the scores should be considered preliminary. Mexico, for example, has not yet implemented its national SWH target, but plans to do so in 2014. Preliminary scores are denoted by an asterisk (*). Overviews of the national SWH programs in the five project countries that were implemented by UNDP are included in Annex II.

3.2 ALBANIA

Overall Score	2.56* / 5.0

Summary: The SWH market in Albania has grown 17% over the past five years, from 29 MW_{th} in 2006 to 64 MW_{th} in 2011. Albania's overall TechScope score is 2.56, which will be discussed in detail in the sections below in order to provide greater insight into the SWH TechScope Market Readiness Assessment for Albania.

General Information (2011)	
Population	3,153,883
GDP	US$12,959,563,902
Total installed solar thermal (flat plate and evacuated tube collectors)	63.5 MW_{th}

Parameter	Score
Solar Water Heating Support Framework	0.80
National conditions	0.82
Financing	0.48
Business Climate	0.47

3.2.1 PARAMETER I: SOLAR WATER HEATING SUPPORT FRAMEWORK

Parameter I	Score	Indicator	Weight (%)	Indicator Score (Raw)	Indicator Score (Weighted)
SWH Support Framework	0.80	SWH Targets	5%	0.0	0.00
		Financial Incentives for System Installation	8%	0.0	0.00
		SWH Loans Programs	7%	5.0	0.35
		Building Mandates	5%	5.0	0.25
		Outreach Campaigns	4%	5.0	0.20
		Subtotal	**29%**	**15.0**	**0.80**

On May 2, 2013, The Government of Albania adopted Law No. 138/2013 on Renewable Energy Sources. The law establishes (i) a national objective to use solar energy; (ii) mandatory installation of SWH systems in certain types of new and renovated buildings (building types have yet to be specified); (iii) minimal technical standards for SWH systems imported to or produced in Albania, (iv) qualification certificates for SWH installers and accreditation procedures for testing SWH devices in line with European standards; and, (v) exemption from the VAT and custom duties on imported SWH systems and parts. The law also requires public buildings to install SWH systems from 2013 onwards. From the day the law was enacted, the government has 6 to 12 months to develop the by-laws which will detail how the law will be implemented (Kamberi, 2011).

As part of Albania's efforts to achieve EU membership, and as part of its obligations under the EU Energy Community Treaty, the Ministry of Energy and Industry (MEI) has finalized a National Renewable Energy Action Plan (NREAP). The plan is in line with the EU's Renewable Energy Directive 2009/28/EC, which sets mandatory national renewable energy targets for achieving a 20% share of renewable energy in the final energy consumption by 2020 (EUR-Lex, 2013). EU Member States were required to submit a NREAP that outlines the sector targets, technology mix, and renewable energy deployment trajectory they will pursue during 2012-2020. The NREAP also specifies the policies and reforms they will undertake in order to meet the EU targets. With support from the UNDP, the MEI undertook the same exercise. The NREAP projects that Albania will supply 38% of final energy consumption from renewable sources (beyond hydropower) by 2020. The NREAP specifically projects that Albania will supply 1.23% of its thermal energy from solar by 2020 – although this does not constitute a formal national target.

3.2.1.1 Solar Water Heating Targets

SCORE 0.0 / 5.0

As of November 2013, Albania did not have legally binding solar water heating targets. The government is currently working to develop the by-laws for the Renewable Energy Sources Law and may adopt SWH targets through the by-laws. Albania currently receives a score of 0 for this indicator, but will receive a score of 5 if a solar thermal target is adopted.

3.2.1.2 Financial Incentives for System Installation

SCORE 0.0 / 5.0

As of December 2013, Albania did not have any publicly available financial incentives for SWH systems; therefore it receives a 0.

3.2.1.3 SWH Loan Programs

SCORE 5.0 / 5.0.

As of December 2013, Albania did not have a dedicated loan program for supporting SWH. Through a loan from the International Finance Corporation, five financial institutions in Albania offer low interest residential energy efficiency loans that can also be used to finance SWH systems (International Finance Corporation, 2013). The interest rates on the energy efficiency loans tend to be 1% lower than other home improvement loans (Albanian Association of Banks, 2013; ProCredit Bank Albania, 2013). Albania receives a score of 5 as a result of the availability of these loan programs.

3.2.1.4 Building Mandates

SCORE 5.0 / 5.0

The Renewable Energy Sources law mandates the installation of **solar water heating systems in newly constructed or renovated buildings and in public buildings from 2013 onwards**. The by-laws, which will detail the specific buildings types that will be subject to the law, are still being developed and therefore the exact mandates remain unclear. Albania's requirement for a national building mandate receives a score of 5.

3.2.1.5 Outreach Campaigns

SCORE 5.0 / 5.0

The MEI has implemented a SWH outreach program that includes a national awareness campaign, launch events for recently installed SWH pilot projects, and promotional events to raise public awareness of SWH in remote areas and tourist areas. These outreach efforts result in a score of 5.

3.2.2 PARAMETER II: NATIONAL CONDITIONS

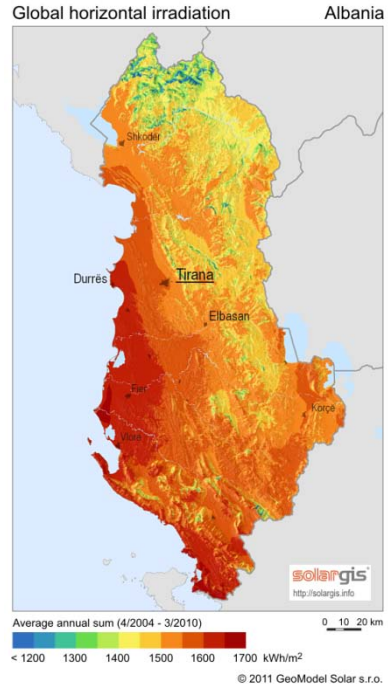
Parameter II	Score	Indicator	Weight (%)	Indicator Score (Raw)	Weighted Score (Weighted)
National Conditions	0.82	Insolation	5%	2.2	0.11
		SWH Market Penetration	4%	0.4	0.02
		Energy Consumption Growth	5%	4.2	0.21
		SWH Market Growth	4%	5.0	0.20
		Competitiveness: LCOE Comparison/Payback Period	7%	4.0	0.28
		Competitiveness: Heating Fuel Subsidy	5%	0.0	0.00
		Subtotal	**30%**	**15.8**	**0.82**

3.2.2.1 Insolation

SCORE 2.2 / 5,0

As can be seen from **Figure 3**, average daily insolation levels range from 3.2 kWh/m^2 in the northeast of Albania to of 4.6 kWh/m^2 in the southwest, with a country average of 4.1 kWh/m^2 (Clean Energy Solutions Center, 2013). This results in a score of 2.2.

Figure 8: Albania Average Daily Solar Radiation (kWh/m^2/day)



Source: SolarGIS © 2014 GeoModel Solar

3.2.2.2 SWH Market penetration

SCORE 0.4 / 5.0

The SWH market penetration rate has almost doubled between 2007-2011, growing from 11 kW_{th}/1000 inhabitants to 20.2 kW_{th}/1000 inhabitants (Weiss, Bergmann, & Stelzer, 2009). Despite this rapid growth, overall penetration remains comparatively low when compared to Greece's 268.2 kW_{th}/1000 inhabitants. Albania receives a score of 0.4 for penetration.

3.2.2.3 Residential Energy Consumption Growth

SCORE 4.2 / 5.0

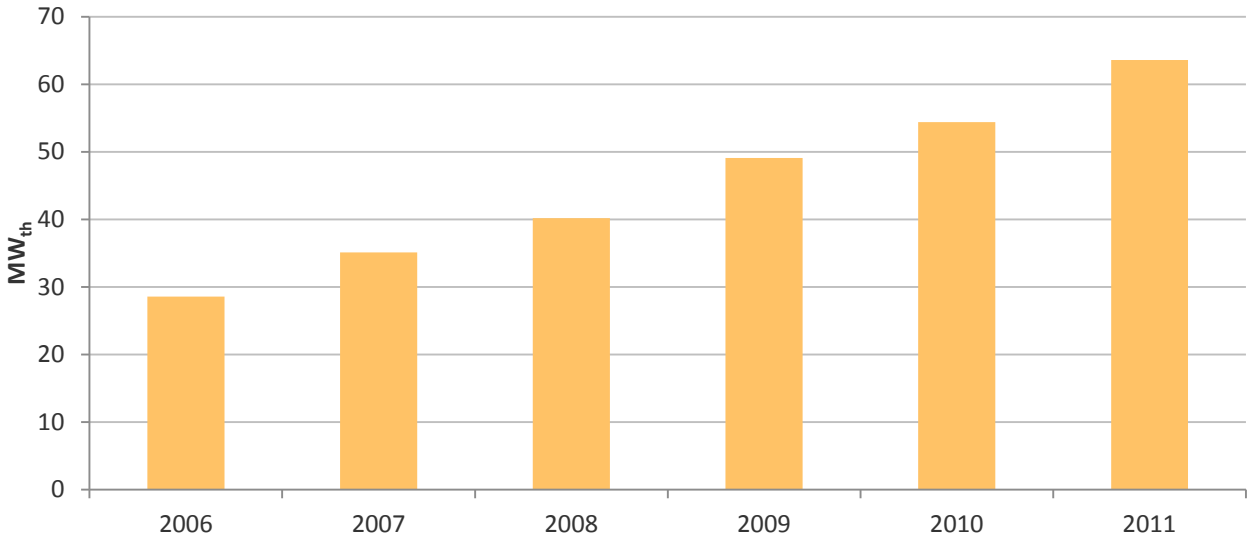
According to IEA statistics, residential energy consumption has varied greatly during the five year period of 2006-2011, ranging from negative growth to growth as high as 7%. Albania has a 5-year average residential energy consumption growth rate of 2.1%. This results in a score of 4.2.

3.2.2.4 SWH Market Growth

SCORE 5.0 / 5,0

The SWH market in Albania has grown rapidly during the past five years, from 29 MW_{th} in 2006 to 64 MW_{th} in 2011 (**Figure 4**) (Weiss et al., 2008; Weiss & Mauthner, 2013). The 5-year average market growth rate is 17%. Albania receives a score of 5.

Figure 9: Albania Total SWH Installed (2006-2011)



3.2.2.5 Payback Period

SCORE 4.0 / 5.0

SWH system costs. Flat-plate collector systems account for approximately 99% of the residential SWH market in Albania, with evacuated tube collectors accounting for the remaining 1% (Weiss & Mauthner, 2013). According to data gathered by the Observatory of Mediterranean Energy (*Observatoire Méditerranéen de l'Energie* or "OME"), the typical collector surface in Albania is 2-3 m^2 and the typical tank size is 150-200 liters. The average system cost is around US$1000 (including installation), with an expected minimum lifetime of 15-20 years (OME, 2012).

Retail energy prices. In Albania, over 80% of domestic hot water systems are powered by electricity. In addition, about two-thirds of Albania's total electricity consumption is used for the domestic hot water and space heating (Oettli & Vollmin, 2012). It is assumed that SWH competes against the average residential retail electricity rate in Albania, which was $0.117/kWh in 2012 (European Commission, 2013).

Based on RETScreen analysis, the payback period for a SWH system in Albania is 2.6 years. This results in a score of 4.

3.2.2.6 Competitiveness: Heating Fuel Subsidy

SCORE 0.0 / 5.0

Electricity prices are subsidized in Albania with the average tariff below the calculated long-term marginal running cost of generation, transmission and distribution (OME, 2012). These subsidies make solar heat less competitive in Albania. The presence of subsidies receives a score of 0.

3.2.3 PARAMETER III: FINANCING

Parameter III	Score	Indicator	Weight (%)	Indicator Score (Raw)	Indicator Score (Weighted)
Financing	0.48	Country Credit Rating	5%	0.5	0.03
		Access to Finance	15%	3.0	0.45
		Subtotal	**20%**	**3.5**	**0.48**

3.2.3.1 Country Credit Rating

SCORE 0.5 / 5.0

Albania has a low per capita GDP and persistently high government debt. However, Albania's economic resilience through the financial and Euro area debt crisis, its long-term growth potential, improvements in its legal framework that explicitly prioritized debt-service payments, efforts to strengthen institutional capacity, and prospects for further EU integration provide a stable outlook for the Albanian economy (Villa & Oosterveld, 2012). Based on circumstances such as these, Albania received a credit rating of B1 from Moody's and a B from S&P. This results in a score of 0.5.

3.2.3.2 Access to Finance

SCORE 3.0 / 5.0

As discussed in section 4.1.2, the access to finance score was arrived at through two measures of equal weight: the real interest rate, which serves as a proxy for the price of loans that accounts for inflation; and domestic credit provided by the banking sector (as a percentage of GDP), which serve as a proxy for the availability of in-country loans. The combination of price and availability create a measure for access. Albania's average real interest rate (2010-2012) is 9%, resulting in a score of 3. The average domestic credit (2010-2012) provided by the banking sector (as percent of GDP) is 68%, resulting in a score of 3. This combination of factors results in Albania's score of 3.

3.2.4 PARAMETER IV: BUSINESS CLIMATE

Parameter IV	Score	Indicator	Weight (%)	Indicator Score (Raw)	Indicator Score (Weighted)
Business Climate	0.47	Doing Business Index	5%	3.0	0.15
		Domestic Manufacturing	3%	4.0	0.12
		Product Certification	5%	4.0	0.20
		Installer Certification	4%	0.0	0.00
		Industry Association	4%	0.0	0.00
		Subtotal	**21%**	**11.0**	**0.47**

3.2.4.1 Business Climate

SCORE 3.0 / 5.0

Albania ranks 85 out of 185 countries according to Doing Business 2013.[20] The scores for the individual indicators within the Doing Business Rank can be seen in **Table 33** below. Albania has a comparatively high rank for certain indicators, such as protecting investors, but a lower rank for indicators such as paying taxes and dealing with construction permits. Overall, Albania's ranking results in a score of 3.

[20] *See* http://doingbusiness.org/reports/global-reports/doing-business-2013

Table 33: Albania - Doing Business Ranking

Category	Doing Business Ranking
Starting a Business	62
Dealing with Construction Permits	185
Getting Electricity	154
Registering Property	121
Getting Credit	23
Protecting Investors	17
Paying Taxes	160
Trading Across Border	79
Enforcing Contracts	85
Resolving Insolvency	66

3.2.4.2 Domestic Manufacturing

SCORE 4.0 / 5.0

As of 2013, there were at least 37 domestic companies in Albania that manufacture or import solar collectors and components. As discussed in Section 2, MVA is used as a proxy for how well positioned a country is for manufacturing.[21] In 2012, Albania had a MVA as percentage of GDP of approximately 16%, which is close to the global average of (~17%). Albania therefore receives a score of 4.

3.2.4.3 Product Certification

SCORE 4.0 / 5.0

Albania has been building its SWH standards and certification infrastructure.

- **Standards**. The government has adopted EU and International SWH standards in coordination with Albania's General Directory of Standardisation. In addition, the Renewable Energy Sources Law adopts minimum technical standards for SWH systems imported into or produced in Albania that are in line with European standards.
- **Testing**. The Albanian Solar Testing Center was launched with support from the GSWH project. The Testing Center complies with some (but not all) EU and International testing standards and the initial testing of Albanian SWH products is underway. The Testing Center has received additional support and assistance from the Solar and Thermal Engineering Stuttgart (*Solar- und Wärmetechnik Stuttgart* or "SW"T) Institute based in Stuttgart, Germany, as well as the SPF Testing Centre in Switzerland. SPF is an independent, internationally recognized testing center for solar thermal components that is testing Albanian SWH products against International and EU requirements and upgrading the products as necessary to ensure they are in line with these requirements. Five Albanian solar producers are in the midst of the SPF process.
- **Certification and labeling**. According to the Renewable Energy Sources Law, all certification and labeling of SWH systems must be in line with EU standards. Working in collaboration with the GSWH project, the government has proposed a certification scheme for Albanian SWH products that would provide an interim 5-year period (2013-2018) to meet the quality management

[21] See: http://www.unido.org/en/resources/statistics/statistical-country-briefs.html

requirements of the EU's Solar Keymark[22] certification. In the meantime, an Albanian provisional label will be used.

Based on Albania's current product certification infrastructure, the country receives a score of a 4. Although Albania has the goal of adopting the Solar Keymark certification, it is still using a national certification system through 2017 and therefore did not receive a score of 5.

3.2.4.4 Installer Certification

SCORE 0.0 / 5.0

Under the Renewable Energy Sources Law, an installer certification program will be developed that is in line with EU standards. Since the installer program is still in development, Albania receives a score of 0.

3.2.4.5 Industry Association

SCORE 0.0 / 5.0

The renewable energy industry, with support from the Norwegian Ministry of Foreign Affairs, formed the Albanian Renewable Energy Association (AREA) in 2013. It remains unclear, however, if AREA will include a focus on solar thermal or will actively represent a significant share of Albanian solar thermal companies. As a result, Albania currently receives a score of 0.

[22] The Solar Keymark is a voluntary third party certification mark for solar thermal products demonstrating to end users that a product conforms to the relevant European standards and fulfills additional requirements. The Solar Keymark was developed by the European Solar Thermal Industry Federation and the European Committee for Standardization in close cooperation with leading European test labs and with the support from the European Commission.

3.3 CHILE

Overall Score	3.11* / 5.0

Summary: Chile's solar thermal market has grown 55% over the last five years, from 4.8 MWth in 2006 to 40.7 MWth in 2011. Chile's overall TechScope score is 3.11, which will be discussed in detail in the sections in order to provide greater insight into the SWH TechScope Market Readiness Assessment for Chile.

General Information (2011)	
Population	17,308,449
GDP	US$ 250,994,104,421
Total installed solar thermal (flat plate and evacuated tube collectors)	40.7 MWth

Parameter	Score
SWH Support Framework	0.60
National Conditions	1.01
Financing	0.73
Business Climate	0.77

3.3.1 PARAMETER I: SOLAR WATER HEATING SUPPORT FRAMEWORK

Parameter I	Score	Indicator	Weight (%)	Indicator Score (Raw)	Indicator Score (Weighted)
Solar Water Heating Support Framework	0.60	SWH Targets	5%	0.0	0.00
		Financial Incentives for System Installation	8%	5.0	0.40
		SWH Loans Programs	7%	0.0	0.00
		Building Mandates	5%	0.0	0.00
		Outreach Campaigns	4%	5.0	0.20
		Subtotal	**29%**	**10.0**	**0.60**

In 2009, Chile took a significant step toward building an supportive policy environment for its solar thermal market by passing Law 20.365, which creates a tax credit for solar thermal systems (Epp, 2013). The law expired on December 31, 2013. Lawmakers have proposed extending the law and revising the law to (i) expand coverage to include individuals and households, (ii) incorporate a mandatory certification and quality assurance program for solar thermal systems, and (iii) adjust the funding limits (Srinivas, 2012). The law has not been extended as of the publication of this report.

In addition to Law 20.365, Chile published a National Climate Change Action Plan 2008-2012. The plan focuses on determining the impacts of climate change and developing a framework for adapting to and mitigating its impacts. While the Plan promotes a transition to renewable energy, it does not establish specific goals and does not emphasize solar water heating (Chilean National Environmental Commission, 2010). Chile is currently drafting a new climate action plan, but it remains to be seen whether it will promote SWH specifically.

3.3.1.1 Solar Water Heating Targets

SCORE 0.0 / 5.0

As of December 2013, Chile did not have a dedicated set of targets for SWH installations. Chile receives a score of 0.

3.3.1.2 Financial Incentives for System Installation

SCORE 5.0 / 5.0

The 2009 Law 20.365 provides financial incentive for installing SWH systems in the form of a tax credit for the companies that install SWH systems. Solar system installers may not have a tax appetite sufficient enough to absorb a large number of tax credits from solar thermal systems, however, which may constrain the overall impact of this incentive. The law expired at the end of 2013 and it is unclear whether Congress will approve an extension.

Since 2007, Chile's Ministry of Housing and Urban Development (*Ministerio de Vivienda y Urbanismo* or "MINVU") has also offered grants to repair or improve housing through its Family Homestead

Project Program (*Programa de Protección del Patrimonio Familiar* or "PPPF"). Qualifying individuals must live in homes that are categorized as social housing or have a tax valuation under 650 Unidad de Fomento (UF)[23] (US$28,837.62)[24] and belong to families with a maximum of 13,484 on their social protection card (*Ficha de Protección Social*).[25] As of 2011, 70.4% of Chile's housing stock qualified as social housing. The grants can be used to cover the cost of several types of home improvements including energy efficiency. Beginning in 2011, the grants could be used to help pay for the cost of solar water heating systems.[26] The grant amount varies from 50 UF (US$ 2,218.28) to 65 UF (US$ 2,883.76), depending on the municipality in which the property is located. Applicants must also demonstrate that they have a minimum of 3 UF (US$132) in a savings account. As of 2011, the program has disbursed a total of CLP 370,645 million (US$ 705.184 million).

Given the existence of these incentives, Chile receives a score of 5.

3.3.1.3 SWH Loan Programs

SCORE 0.0 / 5.0

Chile does not have a dedicated loan program for supporting SWH. Therefore, Chile receives a score of 0.

3.3.1.4 Building Mandates

SCORE 0.0 / 5.0

Chile has not established SWH building mandates. As a result Chile receives a score of 0.

3.3.1.5 Outreach Campaigns

SCORE 5.0 / 5.0

The government is supporting SWH outreach through trainings and capacity building programs for government agencies, including the Ministry of Housing and Urban Development and the Superintendence of Electricity and Fuel (SEC). The Ministry of Energy also hosts a website where information on the country's SWH program can be found: www.programasolar.cl. Due to the government's outreach efforts, Chile receives a score of 5.

[23] The **Unidad de Fomento** (**UF**) is a Unit of account that is used in Chile. UF measures inflation changes in the number of Chilean pesos for 1 UF. It is used as if it were an inflation-proof currency in certain transactions. On December 2, 2013, the conversion rate was: 1 UF = 23,238.20 CLP, 1 CLP = .0019 USD

[24] Conversion from UF to U.S. dollar was calculated using the exchange rate from January 2, 2014

[25] *See* http://www.minvu.cl/opensite_det_20110425113800.aspx

[26] *See* http://www.ministeriodesarrollosocial.gob.cl/ipos/pdf/ipos_2011_en.pdf

3.3.2 PARAMETER II: NATIONAL CONDITIONS

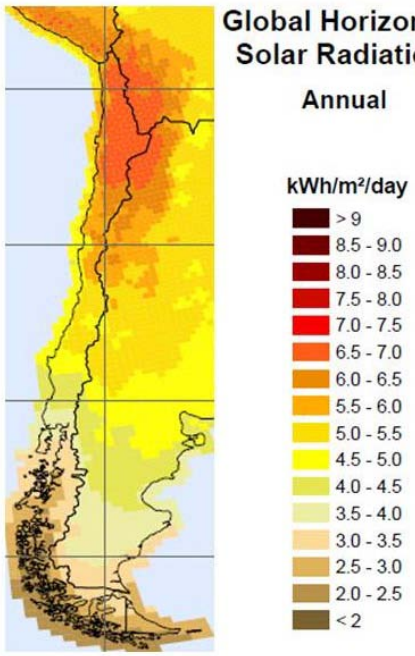
Parameter II	Score	Indicator	Weight (%)	Indicator Score (Raw)	Indicator Score (Weighted)
National Conditions	1.01	Insolation	5%	2.2	0.11
		SWH Market Penetration	4%	0.0	0.00
		Energy Consumption Growth	5%	4.8	0.24
		SWH Market Growth	4%	5.0	0.20
		Competitiveness: Payback Period	7%	3.0	0.21
		Competitiveness: Heating Fuel Subsidy	5%	5.0	0.25
		Subtotal	**30%**	**20.0**	**1.01**

3.3.2.1 Insolation

SCORE 2.2 / 5.0

As can be seen from **Figure 5**, average daily insolation levels range from 3.0 kWh/m^2/day in the south to 6.0 kWh/m^2/day in the north, with a daily average of 4.4 kWh/m^2/day (Clean Energy Solutions Center, 2013). Based on the scoring methodology, Chile receives a score of 2.2.

Figure 10: Chile Average Daily Solar Radiation (kWh/m^2/day)



Source: National Renewable Energy Laboratory (NREL) (2005)

3.3.2.2 SWH Market penetration

SCORE 0.0 / 5.0

In 2011, Chile's SWH market penetration was 2.35 kW_{th}/1000 people (Weiss & Mauthner, 2013). Relative to Greece's SWH market penetration of 268.2 kW_{th}/1000, Chile's market penetration is small and results in a score of 0.0.

3.3.2.3 Residential Energy Consumption Growth

SCORE 4.0 / 5.0

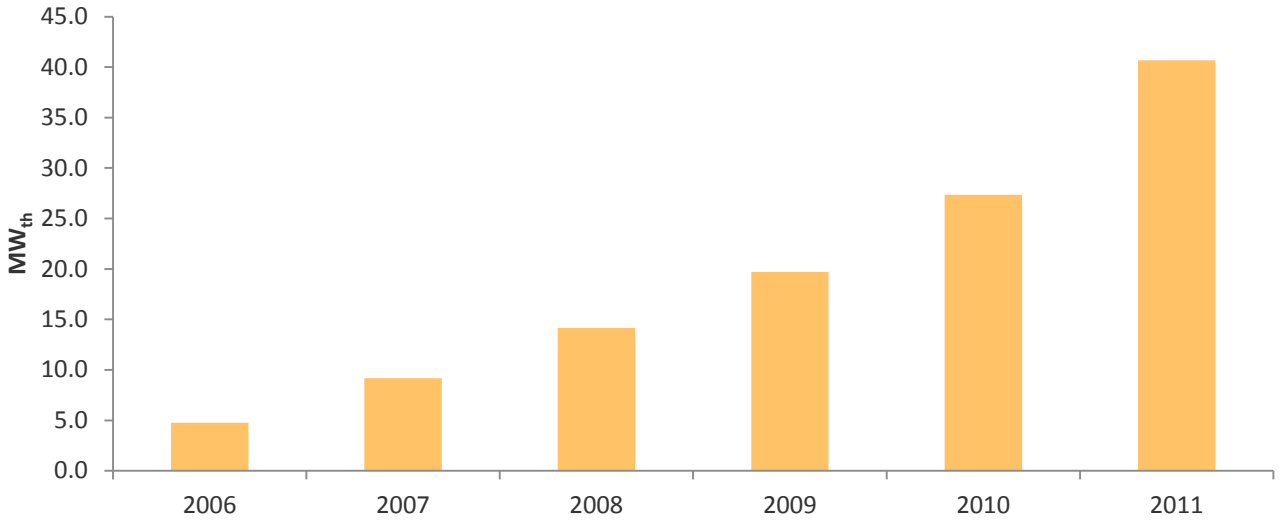
Residential energy consumption in Chile grew between 2006 and 2011, with an average residential energy consumption growth rate of 2.4%. Based on this growth, Chile receives a score of 4.8.

3.3.2.4 SWH Market Growth

SCORE 5.0 / 5.0

The SWH market in Chile grew significantly between 2006 and 2011, 4.8 MW_{th} to 40.7 MW_{th} resulting in an average 5-year market growth rate of 54% (**Figure 6**) (Castañer, 2012). Due to Chile's rapid SWH market growth, its score is 5.

Figure 11: Chile Total SWH Installed Capacity (MW_{th}) 2006-2011



3.3.2.5 Competitiveness: Payback Period

SCORE 3.0 / 5.0

SWH system costs. Glazed, flat plate collectors make up 100% of the residential SWH market in Chile (Weiss & Mauthner, 2013). According to data provided on the Solar Program (*Programa Solar*) website and the UN Development Programme's annual reports the typical collector area is 2-4 m^2 and the typical tank size is 200-300 liters, with an average system cost of US$ 1,900 (Programa Solar, n.d.).

Retail Energy Prices. In Chile, the majority of the residential sector meets its energy needs through biomass. According to the IEA Energy Balance Indicators (2011) biofuels and waste account for 60% of total residential energy consumption and are used mostly for heating and cooking. The analysis assumes that solar water heating competes instead against electricity, which has an average retail rate of US$ 0.195/kWh (Energy Information Administration, 2010).

Based on RETscreen analysis, the payback period is 5.3 years and results in a score of 3.

3.3.2.6 Competitiveness: Heating Fuel Subsidy

SCORE 5.0 / 5.0

This analysis assumes solar water heating is competing with electricity and oil products. Chile has no price capping or subsidies for fuels; however the government reduces price volatility for final consumers through two price stabilization funds – the Oil Price Stabilization Fund (*Fondo de Estabilización de Precios del Petróleo* or "FEPP") and the Taxpayer Protection System for Changes in International Prices of Fuel (*Sistema de Protección al Contribuyente ante las Variaciones en los Precios Internacionales de los Combustible* or "SIPPCO"). The SIPPCO exclusively applies to transport fuels (diesel and gasoline) whereas the FEPP covers kerosene. Fuel oil, LPG and LNG are not covered by any fund or mechanism. TechScope does not consider a price stabilization fund as a formal subsidy and therefore Chile receives a score of 5.

3.3.3 PARAMETER III: FINANCING

Parameter III	Score	Indicator	Weight (%)	Indicator Score (Raw)	Indicator Score (Weighted)
Financing	0.73	Country Credit Rating	5%	4.0	0.20
		Access to Finance	15%	3.5	0.53
		Subtotal	**20%**	**7.5**	**0.73**

3.3.3.1 Country Credit Rating

SCORE 4.0 / 5.0

Chile has a country credit rating of AA- from Standard & Poor's and AA3 from Moody's, both of which are considered stable. In 2012, Chile's rating was upgraded from A-plus to AA- because of its economy's solid performance and resilience during the global slowdown. Chile's credit rating makes it the highest rated country in Latin America and is at the same level as Japan, New Zealand and Taiwan (Esposito 2012). These ratings give Chile a score of 4.0.

3.3.3.2 Access to Finance

SCORE 3.5 / 5.0

The access to finance score was arrived at through two measures of 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. Chile's average real interest rate (2010-2012) is

3%, which scores 4, and its average amount of domestic credit (2010-2012) provided by the banking sector is 70%, which scores 3. This combination of factors results in Chile's total score of 3.5.

3.3.4 PARAMETER IV: BUSINESS CLIMATE

Parameter IV	Score	Indicator	Weight (%)	Indicator Score (Raw)	Indicator Score (Weighted)
Business Climate	0.77	Doing Business Index	5%	5.0	0.25
		Domestic Manufacturing	3%	4.0	0.12
		Product Certification	5%	4.0	0.20
		Installer Certification	4%	0.0	0.00
		Industry Association	4%	5.0	0.20
		Subtotal	**21%**	**18.0**	**0.77**

3.3.4.1 Business Climate

SCORE 5.0 / 5.0

According to Doing Business 2013, Chile ranks 37 out of 185 countries. The score for the individual indicators within the complete Doing Business Ranking can be seen in Table 34 below. As can be seen in the table, Chile has a high rank for certain indicators, such as starting a business and protecting investors, but a lower rank for indicators such as resolving insolvency and dealing with construction permits. Chile's overall ease of doing business results in a score of 5.

Table 34: Chile – Doing Business Ranking

Category	Doing Business Ranking
Starting a Business	32
Dealing with Construction Permits	84
Getting Electricity	40
Registering Property	55
Getting Credit	53
Protecting Investors	32
Paying Taxes	36
Trading Across Border	48
Enforcing Contracts	70
Resolving Insolvency	98

3.3.4.2 Domestic Manufacturing

SCORE 4.0 / 5.0

Chile's MVA (as percentage of GDP) in 2012 was just above 12%, which is lower than the global average (~17%). Chile receives a score of 4.

3.3.4.3 Product Certification

SCORE 4.0 / 5.0

As of December 2013, Chile did not require product certifications for solar thermal systems.

- **Standards**. The National Standards Institute developed a set of quality standards for SWH systems and prepared a code of practice for SWH installers (Castañer, 2012).
- The Superintendence of Electricity and Fuel *(Superintendencia de Electricidad y Combustibles* or "SEC") is responsible for overseeing the approval, testing and certification of solar collectors and storage tanks. These operations are performed by private companies, which include (Collaborative Labeling and Appliance Standards Program , 2011):
  - **Testing**. Silab Ingenieros (SILAB)
  - **Certification and registration**. SICAL; INGCER; ICOMCER; the Center for Measurement and Quality Certification (CESMEC).
  - **Inspection**: SILAB; ECOGAS.

Chile has a national standards body, solar thermal standards, testing facilities and national certification and labeling, however it has not introduced international or regional certification or labeling standards. Therefore, Chile receives a score of 4.

3.3.4.4 Installer Certification

SCORE 0.0 / 5.0

As of December 2013, Chile had no national installer certification program. Chile receives a score of 0.

3.3.4.5 Industry Association

SCORE 5.0 / 5.0

The Chilean Association for Solar Energy (*Asociacion Chilena de Energia Solar* or "ACESOL"), and works to unite the public and private sectors in their promotion of solar power (ACESOL, n.d.). Its primary goal is to build awareness about the market for renewable energy, particularly solar PV and solar thermal. In addition to promoting solar, ACESOL contributes to developing renewable energy policy, standards and incentives. ACESOL is considered an active industry association focusing on solar thermal and receives a score of 5.

3.4 INDIA

Overall Score	3.64 / 5.0

Summary: The SWH market in India experienced strong growth in the last five years, increasing from 1050 MW_{th} in 2006 to 3347MWth in 2011 (Weiss, Bergmann, & Faninger, 2008)(Weiss & Mauthner, 2013). India's overall TechScope score is 3.64, which will be discussed in detail in the sections below in order to provide greater insight into the SWH TechScope Market Readiness Assessment for India.

General Information (2011)	
Population	1,236,686,732
GDP	US$1,841,717,371,770
Total installed solar thermal (flat plate and evacuated tube collectors)	3,026.6 MW_{th}

Parameter	Score
SWH Support Framework	1.33
National Conditions	0.89
Financing	0.60
Business Climate	0.82

India has adopted national level policies to support the development of a solar water heating (SWH) market, and the GSWH project worked closely with the Ministry of New and Renewable Energy (MNRE) to help meet India's goal of installing 7,000,000 m^2 of SWH collector area by 2013. State and local governments in India are also utilizing instruments to support SWH development, such as property tax breaks and direct subsidies for residential SWH systems (Greentech Knowledge

Solutions Inc., 2010). However, these state and local incentives are beyond the scope of this report and are not discussed in detail.[27]

3.4.1 PARAMETER I: SOLAR WATER HEATING SUPPORT FRAMEWORK

Parameter I	Score	Indicator	Weight (%)	Indicator Score (Raw)	Indicator Score (Weighted)
Solar Water Heating Support Framework	1.33	SWH Targets	5%	5.0	0.25
		Financial Incentives for System Installation	8%	5.0	0.40
		SWH Loans Programs	7%	5.0	0.35
		Building Mandates	5%	2.5	0.13
		Outreach Campaigns	4%	5.0	0.20
		Subtotal	**29%**	**22.5**	**1.33**

3.4.1.1 Solar Water Heating Targets

SCORE 5.0 / 5.0

As part of India's 2008 National Climate Change Action Plan, the country launched the Jawaharlal Nehru National Solar Mission (JNNSM). The JNNSM has a target of installing 20,000,000 m^2 of solar thermal panels by 2022. The mission has adopted a 3 phase approach to achieving this target spanning the 11th, 12th, and 13th Five Year Plans and has established the following targets:

Table 35: Capacity Targets Under JNNSM

Phase/ Period (Years)	Cumulative Target	Addition panels during the phase
Phase I (2010-2013)	7 million m^2	3.45 million m^2
Phase II (2013-2017)	15 million m^2	8 million m^2
Phase III (2017-2022)	20 million m^2	5 million m^2

It is estimated that India could install up to 36 million m^2 of residential SWH by 2020, and an additional 5.4 m^2 of commercial and industrial SWH, and the JNNSM targets would make significant progress toward realizing this potential.

India receives a score of 5 for its national SWH targets.

3.4.1.2 Financial Incentives for System Installation

SCORE 5.0 / 5.0

[27] For more information on state and local policies see: http://gkspl.in/whats_new.html and http://solarwaterheater.gov.in/page.php?pid=OP$3ooaiKwC7D:eQPScn4Q

The JNNSM includes a financial incentive program, called the *Capital Subsidy/Refinance Scheme*, for expanding solar thermal for domestic, non-commercial, and commercial users. Flat plate and evacuated tube systems are eligible under the program. The incentives vary depending on the type of user[28] and location, but take the form of either a direct subsidy or a low interest loan (Section 3.3.1.3 below) (MNRE, 2013b). Users can take advantage of either the subsidy or the loan, but not both (MNRE, 2010). The incentives were extended through 2013 (MNRE, 2012a).

Under the scheme, all states are considered *General Category States* except for Jammu & Kashmir, Himachal Pradesh, Uttarakhand, the Island States and Northeast States, which are categorized as *Special Category States.* For the purposes of the incentives, the government has established a benchmark cost for flat plate and evacuated tube systems. In General Category States, the government provides a subsidy of 30% of the benchmark cost of the SWH system or 3000 Rs./m^2 (US$ 48.15[29]) of the total collector area for evacuated tube systems and 3300 Rs/m^2 (US$ 52.96) of the total collector area for flat plate systems. In Special Category States, the government provides a subsidy of 60% of the benchmark cost of SWH system or 6000 Rs/m^2 (US$ 96.30) total collector area for evacuated tube and 6600 Rs/m^2 (US$ 105.93) of the total collector area for flat plate systems. Whichever calculation is the lowest cost option is applied as the subsidy (National Bank for Agriculture and Rural Development, 2011).

Under the program, suppliers are to provide the systems to beneficiaries at the subsidized cost (total cost less the government subsidy) with a 5-year performance guarantee. The supplier then collects the subsidy from the Central or State Government (MNRE, n.d.).

As of August 2012, the MNRE had spent US$ 36 million on SWH subsidies (MNRE, 2012b).

The presence of financial incentives results in a score of 5.

3.4.1.3 SWH Loan Programs

SCORE | 5.0 / 5.0

The Indian Renewable Energy Development Agency (IREDA) is responsible for the low interest loan program under the JNNSM. The MNRE disburses funds to IREDA, which on-lends the funds to designated financial institutions. These financial institutions then extend concessional loans to finance SWH installations (IREDA, 2013; Thirumurthy et al., 2012). As of December 2013, 31 banks and financial institutions are participating in the program.

The interest rate on the loan varies depending on the type of user and the location. In General Category States, domestic users are eligible for a 2% interest rate loan, non-commercial users are eligible for 3% interest rate loans, and commercial users are eligible for 5% loans. In Special Category States, interest free loans are available to domestic users. Otherwise, the same interest rates apply to non-commercial and commercial users in Special Category States. In Special Category States, commercial users are also eligible for accelerated depreciation of the system.

There are also low interest loans available to SWH manufacturers to improve technology and expand production facilities.

The presence of these loan programs receives a score of 5.

[28] Domestic, non-commercial or commercial
[29] Conversion from Indian rupee to U.S. dollar was calculated using the exchange rate from January 2, 2014

3.4.1.4 Building Mandates

SCORE 2.5 / 5.0

As of December 2013, there were no SWH building mandates at the national level. However, at the state level, about 26 States and 100 Municipal Councils have adopted a Government Order from the Ministry of Urban Development to amend building bylaws to require SWH systems for residential and commercial buildings. Thus far, implementation and enforcement efforts have varied across states.

The presence of subnational mandates receives a score of 2.5.

3.4.1.5 Outreach Campaigns

SCORE 5.0 / 5.0

As part of the JNNSM and the UNDP Solar Water Heating Project, several outreach and awareness raising activities are underway. Activities include a SWH website and electronic newsletter, a toll free help line, advertisements in public places and in print media, and awareness raising workshops.

India has an active outreach campaign and receives a score of 5.

3.4.2 PARAMETER II: NATIONAL CONDITION

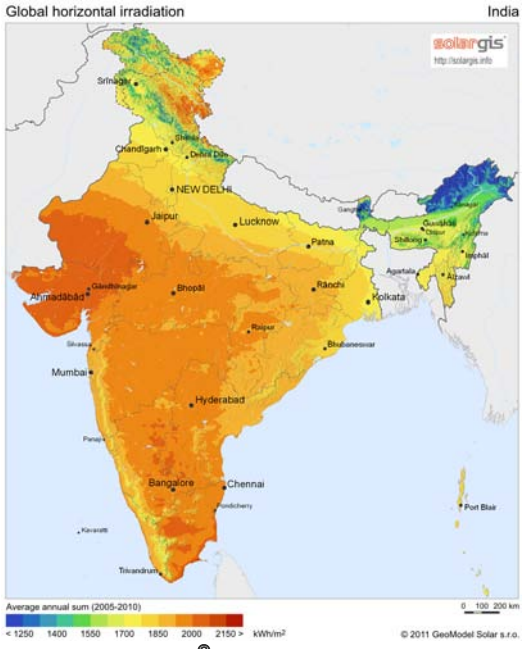
Parameter II	Score	Indicator	Weight (%)	Indicator Score (Raw)	Indicator Score (Weighted)
National Conditions	0.89	Insolation	5%	3.9	0.19
		SWH Market Penetration	4%	0.1	0.00
		Energy Consumption Growth	5%	4.3	0.21
		SWH Market Growth	4%	5.0	0.20
		Competitiveness: Payback Period	7%	4.0	0.28
		Competitiveness: Heating Fuel Subsidy	5%	0.0	0.00
		Subtotal	**30%**	**17.3**	**0.89**

3.4.2.1 Insolation

SCORE 3.9 / 5.0

As can be seen from **Figure 7**, average daily insolation levels in India range from 3.0 kWh/m^2/day in the northeast, to 6.5 kWh/m^2/day in parts of southern India, with an average daily insolation of 5.9 kWh/m^2/day. For scoring purposes, India is classified in Tier 7 and receives a score of 3.9.

Figure 12: Daily Insolation India (kWh/m^2/day)



Source: SolarGIS © 2014 GeoModel Solar

3.4.2.2 SWH Market penetration

SCORE 0.05 / 5.0

The SWH market penetration in 2011 was 2.74 kW_{th}/1000 inhabitants (Weiss & Mauthner, 2013). When this is compared to Greece's 268.2 kW_{th}/1000 inhabitants, India receives a score of 0.05.

3.4.2.3 Residential Energy Consumption Growth

SCORE 4.3 / 5.0

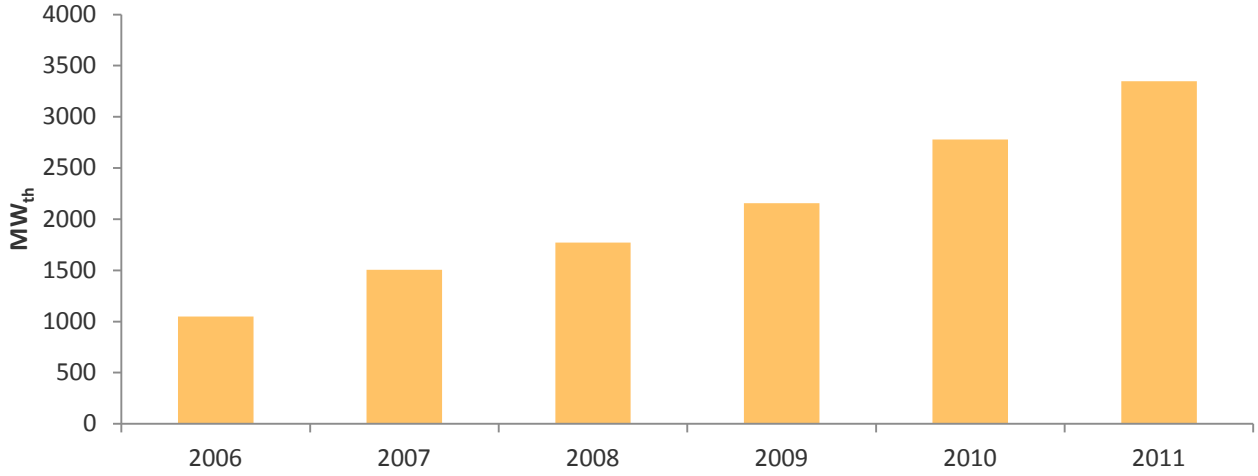
India has a 5 year (2006-2011) average growth rate of residential energy consumption of 2.14% according to IEA statistics; resulting in a score of 4.3 for this indicator.

3.4.2.4 SWH Market Growth

SCORE 5.0 / 5.0

The SWH market in India has grown rapidly during the past five years from 1,050 MW_{th} in 2006 to 3,347 MW_{th} in 2011 **(Figure 8)**. 5 year (2006-2011) average market growth rate is 26%, which results in a score of 5.

Figure 8: India Total SWH Installer Capacity (2006-2011)



3.4.2.5 Competitiveness: Payback Period

SCORE 4.0 / 5.0

SWH System Cost. Flat plate systems account for approximately 90% of the residential SWH market in India, and evacuated tube systems account for the remaining 10% (Weiss & Mauthner, 2013). Typical residential flat plate system size can vary from 2 m^2 collector systems with 100 liter tanks that cost Rs.22,000 (US$ 359) to 10 m^2 collector systems with 500 liter tanks that cost of Rs. 85,000 (US$ 1,387) (MNRE, 2012). For the purpose of this payback period analysis, a 4 m^2 collector with a 200 liter tank and a cost of Rs. 42,000 (US$ 685) is assumed.

Retail Energy Prices. In India, the majority of the residential sector meets its energy needs through biomass. According to the IEA Energy Balance Indicators (2011) biofuels and waste account for 76% of total residential energy consumption and is used mostly for heating and cooking. For the purpose of the payback period analysis, this study only considers marketed fuels (i.e. not traditional biomass). The analysis compares solar water heating against electricity and the average residential tariff rate in $/kWh. The analysis uses an average residential retail electricity tariff of US$ 0.05/kWh (Rs. 3/kWh) (Abeberese, 2012).

After running the RETScreen analysis, the payback period is 4.1 years resulting in a score of 4.

3.4.2.6 Competitiveness: Heating Fuel Subsidy

SCORE 0.0 / 5.0

Retail electricity rates in India are subsidized. The system for providing electricity subsidies is complex and electricity tariff rates differ among states and between consumer categories[30]. In general, retail electricity tariffs are insufficient to recover electric utilities' costs. In response, the government

[30] Users are divided into five sub-categories of users residential, agriculture, commercial, industry and railways. Each of these categories is further dividing into sub-categories based on consumption levels. The categories and sub-categories vary from state to state and some states have different tariff rates for consumers in urban and rural areas (Soni, Chatterjee, Bandyopadhyay, Lang, & Vis-Unba, 2012).

provides a capital subsidy to the state utilities to make up for this shortfall in revenue. The capital subsidy is often below the amount requested by the utility, however. According to a recent report, a study of 89 major utilities found that they recovered only 76% of their costs after the capital subsidy was factored in (Soni et al., 2012).

SWH systems have the potential to reduce consumer electricity demand and therefore some of the financial strain on utilities. However, because consumers pay artificially low prices for electricity, there may be less interest in SWH. As a result of the subsidies, SWH tends to be less competitive than electricity and India receives a score of 0.

3.4.3 PARAMETER III: FINANCING

Parameter III	Score	Indicator	Weight (%)	Indicator Score (Raw)	Indicator Score (Weighted)
Financing	0.60	Country Credit Rating	5%	1.5	0.08
		Access to Finance	15%	3.5	0.53
		Subtotal	**20%**	**5.0**	**0.60**

3.4.3.1 Country Credit Rating

SCORE 1.5 / 5.0

India's credit rating is low with an S&P rating of BBB- and a Moody's rating of BAA3. The rating agencies have cited poor economic fundamentals including slow growth, high fiscal and current account deficits, and lack of improvement in the macroeconomic situation (The Economic Times, 2013). Based on India's credit score rating, the country receives a score of 1.5.

3.4.3.2 Access to Finance

SCORE 3.5 / 5.0

The access to finance score was arrived at through two measures of 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. India's average real interest rate (2010-2012) is 1%, which scores 4, and its average amount of domestic credit (2010-2012) provided by the banking sector (as percent of GDP) is 74.3%, which scores 3. This combination of factors results in India's score of 3.5.

3.4.4 PARAMETER IV: BUSINESS CLIMATE

Parameter IV	Score	Indicator	Weight (%)	Indicator Score (Raw)	Indicator Score (Weighted)
Business Climate	0.82	Doing Business Index	5%	2.0	0.10
		Domestic Manufacturing	3%	4.0	0.12
		Product Certification	5%	4.0	0.20
		Installer Certification	4%	5.0	0.20
		Industry Association	4%	5.0	0.20
		Subtotal	**21%**	**20.0**	**0.82**

3.4.4.1 Business Climate

SCORE 2.0 / 5.0

Overall, India ranked 132 out of 185 countries in Doing Business 2013. The scores for the individual indicators within the Doing Business Rank are displayed in **Table 36** below. As can be seen in the table, India has a comparatively high rank for certain indicators, such as protecting investors and getting credit, but a lower rank for indicator such as enforcing contracts and dealing with construction permits. India's Doing Business ranking results in a score of 2.

Table 36: India - Doing Business Ranking

Category	Doing Business Ranking
Starting a Business	173
Dealing with Construction Permits	182
Getting Electricity	105
Registering Property	94
Getting Credit	23
Protecting Investors	49
Paying Taxes	152
Trading Across Border	127
Enforcing Contracts	184
Resolving Insolvency	116

3.4.4.2 Domestic Manufacturing

SCORE 4.0 / 5.0

In 2012, India had an MVA as percentage of GDP of approximately 15% and therefore receives a score of 4.

3.4.4.3 Product Certification

SCORE 4.0 / 5.0

- **Standards.** The Bureau of Indian Standards (BIS) has developed national level standards for flat plate SWH systems and components. The standards contain minimum performance requirements and testing methods. BIS also runs a testing and certification program for flat plate systems (MNRE, 2010). In order to qualify for the subsidy or concessional loan, the SWH system must comply with the national level standards (MNRE, 2010).
- **Testing.** The MNRE has developed test procedures with minimum performance requirements for evacuated tube systems and an approval system for evacuated tube producers. The BIS is also working on developing performance standards for evacuated tube collectors (MNRE, 2010). There is a network of BIS recognized testing centers around the country that carry out certification testing in accordance with national standards. SWH systems must be tested at one of these test centers. The test center locations are available on the MNRE website (MNRE, 2010).
- **Certification and Labeling**. Currently, there are 63 domestic flat plate manufacturers and 160 evacuated tube manufacturers that are approved by the BIS (MNRE, 2011, MNRE, 2013a).

Based on India's standards and certification infrastructure, it receives a score of a 4.

3.4.4.4 Installer Certification

SCORE 5.0 / 5.0

Manufacturers, installers and equipment providers must be approved and accredited by the MNRE in order to participate in the financial scheme under the JNNSM. A list of approved companies is provided on the MNRE website. The process for accrediting an entity may include assessing:

- Net worth/turnover
- Technical capability for carrying out services such as site selection, feasibility study, design, value engineering, cost optimization, time scheduling, procurement, installation and commissioning and O&M functions.
- Credit rating
- Track Record

Through the accreditation process, companies are classified into grades. The grade determines the financial capabilities of the firm, which influences the types and size of projects the firm can carry out. An accredited company's grade can change depending on their performance. The MNRE has invited rating agencies to participate in the grading process (MNRE, 2010).

Since installers must be certified to participate in the national SWH, India receives a score of 5.

3.4.4.5 Industry Association

SCORE 5.0 / 5.0

The Solar Thermal Federation of India (STFI) is the national association of SWH manufacturers in India. The STFI represents more than 20 companies that make up 85% of the country's SWH market. STFI serves as a voice for the SWH industry in the political and policy arena. The objective of the association is to support industry growth, strengthen performance of member companies, and to ensure India realizes the full potential of SWH (STFI, 2010).

Since India has an active solar thermal industry association, India receives a score of 5.

3.5 LEBANON

Overall Score	3.4* / 5.0

Summary: Lebanon's solar thermal market has grown 17% over the last five years, from 188 MWth in 2007 to 411 MW_{th} in 2012 (El Khoury, 2013; Weiss & Mauthner, 2013). Its overall score is 3.4 which will be discussed in detail in the sections below in order to provide greater insight into the SWH TechScope Market Readiness Assessment for Lebanon.

General Information (2012)	
Population	4,382,790
GDP	US$40,094,328,358
Total installed solar thermal (flat plate and evacuated tube collectors)	411 MW_{th}

Parameter	Score
SWH Support Framework	1.33
National Conditions	0.97
Financing	0.70
Business Climate	0.41

3.5.1 PARAMETER I: SOLAR WATER HEATING SUPPORT FRAMEWORK

Parameter I	Score	Indicator	Weight (%)	Indicator Score (Raw)	Indicator Score (Weighted)
Solar Water Heating Support Framework	1.33	SWH Targets	5%	5.0	0.25
		Financial Incentives for System Installation	8%	5.0	0.40
		SWH Loans Programs	7%	5.0	0.35
		Mandates	5%	2.5	0.13
		Outreach Campaigns	4%	5.0	0.20
		Subtotal	**29%**	**22.5**	**1.33**

3.5.1.1 Solar Water Heating Targets

SCORE 5.0 / 5.0

Lebanon has set renewable energy targets to support renewable thermal energy and solar water heating through a series of policy commitments.

- The Government of Lebanon committed to a roadmap to supply 12% of national energy needs from renewable energy sources by 2020 at the UNFCCC Copenhagen Climate Change Conference in December 2009.
- The Ministry of Energy and Water (MEW) published a strategic vision for the energy sector in the *Policy Paper for the Electricity Sector* in June 2010. The Policy Paper commits to, "launching, supporting and reinforcing all public, private and individual initiatives to adopt the utilization of renewable energies to reach 12% of electric and thermal supply," and to implement demand side energy conservation strategies, "in order to save a minimum of 5% of the total demand" (Bassil, 2010). To achieve these goals, the policy paper also commits to, "increase the penetration of Solar Water Heaters (SWH) and devise innovative financing schemes in collaboration with the banking sector to achieve the slogan, 'A solar heater for each household'."
- In November 2011, the Council of Ministers adopted the National Energy Efficiency Action Plan (NEEAP) 2011-2015, which outlined fourteen specific implementation strategies to achieve the goals of the Policy Paper (El Khoury et al., 2011). One of the strategies was to support the SWH market in order to facilitate the installation of 190,000 m^2 of solar collectors by 2014.

The development of these targets leads to Lebanon's score of 5.

3.5.1.2 Financial Incentives for System Installation

SCORE 5.0 / 5.0

MEW and its partners have established a US$1.5 million fund to provide US$200 grants to SWH systems. In order to qualify for the grant, systems must also have applied for and received a SWH loan (Section 3.4.1.3), and must also utilize one of the solar water heaters suppliers and installers

approved by the Lebanese Center for Energy Conservation (LCEC). As of 2013, over 1,700 SWH systems had been supported with the grant (Shehadeh, 2013).

Since Lebanon has SWH-focused financial incentives, its score for this section is 5.

3.5.1.3 SWH Loan Programs

SCORE 5.0 / 5.0

The Central Bank of Lebanon (*Banque du Liban,* or "BDL") coordinates a SWH loan program in partnership with commercial banks. Residential and commercial customers can apply for 0% interest loans for up to 80% of the system value which can be repaid over a period of 5 years (Shehadeh, 2012). Customers must work with SWH companies approved by LCEC in order to access the low-interest loans. As of 2013, over 3,500 customers had secured the solar loans from eight participating commercial banks in Lebanon. In total, US$18 million in loans have been provided for SWH, and it is anticipated that an additional $30 million will be made available to support SWH in 2014. These solar loans will be augmented by a new $65 million credit line, established by the European Investment Bank (EIB) and the French Development Agency (*Agence Francaise de Developpement* or "AFD"), for National Energy Efficiency and Renewable Energy Action (NEEREA) initiative. Banks have an incentive to participate in the loan program because the BDL allows them to lower the amount of reserves they must hold for each low-interest loan they make. This allows them to make a commercial return on money they would otherwise be unable to deploy. In addition to the dedicated SWH program, a separate loan program under NEEREA is available to a wider range of non-residential (e.g. for hospitals, hotels, etc.) energy efficiency and renewable energy systems. The NEEREA was approved under Council of Ministers Decision No. 59 of 2010. SWH can participate under NEEREA and access a 14-year, low-interest loan, and can also access a subsidy for between 5-15% of system costs which is supported by European Union funding.

The existence of these SWH loan programs gives Lebanon a score of 5 for this indicator.

3.5.1.4 Mandates

SCORE 2.5 / 5.0

The NEEAP calls for the preparation of a draft law that would update the national building code to require SWH systems in new and existing buildings by 2012. Although building mandates have been adopted by some municipalities, a national law has not yet been passed (El Khoury, 2013); therefore, Lebanon's score is 2.5.

3.5.1.5 Outreach Campaigns

SCORE 5.0 / 5.0

LCEC has implemented a broad-based SWH outreach campaign with support from the GSWH project. The campaign was supported by the GEF and through a $150,000 budget from the MEW, which will be augmented by another $100,000 from MEW in 2014. The campaign has included

innovative national media and advertising campaigns that relies on both traditional[31] and social media.[32]

These outreach programs give Lebanon 5 points for this indicator.

3.5.2 PARAMETER II: NATIONAL CONDITIONS

Parameter II	Score	Indicator	Weight (%)	Indicator Score (Raw)	Indicator Score (Weighted)
National Conditions	0.97	Insolation	5%	3.3	0.17
		SWH Market Penetration	4%	1.7	0.07
		Energy Consumption Growth	5%	5.0	0.25
		SWH Market Growth	4%	5.0	0.20
		Competitiveness: Payback Period	7%	4.0	0.28
		Competitiveness: Heating Fuel Subsidy	5%	0.0	0.00
		Subtotal	**30%**	**19.0**	**0.97**

3.5.2.1 Insolation

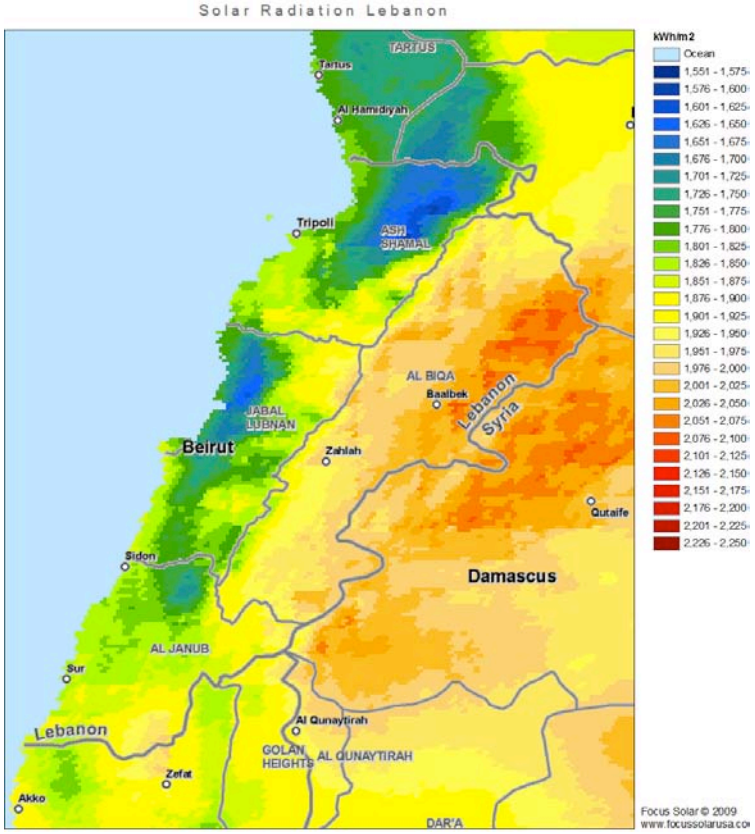
SCORE 3.3 / 5.0

As can be seen in **Figure 9** below, insolation levels in Lebanon vary from 1500 kWh/m^2/year in the northern parts of the country to over 2000 kWh/m^2/year in the eastern parts of the country near Syria. On average, Lebanon has an insolation of 1947 kWh/m^2/year and daily insolation of 5.34 kWh/m^2/day.

This value gives Lebanon a 3.3 for insolation score.

[31] Including a bi-annual newsletter, a weekly email, public informational seminars, TV and radio appearances, and print articles and advertising.
[32] See, for example: http://www.lcecp.org.lb/communication.php?li=3

Figure 14: Average Annual Insolation



Source: Focus Solar (2009)

Table 37: Average Daily Insolation

Average Insolation (kWh/m2/day)	Tier	Score
5.34	6	3

3.5.2.2 SWH Market penetration

SCORE 1.7 / 5.0

The SWH penetration rate has increased significantly during the past five years from 45 kW_{th}/1000 people in 2007 to 93 kW_{th}/1000 in 2012. A survey conducted by AMER Nielsen for the GSWH project in Lebanon concluded that approximately 14% of residential households in Lebanon currently have SWH systems.

Lebanon's score is 1.7 for this indicator.

3.5.2.3 Residential Energy Consumption Growth

SCORE 5.0 / 5.0

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

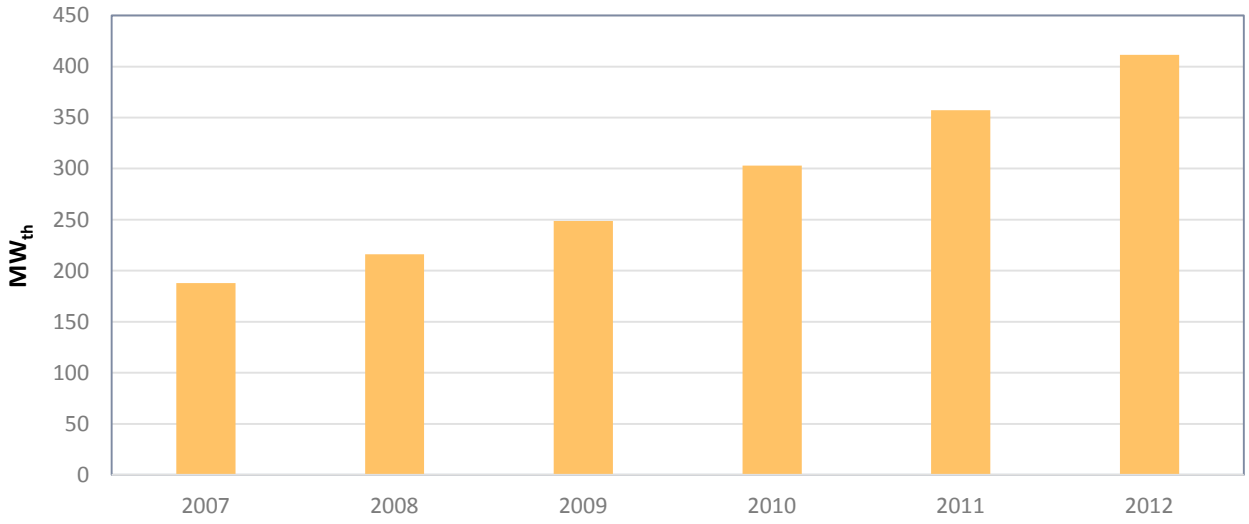
3.5.2.4 SWH Market Growth

SCORE 5.0 / 5.0

The SWH market in Lebanon has grown rapidly from 187 MW_{th} in 2007 to 411 MW_{th} in 2012 (**Figure 10**). The average market growth rate for 2007-2012 has been 17% (El Khoury, 2013; Weiss & Mauthner, 2013).

Lebanon's score for this indicator is 5.

Figure 15: SWH Capacity

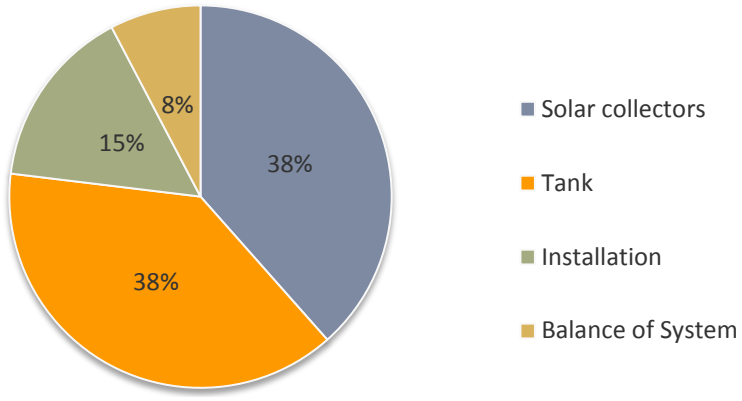


3.5.2.5 Competitiveness: Payback Period

SCORE 4.0 / 5.0

SWH system 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 OME, the typical collector surface is 3.6 m^2 and the typical tank size is 200 liters. The average system cost is US$1300. **Figure 11** below shows the contribution of major system components to total system cost (OME, 2012).

Figure 16: Share of SWH System Cost by Component



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 (Stolp et al., 2011). The residential retail electricity rates charged in Lebanon increase based on the amount of electricity consumed and vary from $0.023/kWh to $0.133/kWh (with an average of $0.10/kWh). For the purposes of this analysis, it is assumed that the average retail electricity rate against which solar heat must compete is $0.10.

Based on RETScreen analysis, SWH systems in Lebanon have a payback 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 to back-up generators for heating water during electricity shortages. When compared against the cost of back-up power (e.g. from diesel), SWH may be viewed as even more competitive. The analysis in this section could therefore be considered conservative.

3.5.2.6 Competitiveness: Heating Fuel Subsidy

SCORE 0.0 / 5.0

The cost of generating electricity in Lebanon is $0.171/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.

3.5.3 PARAMETER III: FINANCING

Parameter III	Score	Indicator	Weight (%)	Indicator Score (Raw)	Indicator Score (Weighted)
Financing	0.70	Country Credit Rating	5%	0.5	0.03
		Access to Finance	15%	4.5	0.68
		Subtotal	**20%**	**5.0**	**0.70**

3.5.3.1 Country Credit Rating

SCORE 0.5 / 5.0

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

3.5.3.2 Access to Finance

SCORE 4.5 / 5.0

The access to finance score was arrived at through two measures of 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. Lebanon's average real interest rate (2010-2012) is 4%, which scores 4, and its average amount of domestic credit (2010-2012) provided by the banking sector (as percent of GDP) is 174.28%, which scores 5. This combination of factors results in Lebanon's score of 4.5.

3.5.4 PARAMETER IV: BUSINESS CLIMATE

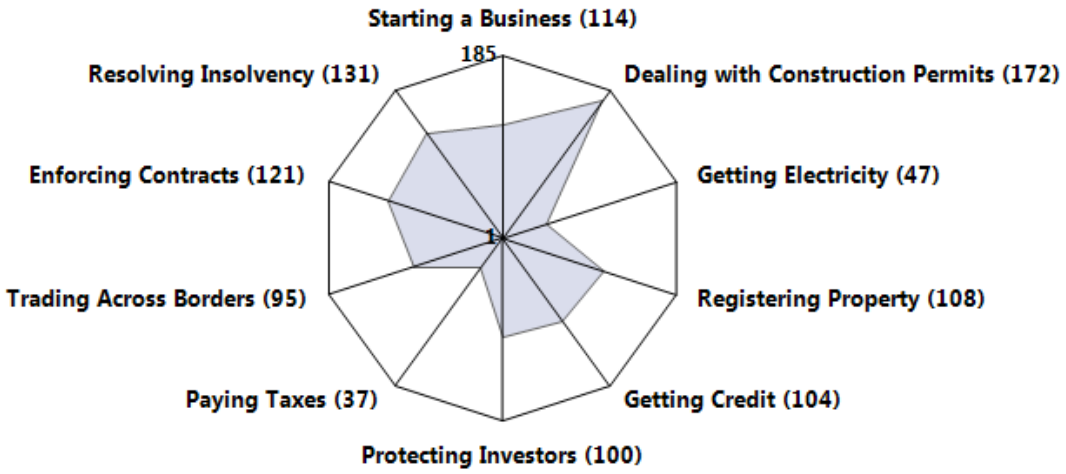
Parameter IV	Score	Indicator	Weight (%)	Indicator Score (Raw)	Indicator Score (Weighted)
Business Climate	0.41	Doing Business Index	5%	2.0	0.10
		Domestic Manufacturing	3%	2.0	0.06
		Product Certification	5%	5.0	0.25
		Installer Certification	4%	0.0	0.00
		Industry Association	4%	0.0	0.00
		Subtotal	**21%**	**9.0**	**0.41**

3.5.4.1 Business Climate

SCORE 2.0 / 5.0

Lebanon ranks 115 out of 185 countries according to the Doing Business 2013 assessment. The scores for the individual indicators within the total Doing Business Rank can be seen in the graph below. As illustrated below (Figure 12), Lebanon has a comparatively high rank for certain indicators such as paying taxes and obtaining an electricity connection, but a lower rank for indicators such as dealing with construction permits and resolving insolvency. Lebanon's score for this indicator gives it a score of 2.

Figure 17: Doing Business Rankings



Source: World Bank (2013)

3.5.4.2 Domestic Manufacturing

SCORE 2.0 / 5.0

The market for solar thermal collectors in Lebanon has historically been dominated by foreign manufacturers. The presence of comparatively low cost imports in the market has made it challenging for domestic manufacturers to gain a strong position. In 2011, for example, domestic manufacturers

supplied only 13% of the market, with Chinese and Turkish manufacturers supplying the majority of collectors. As the Lebanese market gains size and momentum, there may be opportunities for Lebanese firms to manufacture collectors or components.

The Market Readiness Assessment methodology uses MVA as a proxy for how well positioned a country is for manufacturing. Lebanon's MVA as a percentage of GDP in 2012 was just above 7%, which is low compared to the global average (~17%). Given Lebanon's MVA, it receives a score of 2 for manufacturing.

3.5.4.3 Product Standards and Certification

SCORE 5.0 / 5.0

Lebanon has been steadily building its standards and certification infrastructure.

- Standards. The Lebanese Standards Institution (LIBNOR) adopted the European Committee for Standardization's solar systems standards.
- Testing. The Lebanese Industrial Research Institute (IRI) established a SWH testing laboratory with the support of a grant from the Greek Government that complies with International Electrotechnical Commission (IEC) standards and European Standards (EN).
- Certification and labeling. Lebanon has been active in 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 lab is SHAMCI-compliant.

Due to the development of national SWH standards and testing, and its approach to certifications and labeling, Lebanon gets a score of 5 for this indicator.

3.5.4.4 Installer Certification

SCORE 0.0 / 5.0

There is no national installer certification program for installers in Lebanon. For the solar subsidy program, LCEC developed a qualification process for eligible solar installers and system suppliers. As discussed in Section 1.1.2, customers seeking the US$200 subsidy had to work with a company from the qualified list. Qualification was awarded based on two criteria: 70% of the score was awarded based on the quality of the company (e.g. installation track record, references, and composition of the firms' technical and management teams) and 30% of the score was based on the performance of the systems sold by the company (Shehadeh, 2012). As of 2013, 57 SWH firms were qualified. Because Lebanon does not have a national installer certification program or standard, however, its score for this indicator is 0.

3.5.4.5 Industry Association

SCORE 0.0 / 5.0

The solar thermal industry previously formed the Lebanese Association of Solar Industrialists (LASI). However, the association has not remained active or engaged. For the purposes of the Market Readiness Assessment, it is assumed that Lebanon does not have an active SWH trade or industry association. Therefore, Lebanon does not receive any points for this section.

3.6 MEXICO

Overall Score	3.19* / 5.0

Summary: Over the past five years, the SWH market in Mexico exhibited strong growth, increasing 23% from 248 MW_{th} to 704 MW_{th} in 2011 (Weiss et al., 2008; Weiss & Mauthner, 2013). Mexico's total TechScope score is 3.19, which will be discussed in detail in the sections below in order to provide greater insight into the SWH TechScope Market Readiness Assessment for Mexico.

General Information (2012) [33]	
Population	117,053,750
GDP	US$990.7 bn
Total installed solar thermal (flat plate and evacuated tube collectors)	705.5 MW_{th}

Parameter	Score
Solar Water Heating Support Framework	1.08
National conditions	0.59
Financing	0.63
Business Climate	0.77

[33] Population and GDP data from INEGI Banco de Informacion

3.6.1 PARAMETER I: SOLAR WATER HEATING SUPPORT FRAMEWORK

Parameter I	Score	Indicator	Weight (%)	Indicator Score (Raw)	Indicator Score (Weighted)
Solar Water Heating Support Framework	1.08	SWH Targets	5%	0.0	0.00
		Financial Incentives for System Installation	8%	5.0	0.40
		SWH Loans Programs	7%	5.0	0.35
		Building Mandates	5%	2.5	0.13
		Outreach Campaigns	4%	5.0	0.20
		Subtotal	**29%**	**17.5**	**1.08**

3.6.1.1 Solar Water Heating Targets

SCORE 0.0 / 5.0

The Law for the Sustainable Use of Energy of 2008 required the federal government to "integrate goals and strategies in the National Development Plan regarding the sustainable use of energy." As part of this requirement, the Government of Mexico is currently developing a mandatory national goal for solar water heating as part of the National Program for Sustainable Energy Use 2014-2018 (*Programa Nacional para el Aprovechamiento Sustentable de la Energía* or "PRONASE[34]"), which will then be integrated into Mexico's sector-specific plans. The SWH target is expected to be formalized in March, 2014. Since a formal target has not yet been adopted, Mexico currently receives a score of 0. In March, however, this score would change to 5, which would change the overall score to 3.44.

Prior to developing its national target, Mexico has set targets associated with specific SWH programs, such as the GSWH program and the *Programa para la Promoción de Calentadores Solares de Agua en México* or "Procalsol"). Procalsol was a public-private sector collaboration that has implemented a wide range of market development initiatives(Conae et al., 2012). The Procasol program had a goal to install 1.8 million square feet of new solar thermal collectors by 2012, which was achieved before the program expired.

3.6.1.2 Financial Incentives for System Installation

SCORE 5.0 / 5.0

Mexico allows renewable energy system owners to depreciate 100% of the value of the plant and equipment in the first year.[35] If system owners do not have sufficient tax appetite to realize the entire tax benefit in the first year, the depreciation can be carried forward to subsequent years. Systems must remain in operation for at least five years after the depreciation is claimed (SHCP, 2013).

The Trust Fund for Shared Risk (*Fideicomiso de Riesgo Compartido* – FIRCO) is operated by the Mexican Ministry of Agriculture and provides grants for renewable energy systems in the agricultural sector. The grants can cover 50% of the system cost, up to MXN$500,000 (US$37,173).[36] The

[34] *See* http://www.conuee.gob.mx/wb/CONAE/pronase_20142018
[35] *See* http://www.shcp.gob.mx/INGRESOS/Ingresos_pres_gasto/presupuesto_gastos_fiscales_2013.pdf
[36] *See* http://www.firco.gob.mx/Componentes%202013/bioenergia_2013/Paginas/bioenergia.aspx

budget for the fund comes from the World Bank, the Mexican government, and small farmers under a joint-shared risk investment scheme (Epp, 2012). Approximately 5% of the solar thermal market was served by the Trust Fund for Shared Risk in 2012 (Epp, 2013).

As a result of these programs, Mexico receives a 5 for this indicator.

3.6.1.3 SWH Loan Programs

SCORE 5.0 / 5.0

The Green Mortgage Fund (*Hipoteca Verde*) is operated by Infonavit, an independent, quasi-public agency that administers resources for the Housing National Fund and that also supports about one third of home mortgages in the country. The Green Mortgage Fund provides low-interest loans for residential SWH systems and other conservation technologies, with interest rates typically between 4% to 10% (Lastras, 2012). The Green Mortgage Fund provided financing for approximately 100,000 square meters of SWH in 2012, or approximately 53% of the total collector area installed that year (Epp, 2013).

This loan program gives Mexico a score of 5 for this section.

3.6.1.4 Building Mandates

SCORE 2.5 / 5.0

Mexico has not established a national SWH building mandate. However, Mexico has established an energy code for buildings at the federal level. Subnational governments have flexibility for how they implement the federal requirement, and several states and cities[37] have chosen to adopt solar building mandates as part of their implementation of the code requirements. Based on the existence of subnational solar building mandates, Mexico receives a score of 2.5.

3.6.1.5 Outreach Campaigns

SCORE 5.0 / 5.0

As discussed in Section 2.1, UNDP has worked with local policy-makers to develop an outreach strategy to engage stakeholders regarding SWH potential in key sectors, including small-medium sized enterprises (SMEs) such as laundries, dry-cleaners, and hotels (Srinivas, 2012). In addition, the GSWH project has made progress in raising awareness and building capacity for the SWH industry in Mexico by developing pilot projects to demonstrate SWH technology in key sectors and engaging a strategic communication consultancy to develop regular updates on SWH news in Mexico. Finally the GSWH program engages key actors across the SWH industry through networking events and media. Because Mexico has developed several outreach campaigns, it gets a score of 5.

[37] e.g. Aguascalientes, the Distrito Federal , Tabasco, Veracruz, and Zihuatanejo de Azueta

3.6.2 PARAMETER II: NATIONAL CONDITIONS

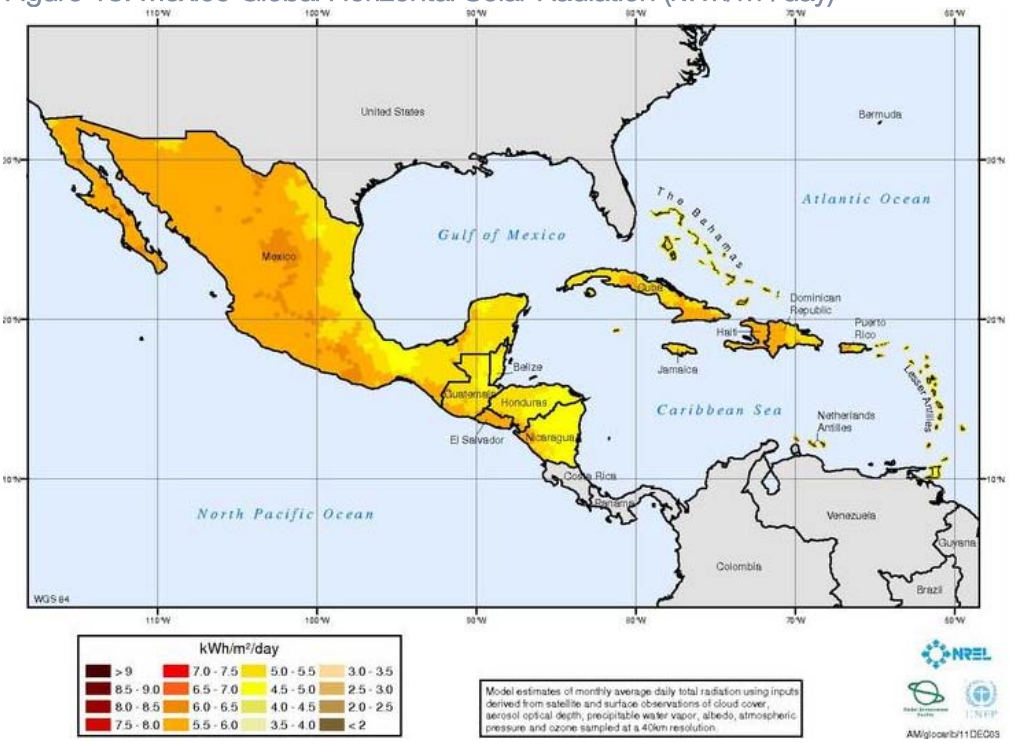
Parameter II	Score	Indicator	Weight (%)	Indicator Score (Raw)	Indicator Score (Weighted)
National Conditions	0.59	Insolation	5%	4.4	0.22
		SWH Market Penetration	4%	0.2	0.01
		Energy Consumption Growth	5%	0.5	0.02
		SWH Market Growth	4%	5.0	0.20
		Competitiveness: Payback Period	7%	2.0	0.14
		Competitiveness: Heating Fuel Subsidy	5%	0.0	0.00
		Subtotal	**30%**	**12.1**	**0.59**

3.6.2.1 Insolation

SCORE 4.4 / 5.0

As can be seen from **Figure 13,** average daily insolation levels range from 6.0 kWh/m^2 to 7.0 kWh/m^2 in Mexico, with a country average of 6.5 kWh/m^2 (Clean Energy Solutions Center, 2013). This insolation results in a score of 4.4.

Figure 18: Mexico Global Horizontal Solar Radiation (kWh/m^2/day)



Source: NREL (2003)

3.6.2.2 SWH Market penetration

SCORE 0.2 / 5.0

In 2011, Mexico had an installed capacity of 11.8 kW_{th} per 1,000 inhabitants. Although this value suggests moderate SWH penetration, when compared to Greece's 2011 value of 268.2 kW_{th} per 1000 inhabitants, Mexico gets a score of 0.2

3.6.2.3 Residential Energy Consumption Growth

SCORE 0.5 / 5.0

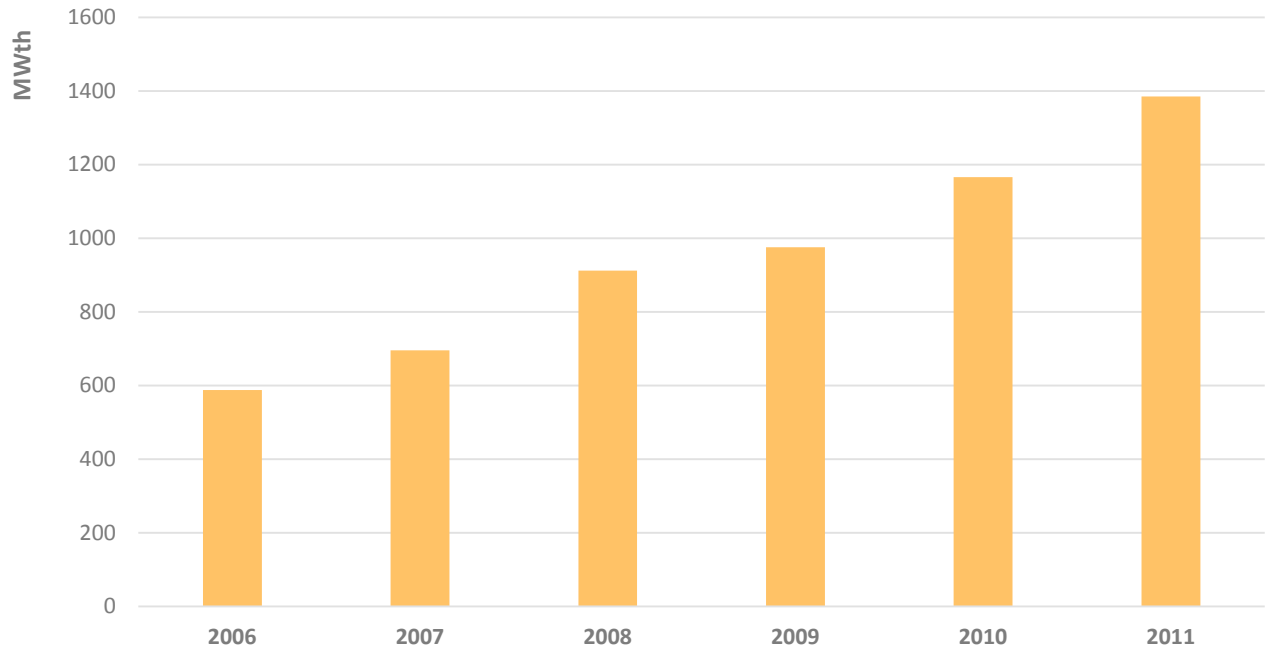
According to IEA statistics, despite a slight dip in consumption between 2008 and 2009, residential energy use has increased steadily over the past five years (2006-2011) (International Energy Agency, 2013b). On average, it has increased by 0.2% annually, which results in a score of 0.5.

3.6.2.4 SWH Market Growth

SCORE 5.0 / 5.0

The SWH market in Mexico has exhibited strong growth over the past five years from 588 MW_{th} in 2006 to 1385 MW_{th} in 2011 (Figure 14). The average market growth rate is 19%, giving Mexico a score of 5 for this indicator.

Figure 19: Mexico Total SWH Installed Capacity (2006-2011)



3.6.2.5 Competitiveness: Payback Period

SCORE 2.0 / 5.0

SWH system costs. SWH system costs can vary in Mexico. In the 25,000 solar thermal roofs programs, GTZ estimated that the average residential SWH system in Mexico costs 8,900 Mexican Peso (MXN) (US$ 684)[38] (Infonavit, 2011). The GTZ estimated the average system size to be approximately two square meters (Epp, 2009).

Retail energy prices. In Mexico, natural gas (liquefied and piped) is typically used for water heating (Milton & Kaufman, 2005). According to IEA, a Mexican household paid on average about $30.36 per MWh (converted on a gross calorific value) of natural gas. Electricity, by contrast, costs about $90.2 per MWh for Mexican households (International Energy Agency, 2013a).

After running the RETScreen analysis, the payback period for a SWH system is 8.7 years. This results in a score of 2.

3.6.2.6 Competitiveness: Heating Fuel Subsidy

SCORE 0.0 / 5.0

Mexico regulates natural gas prices by linking them to futures delivered by the Henry Hub in the United States and adding a transportation fee. Due to the recent boom of U.S. shale gas, Mexico's gas prices have dropped significantly. However, Mexico's supply of natural gas actually comes from a number of sources, including many which are more expensive such as the domestic oil and gas fields run by the state monopoly Pemex and liquefied natural gas imported from South America and Africa. As a result, the Mexican government is effectively subsidizing the cost of gas for users. This is currently creating significant challenges in meeting market demand – with Mexican gas distributors curtailing access to natural gas supplies by as much as 45% in an effort to cope with ballooning demand from households as well as commercial and industrial users (Rodriguez, 2012).

3.6.3 PARAMETER III: FINANCING

Parameter III	Score	Indicator	Weight (%)	Indicator Score (Raw)	Indicator Score (Weighted)
Financing	0.63	Country Credit Rating	5%	2.0	0.10
		Access to Finance	15%	3.5	0.53
		Subtotal	**20%**	**5.5**	**0.63**

3.6.3.1 Country Credit Rating

SCORE 2.0 / 5.0

Mexico benefits from a low private-sector debt-to-GDP ratio, stable asset prices over past several years, a stable market, and bank profitability. However, the country has low GDP per capita, a population with relatively low income, and concerns with regard to creditors' ability to recover

[38] Currency conversion was calculated using the exchange rate from January 4, 2014

collateral. These factors are reflected in Mexico's ratings from Moody's and S&P, which are BAA1 and BBB, respectively, resulting in a score of 2 for this indicator (Standard & Poor's, 2012).

3.6.3.2 Access to Finance

SCORE 3.5 / 5.0

The access to finance score was arrived at through two measures of 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. Mexico's average real interest rate (2010-2012) is 0.33%, which scores 5, and its average amount of domestic credit (2010-2012) provided by the banking sector (as percent of GDP) is 46%, which scores 2. This combination of factors results in Mexico's score of 3.5.

3.6.4 PARAMETER IV: BUSINESS CLIMATE

Parameter IV	Score	Indicator	Weight (%)	Indicator Score (Raw)	Indicator Score (Weighted)
Business Climate	0.90	Doing Business Index	5%	4.0	0.20
		Domestic Manufacturing	3%	5.0	0.15
		Product Certification	5%	3.0	0.15
		Installer Certification	4%	5.0	0.20
		Industry Association	4%	5.0	0.20
		Subtotal	**21%**	**22.0**	**0.90**

3.6.4.1 Business Climate

SCORE 4.0 / 5.0

Overall, Mexico ranks 48 out of 185 countries according to Doing Business 2013. The scores for the individual indicators within the Doing Business Rank can be seen in the **Table 38** below. Mexico has a high rank for certain indicators, such as resolving insolvency and dealing with construction permits, but a much lower rank, for indicators such as getting electricity and registering property. Together, Mexico's score for this section is 4.

Table 38: Mexico - Doing Business Ranking

Category	Doing Business Ranking
Starting a Business	36
Dealing with Construction Permits	36
Getting Electricity	130
Registering Property	141
Getting Credit	40
Protecting Investors	49
Paying Taxes	107
Trading Across Border	61
Enforcing Contracts	76
Resolving Insolvency	26

3.6.4.2 Domestic Manufacturing

SCORE 5.0 / 5.0

Domestic manufacturers, such as Módulo Solar, as well as foreign manufacturers are active in the Mexican SWH market. Determining a country's Manufacturing Value Added (MVA) is useful because this indicator can be used as a barometer of how developed that country's manufacturing sector is. Mexico's MVA as a percentage of GDP in 2012 was approximately 18%, lower than the average for developing countries (~21%) but slightly higher than the global average (~17%). Due to Mexico's strong MVA, it gets a score of 5 for this section.

3.6.4.3 Product Certification

SCORE 3.0 / 5.0

Mexico has been steadily building its standards and certification infrastructure.

- **Standards:** Mexico's national agency for standards and certification (NORMEX[39]) has published standards and testing methodologies for solar thermal systems (e.g. NMX-ES-004-NORMEX-2010[40]). The *Hipoteca Verde* loan program, which has been used to finance a significant proportion of the SWH systems in Mexico, also requires that SWH systems adhere to a specific set of standards managed by CONUEE (i.e. *Comisión Nacional para el Uso Eficiente de la Energía*) known as the DTESTV (i.e. *Dictamen Técnico de Energía Solar Térmica en Vivienda*).[41] The DTESTV standards are more rigorous than the NORMEX standards.
- **Testing:** UNDP recently sponsored the establishment of the new laboratory test facility in Leon Guanajuato, which will perform national certification tests based on DTESTV quality standard. This new laboratory complements Mexico's network of three existing solar testing laboratories.

As a result of its standards and testing infrastructure, Mexico scores a 3.

[39] *See* http://www.normex.com.mx
[40] *See* http://dof.gob.mx/nota_detalle.php?codigo=5138268&fecha=12/04/2010
[41] *See* http://www.conuee.gob.mx/procalsol/dictamen_procalsol.pdf

3.6.4.4 Installer Certification

SCORE 5.0 / 5.0

Mexico's national labor standards and certification body, CONOCER[42] has published standards for the job skills required for solar thermal installers, which have been entered in the National Register of Competency Standards.[43] The federal state of Aguascalientes is piloting the certification, with support from Infonavit and the German technical cooperation agency (GIZ). Following the pilot, it is anticipated that the certification will become mandatory for all installers working on housing developments financed by Infonavit. An additional seven federal states are exploring the certification of another 150 installers. The existence of national solar installer standards receives a score of 5.

3.6.4.5 Industry Association

SCORE 5.0 / 5.0

The organization of renewable manufacturers, FAMERAC (i.e. *Fabricantes Mexicanos en las Energías Renovables A.C.*[44]) actively represents the interests of the solar thermal industry. Mexico receives a score of 5.

[42] Consejo Nacional de Normalización y Certificación de Competencias Laborales
[43] *See* http://www.conocer.gob.mx/seccionesExtras/comites/pdf/avisos_48.pdf
[44] *See* http://famerac.org/

SECTION 4
CONCLUSION

The SWH TechScope Market Readiness Assessment methodology is intended to address the need for a public and replicable tool for evaluating the enabling environment for SWH across different countries. This report used the SWH TechScope Market Readiness Assessment methodology and the SWH TechScope Market Analysis Tool to characterize the SWH enabling environments in the five GSWH project countries: Albania, Chile, India, Lebanon, and Mexico. The analysis of the GSWH project countries involved a combination of primary resource research, interviews with national stakeholders, and a review process that included both international experts and national program managers. Experts provided input on both the assessment methodology as well as the accompanying tool. The resulting analyses provide an overview of the current SWH market conditions in five geographically diverse countries. At the same time, the analyses deliver proof of concept for a standard analytical framework, which can be used in the future to streamline SWH research and strategy development.

The indicators were selected and weighted in response to feedback from a panel of international SWH markets. In most cases, the indicators that have been selected are publicly available and include a majority of the world's countries. In some cases, however, indictor data may not be available and national analysts will need to identify appropriate proxies. For example, the SWH market data collected by IEA SH&C may only be available for more established markets and may not be available for markets that are just starting to emerge. In the event that proxy data must be used, however, it is important to note that overall scores developed for each country are not intended as a value judgment. Rather, they are intended as a way to organize analyses of SWH opportunities and challenges in a standardized manner.

The scoring system provides an opportunity to quickly and easily identify areas of strength in national markets and areas that may require additional exploration. Developers can use the scores, for example, to focus their attention on specific issues when evaluating opportunities for project development. Policy makers can use the scores to identify areas for policy intervention – or to identify market challenges that may be beyond the reach of national energy policymaking alone. The scores also allow stakeholders to readily compare how market and policy conditions have evolved in different directions or have converged across countries. Put another way, the primary benefit of the tool is to organize SWH information in order to make informed strategic decisions within the context of individual countries – rather than creating a system of national rankings for SWH. When determining policy interventions based on such analysis, it is also important to note that it is difficult to define universal "best practices" since what is best will vary from country to country based on national policy objectives and national conditions. What may be considered a best practice for a high-income country with low heating fuel costs, for example may vary from what would be considered a best practice for a low-income country with high heating fuel costs.

The SWH TechScope Market Readiness Assessment could also be used in the future to evaluate SWH programs and policies. The Assessment could be conducted at the outset of a project to

identify areas of focus and could be conducted again upon project completion in order to assess impact and progress. For example, the Assessment might identify that SWH is highly competitive with conventional heating fuels in a certain country, and that the policy framework to support SWH is strong. If market growth remains low, however, and no outreach efforts have been organized, national policy makers may decide that an ambitious outreach and engagement effort would be appropriate. Similarly, it policy makers identify that SWH is not yet competitive and that the policy framework does not support SWH, they may wish to create new incentives to support SWH growth in order to achieve national policy objectives. Such assessments could be conducted to support new national or international programs, such as those supported through the Global Environment Facility, and could also be used to set lay the foundation for action-oriented approaches, such as Nationally Appropriate Mitigation Actions (NAMAs) for solar water heating technologies.[45]

Looking ahead, UNEP and its partners will continue to pursue opportunities to create knowledge products to support SWH strategies around the world and to disseminate lessons learned and best practices from the five GSWH projects and beyond.

[45] NAMAs are sets of policies and actions that countries commit to in order to reduce greenhouse gas emissions. NAMAs were first introduced as a concept at the **United Nations Climate Change Conference in Bali in 2007. The concept has been subsequently refined in** subsequent international processes. A current list of NAMAs that have been submitted by national governments for consideration for funding can be found here: http://www4.unfccc.int/sites/nama/SitePages/Home.aspx

ANNEX I
SUMMARY OF COUNTRY TECHSCOPE SCORES

ALBANIA

Parameter	Parameter Weight (as a %) of Total Score	Indicator	Indicator Weight (as a %) of Total Score	Albania Score (Raw)	Albania Score (Weighted)
I. Solar Water Heating Support Framework	29	SWH Targets	5%	0.0	0.00
		Financial Incentives for System Installation	8%	0.0	0.00
		SWH Loan Programs	7%	5.0	0.35
		Mandates	5%	5.0	0.25
		Outreach Campaigns	4%	5.0	0.20
Subtotal			**29%**		**0.80**
II. National Conditions	30	Solar Insolation	5%	2.2	0.11
		SWH Market Penetration	4%	0.4	0.02
		Solar Thermal Growth: Residential Energy Consumption Growth	5%	4.2	0.21
		Solar Thermal Growth: SWH Growth	4%	5.0	0.20
		Competitiveness: Payback Period	7%	4.0	0.28
		Competitiveness: Heating Fuel Subsidy	5%	0.0	0.00
Subtotal			**30%**		**0.82**
III. Financing	20	Country Credit Rating	5%	0.5	0.03
		Access to and Cost of Finance	15%	3.0	0.45
Subtotal			20%		0.48
IV. Business Climate	21	Doing Business	5%	3.0	0.15
		Manufacturing Capacity	3%	4.0	0.12
		Product Certification	5%	4.0	0.20
		Installer Certification	4%	0.0	0.00
		Industry Association	4%	0.0	0.00
Subtotal			**21%**		**0.47**
TOTAL	**100**		**100%**		**2.56**

CHILE

Parameter	Parameter Weight (as a %) of Total Score	Indicator	Indicator Weight (as a %) of Total Score	Chile Score (Raw)	Chile Score (Weighted)
I. Solar Water Heating Support Framework	29	SWH Targets	5%	0.0	0.00
		Financial Incentives for System Installation	8%	5.0	0.40
		SWH Loan Programs	7%	0.0	0.00
		Mandates	5%	0.0	0.00
		Outreach Campaigns	4%	5.0	0.20
Subtotal			**29%**		**0.60**
II. National Conditions	30	Solar Insolation	5%	2.2	0.11
		SWH Market Penetration	4%	0.0	0.00
		Solar Thermal Growth: Residential Energy Consumption Growth	5%	4.8	0.24
		Solar Thermal Growth: SWH Growth	4%	5.0	0.20
		Competitiveness: Payback Period	7%	3.0	0.21
		Competitiveness: Heating Fuel Subsidy	5%	5.0	0.25
Subtotal			**30%**		**1.01**
III. Financing	20	Country Credit Rating	5%	4.0	0.20
		Access to and Cost of Finance	15%	3.5	0.53
Subtotal			**20%**		**0.73**
IV. Business Climate	21	Doing Business	5%	5.0	0.25
		Manufacturing Capacity	3%	4.0	0.12
		Product Certification	5%	4.0	0.20
		Installer Certification	4%	0.0	0.00
		Industry Association	4%	5.0	0.20
Subtotal			**21%**		**0.77**
TOTAL	**100**		**100%**		**3.11**

INDIA

Parameter	Parameter Weight (as a %) of Total Score	Indicator	Indicator Weight (as a %) of Total Score	India Score (Raw)	India Score (Weighted)
I. Solar Water Heating Support Framework	29	SWH Targets	5%	5.0	0.25
		Financial Incentives for System Installation	8%	5.0	0.40
		SWH Loan Programs	7%	5.0	0.35
		Mandates	5%	2.5	0.13
		Outreach Campaigns	4%	5.0	0.20
Subtotal			**29%**		**1.33**
II. National Conditions	30	Solar Insolation	5%	3.9	0.20
		SWH Market Penetration	4%	0.1	0.00
		Solar Thermal Growth: Residential Energy Consumption Growth	5%	4.3	0.05
		Solar Thermal Growth: SWH Growth	4%	5.0	0.20
		Competitiveness: Payback Period	7%	4.0	0.28
		Competitiveness: Heating Fuel Subsidy	5%	0.0	0.00
Subtotal			**30%**		**0.89**
III. Financing	20	Country Credit Rating	5%	2.0	0.10
		Access to and Cost of Finance	15%	3.5	0.53
Subtotal			20%		0.63
IV. Business Climate	21	Doing Business	5%	2.0	0.10
		Manufacturing Capacity	3%	4.0	0.12
		Product Certification	5%	4.0	0.20
		Installer Certification	4%	5.0	0.20
		Industry Association	4%	5.0	0.20
Subtotal			**21%**		**0.82**
TOTAL	**100**		**100%**		**3.64**

LEBANON

Parameter	Parameter Weight (as a %) of Total Score	Indicator	Indicator Weight (as a %) of Total Score	Lebanon Score (Raw)	Lebanon Score (Weighted)
I. Solar Water Heating Support Framework	29	SWH Targets	5%	5.0	0.25
		Financial Incentives for System Installation	8%	5.0	0.40
		SWH Loan Programs	7%	5.0	0.35
		Mandates	5%	2.5	0.13
		Outreach Campaigns	4%	5.0	0.20
Subtotal			**29%**		**1.33**
II. National Conditions	30	Solar Insolation	5%	3.3	0.17
		SWH Market Penetration	4%	1.7	0.07
		Solar Thermal Growth: Residential Energy Consumption Growth	5%	5.0	0.25
		Solar Thermal Growth: SWH Growth	4%	5.0	0.20
		Competitiveness: Payback Period	7%	4.0	0.28
		Competitiveness: Heating Fuel Subsidy	5%	0.0	0.00
Subtotal			**30%**		**0.97**
III. Financing	20	Country Credit Rating	5%	0.5	0.03
		Access to and Cost of Finance	15%	4.5	0.68
Subtotal			**20%**		**0.70**
IV. Business Climate	21	Doing Business	5%	2.0	0.10
		Manufacturing Capacity	3%	2.0	0.06
		Product Certification	5%	5.0	0.25
		Installer Certification	4%	0.0	0.00
		Industry Association	4%	0.0	0.00
Subtotal			**21%**		**0.41**
TOTAL	**100**		**100%**		**3.40**

MEXICO

Parameter	Parameter Weight (as a %) of Total Score	Indicator	Indicator Weight (as a %) of Total Score	Mexico Score (Raw)	Mexico Score (Weighted)
I. Solar Water Heating Support Framework	29	SWH Targets	5%	0.0	0.00
		Financial Incentives for System Installation	8%	5.0	0.40
		SWH Loan Programs	7%	5.0	0.35
		Mandates	5%	2.5	0.13
		Outreach Campaigns	4%	5.0	0.20
Subtotal			**29%**		**1.08**
II. National Conditions	30	Solar Insolation	5%	4.4	0.22
		SWH Market Penetration	4%	0.2	0.01
		Solar Thermal Growth: Residential Energy Consumption Growth	5%	0.5	0.02
		Solar Thermal Growth: SWH Growth	4%	5.0	0.20
		Competitiveness: Payback Period	7%	2.0	0.14
		Competitiveness: Heating Fuel Subsidy	5%	0.0	0.00
Subtotal			**30%**		**0.59**
III. Financing	20	Country Credit Rating	5%	2.0	0.10
		Access to and Cost of Finance	15%	3.5	0.53
Subtotal			**20%**		**0.63**
IV. Business Climate	21	Doing Business	5%	4.0	0.20
		Manufacturing Capacity	3%	5.0	0.15
		Product Certification	5%	3.0	0.15
		Installer Certification	4%	5.0	0.15
		Industry Association	4%	5.0	0.20
Subtotal			**21%**		**0.70**
TOTAL	**100**		**100%**		**3.19**

ANNEX II
OVERVIEW OF GSWH PROJECTS

INTRODUCTION

This Annex provides a more detailed summary of the GSWH project, with both its two main components (The Global Knowledge Management and Networking Component and The Country Programs Component) that were implemented with support of UNDP and its partners. The introduction to the Annex below provides a summary of the project overall, including a description of the project subcomponents. Each of the subsequent sections provides a description of how the project was implemented in each country.

Project title:

Global Solar Water Heating Market Transformation and Strengthening Initiative

Short Name:

Global Solar Water Heating Project (GSWH project)

Geographical scope:

Global

Project executing organization:

The overall project is jointly implemented by UNEP and UNDP, UNDP being the lead GEF implementing agency and responsible for national execution in 5countries. UNEP DTIE is the co-executing agency with responsibility for global project management, monitoring and technical assistance.

Project summary

Generally composed of solar thermal collectors, solar water heaters provide a simple, cost-effective, and sustainable means of heating water for domestic and other uses. In addition to reducing greenhouse gas emissions, solar water heating (SWH) offers a host of potential benefits to both individuals and governments seeking to reduce their dependence on fossil fuels. In countries where energy demands are exceeding capacity, SWH can reduce pressure on the national power system and diminish pollution produced by conventional energy sources. Economic benefits include enhanced employment opportunities and the creation of small- and medium-sized SWH businesses. The development of such business could, in turn, lead to improved product quality.

Boosting Solar Water Heating on a Global Scale

Funded by the Global Environment Fund (GEF), this project's goal is to accelerate the global commercialization and sustainable market transformation of SWH, thereby reducing the current use of electricity and fossil fuels for hot water preparation. It builds on the encouraging market development rates already achieved in some GEF programme countries and seeks to further expand the market in other countries with good SWH potential where the prerequisites for market uptake appear to exist.

PROJECT COMPONENTS

The project consists of two components:

- The Global Knowledge Management and Networking Component
- The Country Programs Component.

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 learnt.

This KM component is being executed by UNEP and a network of partners to facilitate co-coordinated, timely and professional technical backstopping for country specific SWH activities. The KM component is analyzing and disseminating information on the lessons learnt and "best practices", facilitate cross-country information exchange and networking, and, finally, serves as a catalyst to stimulate and initiate sustainable SWH market transformation in different GEF program countries globally.

UNEP and the International Copper Association, one of the main project partners, have launched a comprehensive web portal for solar thermal professionals: **www.solarthermalworld.org**. This unique Knowledge Management web-based tool acts as a worldwide reference for solar thermal energy. Offering the latest news and background information on the growth of the international solar thermal sector, the site covers incentive programmes, policies, technological trends, and market analyses. The portal also offers a calendar of international SWH-related events and news, as well as online "webinars," interactive web-based seminars and workshops.

UNEP is implementing the knowledge management component in close cooperation with four regional partners, **Observatoire Méditerranéen de l'Energie (OME), Latin American Energy Organization (OLADE),European Solar Thermal Industry Federation (ESTIF),** and the **Regional center for Renewable Energy and Energy Efficiency (RCREEE).**

COMPONENT 2: (UNDP COUNTRY PROGRAMS)

The basic conditions for the development of a SWH market on both the supply and demand side established, conducive to the overall, global market transformation goals of the project.

This component is focusing on overcoming the barriers and supporting the activities needed at the national level to stimulate sustainable SWH market development. It will consist of several, parallel country programs, which are expected to be managed locally under the UNDP National Execution (NEX) modality, but under the overall monitoring and technical backstopping provided by the global KM component.

PROJECT SUBCOMPONENTS

The international experiences, sector and barrier analysis as well as the in-country consultations conducted in the candidate countries as a part of the project preparation phase, have indicated that the typical support needs at the country level can be clustered under five specific subcomponents, which can be further tailored and fine-tuned to the specific needs of each participating country.

These subcomponents are as follows:

SUBCOMPONENT 2.1

Creating an enabling legal, regulatory and institutional framework to support sustainable SWH market development (policy).

The outputs and activities under this subcomponent will raise the awareness of the key national policy makers on the benefits of SWH and evaluate the feasibility of and stimulate and facilitate the policy dialogue in the participating countries otherwise on the possible policy measures to accelerate the SWH market growth. Among these measures are the development and adoption of building regulations favorable for SWH as well as different direct and in-direct financial and fiscal incentives. While the GEF funds can be used to support the evaluation and development of these financial and fiscal incentive policies, the funding for their actual implementation is expected to come from the participating country.

The activities to be implemented at the country level under this subcomponent will also support the development and adoption of voluntary or mandatory quality control, certification and labeling schemes and build the local capacity to effectively implement and enforce them. As highlighted already before, supplying the market with good quality products and consequently assuring positive experience with the technology are essential for sustainable market growth. The quality control systems to be developed are, to the extent possible, sought to be harmonized with applicable international schemes and best practices. Often, a stepwise approach in that respect can be advisable. The quality control scheme typically consists of product standards (looking at safety, performance and durability), a methodology for testing and a certification procedure. As applicable, an advisory committee of industry representatives can also be set up to promote participation.

SUBCOMPONENT 2.2

Creating a sustainable demand for SWH systems in the targeted end-user markets by public awareness raising, marketing support and capacity building (information).

The outputs and activities under this subcomponent will raise the awareness of the targeted end-users on the benefits, economic feasibility and other characteristics influencing a positive purchasing decision. The SWH industry in most countries consists of relatively small, SME type of enterprises, which have difficulties to launch systematic and effective promotion campaigns themselves. As a market neutral actor, the project can cost-share marketing efforts of the private sector by promoting impartial trustworthy information to the targeted end users, including financial and environmental benefits of the technology, list of suppliers and installers etc. The campaign can be broadcasted through TV, radio and printed media, events leaflets, and booklets, by relying, to the extent feasible, on the already available or with other countries jointly developed materials available through the Global Knowledge Management component. It will also use the already existing demonstrations within the country to promote SWH, rather than request funds for any new demonstrations.

It should be taken into account that, especially in emerging markets, the promotion of SWH systems will have to compete with the promotion of consumer goods, such as electronics, or second-hand cars, that are in a similar price/investment range. Advertisement for these consumer goods will be dominant and, in view of the mass market, financial institutes may be more interested to develop financing schemes for the purchase of these goods than for a smaller market to finance small investments into SWH systems. The ability to sell the advantages of SWH systems, especially in competition to alternative consumer goods, to prospective beneficiaries, and the mobilization of the

banks to finance these systems, will be among the most important components of market acceleration. High emphasis is therefore given to develop and implement strong awareness rising programs and sound marketing campaigns and to build up a strong partnership with financial institutions.

SUBCOMPONENT 2.3

Enhancing the demand for SWH systems by the availability of attractive end-user financing mechanisms and new delivery models (financing).

This subcomponent will raise the awareness of the local financing institutions and other key stakeholders, such as local vendors, power utilities etc. on the SWH financing opportunities and build their capacity to structure and introduce new or apply existing financing products or other delivery models, such as specific Solar Energy Service Companies or utility driven models, which are expected to be attractive for the targeted end users - thus promoting the demand.

While the financial resources of the GEF are primarily sought for technical assistance type of activities, in some countries there will be a need to use some GEF resources as incentives for initial testing and risk sharing of the proposed financial mechanisms, thereby attracting the targeted financial entities to enter the SWH financing market. For phase 1, the amount allocated for this purpose is limited to USD 1.5 million in total in order to test some applicable schemes in two participating countries (Chile and Mexico). For further details about the proposed consumer financing and delivery models to be promoted by the project as well as about the envisaged awareness raising and capacity building needs of the local financing entities, see the individual country program documents presented as annexes to this project document.

SUBCOMPONENT 2.4

Enhanced capacity of the supply chain to respond to the growing demand with good quality products and services sustaining the market growth (business skills).

In order to develop the SWH market, the local supply chain must develop in parallel. It is a balanced process, in which the increased demand from the market must be matched with the availability of decent quality products, and along with it, an infrastructure of sufficiently trained installers.

The outputs and activities under this component will build the capacity of the manufacturers to improve their product quality and design as well as the business skill of the distribution chain to offer better quality and more attractive services to the targeted end user. When applicable, co-operation with foreign manufacturers will be promoted. The establishment of a training and certification system for and supporting the actual training of the SWH installers is envisaged to be one of the main outputs and activities under this component.

The lack of craftsmen properly trained to install and maintain solar thermal systems can, in general, become a key barrier to growth. This is particularly relevant for the main market segment of single-family houses, as installers can often decisively act as the decision maker. If installers know solar thermal systems, they may motivate potential users to buy them. If they are not specifically trained, they may discourage consumers or even provide a poor installation, with a negative impact on the functionality of the system and on the image of the technology.

SUBCOMPONENT 2.5

The provided support institutionalized and the results, experiences and lesson learnt documented and disseminated (including monitoring, learning, evaluation and other feedback for adaptive management).

By building on the outputs and lessons learnt from the activities implemented under the previous sub-components and on the identified further support needs identified during the implementation of the project, the purpose of this component is to ensure that the required further support can be institutionalized and made available to support sustainable growth of the SWH market also after the project. While the required actions at the policy side are expected to be addressed under component 2.1, this component will focus on further capacity building, market promotion, supply chain strengthening and financing needs. Furthermore, it will facilitate the compilation, analysis and dissemination of the project results and lessons learnt so as to serve replication as well as the required input to the global knowledge management component.

The specific outputs under this component may include:

- The reporting framework and arrangements for the SWH market monitoring systems established and continuing after the end of the project;
- SWH-related subjects increasingly included into the curricula of the relevant academic and other educational institutions;
- An established SWH Trade Association, Business Advisory Center or similar entity, which can continue to serve as a focal point for further SWH promotional activities on a self-sustaining basis;
- As applicable, further elaboration, resource mobilization for and continuation of the required financial support mechanisms;
- Standard project monitoring and scheduled evaluations; and
- The final report of the overall country program finalized and disseminated, compiling and analyzing the experiences and lessons learnt from the promotion of the national market under consideration.

The common subcomponents discussed above were adapted to the specific circumstances of each participating project country and have, therefore, been described only in general terms above.

For the design of any future participating country program, it will be recommended starting first with the SWH Techscope Market Readiness Analysis Tool to help assess different countries specific conditions and circumstances.

ALBANIA

Project duration: September 2009 - February 2015
Project Budget: GEF: $1,000,000

Project Lessons Learned: Albania

- Entering into Memoranda of Understanding with public entities, such as the Tirana Municipality, helped ensure cooperation between the UNDP and the municipal government. For example, the MOU helped ensure the UNDP-provided technical assistance on how to incorporate the recent solar obligations into local standards and carried out capacity building activities for the local staff and also helped ensure the Municipality of Tirana upheld the cost-sharing agreement for selected pilot projects.
- Broadening the project scope to include other building energy efficiency measures enhanced local partner's interest in the project.
- Awareness raising and pilot project kick-off events helped increase public awareness of SWH. Providing an opportunity for the public to view a SWH system after it was installed and learn directly from the pilot project participants about the benefits of the system helped improve public awareness, ultimately reaching everyone from high level policy makers to owners of public buildings. It was especially important to have representatives of the donor community involved in the events to not only increase the visibility of the project, but to motivate others to undertake similar initiatives in the country.

The UN Development Programme (UNDP), with support from the Global Environmental Facility (GEF), is supporting the Government of Albania in increasing the share of solar thermal energy in the country's energy mix. The UNDP is working in cooperation with the Ministry of Economy, Trade and Energy (METE) and the Ministry of Environment, Forestry and Water Administration (MEFW), to facilitate the installation of 75,000 m^2 of collector area and reach annual sales of 20,000 m^2 by the end of the project. The SWH sector is expected to continue to grow even after the project comes to a close, reaching total installed capacity of 520,000 m^2 by 2020. In addition, the project aims to achieve over 80% customer satisfaction among customers that purchase SWH systems through the program. The goal is to provide high quality products with good after sales service.

Prior to the project, as of 2005, Albania had installed a total of 33,000 m^2 of collector area. In 2005 Albania's SWH sector had a growth rate of 5%. The sector was also known for varying quality of products, and yielded mixed results in customer satisfaction.

In order to reach the project's targets and long-term goal of accelerating the sustainable market development of solar water heating in Albania, the project is supporting policy interventions, providing technical assistance at the central and local government level, and delivering targeted capacity building and awareness raising activities to various stakeholders. The project is forging new strategic partnerships and is working with various national and international partners.

As of June 2013, the project facilitated the installation of nearly 40,000 m^2 of new SWH capacity accounting for more than half of the project's expected final impact (direct post-project and indirect). As a result, the cumulative SWH installed capacity has reached 122,165 m^2.

The following sections detail the progress of the project thus far.

AN ENABLING INSTITUTIONAL, LEGAL AND REGULATORY FRAMEWORK

The project has made significant progress in creating an enabling environment for SWH. The project was instrumental in the drafting and subsequent passing of the recent Renewable Energy Sources Law.

Additionally, in anticipation of the new law, the UNDP worked with the public and municipal sector on drafting "Standards for Renewable Energy Sources (RES) on public buildings." The standards include the adoption of solar thermal obligations for new public buildings and those undergoing major renovations. With the passage of the RES law, the project is continuing to support and scale up enforcement efforts.

In parallel, the project supported the METE in developing Albania's National Renewable Energy Action Plan (2012-2020) and continues to support the implementation of the plan.

The project has also helped improve communications and decision making processes across five ministries by holding several roundtable discussions.

AWARENESS AND CAPACITY BUILDING

The project's second major objective was to raise awareness and increase capacity of targeted end users and building sector professionals in considering and integrating SWH systems into different types of buildings.

The project made major strides in meeting this objective through outreach, education and a significant focus on training.

Outreach

The UNDP, in partnership with the government, has hosted launch events for recently installed SWH pilot projects in Thethi and Tirana and promotional events to raise public awareness of SWH in isolated and tourist areas. Participants included representatives from the media, business, NGOs, local and central government and academia. In addition, the UNDP and the government ran a two week awareness raising campaign across major coastal cities of Albania that promoted the benefits of SWH technology and its potential to contribute to energy conservation and climate change mitigation. The project is also working on a short documentary film to showcase the experiences of public and private sector participants that installed SWH systems during the pilot program.

Training

The project has supported several Vocational Training Centers (VTCs) and Professional Schools in developing new curriculum for training installers and maintenance professional of solar panels for hot water. The project has created the training manuals and trained the instructors for these courses. In addition, the project has installed demo-equipment in six VTCs to provide more hands-on- learning opportunities.

The project has also worked with international and national experts on testing and certification to develop a tailored training course with the Harry Fultz Institute in Tirana on SWH system testing. Twenty three instructors, manufacturers, importers and other interested engineers and students have participated in the course.

The project has established a database for producers, importers and installers of SWH systems.

The UNDP has also undertaken various trainings and capacity building activities around SWH. They have trained 68 architects, building engineers and other professional in the building sector; 173 students of polytechnic universities in Albania; 46 SWH system installers and 5 domestic SWH systems producers; and 25 media representatives to increase their capacities on the benefits of solar energy.

Moreover, the project has introduced an online SWH calculation tool/software aimed at increasing awareness on financial benefits of using solar for water heating which can be accessed at: http://www.ccalb.org/index.php?pg=details&id=131&cid=9.

FINANCE AND INVESTMENT

As mentioned in Section 1.1.2, Albania does not have any specific fiscal incentives or financial support mechanisms to promote SWH. However, the Government recently requested UNDP assistance in establishing a financial support mechanism for renewable energy, including solar. Thus, the project has focused its efforts on providing financing for SWH systems in public and private buildings. The project established a small grants program, co-financed partially by the UNDP, which was used to install SWHs in some of the most hot water intensive public buildings in Tirana, Thethi, Petrela and Preza. These included public health centers, social centers and shelters. The project has also carried out many SWH feasibility and technical studies for specific public buildings. In 2013, 10 SWH systems will be installed in public sector buildings.

In addition, the project is working with the private sector and has supported several feasibility studies for industry and service buildings. In 2012, the UNDP and the GEF Small Grants Programme provided 11 guesthouses with SWHs in the tourist area of Theth.

CERTIFICATION AND QUALITY CONTROL

Prior to the project, there were no specific SWH standards, certifications or quality control mechanisms in Albania. As mentioned in Section 1.4, the project is providing significant support to Albania in building its standards and certification infrastructure and ensuring it's in line with EU and International standards.

The project has helped build relationships with several institutions to provide technical expertise on quality standard and certification programs including The Swiss Consortium INFRAS, which will provide technical assistance to hotels, members of the Albanian Tourism Association and Albanian SWH producers.

As discussed in Section 1.4, the UNDP has also helped the Albanian Solar Testing Center build relationships and secure technical assistance from international testing facilities including the Solar and Thermal Engineering Stuttgart Institute (SWT) based in Stuttgart, Germany as well as the SPF Testing Center in Switzerland.

In addition, the project is collaborating with European Bank for Reconstruction and Development (EBRD) and the Albanian Investment Development Agency (AIDA) through their Business Advisory Services Project (BAS) to support Albanian SWH manufacturers in meeting the European certification standards, specifically the Solar Keymark. Based on these meetings, the project is exploring the possibility of co-financing manufacturer efforts to test and certify their products.

Furthermore, the project is working to better understand the technical and financial performance of SWH systems by monitoring 20 residential systems and three large systems installed across three climatic zones. The project is collecting data on hot water and electricity consumption. This

information will help inform the technical specifications of future SWH systems and potential financial incentives.

PROJECT STATUS

Based on a request from the Government, the project has applied for a one year no-cost extension to assist Albania in designing and establishing a financial support mechanism for solar water heating. In the meantime, the project is continuing to carry out its activities and is working to institutionalize the support provided by the UNDP-GEF project.

The activities, reports and promotional materials are published and available on the webpage of the UNDP Climate Change Programme (www.ccalb.org) under the SWH project and the Facebook page (https://www.facebook.com/undpccp.albania). As mentioned in section 1.1.5, the project is also working on a short documentary to showcase the experiences of public and private sector participants involved in the pilot program. Moreover, efforts continue to develop a network of SWH experts form the public and private sectors in the Mediterranean region and to find synergies between donors contributing to the promotion of SWH in Albania.

In addition, the project is working to transition its SWH market monitoring responsibilities to National Agency for Natural Resources (NANR)—the project has been monitoring the growth in the residential and commercial SWH market since 2010 and this activity is expected to continue through 2025. Furthermore, the project is working to establish a local solar thermal association to advocate for the needs of the industry once the project comes to a close.

For the final years, the project will focus on:

- Implementing demo projects to boost the installation of SWH in the most hot water-intensive public/municipal facilities.
- Implement an Investment Cost-Sharing Small Grants scheme and additional Technical Assistance to energy-intensive end-users in the tourism and industrial sectors.
- Provide technical assistance to the METE to draft the regulations related to a prospective ''Energy Efficiency (EE) and Renewable Energy (RE) Investment Fund'' in order to advance the enforcement of the Renewable Energy Sources law and boost investment in EE and RE.

CHILE

Date: September 2009 - December 2014
Funding: GEF: $1,500,000; Co-financing: $1,831,500

Project Lessons Learned: Chile

- Tax credits can drive markets, but also face limitations. Law No. 20.365 established Chile's first incentive for SWH development, which was a tax credit for developers that install solar thermal. Developers, however, may not have sufficient tax appetite to monetize tax credits. Although the tax credit drove market growth, its structure also constrained the range of companies that could take advantage of it.
- The dynamic policy and political landscape in Chile creates challenges and opportunities. There were delays in getting the GSWH project off the ground in Chile. During this time Law No. 20.365 was passed. This significantly changed the enabling environment for SWH and affected the focus of the GSWH project. Moreover, in 2010, the Ministry of Energy was created and there was a change in government and department staff which also shifted the emphasis that the SWH market received within government.
- There is a need for technical capacity building for the solar thermal industry in Chile, and the lack of technical capability has been a challenge to market growth. As a result, there has been a greater reliance on international expertise within the marketplace.

The GSWH project started in September 2009 and is scheduled to come to a close at the end of December 2014. The project received $1.5 million in funding through the UNDP and Global Environmental Facility (GEF). The GEF funds were matched by additional financing of $1,831,500 from the governments of Chile and institutions participating in this project.

The project has supported the acceleration of SWH in Chile in partnership with the government and other stakeholders. In 2006, there were 6,700 m2 of installed SWH collector area in Chile. The project's goal is to accelerate and sustain a growth rate of 45% for the SWH market in Chile in order to achieve a target of 35,700 m2, and to establish and sustain annual sales of 11,000 m2. The project envisions the majority of this growth will be in the residential sector, accounting for 80% of the total expansion of capacity. The project also set a long-term goal of growing the market to 1 million m2 of total installed collector area by 2020.

By 2011, the country had surpassed the projects goal of reaching 35,700 m2 of SWH installed capacity and as of 2012 the country had a total installed collector area of 93,883 m2. According to project documents, as of June 2013, the project had facilitated the installation of 26,360 m2 of installed SWH capacity. In addition, given the past and current growth rates it is likely that the project will achieve its goal of accelerating and sustaining a growth rate of 45% for the SWH market in Chile (Figure 2).

AN ENABLING INSTITUTIONAL, LEGAL AND REGULATORY FRAMEWORK

One of the main objectives of the project is to strengthen the enabling, institutional, legal and regulatory framework to support SWH. As discussed in Section 1.1 the government passed Law No 20.365 in August 2009, which established a tax credit for construction companies that could be

applied to SWH installation costs in new homes. The tax credit was set to remain in force for five years (2013) and the government allocated US $300 million to finance the incentive. The tax exemption was launched in 2010 and significantly changed the context in which the project was operating and from 2009-2010 SWH installations grew from 28,159 m2 to 39,079 m2. As a result, the project adjusted its focus from assisting the government in developing a legal framework to supporting the implementation of the Law through supporting the responsible institution, promotional activities, and training.

As the law has been rolled out, the project has drawn attention to limitations in the design and implementation and prepared proposals to amend the law including extending the period of time, expanding the coverage of the tax exemption to individuals and households and to incorporate some compulsory elements such as mandatory certification of installed solar thermal systems. At this stage, the Government has yet to make any decision on the proposal.

The 2009 Law 20.365 provides financial incentive for installing SWH systems in the form of a tax exemption for constructions companies. The law is set to expire at the end of 2013, however, and it is unclear whether Congress will approve an extension.

AWARENESS RAISING AND CAPACITY BUILDING

The project has focused most of its efforts on training, capacity building and developing knowledge products.

The project hired an international solar thermal expert to develop technical and training materials on SWH. Thus far, a *Solar Specialist Technical Training* manual has been completed. As of the June 2013 project report, two technical manuals were being developed for the Ministry of Housing and Urban Development and the Superintendence of Electricity and Fuel (SEC). The experts are also developing technical tools that help builders incorporate SWH into the early stages of building design and construction. The project is working to integrate these tools into design programs, such as AutoCAD.

In addition, the international experts have trained personnel from the regional offices of the Ministry of Housing and Urban Development and teachers from 11 technical colleges across different regions of the country. During the second half of 2013, the project will conduct trainings for the Superintendence of Electricity and Fuel (SEC).

FINANCE AND INVESTMENT

As mentioned in Section 1.1 and 2.1, the passing of Law No. 20.365 significantly changed the context of the project. The project attempted to establish a financial mechanism focused on the end user, specifically residential users that would provide a financing line for the purchase, sale, and installation and after sales service of solar thermal systems. However, the idea garnered little interest and no bidders responded to the tender.

The project has recently proposed a new financial incentive in partnership with the Ministry of Housing and Urbanism (MINVU) that would be independent of the tax credit. The mechanism will focus on developing a SWH pilot project for existing low-income housing. The project will install 1 or 2 centralized solar thermal systems for 20 to 40 social housing units. MINVU will implement this activity with the goal of establishing a new financial mechanism. Based on the outcome of the pilot project, beginning in 2016, solar thermal systems could be installed for up to 5,000 households at a cost of US $2,500 per household totaling US$12.5 million. This pilot project was approved by the UNDP in June 2013 and if successful, the MINVU will provide the funding for this mechanism.

CERTIFICATION AND QUALITY CONTROL

In terms of supporting the development of a certification or quality control system, the project has focused on building capacity, developing training materials and training programs, designing high quality projects and developing technical tools that incorporate SWH into the early stages of building design.

PROJECT STATUS

The project is scheduled to come to a close on December 31, 2014. During the final year the project will focus on piloting the financial mechanism with the MINVU and pursuing an extension of the tax exemption under Law No. 20.365. It will also continue raise awareness, build capacity and train potential SWH end-users in the public and private sector with the aim of strengthening certification and quality control for SWH systems.

INDIA

Project Period: November 2008 – March 2013
Project Budget: GEF - $1,000,000

Project Lessons Learned: India

Project Management

- The National Project Director that led the Project Management Unit was also a Joint Secretary at MNRE. This ensured effective coordination with MNRE policy and implementation of the SWH program.
- There should be a documentation specialist on the team or on retainer to improve the quality of knowledge products and the dissemination of products.

Communication

- Communication between the 5 GSWH projects could have been improved. There was initially good communication and engagement across countries, however as the project continued this decreased greatly. More could have been done to foster this communication. However, there is still an opportunity to compile the experiences of the projects and share them with partners, across countries and develop a platform for continuous engagement.

Capacity Building of Installers

- After sales support is still quite poor. Therefore, training of semi-skilled and skilled workers should be emphasized in future projects.

Finance Incentives

- The subsidy and low interest loans were effective in increasing sales of SWH systems. However, the 30% capital subsidy should not be continued as it could lead to market distortion. Instead, an accelerated capital subsidy deprecation should be applied to reduce chances of market distortion.
- Industrial Sector: Financial support including accelerated depreciation and the capital subsidy should be continued to encourage and catalyze SWH installations in the industrial sector.

Energy Service Company (ESCO) model

- A lack of loans is a key barrier to ESCO project development. Financing from a financial institution or an equity partner was essential.
- SWH ESCOs are most suitable for industries that run their own production lines and need assistance in improving their energy efficiency.
- Measures should be taken to reduce any risks of integrating the SWH system with the existing machinery and processes, and should be done quickly to minimize manufacturing downtime.

The UNDP-GEF GSWH project sought to establish a supportive regulatory environment, build market demand and strengthen the supply chain of the SWH market in India. A major objective of the project was to contribute to the achievement of India's SWH targets by adopting a goal of installing 2 million m^2 of collector area by the close of the project to assist the MNRE in reaching its cumulative target of 7 million m^2 of SWH by the end of the 11th Five Year Plan. Specifically, the focus of the project was to remove supply chain inefficiencies, build awareness of the benefits of solar-powered water heating systems, and refine and replicate effective SWH incentive programs across the country (MNRE, 2012b).

AN ENABLING INSTITUTIONAL, LEGAL AND REGULATORY FRAMEWORK

The growth in India's SWH market is a result of the policies, targets, and incentives established by the Government of India through the JNNSM and support provided by the UNDP. As of March 2013, the UNDP project was facilitated the installation of 2.4 million m^2 of collector area. From October 2008 to March 2013, the installed SWH capacity grew by 4.56 million m^2 of collector area for a total collector area of 7.11 million m^2. Measured against a baseline of 2.55 million m^2 the total collector area across the country more than doubled in 5 years. It is estimated that the project contributed to 52% of this total growth.

In addition, the project supported the development of a stronger legal and regulatory framework to promote SWH at the State and local level. Twenty-six out of 28 states in India have adopted by- laws that require the installation of SWH in functional buildings. The extent to which these mandates are implemented and enforced varies across the different jurisdictions. The UNDP initiated two studies to better understand the implementation and enforcement problems including *Building Sector Policies and Regulations for Promotion of Solar Water Heating Systems* and *Promotion of Solar Water Heating Systems by Utilities and Regulation Policies*. Based on the findings of these studies, the project provided support to eight states (Gujarat, Andhra Pradesh, and Tamil Nadu, Kerala, Bengaluru, West Bengal, Bhopal and Chandigarh) to strengthen the implementation and enforcement of the SWH building mandates, as well as the overall regulatory framework (UNDP-GEF, 2013).

AWARENESS RAISING AND CAPACITY BUILDING

A major objective of the UNDP project was to raise awareness and capacity of various end-users on SWH. Awareness raising efforts targeted residents, public institutions, businesses, building sector professionals, policymakers, financiers, manufacturers and installer.

The project developed over 25 knowledge products and reports including 10 study reports were prepared and summarized as booklets, which included case studies, assessments of SWH potential in selected industrial segments and information on support policies, regulations and financing. The project also developed guidelines for the installation of systems in multi-storied buildings, reference manuals for the hospitality sector, and training manuals for installers and local consultants. The installer training manuals were translated into nine different local languages.

Based on these knowledge products, awareness raising and training programs were carried out across the country. Thirty-two awareness raising programs targeting the domestic, hospitality, health and industrial sectors were held. A total of 27 SWH instillation trainings were completed including four to train additional certified trainers on SWH instillations, four for builders and architects, four for local consultants, and nineteen for installers. In total, the project trained 77 trainers and over 450 installers were trained.

The project also conducted a broad outreach campaign to reach the residential sector. In 30 small cities across the country, billboards promoted the use of SWH. To ensure end-users had the most accurate and up to date information on the SWH program, a dedicated website was launched (www.solarwaterheater.gov.in). The website includes information on SWH in general, the program financial incentives and directions on how to access the subsidy or concessional loan, and a list of certified manufacturers and their associated suppliers and servicing networks including contact details, among other topics. Additionally, a toll free helpline was set up to respond to end-users specific questions on SWH and the SWH program. An SMS campaign was used to publicize the toll free helpline, which resulted in an increase in callers. The Solar Thermal Federation of India (STFI) also began publishing a monthly newsletter called InSolTherm Times to publicize SWH market developments.

FINANCE AND INVESTMENT

The UNDP supported the development of the financial incentives established under the JNNSM greatly influencing the growth in the SWH market in India. The UNDP sponsored the studies, *Design and Implementation of New Financing Mechanisms & Instruments for Promotion of SWHs in India* and *Capacity building in the financing sector and for utilities and regulators,* which both informed the development of the financial incentives including the subsidies and concessional loans. Additionally, based on the reports, the UNDP explored innovative financing mechanisms such as registering projects under the clean development mechanisms (CDM) and using the revenue to support after sales services and performance guarantees for the lifetime of SWH systems installed under the JNNSM (MNRE, 2012b).

The studies also led to the development of an energy service company (ESCO) model to accelerate growth in the industrial SWH market. The UNDP piloted two industrial SWH units using ESCOs to install, own, operate and provide water heating services to Soya Koya Sterring Limited (35,000 LPD capacity system) in Sriperumpudur, TN and to Wheels India Ltd (105,000 LPD capacity system) in Padi, Chennai. In addition to the subsidy or concessional loan the ESCOs could access under the JNNSM, the project provided further funding to cover 15% of the total cost of the projects. Under the project, the ESCOs will provide heating services for up to five years and thereafter, the SWH system and its' operations will be handed over to the commercial user at no cost. The industrial user pays a fixed monthly amount to the ESCO and in return the ESCO meets the industrial water heating needs of the users. As a result of switching from fuel oil to solar powered water heating, the users' monthly water heating costs have decreased by 50% (MNRE, 2012b; UNDP-GEF, 2013).

CERTIFICATION AND QUALITY CONTROL

The UNDP project worked with the MNRE to improve the quality control of the SWH sector in India. Based off the findings of several project knowledge products, the MNRE established a minimum set of technical requirements for the instillation of SWH systems and mandatory quality and standard requirements for SWH equipment. There requirements are compulsory for any manufacturer or supplier to participate in the SWH program. In addition, the supplier must also offer a five year performance guarantee. According to project documents, these new requirements resulted in greater customer satisfaction and helped increase installations by 10% during 2010-2011.

LEBANON

Project Lessons Learned: Lebanon

- The embedding of project work directly within the responsible Ministry can be an important strategy for aligning project activities with Ministry work and activities.
- The combination of low interest loans and small subsidies can have a significant impact on market development – even without construction mandates in place.
- Combining a significant focus on traditional outreach channels with new and innovative stakeholder network partnerships (e.g. engineers and architects) can have a significant impact on consumer awareness and market momentum.

The GSWH project was implemented from 2008 to 2013 and received $1 million in funding through UNDP and the Global Environment Facility (GEF). The GEF funds were matched by additional financing of $2.1 million from the governments of Spain, Sweden and Greece.

The project has been judged to be highly successful in supporting the acceleration of SWH in Lebanon in partnership with government and other stakeholders. Before the project started, there were 74.7 MW_{th} (106,000 m^2) of SWH capacity installed 2005, with 11 MW_{th} added in that year. The market had grown historically at a rate of 10-15% annually. The project set a goal to install 133 MW_{th} (190,000 m^2) during the course of the project, and to establish and sustain annual growth of 35 MW_{th} (50,000 m^2). The project also set a long-term goal of growing the market to 735 MW_{th} by 2020 (1.05 million m^2).

As discussed in Section 1.2.4, the SWH market has grown rapidly since 2005, and Lebanon has exceeded both the annual growth target and the overall target set by the project. The SWH market has proven to be resilient and has continued to grow despite regional political disruptions (e.g. the war in neighboring Syria). This section provides additional detail on the project experience and outcomes.

AN ENABLING INSTITUTIONAL, LEGAL AND REGULATORY FRAMEWORK

The UNDP-GEF supported project team was physically based within the Lebanon Center for Energy Conservation (LCEC). LCEC was created in 2002 as a financially and administratively independent entity that operates under the direct supervision of the Minister of Energy and Water. The embedding of the project within LCEC enabled the project to coordinate directly with project partners within the Ministry of Energy and Water and within BDL and to ensure that project objectives were harmonized with policy decisions. The role of the project within LCEC will also help ensure that post-project impacts are sustained.

When the project began, there were no specific policy mechanisms in place to support SWH systems in Lebanon. During the project, the project team supported the development of both the low interest SWH loan program and the subsidy from the concept stage to final approval, and then worked with the MEW to implement the subsidy program.

AWARENESS RAISING AND CAPACITY BUILDING

The project directly supported and funded outreach and education initiatives to raise awareness about and interest in SWH.

- As discussed in Section 3.4.1.5, the project helped launch a national advertising campaign through print, television, radio, and social media channels.[46] The Ministry of Energy and Water is currently launching a follow-up campaign based on the success of the first. A recent survey conducted by AMER Nielsen on behalf of the project showed that 94% of the population is aware of solar water heating and 85% of respondents are willing to install an SWH unit.
- The UNDP project has signed a memorandum of understanding with the Lebanese Order of Engineers with a goal of raising awareness among this important constituency by encouraging the adoption installation of SWH on 1,000 residences of engineers and architects over the next two years.
- The project maintains a website and email newsletter, and co-organizes the annual Beirut Energy Forum. The project team also has organized and participated in a broad range of national and international events, webinars, and workshops in order to build industry and policymaker capacity, leverage additional resources, and connect industry stakeholders.

FINANCE AND INVESTMENT

The uptake in demand for finance for SWH systems has been a success story of the project. As discussed above, the project was directly involved in the development of not only the SWH loan program, but also of the broader NEEREA loan program. In total, approximately $87.7 million worth of energy efficiency and renewable energy projects have been financed through NEEREA, of which $20 million was designated for SWH in 2012. BDL is planning to support an additional $150 million in low-interest financing with its commercial bank partners in 2014, of which it is expected that $27-$30 million will be for solar water heating.

CERTIFICATION AND QUALITY CONTROL

The project team maintains an updated database of SWH installers, distributers, and manufacturers. At the start of the project, there were approximately 20 active companies. The number of companies has since expanded to 140 companies in the sector. In order to support this rapidly evolving sector, the project team was directly involved in conceiving and supporting the SWH quality standards and certification infrastructure that is currently being implemented. This involved support for the mandatory SWH standards that were adopted and in the development of the qualification criteria that LCEC has used to approve companies eligibility for the $200 subsidy. The project team also provided technical support to the IRI during the successful establishment of the SWH testing facility.

[46] *See* http://www.youtube.com/watch?v=Y0iLygXHVYQ and http://www.youtube.com/watch?v=_M3VqYne5XY

MEXICO

Project duration: 2009- 2013
Project Budget: GEF- 780,000

Lessons Learned: Mexico

- The GSWH programs provides a "blue print" to support countries address SWH market development barriers. While generally successful, it is essential to adapt the programs and approaches to the unique context of individual SWH country markets. It is recommended that the GSWH Program classify not only barriers, but also specific country conditions and context. This would be helpful to make country experiences more comparable, improving the ability of countries to share best practices and apply them to their unique markets.
- Establishing broad stakeholder support and buy-in of key actors in the market is essential to achieve success. In some cases, the GSWHP project in Mexico clearly succeeded in this, establishing strong relationships with government and international actors to support or implement robust financing programs. In other cases, such as development of quality control mechanisms with supply chain actors, outcomes have been delayed or otherwise suffered due to inadequate stakeholder support or the inability to mediate stakeholder concerns.
- Financing is essential for SWH market growth, though it is not always clear how best to apply international funding (such as GEF funds) to support development of robust financial structures. In countries such as Mexico with large financial markets, it is not feasible to use direct GEF funding to increase access to investment capital (e.g. via a revolving fund) or to reduce the costs of available capital (e.g. guarantee fund, risk mitigation, etc.). Instead, it is more effective to use targeted GEF funds to strengthen the implementation of the envisaged financing scheme. This can be achieved, for example, by developing project evaluation and verification procedures. Such approaches additionally benefit by leveraging substantial capital for investment from non-GEF sources and are much more likely to be sustainable over time.
- Mexico's SWH market could benefit from a variety of market development mechanisms, especially those that address soft costs. Compared to conventional water heating alternatives, Mexican SWH system costs are high. This is likely due to a variety of reasons, though there appears to be significant potential to reduce soft costs of SWH projects, which includes costs associated with installation, customer acquisition and marketing, permitting, among others. It is recommended that the GSWH Program consider implementation of market program focused specifically on reducing soft costs associated with SWH projects.

The Mexican GSWH project was implemented from 2009 to 2013 and received approximately $780,000 from the Global Environment Facility (GEF). UNDP-GEF funds were complemented by funding to support SWH financing programs and incentives from the Mexican National Energy Efficiency Commission (CONUEE), the German Agency for Technical Cooperation (GIZ), as well as the Mexican quasi-public housing agency (Infonavit) via the Green Mortgage Fund.

The project has generally met its objectives to accelerate the SWH market in Mexico. Overall, the Mexican SWH market has reacted positively, and initial project objective to install 1.8 million square meters of new collectors has nearly been accomplished. Though SWH market growth has varied from year to year, it has on average grown by approximately 20% annually over the past five years.

This is attributed in large part to the success of new policies and initiatives improving market conditions, which have been actively supported and enabled by the GSWH program. However, the GSWH project has suffered from several challenges, notably changes in project leadership, which interrupted project progress and caused delays in implementation of key deliverables.

Looking ahead, it is expected that GSWH project activities will serve as a guide to support CONUEE's continued efforts, specifically to create the next generation SWH market development program. As discussed above, industry leaders expect the SWH market to grow at an average annual rate of 20% in the future and are actively working with policy-makers to develop new incentive programs to enable market development. Additionally, new synergies are expected to develop in the coming year between the Mexican Secretary of Energy (SENER) and CONUEE in order to ensure institutional support for the SWH market development extends into the future.

AN ENABLING INSTITUTIONAL, LEGAL AND REGULATORY FRAMEWORK

The GSWH program was executed at the national level by CONUEE in support of Mexico's national solar water heating program (PROCALSOL). PROCALSOL launched in 2007 and represents a collaboration of private and public sector stakeholders engaged on developing the SWH market. Market growth of the Mexican SWH market is attributed to public policies that encourage their use, as in the case of Green Mortgages in new homes as well as the PROCASOL program.

By cooperating with and supporting local market development initiatives, the GSWH project contributed to the development of an enabling regulatory environment over the project period. The project has also strengthened policy instruments that ensure installation of quality installations as well as efforts to assess the potential of underserved markets. It is also worth noting there have been advances in the Mexico's SWH regulatory framework over the past several years thanks in part to the dialogues that the GSWH project sponsored (e.g. forums, workshops, exchanges, etc.). Collaboration with other countries and the global coordination of the project has proven to be useful to identify capacity building needs, especially to support development of regulatory frameworks.

Looking ahead, due to a change in government in 2012, the PROCALSOL program as administered by CONUEE ended. The new administration is evaluating options for moving forward and will be reviewing – and potentially redefining – the existing SWH program. As mentioned earlier, a "new PROCALSOL" was re-launched by industry partners in August 2013, though it does not currently have direct participation of CONUEE or other government leaders. As a result, the policy and regulatory framework for the SWH industry in Mexico is at this time unclear.

AWARENESS AND CAPACITY BUILDING

The GSWH project has made progress in raising awareness and building capacity for the SWH industry in Mexico. Three pathways in particular that have been pursued:

- Development of pilot projects to demonstrate SWH technology in the hotel and multi-family (vertical) housing sectors
- Engagement with a strategic communication consultancy to develop regular updates on SWH news in Mexico
- Continuous engagement with key actors in the SWH industry through networking events and communication media in order to achieve initiative objectives.

FINANCE AND INVESTMENT

As referenced in previous sections, a number of organizations have collaborated with the GSWH project to contribute investment and financial resources in support of Mexico's SWH market. CONUEE invested in-kind support and resources to the program, including office space, phone and internet services, as well as coordination services in support of the development of Mexico's quality standard (DTESTV).

Additionally, Infonavit incorporated SWH into its Green Mortgage Fund, providing low interest loans for installations, which has contributed significantly to the growth of the SWH market. In 2012, for example, the Green Mortgage Fund was responsible for financing approximately 53% of the total collector area installed. It is also worth noting that GIZ contributed technical resources to develop that program in addition to financial incentives to buy down the upfront costs of SWH systems under its 25,000 solar roofs program.

CERTIFICATION AND QUALITY CONTROL

The design of formal quality standards for SWH products and installation has been progressing, albeit slower than initially planned in Mexico. Development of comprehensive technical standards have in some cases been slowed by the diversity of viewpoints and market interests of SWH vendors in Mexico. For example, some national manufacturers have expressed concern that quality standards may adversely affect their market position. By consequence, it has been challenging to reach agreement about specific technical requirements and test procedures in the established technical committee for standard development.

Nonetheless, Mexico does have a quality standard based on the Technical Report of Solar Thermal in Housing (DTESTV), which is used by CONUEE as well as the Green Mortgage Program. This regulates the types of collectors used in installations and is generally credited with increasing the quality of installations across the country. IN collaboration with project partners, the GSWH project is now working to develop a voluntary quality control and certification scheme for SWH equipment and installation services. It is expected that this certification scheme will ultimately be adopted by the majority (over 80%) of SWH equipment and service providers in Mexico.

In addition, the GWSH project is sponsoring the installation of the new laboratory test facility in Leon Guanajuato, which will perform tests on equipment to assess the SWH thermal performance and operational integrity (pressure, impact, thermal shock, and others), security, and general quality of SWH components. The testing facility will operate in accordance with the national DTESTV.

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This report presents a replicable and public methodology to evaluate the solar water heating (SWH) policy, finance and investment, business, and quality control infrastructure across countries: the SWH TechScope Market Readiness Assessment methodology. This report is intended by be used in concert with an Excel-based evaluation tool, the SWH TechScope Market Readiness Analysis Tool, which can be used to benchmark and evaluate different SWH markets.

SWH TechScope was developed as part of the Global Solar Water Heating (GSWH) Market Transformation and Strengthening Initiative.
The GSWH initiative supported SWH development in five countries: Albania, Chile, India, Lebanon and Mexico. The report contains an analysis of each of these countries' SWH enabling environment using the Market Readiness Assessment methodology.

DTI/1734/PA